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Artificial intelligence in the information ecosystem: Affordances for everyday information seeking

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Abstract

In this conceptual article, we argue that artificial intelligence (AI) systems are contributing to the generation of an environment of affordances for everyday information practices through which they exert influence on people and the planet in ways that often are left unrecognized. We illustrate our insights by focusing on the practices of information seeking in everyday life, suggesting that the affordances of AI systems integrated into search engines, social media platforms, streaming services, and media generation, shape such practices in ways that may, paradoxically, result both in the increase and reduction of diversity of and access to information. We discuss the potential implications of these developments in terms of the sustainability of information ecosystems and suggest solutions for addressing them through regulation and education. Drawing from the fields of library and information science and science and technology studies and research on affordances, everyday information practices, and sustainability, the article seeks to respond to the need for more nuanced theoretical insights on the impact and implications of AI on information practices and to develop conceptual tools with which to examine the co-evolution of humans and information systems from a systemic perspective.

1 | INTRODUCTION

In a Chapter included in the 1989 book Distributed Artificial Intelligence, Susan Leigh Star (1989) argued that we should understand artificial intelligence (AI) through a social rather than a psychological metaphor. Instead of the Turing Test, which refers to a computer being able to mimic the thinking or actions of humans in ways that are indistinguishable from human thinking and actions, she argued, we should rather implement a Durkheim Test that refers to testing systems with respect to their ability to meet community goals. Star (1989, p. 41), drawing from the ideas of French sociologist Emile Durkheim (1858–1917) who theorized about "social facts" and sought explanations to apparently individual decisions from social forces (see Durkheim, 1938), argued that a Durkheim test for AI would be "a real time design, acceptance, use and modification of a system by a community" (Star, 1989, p. 41). Consequently, the intelligence of the system would be the direct measure of its "usefulness applied to the work of the community; its ability to change and adapt, and to encompass multiple points of view while increasing communication across viewpoints of parts of an organisation" (Star, 1989, p. 41). Star (1989, p. 41) claimed that "the futility of the Turing Test comes [...] from a fundamental misunderstanding of the nature of computers and

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society as closed, centralised, and asocial" whereas the idea of the Durkheim Test articulates the need to understand technologies as open and evolving systems, where the boundaries between design and use; technology and user; and laboratory and workplace are often blurred.

Star's thinking is more relevant than ever now as AI is at the center of public discourse and research efforts. AI systems that collect, process, and react to data in ways that "simulate human intelligence" (Canhoto & Clear, 2020; Elliot, 2019) are now considered as general-purpose "system technologies" that have been integrated into wider systems of technologies and have systemic effects on society (Sheikh et al., 2023a), shaping or even revolutionizing organizations and communication (see Ågerfalk, 2020; Ågerfalk et al., 2022; Davenport, 2018; Sheikh et al., 2023b; Simon, 2022). This AI revolution (e.g., Davenport, 2018) is not only brought about by the technological development of specific AI technologies but their quick adoption in increasingly many areas of human life (The Finnish Innovation Fund Sitra, 2020) and the massive changes they have brought—and will bring—to everyday life here-and-now (Elliot, 2019). Among such changes are the ways AI systems are being used both to mediate communication and information interactions between people and to modify, augment, and generate content to accomplish such goals (Hancock et al., 2020).

While there is an extensive body of research on AI in library and information science (LIS), not much attention has been given to the ways AI systems are contributing to the re-arrangement of information practices, specifically in everyday life (see Haider & Sundin, 2019). Overall, even though information systems are clearly central to everyday life, influencing and restructuring our thinking and actions, social relations, and identities in many ways (see Elliot, 2019), their importance for everyday information activities has been overlooked (Haider & Sundin, 2019). This applies to seemingly mundane, everyday uses of AI systems which have received less attention both in research and in public discussion in comparison to the achievements in developing "an AI" and the technological progress that can be anticipated in the future (Elliot, 2019).

In this conceptual article we aim to respond to the need for more nuanced insights on the impact and implications of AI systems on everyday information practices and to develop conceptual tools with which to examine the co-evolution of humans and information systems from a systemic perspective. In the following section, we outline the theoretical framework of the study where we take the metaphor of the information ecosystem as a starting point and develop it further with the help of theorization in the fields of LIS and science and technology studies (STS) on technological affordances, everyday information practices, and sustainability. We then move to an analysis focusing on AI in everyday information seeking, guided by the following research questions:

1. In what ways are the affordances of AI systems shaping information seeking in everyday life?
2. How are those affordances conditioned?
3. What are the implications of this on the sustainability of the information ecosystem?

Rather than offering a holistic review of existing literature, the analysis draws on selected prior studies and media coverage identified by searching and citation-chaining to illustrate how AI systems are contributing to the generation of a particular environment of affordances (Huvila, 2009; Madianou & Miller, 2012) for everyday information seeking. As everyday spaces tend to be occupied by commercial platforms, our focus is placed on AI in commercial search engines and social media platforms, and generative AI systems depending on the so-called foundation models developed by large tech companies (see Bommasani et al., 2021). The analysis combines inductive and deductive reasoning and is conducted in interplay between the ideas developed in the theoretical framework and ones foregrounded in the material. In Discussion, we return to the Durkheim Test and discuss the sustainability of AI in the information ecosystem and potential solutions for addressing the identified issues through regulation and education. The article concludes with final remarks on its contribution and suggestions for future research.

2 | THEORETICAL FRAMEWORK

The idea of the Durkheim Test highlights the need for an ecological way of "testing" the intelligence of an open and distributed system (Star, 1989). In this article, we refer to the metaphor of the *information ecosystem* to help conceptualize this ecological understanding of the social integration of AI systems and the ways they are embedded in and enmeshed with various platforms, applications, and contexts rather than operated as closed and separate systems. The concept of information ecosystem points to an ecological view to information interactions happening in the relationships of the natural environment and living organisms (Norris & Suomela, 2017) and invites questions about the sustainability of this ecosystem. As such, it is well aligned with the idea of the Durkheim Test (Star, 1989) as well as with recent discussions on sustainable AI (see Larsson et al., 2019; van Wynsberghe, 2021). While Norris and Suomela (2017) have critiqued the use of the term claiming that instead of bringing forth the natural environment, its use tends to further disconnect us from it, we find the concept useful as it directs our attention to, first, the ways AI

systems are contributing to the re-arrangement of information practices through "complexes of data, people, and machines" (Norris & Suomela, 2017, p. 27) and, second, the implications of such rearrangements. However, to address the challenges pointed out by Norris and Suomela (2017), we develop this conceptualization further by building upon theorization of *affordances* and *sustainability*, as explained in the following sections.

2.1 | Affordances for everyday information practices

Within information practice research, sociocultural and practice theories (see e.g., Cox, 2012; Olsson & Lloyd, 2017; Savolainen 2008, McKenzie, 2003) have informed our understanding of people's collectively constructed ways to seek, share, create, and use information in everyday settings. This everyday-information-practices approach directs attention to the socially and culturally established, "recurrent, materially bounded and situated" (Orlikowski, 2002, p. 256) ways people interact with information as members of groups and communities when their actions are not directly connected to accomplishing professional or education-related goals (Savolainen, 1995, 2008). As everyday practices are routinized and mundane, embedded in their context of occurrence (Savolainen, 2007), they are challenging to notice and tend to become invisible or largely unquestioned. Consequently, research on everyday life is often "concerned with rendering the seemingly invisible visible" (Willson, 2017, p. 138). The same applies to information systems that arrange everyday life and society at large (see Gran et al., 2021) often operating in unnoticeable ways to appear as frictionless to users (see Haider & Sundin, 2022).

One way to conceptualize how information systems, or technologies overall, shape information practices is to consider them as cultural tools (Vygotsky, 1978; Wertch, 1991) that, when appropriated by particular people in particular situations, mediate action, making "certain kinds of actions more possible (and other kinds of actions less possible)" (Jones, 2020, p. 202). In other words, they come with different *affordances* (see Gibson, 1982), that is, potential or opportunities to serve as tools to perform certain actions (Jones, 2020). From this perspective, affordances are understood as relational rather than as properties of things (Jones, 2020; Kaptelinin & Nardi, 2012) and as functional in the sense that they can both enable and constrain actions (Hutchby & Barnett, 2005). This approach is not limited to considering the "low-level" technical affordances located in the materiality of specific tools, but also the "high-level" conditions they enable and the practices they allow for or constrain (Bucher & Helmond, 2018).

Within LIS, the concept of affordances has been "adopted or adapted" (Zhao et al., 2020) to explore people's (inter)action with both technologies (Haider, 2016; Kitzie, 2019; Leonardi, 2013) and services (Sadler & Given, 2007; see also Day, 2011; Cox, 2012). Zhao et al. (2020) have conceptualized "affordances for information practices", viewing affordances as constituted in the relationship of artifacts, people, and the sociocultural environment "with which they come in contact through an array of information practices" (Zhao et al., 2020, p. 230; see also Evans et al., 2016; Costa, 2018). This view aligns with Lloyd's (2005, 2011) ideas of affordances as "information opportunities," that is, "invitational qualities" for people to engage in certain activities, which can lead to access to information. Going beyond the affordances of individual systems, Huvila (2009, p. 9) has used the characterization of "an environment of affordances" to describe the interplay of information use and information infrastructures. Madianou and Miller (2012, p. 170) have used a similar expression to highlight how, from individuals' perspective, new media can be considered as a communicative environment of affordances rather than discrete technologies.

Davis (2020; see also Davis & Chouinard, 2016) argues that we should not only ask what something affords, but how, for whom, and in what circumstances, and outlines three central conditions of affordances: perception, dexterity, and cultural and institutional legitimacy; affordances are considered as being shaped by what individuals know about an artifact (perception), what they can concretely do with it (dexterity), and, importantly, its cultural and institutional legitimacy, including cultural norms and institutional regulations (Davis, 2020, p. 11).

2.2 | Affordances for sustainable information practices

The concept of affordances offers a way to recognize the ways technologies materially constrain and enable actions, while also being socially constructed and situated (Bucher & Helmond, 2018; Hutchby, 2001). As such, the concept allows the examination of the impact of technologies in a non-deterministic way (Davis, 2020, p. 7); "[t]echnologies don't make people do things but instead, push, pull, enable, and constrain." The concept of sustainability invites us to further consider the implications of technologies and their invitational qualities (see Lloyd, 2005) for information practices, and consequently, the people and the planet.

Sustainability refers to the ways we can meet "the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987) and is often viewed to cover environmental, social,

and economic aspects. In previous work on information ecosystems, questions about their sustainability have been raised including "[w]hat do we sustain, for who, and at what cost" and "who wins and who loses" in competing for the limited resources of an ecosystem (Norris & Suomela, 2017). Nathan (2012, p. 2267) theorized on the sustainability of information practices, arguing that we should pay attention to, first, how the socially negotiated ways through which "we create, change, share, and store information" may contribute to sustainability challenges in the long term, and second, people's capabilities to influence those practices. In Nathan's (2012) work, information practices, especially when involving digital information tools, appear as resistant to change, even when in direct conflict with sustainability-related values of individuals and communities. While Nathan (2012) highlights the agency of individuals in shaping information practices to align with their values (see also Nardi & O'Day, 2000) and toward more sustainable directions, she argues that values alone are not enough. Instead, we need to raise our awareness of "what sustainability looks like in relation to the long-term consequences of our interactions with information tools" and develop practices that reduce prospective negative impacts (Nathan, 2012, p. 2266).

Recent discussion of sustainable AI and AI for sustainability (van Wynsberghe, 2021) directs attention to the tensions between the potential of technologies and the economic, social, and environmental consequences of their development and use (Larsson et al., 2019). For instance, while AI systems hold potential in contributing to environmental sustainability actions and contribute to reducing poverty, their development and use also involve considerable emissions and planetary costs and can increase already existing inequalities and damage human rights (Bender et al., 2021; Crawford, 2021; van Wynsberghe, 2021; Vinuesa et al., 2020; Galaz et al. 2021). These tensions are associated with conflicting values and needs but also to the central systemic problem with AI, and digital technologies more generally, that in spite of such technologies impacting the lives of all people on the planet, only few are included in the discussions and decisions about them (Bon et al., 2022). Liu (2018, p. 197) claims that, overall, the central challenges posed by AI should be viewed as problems of power and suggests the power structure of AI as consisting of three levels: "(i) power exercised over the individual or groups in mundane spheres of activity where certain kinds of everyday decision-making may be displaced; (ii) power impacting upon the trajectories of societal development and hence impinging upon human rights, values, and aspirations, and their track-dependencies; and (iii) power involving existential threats to humanity."

In brief, in this article, we view an information ecosystem as an environment of affordances for information practices, conditioned by various aspects, including perception, dexterity, and legitimacy (see Davis, 2020) and being both shaped by and shaping humans and their material environments. The sustainability of such ecosystems is dependent on the long-term ecological, social, and economic consequences of information practices as well as the extent to which they meet present and future generations' needs (see Brundtland, 1987). In the following section, we move from this conceptualization to examining it further with the help of academic research and media coverage exemplifying of the affordances of AI systems for everyday life information seeking.

3 | ANALYSIS

In this section, drawing from previous research and media coverage, we seek insights into the questions of, first, in what ways are the affordances of AI systems shaping information seeking in everyday life and, second, how are those affordances conditioned? These questions are addressed concentrating first on the integration of AI in recommender systems and search engines and then focusing on the affordances of generative AI tools. The third research question concerning the implications of these developments on the sustainability of the information ecosystem is addressed in Discussion.

3.1 | AI in search engines and recommender systems

For a large part of the human population, AI technologies have already become integral to everyday information seeking through the automatically formulated queries on search engines; seemingly effortless recommendations in streaming and video-sharing services, social media platforms, and navigation applications; and voice assistants and chatbots integrated into various services (see Elliot, 2019, p. 8; Haider & Sundin, 2019, p. 2). Instead of advanced searching, many of these AI-supported applications encourage either multimodal, quick searching or active scanning (see Table 1). Increased opportunities for multimodal search apply both to search queries and content to be retrieved. In addition to text, search engines are increasingly voice- or image-based (Haider & Sundin, 2019). Examples include Google Lens, a neural network based image recognition software (Shapovalov et al., 2019) and voice assistants, such as Amazon's Alexa or Apple's Siri (Lopatovska et al., 2019; Mckie et al., 2022). While voice assistants are

TABLE 1 Affordances of AI for everyday information seeking identified from previous research and media sources considering search engines and recommender systems.

Affordance for everyday information seeking and description	Examples
Enabling multimodal, quick search Encouraging performing search using sound, text or images for references and of searching multimodal content	Voice assistants or intelligent personal assistants enabling quick (simple) searches: listening to news, checking weather or traffic (Lopatovska et al., 2019), and access to information without the need to physically operate a machine, travel or move; audio presentation and frictionless access adding variety to how information is consumed (Mckie et al., 2022). Google Lens used in species (animals, plants, etc.) recognition (Shapovalov et al., 2019), and identifying text objects and converting images to text (Lucia et al., 2021).
Encouraging active scanning Highly personalized recommendations based on the user's location, past searches, and interactions on other platforms encouraging active scanning instead of advanced search	Ranking content based on relevance for the user (Bucher, 2012; Nechushtai et al., 2023), and personalizing and adapting to individual users (Haider & Sundin, 2019) encouraging the delegation of active information searching and query formulation as well as relevance evaluation to the information system (Willson, 2017). Increased emphasis on micro-targeting and personalization of information enabling matching people with relevant content based on their interests instead of their social networks (Zha, 2020).
Restricting access Discouraging accessing certain information by restricting access to selected content	Algorithms in search engines, music streaming, and social media platforms restrict access by hiding or showing certain content (tags, words, identifiers, music) in their interfaces (Bucher, 2012; Maasø & Hagen, 2020). In the case of autocompletes and suggested searches, pornographic or otherwise offensive content blacklisted by major search engines (Haider & Sundin, 2019; Miller & Record, 2017).

not exclusively meant for searching information, they are often used for quick searches, such as checking the weather or to look up facts or news (Lopatovska et al., 2019). Beyond voice assistants, search engines too have become more conversational, providing "answers" directly, instead of displaying lists of links to matching or suitable results (Haider & Sundin, 2019, p. 13). Recently, Google has introduced their conversational AI service Bard, which draws from web search to provide users with "fresh, high quality responses" (Pichai, 2023).

Encouragement to active scanning applies to YouTube and streaming services such as Netflix and Spotify, but also to search engines (Haider & Sundin, 2019, 2022), that have incorporated AI techniques in their ranking algorithms to generate personalized recommendations (see Amatriain & Basilico, 2015; Zhang et al., 2021) and individualized information (Haider & Sundin, 2019, 2022). This often means deploying various types of user data, including presentation and impression data; social data based on users' social media connections and interactions with other users; and data on users' interaction with recommendations (Amatriain & Basilico, 2015). An increased emphasis on micro-targeting and personalization of information enabled by AI technologies, visible in Google Search, YouTube, and TikTok, applies to a range of digital platforms. Essentially, they work as recommender systems that seek to anticipate what their users will experience as relevant (Haider & Sundin, 2022) or engaging, and offer content to match those anticipations. For example, Google Search has over time developed toward a "suggest engine" that anticipates the user's needs and wishes without the user having to actively carry out the search by entering a query (Haider & Sundin, 2019, p. 5). Similarly, many social media platforms share features of a platform model that focuses on mediation of content based on relevance for the user (Bucher, 2012; Nechushtai et al., 2023) and matching people with their interests rather than social networks (Zha, 2020).

What these technologies enable from an information-seeking perspective is, to some extent, the delegation of active information searching and query formulation (Willson, 2017) as well as relevance evaluation to the information system. Such AI-supported tools may add variety to the ways information is consumed, increase accessibility (Mckie et al., 2022), and enable ways to receive relevant information with little active effort. At the same time, these applications may restrict access to certain information and constrain actions such as performing predictable and replicable searches that do not vary based on who is searching, with what device, where, and when, lacking high-level affordances such as searchability and persistence (see Boyd, 2011). For example, although the use of voice assisted searches can add variety to how information is consumed, they may in turn

act as barriers to access information as they do not offer related information, their users lose control over search and browsing results, and the users' expectations of the quality of information may also be lowered (Mckie et al., 2022). Moreover, many search engines, music streaming services, and social media platforms use AI tools to hide or show specific types of content in their interfaces (Bucher, 2012; Maasø & Hagen, 2020) both through search functionalities and by flagging, blocking, and removing inappropriate or offensive content (Lefkowitz, 2022; Rangaiah, 2021). For example, reportedly, in the case of autocompletes and suggested searches based on users' search history, pornographic or otherwise offensive content has been blacklisted by major search engines (Haider & Sundin, 2019; Miller & Record, 2017).

Recommendation of content is suggested to shape users' preferences and choices (Milano et al., 2020), homogenize exposure to information (Nechushtai et al., 2023) and taste (see Hesmondhalgh et al., 2023), reduce diversity in content consumption (Anderson et al., 2020), and narrow information landscapes (see Lloyd, 2019) as they prioritize and privilege certain types of information. Importantly, major search engines, social media platforms, and streaming services are driven by commercial objectives (Milano et al., 2020). They tend to include advertisements (Haider & Sundin, 2019) and are often designed to "hook" people into consuming content as long as possible rather than efficiently finding the needed information, since that is what serves the business model of the online platforms, which is why Seaver (2019) has characterized these systems as "traps." For example, TikTok's "immersive platform design" (Montag et al., 2021) has been suggested to create an environment where the user can be engaged in viewing a seemingly endless personalized stream of videos without having to actively search for information on a topic of their interest (Bhandari & Bimo, 2020). Likewise, many music streaming services, such as Spotify, employ autoplay functions which remarkably reduce the need for search query formulation, while they both ensure flow prolonging and reduce choice at the users' end (Maasø & Spilker, 2022).

Naturally, people make use of these systems in various ways, which in turn affects what people encounter on different platforms (Haider & Sundin, 2022). For example, Anderson et al. (2020) found that users of music streaming services were able to overcome the lack of diversity in recommendations and became more varied in their listening by reducing algorithm-driven consumption of music and increasing their own searching activity. This requires awareness of the functions of the system and capabilities to use those functions (see Davis, 2020). In turn, the lack of capabilities to use the functions of an interface can make certain types of searches difficult if not impossible (Haider & Sundin, 2019), especially if an interface is designed to hide particular content (Bucher, 2012; Maasø & Hagen, 2020). While Google Search has generally been accepted as a go-to way of searching, given that "googling" is considered synonymous with searching (Andersson, 2017), recommender systems seem to be less recognized as legitimate tools for those purposes. However, social media platforms and streaming services with their AI-powered recommender systems have steadily grown in popularity and are being used, to some extent, to serve similar functions to general-purpose search engines. For example, a recent study by Andersson (2022) shows how social media apps, such as YouTube and Instagram, dominate over Google Search when young people look for entertainment on their smartphones (Andersson, 2022). Perhaps somewhat surprisingly YouTube, owned by Google, can be considered to be the second-largest search engine globally (see Davies, 2021) and has been identified as important also to educational and informational use (Andersson, 2022).

3.2 | Generative AI systems

The advancement of Generative AI, referring to deep-learning models that enable the automatic creation of novel high-quality content, such as text, image, video, audio, and computer code (Martineau, 2023), has recently garnered attention both from the industry and the general public, especially with the launches of the text-to-image model DALL-E and the large language model-based chatbot ChatGPT by OpenAI (2023a; 2023b). A recent report from McKinsey & Company (Chui et al., 2022) comments that generative AI is becoming a game-changer for businesses, which, consequently, influences the people consuming the products of these businesses. With these developments, these tools are also reshaping everyday information seeking (Chan & Moore, 2013; Coyle, 2013; Noone, 2023), for example, by enabling information retrieval in human-like interaction and encouraging information creation and modification to meet information needs (see Table 2).

Conversational AI tools, that is, text generators or intelligent agents that can simulate human conversation (see Google Cloud, 2023), enable new ways to retrieve information through interactions resembling human-like dialogue (Balog, 2021). Due to the breakthroughs in neuro-linguistic programming (NLP), present-day chatbots can pull together a massive corpus of content into context and show their responses in a way that not only allows users to obtain "answers" to their input (Balog, 2021) but does it in a way that resembles natural human communication (Gentsch, 2018). Chatbots have been widely used for some time by companies, medical

TABLE 2 Affordances of AI for everyday information seeking identified from previous research and media sources considering generative AI.

Affordance for everyday information seeking and description	Example(s)
Enabling information retrieval in human-like interaction Enabling the acquisition of information in a way that resembles interactions between humans	The chatbot ChatGPT reportedly enabling users to employ it as a "search engine" for information retrieval (Dwivedi et al., 2023, p. 11). Chatbots generating texts by mimicking the personality of specific human-beings (Gentsch, 2018).
Encouraging information creation and modification to meet information needs Encouraging information creation and modification to meet specific information needs and/or other requirements, including information in certain styles, based on prompts and prompts with specific material	GPT-4 used to process a photo inputted by the user and describe it in texts according to users' requirements (Derico & Kleinman, 2023). ChatGPT responding to users' queries in a "narrative form" (Dwivedi et al., 2023, p. 11) or in other styles such as academic texts, as requested by the user (Nield, 2023).
Discouraging information triangulation Discouraging the use and comparison of multiple sources in information seeking by enabling condensed information generation without explicitly revealing sources	GPT-4 enabling users to gain information "summarized" by the system based on the input prompts and material (Clark & Vincent, 2023) ChatGPT generating information by repackaging sources unknown to users, making it difficult to ensure the credibility and accountability of information (Graham, 2023, Haggart, 2023).

institutions, and public sector agencies (Dharwadkar & Deshpande, 2018; Xu et al., 2017), but recent developments point both toward more convincing human-like interactions and to generalized uses of chatbots as "search engines" at least when it comes to ChatGPT (Dwivedi et al., 2023, p. 11). Moreover, some chatbots generate texts imitating the personality of specific human beings, such as Eugener Goostman that mimics a 13-year-old Ukrainian boy (Gentsch, 2018).

Beyond conversational AI tools, the capabilities of generative AI systems may drive the construction of information seeking practices toward information creation and modification to meet information needs or to solve problems. With the help of Generative AI tools, people may acquire information by generating it based on their specific inquiries or via certain prompts and materials or modify existing information to better meet their needs or requirements. For instance, ChatGPT is reportedly being employed to respond to users' queries in a "narrative form" (Dwivedi et al., 2023, p. 11) and in specific requested styles, for example, as an academic text (Baron, 2023). Moreover, the emergence of advanced large multimodal models, such as GPT-4, enable users to gain information "summarized" by the system based on input prompts and material. GPT-4 can be used to describe graphic information based on an input photo, point out trends in a graph, and create captions for images (Terrasi, 2023), or to identify food on a photo inputted by the user and to generate a recipe of the ingredients in text (Derico & Kleinman, 2023), for instance.

As many generative AI systems provide "answers" or summarize content in different ways, they may discourage the use and comparison of multiple sources in information seeking. Unlike traditional search engines that provide a list of resources for information seekers to select from, generative AI systems act as information intermediaries, outputting with condensed information generated based on various types of inputs (Gentsch, 2018; NVIDIA, 2023). In this mechanism, the sources of input data tend to become hidden, which may hamper source evaluation. For example, chatbots may use sources unknown to users (Welborn, 2023), making it difficult to ensure the credibility and accountability of the information generated by these systems (Graham, 2023; Haggart, 2023; Larsson et al., 2023).

In addition to directly shaping information seeking, generative AI systems may impact people's information environments by contributing to the ease of automatic content creation and by generating representations replicating the cultural properties of the data sets they are trained with (Cheong et al., 2023; Chui et al., 2023). Importantly, the use of generative AI enhances the exponential growth of online content as it increases the scale of content applied in different areas (Chui et al., 2023). Moreover, by offering opportunities to mimic human interaction, generative AI systems increase the ease to create convincing "deepfakes" and speech synthesis, which has awaken concerns on their potential in spreading misinformation and fostering overall distrust (Elliot, 2019; Vales, 2019; see also Wagner & Blewer, 2019; de Vries, 2020). For example, deepfake technologies have

been applied to generate fabricated political videos associated with radical right-wing positions (Hameleers et al., 2022, p. 2). An example of a representation-related issue concerns the content generated by generative AI tools. For instance, the images of nurses, secretaries or assistants generated by DALL-E are usually white women, which fits the gender bias related to social norms (Cheong et al., 2023) and American and European cultures are reportedly overrepresented in the data sets which creates biases in the generated output (see jenka, 2023; Shankar et al., 2017).

People's perceptions of generative AI systems shape their practices of information seeking enabled by these systems. For example, previous literature shows how ChatGPT can be perceived as a tool of academic writing (Baron, 2023) or as search engine (Dwivedi et al., 2023), which shapes the ways this tool is used. From the perspective of cognitive aptitude (Davis & Chouinard, 2016), generative AI systems require their users to possess novel capabilities such as "crafting prompts" that Gattupalli et al. (2023, p. 3) have marked to be a "21st Century Skill." At the same time, in terms of physical ability, many generative AI applications enable people with disabilities to interact with the systems in ways that have not been possible before (see Enderle, 2023; Henneborn, 2023). Regarding cultural legitimacy, social norms and political and economic environments play an important role in shaping the affordances of Generative AI systems, and currently, the norms and regulations concerning Generative AI are being widely negotiated in different communities, organizations, and countries. As an example of internal company policy, DALL-E (2022) has launched a policy that the image generator will not create images based on prompts indicating violence, self-harm, sexual, shocking, illegal activity, deception, political, public and personal health, and spam, with an aim to disable the generations of harmful and unhealthy images. More broadly, issues such as AI-powered cyber-attacks and AI-related misinformation are urged to be addressed in the first ever UN Security Council meeting (Dempsey, 2023) and ChatGPT has been blocked in countries including China (Kwan and Agencies, 2023), which means that their citizens may be excluded from using the system.

4 | DISCUSSION

Our analysis exemplifies the *environment of affordances* that is created as AI tools are being incorporated into existing systems and practices and appropriated to different purposes. As such, it is not only single tools that are shaping information practices, but their use in increasingly many areas of human life. The introduction of AI seems to have resulted in less static systems that adapt to users both individually and collectively (see Haider & Sundin, 2019), contributing to the trend of personalized, customized, directed content becoming the norm in digital platforms (UNESCO IITE and TheNextMind, 2020). While the affordances of these systems are conditioned by perception, dexterity, and cultural and institutional legitimacy (Davis, 2020), among other things, our analysis points to certain common orientations. Based on our analysis, new opportunities for information seeking emerge as AI systems enable multimodal search, information retrieval in human-like interaction, and creation and modification of information to meet specific information needs. At the same time, these systems may restrict access to information, encourage active scanning instead of searching, and discourage triangulation of sources.

Interestingly, these affordances point to orientations both toward increased and decreased levels of access and diversity of information; while AI tools enable increased levels of personalization and add variety to how information is consumed, they seem to contribute to the homogenization of information content, both from the perspective of individual users (see Anderson et al., 2020) and collectively (see Rivas & Zhao, 2023). As such, AI systems may contribute to producing unbalanced views by privileging certain knowledges and ways of knowing over others and by potentially narrowing our information landscapes (Lloyd, 2019; Noble, 2018). This is of particular concern as the power in AI development is currently concentrated within a limited number of technology companies whose AI tools are being integrated into various systems. This concentration of power is a challenge not merely related to data extraction and privacy issues, but also to the lack of transparency of both AI technologies and secretive commercial organizations, and of dominance and monopolization (see Larsson, 2021).

The implications of AI use for information seeking depend not only on the features of the technologies used, but on what they are used for, how, and by whom (see Davis, 2020). Both the benefits and the harms that AI systems contribute to may be specific to certain people or communities, while others are collective, influencing all humans on the planet, whether they themselves use the technologies or not. Consequently, we need to be attentive to the perspectives of diverse communities and contexts where AI systems are being used but not leave the planetary costs of AI technologies (see Crawford, 2021) unrecognized. Recent scholarship on increased awareness of the energy and human resources that the large AI models demand in both training and deployment (see Bender et al., 2021; Crawford, 2021), emphasize the need to consider the sustainability of their use. The Durkheim Test (Star, 1989) aligns with the discussion on sustainable

AI (Larsson et al., 2019; van Wynsberghe, 2021), pointing to the view that rather than focusing AI systems' abilities to mimic human intelligence, we need to consider how they enable the inclusion and distribution of social and community-based values, inviting questions such as: whose values are AI systems aligned to, who benefits from their use, and who might be harmed by them? As Nathan (2012) argued, however, values are not enough; people also need increased awareness and capabilities to be able to act differently. Next, we will discuss ways in which we can act differently by developing sustainable information practices through improved governance of AI and AI literacy education.

4.1 | Improved governance of AI

The Durkheim test points toward a more community-including AI development as means to contribute to more sustainable information ecosystems. Given the distance between the end-users and the globally operating, non-democratic AI-providers, governance and regulation of AI are central in terms of legitimacy as a condition for AI systems' affordances (see Davis, 2020). Governance and regulation, often played out via other institutions, including authorities and service-providers, can target actors with the most influence over AI use and development, including large tech companies and data-intense platforms.

The past years have been globally formative for the development of corporate, governmental, and NGO level AI guidelines (Jobin et al., 2019), often focusing on transparency, privacy, and accountability. Critics have pointed out that the lack of enforcement mechanisms in non-legal, "ethics" guidelines makes them weak (Coeckelbergh, 2019) or even meaningless (Munn, 2023). Moreover, given the multifaceted meaning of concepts such as AI transparency (see Larsson & Heintz, 2020) and to enable more *meaningful* AI transparency, questions such as *what type* of transparency and *for whom* (Kemper & Kolkman, 2019) need to be considered, requiring input from the humanities and social sciences on how humans understand explanations (Larsson et al., 2023; Miller, 2019).

The governance of global and data-collecting digital platforms has proved to be a particularly scattered field with highly different circumstances in, for example, Europe compared to the USA and China. Ethics guidelines development is a clear part of The European Union's AI strategy (Larsson, 2020), which has worked as a precursor for a proposal for an AI Act. The AI Act is a risk-based regulation obligating anyone who develops and implements AI systems to assess their level of risk and, if deemed to be of high risk, follow obligations for documentation and assessment of the system before allowing it to be used in the European market. During the autumn 2023, the European institutions have negotiated this regulation, including aspects of "general purpose AI" and "foundation models," (see Bommasani et al., 2021) which could be impactful for systems like OpenAI's ChatGPT. The (seemingly) final version of the act speaks to transparency obligations for all developers but with stricter obligations for 'high impact' models. In addition, the quick development in the field has spurred a new wave of policy-oriented guidelines on generative AI, including, for example, concerns relating to mis- and disinformation and intellectual property rights (see OECD, 2023).

While many of the mundane, everyday uses of AI may not be targeted by the AI Act, it can be seen as part of a bigger wave of digitally oriented European regulations. These include the already present data protection regulation (GDPR) and the Digital Services Act (DSA), that, among other things, put obligations on large platforms with regard to transparency. The Digital Markets Act also places obligations on the very large platforms regarding their dominance (see Larsson, 2021), which may be beneficial for a more diverse information ecosystem. This is also in line with how Sheikh et al. (2023a) argue that the concentration of power within a limited number of technology companies needs to be reduced.

Lastly, and according to Sheikh et al. (2023a), the regulation of AI should be approached as a systemic phenomenon, which presents a particular challenge to the regulator. According to Sheikh et al. (2023a, 360), "[t]reating the regulation of AI as a systemic issue—and hence an issue of AI's integration into society—reveals how the digital living environment needs to be organised accordingly." Consequently, and following Star's (1989) critique of the Turing test, the visions for how AI systems should be regulated need to be more informed by the notions of AI as a social community-dependent phenomenon rather than an expression of a singular brain that can mimic expressions of human intelligence.

4.2 | AI literacy as a civic competence

Increasing people's *AI literacy*, including a better understanding of the operations of AI technologies and their potential positive and negative impacts, is framed as a remedy for some of the potential harms of AI (Council of Europe, 2019). For example, the European multi-stakeholder forum AI4People (2020) argues that without AI literacy humans will not be able to embrace and protect their own agency. Kaspersen et al. (2022, p. 1) claim that the goal of AI literacy education should not only be

in developing instrumental skills, "but a critical understanding of manifestations of power and ideology in AI technologies, and consequently, its personal and societal implications." This approach underlines the need to learn about AI not only to be better able to use or design such technologies but to be able to engage with the real-world political and ethical questions that are associated with them (Kaspersen et al., 2022; Ng et al., 2021). As a standalone competency, or as part of media and information literacy (UNESCO IITE and TheNextMind, 2020), AI literacy can be considered as a civic competence, necessary for people "to act as responsible citizens and to fully participate in civic and social life, based on understanding of social, economic and political concepts and structures, as well as global developments and sustainability" (European Commission, 2018).

To maintain their agency and ability to work against the potential negative implications of AI technologies, people need capabilities and resources to, first, make visible the seemingly invisible ways in which such tools shape actions and thinking; and second, to develop ways to take action toward changing practices. The development of these capabilities is inseparably connected to cultural norms and institutional regulations shaping affordances (Davis, 2020; Davis & Chouinard, 2016). As AI systems are becoming increasingly integral to communication and information interactions (Hancock et al., 2020), people should be supported in developing a critical and reflexive approach to understanding them as part of the "conditions which scaffold the operationalisation of information" (Lloyd, 2019, p. 1482). In support of this thinking, Haider and Sundin (2019, 2022) have introduced the notion of *infrastructural meaning-making* to refer to the awareness that algorithms, as well as AI systems, are located in wider infrastructural arrangements (Haider & Sundin, 2019) that shape both information and the opportunities for this awareness (Haider & Sundin, 2022). Therefore, the infrastructural conditions of enabling and disabling our access to information (Haider & Sundin, 2022) and related issues such as bias, trust, credibility, opacity, diversity, and social justice (Lloyd, 2019, p. 1483) should be addressed in media and information literacy pedagogy.

Importantly, the consideration of the implications of the infrastructural conditions that shape information practices should be extended beyond the perspective of the individual to include our shared information ecosystems and their environmental, social, and economic sustainability. The concept of sustainable information practices (Chowdhury & Koya, 2017; Nathan, 2012) invites scrutinizing the socially negotiated ways through which we acquire, create, share, manage, and store information and their implications in the long term. Addressing the sustainability of practices may open a way to recognize individuals' agency in shaping information ecosystems and identifying actions with potential to become tactics to change (Wohlwend, 2020).

5 | CONCLUSION

The Durkheim Test for AI (Star, 1989) points to the need to consider how AI tools can meet the values, norms, and needs of communities. In this article, we have illustrated some of the ways in which the affordances of AI systems, integrated into search engines, social media platforms, streaming services, and media generation, request, demand, allow, encourage, discourage, and refuse our actions (see Davis, 2020) in ways that may result in both increased and reduced diversity of and access to information. As such, AI systems are contributing to the generation of an environment of affordances for everyday information practices through which they exert influence on individuals, communities, societies, and the planet in ways that often are left unrecognized. While the article is limited in its approach as it does not offer an empirical examination or a systematic review on the topic, we wish that it can provide insights and generate discussion about the impact and implications of AI on information practices and their contribution to the environmental, social, and economic sustainability of information ecosystems. Future research is needed to examine how information practices are mediated at the intersections of multiple affordances and in relation to each other, rather than "in isolation or as mutually exclusive" (Kitzie, 2019), to scrutinize the sustainability of such practices (see Nathan, 2012), and to identify tactics to change them (Wohlwend, 2020). Moreover, as Bon et al. (2022) have argued, achieving a more inclusive digital society instead of "digital coloniality," requires the active involvement of all types of stakeholders as co-researchers, co-creators, or co-designers, also from the parts of the world and our societies that often are excluded from the decisions that shape information ecosystems.

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