



Information behavior and practices research informing information systems design

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Abstract

Information behavior and practices (IBP) research has been repeatedly criticized for having little impact on information systems development (ISD). Claiming that there is a complete disconnect would be an exaggeration but it is apparent that it is not always easy to translate findings of IBP research to workable design recommendations. Based on a reading of earlier literature and a closer investigation of three illustrative example contexts, this article underlines that the value of IBP research for ISD lies in its capability to inform ISD of the variety of ways people deal with information beyond individual systems, their own wants and designers' assumptions. Moreover, it highlights that the implications of information systems go beyond their primary users. Instead of overemphasizing the contextuality of findings, a part of IBP research would benefit from an increased focus on explicating its epistemological extents and limits and identifying, which findings are transferable, what distinguishes specific contexts, what are their defining constraints and priorities, and what aspects of their uniqueness are assumptions and simple clichés.

1 | INTRODUCTION

The concern for a disconnect between information behavior and practices (IBP) literature and information systems development (ISD) has been voiced regularly especially by IBP researchers (Fidel, 2012; Fisher & Julien, 2009; Haider & Sundin, 2019; Ingwersen & Järvelin, 2005; Julien et al., 2011; Julien & O'Brien, 2014). In parallel, ISD literature has called attention to the need for a better and more holistic understanding of user

needs and perspectives (Leitch & Warren, 2010). Bates (1986) underlined that digital information environments should be developed to support human needs, practices, and behavior. Hepworth (2007, p. 33) claimed much similarly that: “[u]nderstanding the consumer of data, information and knowledge is becoming increasingly important in relation to the design and development of electronic information products and services.” There are examples of applying knowledge of information consumers' informational needs and wants in ISD

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and especially human and design-oriented strands of ISD have developed a detailed understanding of the rapport between people and information technology (IT) artifacts (Grudin, 2011; Hevner et al., 2004). However, as Hepworth (2007) argues, IBP research has developed a more detailed body of knowledge of the *information* consumer. This can be considered particularly relevant when designing information systems (IS) that, by definition, are explicitly focused on communicating and providing people with information and supporting their information activities rather than automatic or semiautomatic processing of information (cf. e.g., definitions listed by Alter, 2008 and social or socio-technical versus technology and process-oriented views in Boell & Cecez-Kecmanovic, 2015). Whereas system-centered approaches in IBP have been claimed to fail to account for individual informational preferences, user-centric models are thought to increase understanding of individuals' information behaviors and their possible influence on system use. These behaviors include, for example, information searching and seeking, their underlying mechanisms, sense-making, and information avoidance (Harland & Bath, 2008).

There are undoubtedly several different reasons why some of the insights from the long tradition of IBP studies have not ended up informing the development of new ISs. For instance, IBP and ISD researchers have had a tendency to keep apart, publishing and presenting in their respective outlets. Johnstone et al. (2004) suggest that a difference in the focus of interest might be a reason for the lack of interest in IBP within the IS discipline. Users and their role have been discussed extensively in systems design literature (see e.g., Kujala, 2003) but with an emphasis on the functional capabilities of technologies and human interactions with ISs rather than on human information processing. Moreover, especially the descriptive (versus prescriptive) strands of information behavior research can be criticized for a certain reluctance to explicate the practical implications of their findings (Fidel, 2012; Makri, 2020). This applies both to design and development, and the broader societal impact of research (Steinerová, 2019). Haider and Sundin (2019) note that contemporary IBP research tends to position ISs simply as one of the many elements relevant for people's information activities, making them and their role for people's activities move further away from the main focus of interest. At the same time, they argue, ISs have clearly moved into the center of everyday life and should also, according to them, be moved "back into the centre of information science" (Haider & Sundin, 2019, p. 7) and its research interest. However, despite the relative disconnect between the two communities, there is no doubt

that IBP research has contributed a lot and has further potential to do so for ISD and vice versa.

The aim of this article is to contribute to IBP research by inquiring into its interface with ISD for new insights into (a) how different approaches to IBP research can inform ISD, and (b) how IBP researchers could express their findings in a manner that makes them more relevant and easier applicable in the context of ISD. Rather than addressing the general research-practice disconnect, the focus is on positioning IBP research in relation to the ISD field. We use IBP as an umbrella concept to refer to the totality of information-related human behavior and practices following T. D. Wilson (2000) and Case and Given (2016), and ISD to refer to "integrated social and technical practices of conceptualizing and realizing information technology-based systems, and managing the associated changes and implications to accomplish specific goals in organizational contexts" (Hassan & Mathiassen, 2018, p. 178)—and as could be added, also outside of organizational contexts in everyday life. IBP is one of the major research areas in information science whereas ISD research is mostly conducted in computer and IS science, including software engineering, human-computer interaction (HCI), and computer-supported cooperative work (CSCW), but also to an extent in information science as the literature review below demonstrates. Instead of attempting to provide a systematic review of all IBP research, this article explores these questions with the help of examples from three widely different fields, namely, consumer-centered e-health (CCEH), digital archaeology, and safety-critical environments, all within the authors' areas of expertise, and where IBP research has informed and has opportunities to inform ISD and engage with it. Scrutiny and comparison of experiences and observations from these three contexts help provide insights into the IBP research and ISD nexus, as well as the long-established but still largely unresolved question of how to develop ISs that match with the needs, preferences, behavioral patterns, and practices of their intended users.

2 | IBP AND ISD

2.1 | IBP research in relation to ISD

Characteristic to IBP research are domain-specific studies of the IBPs of, for example, professional groups (Case & Given, 2016), whereas much of ISD research has focused on the design and usability of specific ISs for particular groups or individuals (Kim & Crowston, 2011). IBP research is, also, often more focused on understanding and describing the diversity of users and situations than

explaining them (Haider & Sundin, 2019). In contrast, even if the complexity of social situations where systems were designed and used urged for “softer” human-centered approaches to systems engineering already in the early 1980s (e.g., soft systems methodology and systems thinking, Checkland, 1981), much of IS science is dominated by confirmatory and prescriptive rather than descriptive (Fidel, 2012)—or as Iivari (2007) adds, design-oriented research. Moreover, the heterogeneity of theoretical perspectives in IBP research (Haider & Sundin, 2019) complicates the pooling of insights between studies.

There are, however, examples of IBP research that are explicitly linked to ISD. Of individual IBP researchers, Bates has produced a comprehensive line of research with explicit recommendations to systems design already in the 1980s (Bates, 1994; Bates, 2016a, 2016b). Other examples of systems-oriented IBP research include Huvila's (2012b, 2018a, 2018b, 2018c) and colleagues' work in archeological information management, Somerville and colleagues' Informed Systems framework that promotes using information to learn during systems design and within designed systems (Somerville et al., 2019), and Du and colleagues' work on marketing professionals' information seeking (Du, 2014; Du et al., 2013) that provide guidance for designing systems that match information needs during professionals' information journeys. In addition, recent research in health information behavior and e-health technology has aimed at increasing understanding of IBP as a factor that affects ISD and technology use (Eriksson-Backa & Nguyen, 2020; Huvila et al., 2016; Moll et al., 2018). Researchers have examined e-health users' health information acquisition both in context (Lee, 2018; Oh & Kim, 2014; Yoon et al., 2017; Zimmerman, 2018) and in specific systems (Huvila et al., 2018; Rexhepi et al., 2015; Sabelli, 2014). Studies have also investigated individuals' health information-related capabilities and opinions about e-health services (Enwald et al., 2018) and, for instance, how factors such as time (Tana et al., 2020), gender (Rowley et al., 2017), or diversity (Caidi & Dali, 2017; Dali & Caidi, 2017) influence information use.

Moreover, ISD-oriented research in information science, for instance, on information searching and retrieval, is feeding to the development of search systems (Ingwersen & Järvelin, 2005; Järvelin & Wilson, 2003; White, 2016)—although here it is relevant to remark that a gap that is comparable to the one between IBP and ISD has been claimed to disconnect information retrieval and IBP research (Haider & Sundin, 2019) and, in general, research and practice.

There are also examples of projects explicitly focusing on translating findings from IBP research to ISD (Huvila

et al., 2013; Huvila et al., 2016; Lin & Hertzum, 2018), as well as work residing in the interface between ISD and IBP research (Blandford & Attfield, 2010; Dillon, 2016; Fidel & Pejtersen, 2004; Sonnenwald & Lievrouw, 1997). Participatory design is also increasing in popularity as a research method in information science (Greifeneder, 2014; Meyer et al., 2020), has obvious potential for increasing cross-pollination between design-oriented ISD (Baskerville et al., 2018) and IBP. As Greifeneder (2014) remarks, a contributing factor to the seeming dearth of IBP-oriented design studies is that work related to information use, creation, saving, and learning is not always included in reviews of IBP research. Despite examples of convergence between IBP research and ISD, there is room for a more lively exchange between the two fields.

2.2 | IBP-ISD gap

The criticism that IBP research fundamentally diverges from ISD has been put forward by several information researchers (Fidel, 2012; Fisher & Julien, 2009; Haider & Sundin, 2019; Hepworth et al., 2014; Ingwersen & Järvelin, 2005; Julien et al., 2011; Julien & O'Brien, 2014). The gap becomes evident, particularly when compared to such neighboring fields as HCI and CSCW with lively exchange with ISD (Isomäki & Pekkola, 2010) and multiple points of convergence with IBP (Gorichanaz & Venkatagiri, 2021). They share partly overlapping interests with IBP but take an a priori focus on IT artifacts, whereas IBP research concentrates on people and their information-related actions and perspectives without prioritizing particular technologies—even if as Fidel (2012), and recently Gorichanaz and Venkatagiri (2021), correctly remind us, there is nonnegligible overlap. Unsurprisingly, even if technology-agonistic conceptions of ISs are common both in IBP and ISD, the implicit and explicit definitions of “information system” in IBP and information science (Buckland, 1991; Fidel, 2012; Haider & Sundin, 2019; Swanson, 2017) have a tendency to downplay, and in ISD and ISs contexts to emphasize (Gregor & Hevner, 2013; Hevner et al., 2004; Rainer et al., 2020), the position of IT artifacts as a key component of ISs.

Many factors have contributed to the current situation—yet hardly a lack of mutual interests and potential (Beyene & Byström, 2017; Haider & Sundin, 2019). Context-specific findings of IBP research (Makri, 2020) can be difficult to generalize, and research designs sometimes suffer from methodological shortcomings and a lack of standardized measures (O'Brien et al., 2017). As Fidel (2012) suggests, IBP research appears to show a certain resistance to frame key concepts, including information, in easily operationalizable terms. The usefulness of

IBP theories in explaining the information-technology nexus has also been questioned (Allen, Given, et al., 2019). Moreover, IBP researchers tend to frame the impact of their findings narrowly in specific parts of a broader information experience, instead of combining insights for, for example, assisting people to find information by the development of tools *and* provision of personal assistance (Huvila, 2012a, 2012b). Moreover, findings are not always communicated in a manner and language that is useful or comprehensible for ISD (Allen, Irnazarow, & McLaughlin, 2019)—and designers might not see the value of applying them.

3 | ILLUSTRATIVE EXAMPLE CONTEXTS

In the following subsections, three illustrative contexts in the authors' areas of expertise, namely, CCEH, digital archeology, and safety-critical environments, are described to provide insights into the ways IBP research can inform ISD. This is done both to concretize and illustrate the potential impact of IBP and to underline the contextual and situational nature of IBPs that is impossible to avoid when considering the applicability of IBP research. The purpose of these three exposés is to use them to highlight three different perspectives to how IBP research can provide useful insights into ISD in contexts where developing useful ISs has proven to be difficult (Monkman & Kushniruk, 2015) and to showcase how a better understanding of IBPs can potentially help to overcome these hurdles. The three contexts highlight the (a) critical importance of personalizing not only systems but also information (i.e., contents) to their multiple users with often different needs, wishes, and competencies; (b) different and potentially longer temporalities of information than systems and systems related behaviors and practices; and (c) how many technical and decision-making tasks are tightly intertwined with critical information tasks that IBP research can elaborate and thus contribute to a design of task-relevant ISs. Even if the contexts have been selected with a particular set of insights in mind, the exposés show that there is non-negligible overlap in how and what practical and theoretical issues are pertinent in multiple contexts.

3.1 | Consumer-centered e-health

Consumers or clients are increasingly expected to take an active role in their healthcare and decision-making (Johnson & Case, 2012), which emphasizes the significance of understanding and taking into account individuals' health-related IBP. CCEH applications range from

patient-accessible electronic health records to services designed to improve and support wellbeing in people's daily lives. A closer look at CCEH highlights issues related to the diversity of contexts where information leveraged by ISs is used in everyday life and provides an illustrative example of a context where many ISs operate in the consumer-professional boundary. The systems and especially types of information provided for consumers have their roots in professional healthcare and medical records (Martikainen et al., 2018; Pitkänen & Pitkäranta, 2016), with features and particularly content developed for professionals rather than consumers. As a result, CCEH applications can be difficult to understand and use because of their poor fit to their lay users' IBP. In contrast to many systems developed for professional users, CCEH services aim to serve broader audiences, which is a challenge for ISD as people's information needs are similarly broader and subject to diverse internal (Beverley et al., 2007) and external (Zhang, 2013) factors.

CCEH-related IBP research has also demonstrated how people's health information environments extend far beyond individual systems (Huvila et al., 2016). However, a recent systematic review of studies on CCEH use revealed that most studies concentrated on the usability and accessibility of the ISs instead of their usefulness or the value of their information content to their users (Hirvonen, Enwald, Käsäkoski, et al., 2020). These factors are important, however; when studying lay users' opinions on the national patient-accessible electronic health record My Kanta in Finland, consumers' concerns and barriers to use this service were not merely technical, social, or socio-technical but "socio-techno-informational," by being tightly connected to the information contents of the electronic health record (Eriksson-Backa et al., 2021).

A central contribution of IBP research is that it goes beyond the socio-technical and puts explicit emphasis on explicating people's diverse information needs, their ways of seeking, evaluating and using information, and their situational and social (Zhang, 2013) underpinnings. Information needs are also subject to diverse personal factors, including individual health conditions, previous interactions with information providers, and varying support from friends or family (Beverley et al., 2007). Enwald (2020) remarks that consideration of individual characteristics is the fundamental premise of tailoring (or personalizing) health communication in digital information services and systems. In CCEH context, IBP research has, for example, underlined the need to provide contextual information such as dictionary definitions, background information, and explanations of medical information for nonprofessionals (cf. Baudendistel et al., 2015; Eriksson-Backa et al., 2021; Zhang, 2013),

and providing links to additional authoritative information (Rexhepi et al., 2021, cf. Eriksson-Backa et al., 2021), organizing information according to comprehensible subject categories, providing assistance for query formulation, layered presentation of results, and adding functions for sharing or moving information between stakeholders, sources or platforms (Zhang, 2013). IBP research has also helped to situate discrete e-health services in a broader sense as tools for individuals' personal health information management (Civan et al., 2006). Beside their intended principal function, CCEH services are frequently used as a combination of an information source, a personal archive, and a channel or tool for contacting and exchanging information with both peers and healthcare providers.

A long line of research also points to the significance of health information literacy as a basis for tailoring and personalization of CCEH. As a concept tightly connected to IBPs, and unique to the field of information science, health information literacy covers competencies relevant in health settings, including those needed to seek, evaluate, understand, and use information. People have been found to face challenges with different aspects of health information literacy (Hirvonen, Enwald, Mayer, et al., 2020). These challenges differ according to individuals' background and life situations (Enwald et al., 2018, Eriksson-Backa & Nguyen, 2020; Hirvonen, Enwald, Mayer, et al., 2020; Huvila et al., 2019). Beside the already mentioned issues, the importance of the comprehensibility of information content has been emphasized in IBP research (Baudendistel et al., 2015; Eriksson-Backa et al., 2021), suggesting that health information could be provided on different levels of complexity and scope in ISs (cf. Easy Readers literature versus ordinary fiction) and targeted to persons based on a screening of health information literacy (cf. Monkman & Kushniruk, 2015).

3.2 | Digital archaeology

While CCEH-related IBP research highlights how an IBP perspective can shed light on the need and means to address informational needs and preferences of individuals alongside but distinct from their technological priorities, a glance at IBP and ISs in digital archaeology provides an illustrative example of how information and technology behaviors change in different pace and what implications it has for ISD. A common problem with the development of archeological IS is that they are developed for contemporary needs in project, region, or at the most, country-specific contexts without enough attention to change of different and changing user needs in timespace.

Even if archaeology has a reputation of being technology and data management savvy than many other scholarly fields, several factors complicate the development of ISs for archeological field documentation, data management, and analysis. Archeologists use a broad variety of information sources from historical, geographical, geophysical, and contemporary documentary materials to close and long-range observational and linguistic data in their work. In parallel, the long temporal perspective and scope of research work and its interest in the human past and present, coexistence of several parallel standards and assumptions of what counts as information, and the often fragmentary nature of the available evidence makes archeological information highly heterogeneous. The documentation and analysis methods have a similarly broad scope and diverse epistemic underpinnings ranging from positivism to interpretivism and from qualitative and hermeneutical interpretation to advanced statistics to machine learning (Carver, 2009; Léglise et al., 2018). Moreover, even if there are successful examples (Gruber et al., 2013; McKeague et al., 2019) and striving for an increasing standardization of the management of arts and humanities research information (Moulin et al., 2011; Vanden Daelen, 2018) and development of formal scholarly workflows, for instance, the fragmentary and iterative nature of information processes (Buchanan, 2016; Huvila, 2018a, 2018b, 2018c; Wylie, 2017) complicate such endeavors. The rapid development of new methods has increased the complexity of information and technology requirements in the field and simultaneously raised concerns of a widening gap between technology use and the development of an in-depth theoretical understanding of its implications in the contexts of research where it is applied (Fiormonte et al., 2015; Smithies, 2017). Symptomatic of these concerns are the lingering debates on if and how it is relevant to juxtapose digital and nondigital practices (Huggett, 2015; Huvila & Huggett, 2018; Zubrow, 2006), how to understand and describe what is digital archaeology, and concerns that research is driven too much by technological means and too little by archeologically interesting research questions.

From an IBP perspective, an apparent defect in the discussions so far is the polarization of the debate between humans and technologies, the relatively scarce attention to digital and nondigital IBPs and especially, to the implications of how information is managed and used in the course of research. Much of the debate lingers on the people-technology axis rather than on how archeologists interact with earlier and current genres and forms of archeological information and what informational implications and outcomes new systems have. To this end, the existing, albeit somewhat scarce, research shows the power of IBP concepts and models from

information horizons (Huvila, 2009; Sonnenwald, 2005) to conceptualizations of information searching and seeking processes (Palmer et al., 2009) explicating the patterns and unfolding of archeological, and in broader terms scholarly, information work (Given & Willson, 2018 on complexity of research IBP; Huvila, 2018a, 2018b, 2018c on nonlinearity and discontinuity of archeological information processes) in time and in relation to its changing infrastructures and tools. In parallel, digital archaeology is an illustrative context where the choice and use of different nondigital and digital information technologies in different times highlight the importance of following IBPs rather than mere technology-use to account for the informational implications of introducing new and abandoning old ways of managing and manipulating information. This makes it easier to avoid cosmetic interface-level accommodation of obvious (information) needs and focus on making both ISs and information itself compatible with IBPs. Without a comprehensive insight into what IBPs particular system supports with its different stakeholder groups, introducing a new system might disrupt many of the IBPs even if the system would appear to come with many apparent benefits and no obvious drawbacks.

3.3 | Safety-critical environments

In safety-critical environments, a critical issue is to provide people with actionable information in time. The literature shows that the available systems are not always helpful to this end. The social practice of making sense of information and user interactions with tools for decision-making have been studied extensively in such contexts, although fairly seldom with a specific attention to IBPs. A typical example of such an environment is an airline cockpit. A typical perspective has been that of HCI, in particular, with references to distributed cognition, which focuses on the interactions between the internal and external representational structure of information as structured activity (Hutchins & Klausen, 1996). For instance, studies have described pilots' strategies of consulting procedural aids in emergency situations (Carim et al., 2016) and the value of having such tools as the Quick Reference Handbook that is not a part of aircraft systems (Pauchet et al., 2018). Further, researchers have specifically considered the balance between context as representation and context as interaction (Dourish, 2004; Pauchet et al., 2018) and the mutual understanding in the human-agent team, with particular emphasis on the transparency of systems in human-agent team operations (Schaefer et al., 2017). The structured activity in a cockpit environment demonstrates that the expertise lies in the knowledge and skills of human actors and the

organization of systems and tools in the workplace (Hutchins & Klausen, 1996).

In contrast to human factors research, there are very few IBP studies conducted within this domain. An exception by von Thaden (2008) introduced the concept of distributed information behavior system to understand the social information practice in a safety-critical environment in a flight simulation study, with 19 pilot training students. Video-recorded transcripts were analyzed as information acts between high and low-performance crews. A key finding of the study was that “[o]verly conditioned information behaviors, which would

TABLE 1 Problems stemming from the information behavior and practices (IBP)-information systems development (ISD) gap and potential ways forward

Problem	IBP actions	ISD actions
A: Too little attention to information and informational needs	Engage with ISD research and practice and make findings actionable for ISD	Consider collaborating with content developers and IBP researchers
B: Understanding rather explanation or action orientation in a part of IBP research	Provide actionable implications in IBP studies when possible; explain the rationale of the study (to provide understanding or to inform ISD)	Use understanding-oriented research to guide thinking rather than as a blueprint
C: IBP research is unclear about its object of study	Explain explicitly what is being studied: What is meant, for example, by information, practices, or behavior	Consider what an IBP study is investigating without assuming a particular conceptualization of, for example, information or IBP
D: An IS is not always the solution to a human problem	Be explicit with findings and communicate them to audiences outside of one's own discipline	Consider to be open to solutions that are not based on technologies
E: IBP findings are too contextual to be useful	Put more effort on explaining, which findings are transferable and how	Consider if and how IBP findings are relevant in the context-in-hand

Abbreviation: IS, information systems.

correspondingly limit methodical information behaviors, can lead [flight] crews to miss crucial steps in the process of projecting the future state of the aircraft and suitably planning ahead” (von Thaden, 2008, p. 1,567). HCI problems in a cockpit are essentially not (only) human-technology problems but in fact, information seeking, searching, and organization or management tasks. A closer attention to IBP can help to understand and communicate better the rationale of using the technologies in particular ways not only for making sense of and performing technical tasks at-hand, but as a part of how pilots learn, interact with information, and know what they need to know in the work. The findings of existing IBP research, however, have not been widely adopted in the design of systems in the airline cockpit.

Outside of aerospace context, a study of information seeking practices in an emergency department (Hertzum & Simonsen, 2019) makes a related observation that information seeking is shaped by procedures in the workplace. Specifically, the triage and timeout procedures in an emergency department for normal, abnormal, and emergency situations evoked different tasks, and experts and novices used different information-seeking strategies. The findings highlight the dynamic nature of context, which evokes tasks, procedures, and information practices when interacting with the internal (i.e., human actors) and external (i.e., systems and tools) representational structure of information. In particular, an IBP perspective is potent in enriching the understanding of the interplay among the context, tasks, procedures, and user interaction with systems. Similar evidence has been gathered also outside of the emergency context. A study of the relationship between tasks and information resources (Freund, 2013) revealed

that task type (i.e., learning, fact-finding, doing, decision-making, and problem-solving) and document genre (e.g., best practices, frequently asked questions documents (FAQs), product documentation, and whitepapers) and their interactions affect the perceived usefulness of documents in the workplace. Earle et al. (2015) found that apart from tasks, also work roles and past experience affect the use of software documentation. Salminen et al. (2020) further demonstrate that the work roles of professionals (marketing professionals and data analysts) affect their visual engagement with the persona system.

Finally, back in the cockpit, Liu et al. (2020) designed and conducted a user evaluation of conversational agents for pilots drawing on IBP theory and earlier empirical findings. A prototype system called Smart Librarian was developed to access the Flight Crew Operating Manual in a cockpit environment. The user experiment with flight school students in a flight simulator revealed that user perceptions of the usefulness of the system and its relevance are good predictors of search performance. These findings combine earlier observations and highlight how IBP literature as a whole can make a major contribution to the design and evaluation of domain-specific conversational agents by conceptualizing the system design problem not as a procedural issue but as a question of addressing a series of information seeking, searching, and organization or management tasks. Information practices are constrained by the contexts of information seeking, tasks, and procedures, with particular references to work roles, search tasks, and user-perceived usefulness of documents. Moreover, in the cockpit context, IBP provides a vocabulary and language to discuss and describe IBP issues in systems design context.

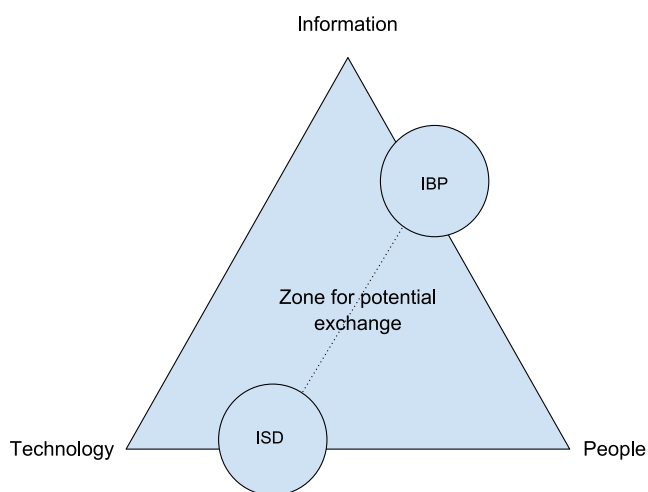


FIGURE 1 Focal areas of interest in information behavior and practices (IBP) and information systems development (ISD) research and the zone of potential exchange between the two fields

4 | DISCUSSION

4.1 | Framing the IBP-ISD gap

The comparison of experiences and observations from the three illustrative example contexts of CCEH, digital archaeology, and safety-critical environments provide several insights into the nexus of IBP research and ISD. It is possible to identify both differences and points of convergence. IBP and ISD clearly fall under the same umbrella framework interested—with different emphases—in people, technologies, and information. Even if it is obvious that much of the present IBP-ISD gap can be traced back to the general lack of convergence between IBP and ISD communities, we suggest that there are certain specific issues and ways forward to consider for bridging the gap (summarized in Table 1 and discussed in more detail below). These are partially

illustrated by the three above-discussed illustrative contexts. At the same time, it is important to underline that there is also room for both basic and applied IBP research that does not attempt to inform ISD but has other implications, for example, by providing general understanding of IBPs and informing management and organization of human action.

4.1.1 | Too little attention to information in ISD

Above all, the three cases highlight what IBP research is all about (cf. Case & Given, 2016; Makri, 2020)—its capability to shed light on the variety of ways people deal with *information* in very diverse contexts and beyond the use of individual ISs. Health IBP research points to the need to consider the diverse ways different groups of people interact with information, not only with ISs (Johnson & Case, 2012). Digital archaeology suggests the importance of following the “red thread of information” (Bates, 1999, p. 1,048) and IBPs in time across and with often fast-changing technologies and tools. Safety-critical environments do for their part point to how inherent IBPs underpinning a technical task have a crucial impact on its outcomes and completion. Even if it would be a similar exaggeration to criticize ISD for ignoring information content altogether that it is to disregard the engagement of IBP research with technologies (Gorichanaz & Venkatagiri, 2021), the primary interest of ISD is in human-technology interaction where information tends to remain relatively unarticulated. In contrast, IBP is primarily about information and people, not about systems. Needs, preferences (Beverley et al., 2007; Harland & Bath, 2008), and intentions vary between individuals with different tasks and situations similarly to how individuals engage with information by diverse means of seeking, browsing, and encountering (Makri, 2020). While both earlier and contemporary ISD has made significant progress in explicating how people deal with technologies, IBP has done the same with people and information. We argue that the major point of convergence lies in this complementarity of the perspectives sketched in Figure 1.

As the studies with pilots, archeologists, and e-health consumers demonstrate, IBP can help to counter purported tendencies of user interface and user experience designers (Arowoselu, 2020), system developers, and others involved in envisioning ISs to design systems for themselves (Keates, 2006; Lin & Hertzum, 2020) by providing understanding of what kind of information users need beyond what they want and what designers assume that the users might prefer. By unfolding the complexity

of information practices, IBP research—and as Bates (1986) suggested, information science theory, in general—can guide ISD from occasional simplistic assumptions about the linearity and uniformity of information processes (e.g., Arnott, 2010) and encourage ISD to explore approaches that are resilient to complexity and fluidity of information and how people deal with it in a socio-techno-informational (cf. Eriksson-Backa et al., 2021) rather than merely socio-technical sense. This is exemplified in the CCEH context by failures of taking individual preferences but also contextual factors and suitable content properly into account. In archaeology, it is illustrated by the diversity of archeological work and its underlying epistemic assumptions. This can be seen even in the highly structured safety-critical environments, in how established procedures are applied rather than followed to the point based on current information needs. Here, IBP concepts and especially the “sociologically and contextually oriented line of research” (Talja, 2005) conducted from information practices and domain analytic perspectives can be helpful in providing keys to understanding why, how, and when people do not always work as systems designers expect them to work. Consequently, this understanding can be used to facilitate collaborating with content developers and to inform tailoring of systems and services for their users and specific types of interactions with information.

4.1.2 | Orientation toward actionability versus providing understanding

From an ISD perspective, an ostensible problem with a lot of IBP research is its tendency to be eclectic and focused on describing and understanding phenomena rather than being directly actionable. This characterizes IBP research in all three discussed illustrative contexts. However, as with all research, there is undoubtedly a place for basic IBP research as well as research that aims directly at informing practice. Even if the gap between these two strands of research is very real in the information science field (Haider & Sundin, 2019), it does not need to be as impermeable as it sometimes seems to be. A better understanding of information experiences and phenomena is no less useful than studies of critical success factors and causalities, but their contribution to and usability in ISD are fundamentally very different. The sometimes misplaced expectations reminds of Dourish's (2006) criticism in the HCI community that ethnographic studies should explicate “implications for design” while the real value of ethnographies is in providing “models for thinking about those settings and the work that goes on there” rather than a bullet-point list of

how-to-dos. Besides rectifying inaccurate ideas of understanding-oriented research (as Dourish suggests), including ethnography and others, among ISD and IBP researchers alike and to use them, it would undoubtedly be helpful if IBP researchers would be more explicit about the aims of their studies. When the aim of a study is to provide orientation and basic understanding of information phenomena rather than to directly guide practice, it can be advisable to focus on explaining IBP in the study context rather than to attempt to enumerate technical recommendations to, for instance, ISD. Whenever the aim to provide orientation is clearly articulated, the findings are easier to integrate as a part exploring in the early phases, the “fuzzy front end” (Herstatt & Verworn, 2004), of a development project. However, when aiming at providing guidance, IBP research should be explicit about making recommendations. Bates’ corpus of work on humanities scholars (published in Bates, 2016b) with a set of orienting papers on their IBPs and others with recommendations for systems design, could serve as a useful example to this end. As Fidel (2012) notes, IBP research tends to favor descriptive models, whereas the IS field tends to prefer normative models. There is no point in denigrating the value of descriptive models but in the spirit of distinguishing basic and applied IBP research, the research should not stop at the descriptive model but should proceed, distill observations and develop prescriptive models on the basis of the results from the studies that focused on understanding phenomena. Boiling down findings could also result in simpler design models favored in ISD (Bates, 2016a; Dillon, 2016)—in comparison to often complicated and eclectic ones that tend to be typical for IBP research.

The use of IBP research as a language to communicate with the system designers about the users’ perspectives to their information needs and use, to inform ISD decisions, and to adopt a user evaluation of the prototype system in the safety-critical environments case provides an example of an additional approach to making the understanding of IBPs actionable. However, so far, user evaluations have been rarely conducted in the design of conversational search systems, even if research in this area has attracted lots of interest recently (Logacheva et al., 2020; Radlinski & Craswell, 2017; Trippas et al., 2020).

4.1.3 | Unclear objectives of IBP studies

There are also differences in ISD approaches, systems, their contexts, and situations of design and use that entail different approaches to implementing these recommendations. IBP research can inform them in various phases of ISD and particular insights from IBP research can turn out to be useful with specific design and development

methods. In this sense, a typical shortcoming in the contemporary IBP research is that we might not know enough about the epistemological underpinnings of IBP theories—and what they actually do explain (cf. Sovacool & Hess, 2017). The problem is similar to what counts as digital archaeology and digital archeological practice in the digital archaeology case. Therefore, IBP researchers should describe their epistemological underpinnings in more clear terms. The lack of clear understanding of what IBP researchers write about when they are referring to IBP makes it difficult to apply its results to inform practice. These complications remind of the on-going conundrum of integrating design science perspectives in ISD (Baskerville et al., 2018). The lack of clarity applies to IBP research also outside of information science. T. D. Wilson’s (2020) review of the impact of IBP research suggests that when the concept of IBP is used outside of information science, it is often used in unspecific terms without a clear explanation of what it entails. It also raises the question if IBP research as a whole is too empirical and if the empirical and theoretically aligned lines of work could be brought closer to each other.

4.1.4 | An information system is not always the answer

Further, the implications and usefulness of the results of IBP research do not always need to relate to ISD, but could be somewhere else—for instance, in the spirit of action research (Checkland & Holwell, 1998), in informing the investigated groups of individuals or other stakeholders of studied activities like policymakers, managers, or those who are indirectly working or interacting with them. The true impact can also be difficult to identify and measure (Lund, 2019). While, as Hepworth (2007) criticizes, ISD is not focused on information processing beyond interaction with the system, IBP research is explicitly interested in the broader context of human information activity. In contrast to what designers sometimes expect, systems are not always considered to be useful at all (Hirvonen, Enwald, Käsäkoski, et al., 2020) and the reasons for their nonuse can be perfectly legitimate. This has become blatantly evident, for instance, in relation to health information and e-health services. Similarly to how an in-depth HCI-oriented ethnography can advise what types of systems *not* to develop (Dourish, 2006), IBP studies can help to disclose how and why ISs are not as useful as they might appear, what alternatives there are, and why people might prefer them. Here, especially the people-oriented IBP research that usually considers any system that provides “information services intended to result in human beings’ becoming informed”, including “archives, libraries, databases, and so on” (Buckland, 1991, p. xiv) as an IS and focuses literally on

people's IBP rather than any tools or systems, can help to understand how to facilitate human action without assuming that the solution needs to be a computer-based IS.

4.1.5 | Too contextual findings

The contextuality of information interactions also means that explanations and recommendations have the most value when they are connected to specific services and contexts of use—even if there are many general traits in how people interact with information. Similarly to design-oriented ISD research (Hevner et al., 2004), a part of it is perishable when contexts, information sources, and technologies change. The problem is that these tendencies manifest themselves in different ways in different contexts as the digital archaeology case blatantly exemplifies. One of the strengths of IBP research (Makri, 2020)—that IBP is examined on multiple different levels from interactions with specific systems to domains, groups of users, and beyond—also becomes its weakness due to the incommensurability of the findings obtained in studies with widely different points of attention.

IBP research would undoubtedly benefit from an increased focus on identifying, which findings are transferable and how, in contrast to the far too typical conclusion that IBP is complicated, highly contextual, and impossible to generalize. As information interactions and learning always happen in specific contexts, this would not necessarily imply a turn to an extreme form of what is usually described as positivism, but a closer consideration of what an analytical transferability of findings—that contextual and case-based research still has broader validity beyond a unique situation—means in practice. A parallel closer consideration of what really distinguishes specific contexts, what their defining constraints and priorities are, and what aspects of their uniqueness are mere assumptions and clichés would be helpful to the same end. For instance, in archaeology, the complexity and fragmentary nature of archeological information is a plain fact but there is still a lot of information available and the understanding of the past is gradually increasing.

4.2 | Rethinking IBP-ISD nexus through usefulness

Besides integrating technology perspectives in IBP research and models (Huvila, 2018a, 2018b, 2018c; Zhao et al., 2021) and bringing information into ISD (Fidel, 2012; Gorichanaz & Venkatagiri, 2021;

Marchionini, 2008), one possible approach to rethinking IBP research and its links to ISD could be to consider it more closely through the concept of usefulness (cf. Huvila et al., 2019). Thinking about the multiple possible levels and ways of how IBP research itself can be made relevant both in theory and practice for ISD and in different illustrative contexts—from CCEH to digital archaeology and safety-critical environments—might help to find ways to bridge the criticized gap. Thinking about the partly undoubtedly real and partly imagined (Fisher & Julien, 2009; Haider & Sundin, 2019; Ingwersen & Järvelin, 2005; Julien & O'Brien, 2014; Julien et al., 2011 cf. Makri, 2020) gap itself might not be exactly that helpful. Rather, thinking about the major difference of emphasis of ISD and IBP outlined in Figure 1, framing the complementarity of IBP for ISD could be done through its explicit focus on the usefulness of information versus the usefulness of IS. In this sense, it is obviously necessary to consider IBP, as Makri (2020) reminds us, not only as an influencing factor but also as a trait that is shaped by systems and how they are used. Thinking about different forms, types, and contexts of usefulness could help to open a more holistic understanding of people's information landscapes and practices and could provide novel insights into understanding systems in their lifeworld-wide context of use: a better understanding of why people do things with systems that are difficult to anticipate and understand, and why there often seems to be discrepancies between how people think and act.

5 | CONCLUSIONS

The value of IBP research for ISD lies in its capability to shed light on the variety of ways people deal with information in diverse contexts beyond their wants and designers' assumptions. The situated and contextual understanding of IBPs that goes beyond individuals' information interactions with specific ISs and fathoms them in their lifeworld-wide context of use is a major strength of IBP research. IBP is interested in information rather than systems, their design, uptake (Hevner et al., 2004), and “associated changes and implications” (Hassan & Mathiassen, 2018, p. 200). In this respect, an increased focus on stressing the *usefulness of the information*, the systems are used to process in the context of people's information landscapes and practices, rather than the usability or usefulness of specific systems, could help to position IBP clearer as a critical human factor in ISD and clarify the relation of the two fields. The broad focus of IBP research also has the potential to highlight the implications of ISs beyond their primary users. Moreover, instead of overemphasizing the contextuality of findings, IBP research would benefit from an increased focus on

identifying, which findings are transferable, what distinguishes specific contexts, what their defining constraints and priorities are, and which aspects of their uniqueness are assumptions and simple clichés.

IBP researchers should also be more explicit about the aims of their studies. When the aim of a specific study is to provide understanding rather than to guide practice, it would be advisable to admit that without attempting to enumerate unspecific recommendations to, for instance, ISD and instead focus on explicating implications on a broader level. Further, as earlier literature has pinpointed, IBP research and theorizing are not always clear enough about their epistemological underpinnings, that is, what they actually describe and explain when they are referring to IBPs. IBP research has a potential to provide a vocabulary, or as suggested in the safety-critical environments case, a language to communicate user perspectives to systems designers and vice versa in a lifeworld-wide socio-techno-informational sense. As a whole, IBP and ISD research have a lot in common. They both share a passion for helping people to deal with information in their pursuits. What is perhaps needed the most, is a serious dialogue and a small dose of clarity in what individual IBP studies are aiming at and capable of doing in such terms that are actionable in ISD.

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