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HUMAN-INFORMATION INTERACTION: AN EXPLORATION OF USER BEHAVIOR, INFORMATION SEEKING AND LIBRARY ENGAGEMENT

BY

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Abstract:

Purpose: *The aim of the study is to determine how people process information in the digital contexts in terms of information seeking behavior, their use in libraries and information literacy practices. It aims to analyse the impact of cognitive, social, and technological factors on the user behaviour on the way the old models of information-seeking between Wilson (1999), Kuhlthau (1991), and Savolainen (1995) are applicable in a digital environment.*

Design/Methodology/Approach: *The paper was a qualitative research design that was exploratory and intended to offer a thorough insight on human-information interface, especially user seeking, receiving and exploiting of information within digital and library settings. Exploratory research design is suitable since HII relates to intricate social, cognitive, and contextual procedures that involve amorphous inquiry and interpretation as opposed to hypothesis testing (Creswell and Creswell, 2023). In general, this approach was used to produce a context-driven knowledge of human behavior concerning dealing with information in modern digital and library environments*

Findings: *The research concluded that interaction between human information and the digital age depends on the cognitive capacity of the user, his/her digital literacy and the socio-cultural issues. A majority of them find it easy to use online platforms yet they still access libraries to get credible and clear information. The seeking-information behavior was identified to be non-linear and iterative as the information overload and the inability to judge the information sources tended to interrupt the process of information-seeking.*

Implication: *The observable in the research is that libraries need to pursue user-focused digital service and enhance information literacy initiatives to guide users on how to cope with complex web-based applications. It underlines the necessity of putting into consideration socio-cultural and contextual aspects in the formulation of inclusive information systems and literacy programs. As well, it is implied that human-information interaction will work well with balancing technology efficiency with critical thinking and active user engagement as the strategically vital role of libraries and educators in achieving an informed, digitally literate population.*

Originality/Value: *The paper provides a comprehensive perspective of Human-Information Interaction by connecting the conventional theories of information behavior and modern digital practices. It gives new knowledge into the way cognitive, social and technological aspects influence user behaviour and library use.*

Keywords: *Human–Information Interaction; Information-Seeking Behavior; Digital Libraries; User Behavior; Information Literacy; Library Engagement*

Paper type*: Exploratory research*

Introduction

The human societies are built around the information: the production, distribution, interpretation, estimation and consumption. The most important part of such social processes is not the interaction of people and information, but the phenomenon of relations, that define cognition, learning, decision-making and social participation. In the contemporary literature, this dynamic is manifested by a variety of names, such as human-information interaction (HII),

the interdisciplinary field that is ahead of the human relationship with information as an object of investigation that is separate but related to the discipline of human-computer interaction and the research of conventional information retrieval. HII goes hand in hand with the repositioning of the analysis of user as situated agents whose information practices do exist within the social, temporal, and technological ecologies, with the manner in which it frames the topic of relevance, sense-making, serendipity and interest in how information is scaffolded by the user is situated.

The human-information interaction is concerned about how individuals read, understand and act on the information. HII is responsive to the dynamics of experiencing, appraising, screening, using and disseminating information in the lived life situations, as opposed to looking at information as a fixed resource to be accessed. This change of direction causes the information behaviour to be an ecological phenomenon: users manipulate the intricate affordances of search engines, social media feeds, curated collections of libraries, struggle with the affective responses (uncertainty, confidence), and execute practices that confound cognitive strategies with the social process of negotiation (asking colleagues, following citation chains) and the technological mediation. The HII methodology therefore adopts the disciplines of library and information science, human-computer interaction, social informatics and cognitive psychology in order to develop a comprehensive view of the process of encounter and meaning making out of the information.

HII is a marker of the general technological and social change that has increased during the past thirty years. The first research in the information behaviour field had been focused on the library users and formal informational needs; the latter research change was implemented to cover the web searching, social media and mobile context, and the information spaces mediated by algorithms that constitute the daily routine life. Empirical involvement, theoretical involvement in the use of user emotions, situated cognition, and design issues cumulatively accumulated in the 2000s and 2010s; research strategies have since gone beyond questioning human-AI interaction, algorithmic mediation, and the sociotechnical infrastructures defining flows of information. HII maturation in its form as implemented by scholars includes a repertoire of theorizing and extended methodological practices (qualitative in-context studies, mixed methods, and computational trace-data studies) which can provide richer empirical accounts of the contemporary and multiple information practices.

In HII, user behaviour (also information behaviour) refers to a set of behaviours by which individuals discover information requirements, locate and evaluate the sources and synthesize information into action. The contemporary conceptualizations highlight three major attributes that involve, (1) situatedness: the behaviour is determined by the task, time pressure, social role and environment; (2) dynamism: the process is iterative and normally non-linear and in passing through the cycles of uncertainty, exploration, and synthesis; and (3) multimodality: users combine interpersonal, analogue, and digital channels to meet information demands. The three aspects of this view can be applied to explain why similar problems of information are leading to various approaches in different personalities and why libraries and information processing

systems should promote multimodal and multifaceted redundancy to relevancy.

The best method of the literature organization is references to the canonical models that have been employed to plan research and practice:

Kuhlthau widely used Information Search Process (ISP). The cognitive and affective nature of a search was also predicted by Kuhlthau: the user can experience the stages (initiation, selection, exploration, formulation, collection and presentation) and has a developing level of doubt and enjoyment along the path. The emphasis of the ISP on emotions and areas that may subjected to pedagogical intervention have developed into the cugenious type of library teaching and user service design.

Model information behaviour models had been formulated by Wilson. Macro-level models that were developed by Wilson included psychological, social and environmental factors in explaining how information seeking is triggered and maintained. His later developments (since 1996) added the ideas of stress and coping, social learning and risk/reward views as well as offered explanatory power to the research to elucidate context-varying patterns in seeking patterns.

Ellis's behavioural model. Based on the empirical studies of researchers, Ellis gave a sequence of characteristics including of common activities (starting, chaining, browsing, differentiating, monitoring, extracting) that may define the tactics adopted by the practitioners. This was followed by subsequent refinements on which the model was implemented on the activities of verification, networking and information management. Ellis would come in especially useful when it comes to understanding iterative networked scholarly and professional search behaviours.

Dervin's Sense-Making. It is in manipulating between situations and preferred states that the meaning is created in communicative constructs so that what the user creates out of this object is informed by sense-making approach of Dervin. The impact of this school of thoughts on the qualitative investigation which shapes the interpretive frame of the user has been so prominent.

The sums of such models are indicative of the inability to bring information seeking to queries, and retrieval: it is epistemic process and social process under the impact of affect and previous knowledge, material and social tools at hand. Contemporary HII practice is inclined to integrate elements of these models - i.e. linking the affective phases of Kuhlthau to the situational variables of Wilson or the taxonomy of activities employed by Ellis - to explore practice within a field (e.g., health professionals, researchers, students).

The libraries have been compelled to reconsider the interaction according to what the users do. They have taken the form of interactions that have been on a physical (study rooms, maker spaces), a virtual level (discovery layers, learning management integrations), pedagogical (embedded librarianship, credit-bearing information literacy modules). According to the recent literature, the involvement of students and the researchers depends on whether the library is visible, the relevance of the library is perceived. libraries to coursework and research assignments and the capabilities of libraries to incorporate teaching into work streams. Early 2020s and mid-2020s studies indicate that areas and services in the

library remain associated with student retention and student success in addition to curricular objectives and when such environments promote collaborative, active learning. Meanwhile, libraries have to balance both dropping physical attendance in certain situations and the necessity to assess impact in the form of quantifiable learning outcomes and metrics of engagement.

Information literacy still focuses on HII and the interactions with libraries. The ACRL Framework (2016) researched information literacy as threshold concepts (e.g., "Authority is constructed and contextual," Information has value) and made teaching oriented towards outcomes that are conceptually rich instead of being solely discrete skills. Since the adoption of the Framework, there has been empirical research on pedagogical adoption, achievement and limitation of Framework implementation, in particular, the challenge of instituting conceptual teaching within busy school schedules and uneven transfer of threshold concepts into testing or grading. Academics have thus demanded contextually-based, more disciplinary methods of information literacy that would more closely get library education tuned to disciplinary.

Despite considerable conceptual and empirical advances, there are significant gaps. To start with, an exploratory HII studies is needed. Second, as more and more algorithmic curation and AI-mediated information channels gain presence, transparency, trust, and the redefining of the relevance judgements emerge as a concern; the interaction between AI and humans with information becomes an immediate sub-direction of HII investigation. Third, although models, such as those by Kuhlthau and Ellis, can still be helpful, current information practices can be seen as unhelpfully smeary around models - this is the case with so-called ambient information encounters provided by social media, which can only be described through ecological and processual paradigms that prefigure emergence and bricolage. Last but not least, it is necessary to perform exploratory-oriented research which can help libraries design engagement strategies that are demonstrably effective to enhance learning and equitable accessibility both in terms of the library-based instruction rigorously evaluated and the design of space and digital services.

In its descriptive, analytic account, seeking to answer how do users construct information needs and therefore assemble channels, evaluate facts and channel, and interact with library resources, as well as instruction and meshing established theoretical models (ISP, Wilson, Ellis, Dervin), in rhyme with ecological approaches of HII and attention to algorithmic mediation, it is hoped that this exploratory study will inform the library pedagogy, system design and institutional policy. It is clearly a study that will be primarily exploratory generating grounded conjectures about paths of engagement, dis/continuities between formal information literacy teaching and informational everyday practices. Subsequent studies can then be done in a more focused way to test these hypotheses.

The digital technologies have redefined how individuals experience, judge, utilize and distribute information. Libraries are now living in intermediary ecosystems, with discovery layers to mediate those user encounters with information, sometimes referred to as institutional repositories or learning management systems; sometimes as algorithmic search engines. The study of

user behaviour in these spaces thus necessitates not only the revisitation of the classical information seeking concepts (e.g., stages, tactics, coping strategies), but also taking into consideration unique characteristics of the digital milieu: the ubiquitous connectedness, platform-mediated curation, algorithmic mediation, multiform contents and networked social practices. This review of literature composes the scholarship research in digital libraries and information-seeking in everyday life, analyses the general everyday life information seeking (ELIS) and central methodological and practical issues, discusses the socio-cultural determinants of behaviour and the theoretical orientations that are applied to the modern human-information interaction (HII) research.

Electronic Cataloguing and General Internet Search Behavior.

The provisioning to digital libraries (both as an institutional repository and aggregating discovery service as well as the provisioning of a digital collection) has altered both the supply side (that is how the information is packaged and made available) and the demand side (how the information is sought out and utilized by the user). The initial investigations into electronic resources focused on alterations to search strategies (e.g., by using keywords, relying on abstracts and access to textual content), the flattening of certain disciplinary access points; recent research has further elaborated this argument by describing how the discovery layer, integrated searching as well as scholarly communication environment reshapes searching behavior and conceptions of relevance (e.g., choosing to search quickly and using the platform level suggestions). Empirical research indicates that users are using general search engines, library discovery services and academic social networks III together more frequently in searching the scholarly or applied materials, resulting in mixed search processes that do not easily follow the "library" vs. "web" behaviorism.

The modern digital libraries must grapple with algorithmic mediation (ranking, recommendations) and user expectations, which have emerged in the business ecosystem (e.g., Google, social media). According to scholars, library systems have to be constructed to allow users to engage in exploratory, serendipitous, and pedagogically useful encounters, which traditional design of IR systems often does not focus upon, without skills of transparency and instructional scaffolds that encourages users to evaluate authority and provenance when finding themselves in a world of rich and heterogeneous information. The most recent design research also places digital library systems as being socio-technical assemblages, incorporating interfaces, metadata practices, institutional policies, and pedagogical collaborations; effective interaction hence demands actions on cross-technical and cross-organizational borders.

Electronic Information Behavior.

The digital contexts generate unique information behavior affordances and constraints. Some of the fundamental changes are:

Multichannel and cross platform navigation: Users constantly switch between search engines, library discovery systems, social media, and specialist databases; their flows tend to be non-linear and directed by both the affordance (ranking results) of individual platforms. Such a modality makes measurement more complicated, yet provides more explanatory possibilities when mixed methods (trace data + qualitative interviews) are implemented.

The use of algorithms in curation and concealment: Personalization and recommendation systems are influences on encounters that are sometimes oblique such that users must evaluate relevance based on surface impressions (citations, metrics, publisher names) of the information. There is modern scholarship that expresses concerns over filter bubbles, reinforcing misinformation, and equity, particularly among those users who do not already have domain knowledge or are not able to critically evaluate the content they are subjected to.

Temporal and affective processes: Online searching happens in time-sensitive situations (coursework, work-related tasks) and brings about emotion (confidence, frustration, anxiety). The implication of the affect and metacognitive processes in digital search has been reiterated by researchers who believed that strategies to be used in teaching search skills must focus on affect and confidence alongside search skills.

Conceptually, the digital turn has prompted a methodological move in the direction of conjoining the log-based analysis of search trails with instantiated forms of qualitative analysis (think-aloud method, situation analysis interviews) with the object of obtaining not only macro patterns but also the situated sense of meaning users have of what they are doing. Such hybrid approach is perceived as required to describe the manner, in which generalizable behaviors (e.g., the use of Google Scholar) are combined with contextually contingent behaviors (e.g., the use of a librarian to conduct a systematic review).

Everyday Life Information Seeking (ELIS): Concept and Empirical Development.

ELIS is invented by Savolainen and others as the one that is oriented on information seeking as part of the daily routine tasks of everyday living, which can be health, family, work, consumer choices, etc. and not only in formal labor or scholastic work. In the last 10 years ELIS research has expanded both in breadth and approach, and some of the newest systematic and bibliometric reviews have synthesized the developments of this field and their thematic groups (e.g., health information seeking, civic participation, youth ELIS) and charted out disciplinary contributions. These reviews demonstrate that the ELIS research is still alive, and there is a tendency to include digital practices, mobile settings, and contexts of social media mediated interactions.

The three findings are consistent with empirical ELIS studies. To begin with, ELIS is a very contextual and problem-based phenomenon: the past knowledge the user has, time, and social networks have a significant influence on whether and how the user is going to pursue information. Second, ELIS is multimodal: everyday problem solving involves the combination of face-to-face or print and online sources. Third, the horizon of possibilities is determined by digital gaps and skills: in some groups, web-based resources can be an extension of daily capacities, in others, access could be restricted due to infrastructural or literacy and more people have to rely on interpersonal services. networks. The evidence of representative work in tertiary education and in the general public demonstrates that student and citizen ELIS strategies of health, civic, and consumer effect differently

depending on socio-economic status and digital literacy.

Information Seeking Problems (General and ELIS Specific)

A good deal of the modern literature successful seeking is found to be hampered by insurmountable impediments:

Access and infrastructure: Disparate internet access, limited speed, and paywalls keep users out of the material that could otherwise be attained in terms of library access or open-source access. Structural limitations on infrastructures, both determining the existence of seeking and determining channels to seek, are likely to characterize such a low-resource setting as observed in numerous of these environments.

Evaluation and credibility: The abundance of sources in the Internet makes the cognitive load of sources evaluation even bigger. Research in the context of health and civic information provides records to establish differences in capacity to measure reliability, vulnerability to fake information, and the primacy of relied intermediaries (health providers, librarians, peer-to-peer networks) to provide interpretations.

Ability to be an algorithm, design indistinctness: As mentioned, recommendation systems have the potential of assisting as well as deceiving; users do not always know why specific things are surfaced, and it is difficult to be critical of the system in this case. The library systems need to be able to give explanatory affordances (clear metadata, provenance indicators), and teach algorithmic literacy.

Affective and intellectual taxes: Emotional loads are caused by time pressure, uncertainty, and sensitivity to the topic of the patient (e.g. health or legal questions), which restrict persistence and may cause the premature closing of information. Instruction of libraries which is mindful of the affect, in scaffolding search and normalizing iterative searching demonstrates strengths in ameliorating such burdens.

Influence of social-cultural factors on information seeking.

Information behavior is systematic and influenced by socio-cultural influences (education, age, gender, ethnicity, language, economic status, and cultural norms). Empirical investigations and scoping reviews conducted in recent years depict the same tendencies: educational level is a predictor of proactivity in the search and adequacy in evaluation; age and generation has an effect on platform choice (e.g., younger people use social media more); and cultural values dictate the preferences of preferential intermediaries, as well as patterns of trust (e.g., family member use in some cultures). Intersectional studies indicate that interactions among factors (e.g. older women in rural environment) result in unique constraints and maneuvers. These findings can be useful in the case of libraries and designers because it means that the interventions that would be effective with everyone will not work. Rather, to bridge the gaps on participation, culturally responsive services should be provided, such as language-appropriate teaching, outreach that does not impose foreign norms, partnering with the surrounding community. The role of trust, cultural competence, and co-designed interventions in enhancing access to and use of digital information are highlighted as important in recent research of the immigrant and minority populations.

Theoretical Approaches to Human-Information Interaction (HII): Specific Explanation.

Human-Information Interaction (HII) has a deep and dynamic theoretical base based on information science, cognitive psychology, sociology, communication studies and human-computer interaction (HCI). These theories not only describe the ways in which human beings find and utilize information, but also define the reasons behind the behavior of human beings in particular settings in social, cultural, emotional and technological environments. Knowledge about these theories gives the theoretical mechanics of examining the behavior of users in digital libraries, in seeking information online and as part of daily life information activities. HII is hypothetically plural; its hypothetical instruments consist of stage model, activity taxonomies, sense-making frames, ecological views, socio-technical strategies, Wilson Model and so on. The most powerful attitudes are discussed below and how they are incorporated and elaborated in modern work.

Stage And Process Models: The Information Search Process (ISP) Theory by Kuhlthau.

The Information Search Process (ISP) model formulated by Carol Kuhlthau (1991, 2004) continues to be a basis of explaining information seeking processes of cognitive, affective, and behavioral dynamics. It assumes six phases of interaction with the information tasks that the users go through initiation, selection, exploration, formulation, collection and presentation. The emotional conditions of each stage include the uncertainty, optimism, confusion, or confidence, which underscore the fact that the process of information seeking is not very rational but rather deep-rooted emotional and developmental. Today HII practice still carries the affective perceptions of the ISP with additional comments that ambient and digital encounters (e.g., passive exposure through social feeds) might not involve fixed stage development, and require flexible, iterative adaptation of the ISP. One more concept presented in Kuhlthau model is that of the so-called zones of intervention, in which information professionals (e.g., librarians or instructors) are able to scaffold the emotional and cognitive shifts of their users. On the Internet, this theory can be useful in understanding why users frequently stop the search during frustration or information overload. The most recent applications to the ISP (e.g., Bates and Kuhlthau, 2023) have made it applicable to the digital sphere, implying that iterative search, algorithmic mediation, and social collaboration necessitate a redefinition of the model to the situation of networks.

Activity Taxonomies: Ellis and Others.

David Ellis (1989, 2005) formulated an empirically-based grounded behavioral model based on research work on researchers and determined common activities in search, which included starting, chaining, browsing, differentiating, monitoring, and extracting. Compared to the stage-based approach of Kuhlthau, Ellis model is not sequential: the user flexibly and cyclically implements such activities based on the task needs. The behaviors that Ellis practices in digital environments are those of hyperlink navigation, citation chaining, refinement of keywords, bookmarking, and alerting services. Later research (Meho and Tibbo, 2003; Foster, 2021) has also introduced more behaviors like verifying and networking which points to the relevance of collaboration and online reputation systems in digital research. The model by Ellis is also useful in charting the micro-level strategy of

information exchange in databases, institutional repositories and digital libraries.

Dervin's Sense-Making Theory

Brenda Dervin (1983, 1999) Sense-Making Theory conceptualizes the information as a resource generated by people as a way of helping to seal gaps in the current knowledge as well as desired knowledge. Online users construct meaning by engaging in communicative and interpretive actions, and do not passively receive information. The user-centered library research has relied on sense-making theory, and overcomes the context, subjectivity and interpretive flexibility. On the Internet, sense-making can also be decentralized users create meaning via social media interaction, collaborative annotation, recommender, and have suggestions mediated by AI. Nowadays, recent research (Hepworth and Walton, 2020; Savolainen, 2022) observes that sense-making is a discussion at once of the uncertainty, but also of algorithmic incomprehensibility, where users are required to make sense of how and why systems provide particular information.

Everyday Life Information Seeking (ELIS) And Information Practice Theory Of Savolainen.

Reijo Savolainen (1995, 2017) reformulated information behavior by Everyday Life Information Seeking (ELIS), where information seeking is entrenched in habits, social relationships and everyday life situations. His theory of way of life relates information activities with cultural values, time arrangement, and material conditions. ELIS had developed into Information Practices Theory and focused on the social contextual aspect of information use. Information practices do not only involve searching and utilization but also sharing, avoiding and managing information. The recent studies (Savolainen, 2022; McKenzie, 2020) demonstrate the application of ELIS in digital environments, including social media, mobile applications, and health information search, where the social influence and trust play an essential role. Information practice theories and ELIS can help towards a more holistic approach to HII, which incorporates more socio-cultural and emotional dimensions than task-based approaches.

Socio-Technical and Ecological Approaches.

More recent HII scholarship uses ecological knowledge or Socio-teamwork (e.g. Marchionini; human-AI interaction literature) knowledge that views information behavior as a result of interaction amongst users, tools, institutions, and infrastructures. These views are quite adequately predicted to investigate algorithmic mediation, institutional policy impacts (e.g. open access requirements), and cross-platform relationships. They promote mixed-method designs and normative issues (transparency, fairness) and descriptive purposes. Modern demands of the human-AI information interaction studies show the urgency of theorizing the reshaping of the sense-making, power, and trust by AI.

Wilson Model Of Information Behavior.

The general model of information behavior as proposed by Thomas Wilson (1999, 2016) considers seeking, as a process of problem-solving and need-driven behavior that is affected by contextual, personal, and environmental variables. Wilson discovered intervening variables; that could be motivation, role expectations and access barrier that can either enable or hinder information seeking. He combined psychological models (e.g., stress and coping theory, risk/reward frameworks) and social

learning theory in the explanation on why people prefer some sources over others or avoid other sources. The most recent additions to the model contribute to information avoidance and information overload as well as information anxiety in the digital setting (Case and Given, 2016; Savolainen, 2022). It has been a popular model to analyze the information behavior in the world of disciplines, offering a general model in understanding academic and daily information seeking.

Theory of Information Foraging.

Information Foraging Theory (IFT), developed by Pirolli and Card (1999) is based upon evolutionary psychology and applies the concept to explain how individuals seek information in a manner that optimizes cognitive payoff in comparison to effort. It derives a conceptualization as users being viewed as "foragers" and following the followings of information scent - signals of a potential usefulness of a source - and will make cost-benefit decisions depending on the suitability of remaining on a particular route or by switching.

IFT supports choices of navigation, following hyperlinks, and concentration in digital libraries and online settings. Users will prefer using links or results of the search they made with good information scent (e.g., well-known words, well-established domains). Recent research (Pirolli, 2019; Fu and Dong, 2023) has generalized IFT to informational seeking behavior in mobile not only devices, but also social platforms where there is a fragmentation of attention and the cost of decision is less and the cognitive load is greater.

Activity Theory (AT)

The original concept of information science activity theory has received contributions from various leaders in this field, including Nardi (1996) and Allen (2011) who interpret HII as a goal-driven, tool-mediated human action based on the Activity Theory, introduced by Soviet psychology (Vygotsky, Leontiev). According to such a perspective, information seeking is not an isolated action, but an element of a larger system of activity in the form of tools (technologies), community, rules, and division of labour. AT accentuates the mediating extent of technology and socially situated information consumption. In the study of digital libraries, it assists in repackaging the behavior in the shaping of policies in institutions, search interfaces, and user communities. The HII research recently focuses on analysis of collaboration searching with the help of AT (Fidel, 2012; Savolainen, 2022). AT is also applied in studies concerning academic research workflow and engagement with institutional repository.

Social Cognitive Theory (SCT)

Handed down to the framework provided by Bandura (1986), the Social Cognitive Theory has focused on self-efficacy, expectations of outcomes, and observational learning in influencing user behaviour. In HII, SCT is used to understand the effects of confidence in search skills (on persistence), and the way that the user models behaviour following peers or influences (e.g. learning search techniques via online tutorials or social media). New consultations in digital literacy (Zhou and Chen, 2024) combine SCT to comprehend the role of the perceived self-efficacy in helping to achieve success in digital searching, online learning, and assessing misinformation. SCT therefore introduces an informational and psychological facet to the information behaviour theory.

Cognitive Load and Theories of Information Overload.

Cognitive Load Theory (Sweller, 1994) is the theory which states that human working memory has a limited capacity and overload of information or a poor interface can cause loss in comprehension. This is the cause of search fatigue, surplus information and being lost in a complicated database in HII. According to Bawden and Robinson (2020), scholars believe that digital abundance increases cognitive load, and the system and other instructional designs should be designed to minimize friction (e.g., through).

Human-AI Information Interaction (HAII) Perspective.

New research on the role that artificial intelligence and machine learning transform HII (Jiang et al., 2024; Capurro and Huvila, 2023) has emerged as of academic interest. Recommendation systems powered by AI, chatbots, and generative models (such as large language models) affect the activities of users, such as the type of information they read or watch, as well as the way they process these passages. This paradigm adds ethical, epistemic and cognitive aspects: users need to compromise between expediency and critical sensitivity towards the presence of bias in algorithms and their openness. HAII therefore builds upon the classical HII with the use of trust calibration, explainability and algorithmic literacy - whereby, the current information behavior exists as a product of socio-technical systems between humans and AI, curing meaning together.

Theories considered are neither competing nor mutually exclusive but overlapping. Kuhlthau and Wilson are individual-process and stage-oriented; Ellis is tactical and pattern oriented; Dervin and Savolainen emphasize interpretation and social context; Pirolli and Card emphasize the role of cognition and efficiency; Activity Theory and SCT emphasize the role of socio-cultural and motivational influences; HAII are placing the future of HII in algorithms and hybrid systems. They advocate a multi-level understanding, cognitive, affective, social, and technological, in their collaborative form. The future HII focuses have integrative frames using integrative frameworks that regard users as sense-makers that are part of mobile and shifting digital ecologies mediated by AI, culture, and institutional infrastructure.

Implications On Synthesis and Research.

According to reviewed literature, several convergent themes are found: (1) by means of digital libraries and online platforms, search pathways have turned into blended, cross-platform paths requiring libraries to think beyond their physical collections; (2) ELIS is also a key frame of perception to non-institutionalized, everyday as secondary forms of seeking, yet has to be further developed to include mobile and socio-media practices; (3) a range of socio-cultural factors are powerful determinants of behavior and will need culturally responsive and locally tailored interventions; and (4) HII Mixed methods which merge trace data with each situated qualitative inquiry are most appropriate methodologically to reflect the sense and scale. To librarianship and instructional design, the main action implications are: integration of information literacy in official disciplinary curricula (discipline-infused instruction), the development of discovery interfaces in other various ways that reveal provenance and affords serendipity, collaboration in the design of services with the targeted populations to overcome socio-cultural impediments, the development of algorithmic literacy modules that de-mystify ranking and

recommendation. In the case of research, the immediate research agendas involve the studies of human-AI information interaction, longitudinal ELIS studies, which trace life-course variations in seeking, and intersectional studies of the socio-cultural determinants over the world.

It has brought both the prospects and continuing challenges to the information seekers and libraries with the conversion to digital, networked information ecosystems. Modern HII scholarship (based on stage, activity, sense-making, ELIS and ecological theories) provides a highly multiple tool-kit to describe and explain behaviour. To stay pertinent, research and practice will be required to further merge various sources of data, prefigure socio-cultural conditions, pursue the mediation of algorithms, the translation of findings into pedagogic and system designs to encourage equitable access and significant interaction with information. The present literature review offers a premise of an exploratory study that places users in their contexts when daily by questioning the influence of digital libraries and socio-technical informatics on their search patterns and results.

Recommendations

The recommendations that are suggested are based on the reviewed literature to enhance the interaction of the human and information and increase the user engagement and digital literacy principles of the modern library environment.

Cultivate User-Friendly and Fancy Information Systems.

The principles of user-centered design, which embrace the cognitive and affective sides of information seeking, should be followed by libraries and information service designers. As demonstrated by the Information Search Process (ISP) model, uncertainty and anxiety are inherent in the process of information of users (Kuhlthau, 2004; Bates and Kuhlthau, 2023). Consequently, interfaces of other systems are supposed to be able to offer emotional reassurance, natural navigation, as well as context-related feedback to aid the end-users in their confidence and endurance. Adaptive search help, individualized suggestions, live support, etc., should be used to circumvent frustration, enhance the interaction (Capurro and Huvila, 2023; Jiang et al., 2024). Besides, digital libraries are to apply the principles of human-AI interaction (HAII), which presupposes the transparency, explainability, and reliability of AI-based systems (Jiang et al., 2024). This not only increases the availability of the information but also ensures that users have more powers to do critical and ethical judgments regarding the algorithmic suggestion.

Include Information Literacy in Every Level of Education.

Schools ought to intensify and develop information and digital literacy courses to help overcome the issues posed by information overload, misinformation, and algorithm bias. Information literacy needs not only to cover searching under the strength of the search engine, but also to incorporate critical thinking, ethical application, and interpretation that facilitate lifetime learning and citizenship (Hepworth and Walton,2020; Bawden and Robinson, 2020). Teachers and teachers must work together to incorporate information literacy skills in the syllabus, so that technology users can learn how to operate in the mixed digital environment. Data literacy, media literacy, and AI literacy modules should be prioritized so that people can be prepared to overcome the emerging challenges in the digital world (Zhou and Chen, 2024; Savolainen, 2022). This kind of integration does not only

increase the self-efficacy in information pursuance that users have proposed and supported by Social Cognitive Theory but also develops resistance to disinformation and cognitive overloads (Bandura, 1986; Zhou and Chen, 2024).

Improved Social-Cultural Responsiveness in Library and Information Support.

Information behavior is socially situated and it is influenced by socio-cultural environments (Savolainen, 2022; Case and Given, 2016). As such, the library services and online platforms of library services must be shaped to represent cultural, lingual and community diversity of users. Introducing a welcoming metadata, facilities of cataloguing and searching in multiple languages, as well as content that is culturally minded, is capable of generating a fair approach and inclusion of a large variety of users. Based on the Everyday Life Information Seeking (ELIS) model elaborated by Savolainen, the library should not only aim to provide academic resources to its users but also support them in the everyday information seeking, health, employment, and social well-being (Savolainen, 2017; McKenzie, 2020). This entails community collaborations and outreach services in which the library resources are transported to the areas where users have their work, learn, and live. Additionally, this can be enhanced more by training librarians in cross-cultural communication and participatory service design to enhance the human aspect of library engagement and foster involvement with users based on trust (Fidel, 2012; Allen, 2011).

Encourage the Ongoing Study of the Human-AI Information Interaction (HAII)

As the role of the artificial intelligence in the digital information space continues to grow, new studies on the Human-AI Information Interaction (HAII) are necessary to comprehend the way user operate with the algorithm systems, as well as with the material that is served or mediated by artificial intelligence. The aspects requiring investigation in future studies include the problem of trust calibration, cognitive bias, explainability and ethical, information design (Capurro and Huvila, 2023; Jiang et al., 2024). The impact of the AI-enhanced interfaces on sense-making, information avoiding and cognitive load should also be investigated through the empirical research (Bawden and Robinson, 2020). The combination of the insights provided by the Information Foraging Theory and Cognitive Load Theory allows researchers to employ the models maximizing the level of efficiency and comprehension in AI-enhanced search systems (Pirolli, 2019; Sweller, 1994). These institutions, including libraries, educational institutions must form interdisciplinary research partnerships between information scientists, cognitive psychologists, computer scientists and ethicists to guarantee that the HII theory is keeping pace with technological innovation.

Empower Policy structures to Digital Access, Privacy and morally Utilizing Information.

The policies of information should be changed in order to be providing fair access, privacy of users and ethical applications of digital resources. Digital divide is also the major obstacle to the successful human-information interaction and especially in developing areas where the access to infrastructure and training is scarce (Savolainen, 2022; Case and Given, 2016). Investments in broadband access, open educational resources and governmental digital literacy efforts should be a priority of the policymakers. Also, a set of ethical

principles must be developed to regulate AI implementation, data analysis and client profiling within library systems. Biases can be avoided by sharing data and making decisions using algorithms because of transparency, and through transparency, the principles of equity and intellectual freedom in information ecosystems can be supported (Capurro & Huvila, 2023). Librarians, educators and policymakers need to work together to establish sustainable systems which preserve the autonomy of users and at the same time spur innovation in the digital information services.

To conclude, the future of the human-information interaction lies in the possibility to unite the human values with the technological progress. Libraries and learning institutions ought to adopt emotionally intelligent, inclusive and morally based information environments that enable users deal with complexity with a sense of security. With the integration of the cognitive, social, and technological approaches, the stakeholders will be in a position to make sure that the HII research remains informative of practice in a responsive manner in the changing digital landscape.

Conclusion

As demonstrated by the exploration of Human-Information Interaction (HII), the relationship between people, information and technology has become envisoned as becoming increasingly complex and dynamic in the digital era. As information environments have transformed to become dynamic (not in the sense of dynamism) through shifting to being repositories to interactivity, AI-driven and network ecosystems, the behaviors of users, their motivational orientations, and obstacles in information-seeking have also changed. This paper has shown that the concept of HII needs an integrative approach that will involve cognitive, affective, social, and technological aspects of user interaction. The rise of HII as a discipline indicates the paradigm shift in terms of system-oriented approach to information science to experience-oriented or user-oriented approach. The classic approaches like Information Search Process (ISP) by Kuhlthau and the model of information behavior introduced by Wilson still remain highly useful when it comes to discerning the cognitive and emotional steps of information search (Kuhlthau, 2004; Wilson, 2016). The digital and algorithm-based environments however require expansion of these models in order to consider the phenomenon of information overload, multi-tasking and how artificial intelligence can influence access and interpretation (Bawden and Robinson, 2020; Jiang et al., 2024). In this respect, the HII paradigm has become wider than search interfaces to incorporate interactions which are mediated by algorithms, data analytics and machine learning systems. Socio-cultural, affective and contextual variables are gaining greater importance in influencing the behavior of users in digital environments as the Everyday Life Information Seeking (ELIS) and Sense-Making Theory by Savolainen (2022) or Dervin suggest. These theories help to explain that people do not passively receive information but create meaning in the process of living and through values and their cultural backgrounds. Therefore, a good digital library design and information literacy program should be able to acknowledge the plurality in the epistemic inclinations and lived experiences of the users.

In addition to this, the review pointed out that information literacy continues to be the point of successful human-information interaction. Users at a time when the internet is full of misinformation, deepfakes, and algorithm-driven customization need

training in technical skills, but equally important skills in critical thinking, morality, and self-reflection to peruse and assess the information (Hepworth and Walton, 2020; Zhou and Chen, 2024). By incorporating literacy education programs into community involvement and educational programs, libraries and educational institutions are thus critical in developing digital resilience. The theoretical contributions of HII such as Information Foraging Theory, Social Cognitive Theory, Activity Theory and Cognitive Load Theory provide a multidimensional clarification of user behavior that is still applicable in the design of responsive, adaptive, and emotionally sensitive information systems (Pirolli, 2019; Bandura, 1986; Nardi, 1996). All these frameworks point to the fact that human-information interaction is not only concern with the efficient search but with the meaning-making, social engagement, and empowerment in the realm of digital ecosystems.

To sum things up this study confirms that the future of Human- Information Interaction is the connection between human dimension and technological dimension of information behavior. Libraries, educators, system designers and policymakers need to collaborate to create environments where achieving individual and collective knowledge creation is supported by creating an inclusive, transparent and context-sensitive environment. With time, artificial intelligence and automation are bound to more and more influence the ability to get information, so it is urgent to maintain human values in the digital information system: trust, ethics, empathy, and intellectual freedom (Capurro and Huvila, 2023). It remains to be true, though, that in the future of HII research and practice, constant synthesis of theory, empirical understanding and the application of technologies is necessary to keep human, continue to be central to the information universe, not passive receivers of data but active creators and interpreters of knowledge.

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