ARTICLE

Information practices and design thinking
Approaching Users 3.0 in Information Science

Leila Jane Brum Lage Sena Guimarães [1] ID https://orcid.org/0000-0002-4008-2771

Eliane Cristina de Freitas Rocha [2] ID https://orcid.org/0000-0002-4606-016X

[1] Universidade Federal de Minas Gerais – Belo Horizonte, MG – Brasil / e-mail: leilajane@ufmg.br
[2] Universidade Federal de Minas Gerais – Belo Horizonte, MG – Brasil / e-mail: elianecfr@ufmg.br

ABSTRACT

Introduction: The web 3.0 environment has, as a remarkable characteristic, the presentation of personalized data to its users, through its algorithms that act as mediating artifacts of the users' relationships with the network. In this scenario of cooperation between people and computers, inherent to web 3.0, Information Science contributes by reflecting on the informational subject and their context, especially through the informational practice approach. **Objective:** Build theoretical contributions across the purposes of design thinking that are combined with the study objectives of situated practices of technology appropriation by users. **Methodology:** Through an exploratory narrative literature review, the theoretical underpinning for the construction of mediating artifacts on the web 3.0 is developed based on the perspective of studying information practices associated with the methodological approach of design thinking as an alternative for the participatory and human development of new contexts of social organization and relationship on the web. **Results:** Conceptual relationships are woven among web 3.0, dismediation and mediating artifacts. The design thinking methodology is presented and related to the approach of user studies of information practices. **Conclusion:** The construction of mediating artifacts for the web 3.0 requires a study approach centered on the interaction context of its users, through a context-sensitive methodology, as proposed by design thinking. The theoretical proposal is that design thinking is convergent with the informational practice approach of information users, and it can be an innovative approach for the field of Information Science.

KEYWORDS

Information practices. Web 3.0. Mediation. Users. Design thinking.

Práticas informacionais e design thinking
Abordando usuários 3.0 na Ciência da Informação

RESUMO

Introdução: O ambiente da web 3.0 tem como característica marcante a apresentação de dados personalizados aos seus usuários, por meio de seus algoritmos que atuam como artefatos mediadores das relações dos usuários com a rede. Neste cenário de cooperação entre pessoas e computadores inerentes à web 3.0, a Ciência da Informação contribui ao refletir sobre o sujeito informacional e seu contexto, especialmente por meio da abordagem das práticas informacionais. **Objetivo:** Construir aporte teórico entre os propósitos do *design thinking* que se aliam aos objetivos de estudo de práticas situadas de apropriação de tecnologias pelos usuários. **Metodologia:** Através da revisão bibliográfica exploratória narrativa, desenvolve-se o aporte teórico para a construção dos artefatos mediadores na web 3.0 com base na perspectiva de estudo das práticas informacionais associada à abordagem metodológica do *design thinking* como alternativa para o desenvolvimento participativo e

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humano de novos contextos de organização e relação sociais na web. **Resultados:** São tecidas relações conceituais entre a web 3.0, desmediação e artefatos mediadores. A metodologia do design thinking é apresentada e relacionada à abordagem de estudos de usuários das práticas informacionais. **Conclusão:** A construção de artefatos mediadores para a web 3.0 requer a abordagem de estudos centrada no contexto de interação dos seus usuários, por meio de uma metodologia sensível à modelagem de contexto, como é a proposta do design thinking. A aposta teórica é que o design thinking é congruente com a abordagem de práticas informacionais dos usuários da informação, podendo ser uma abordagem inovadora para a área de CI.

PALAVRAS-CHAVE
Práticas informacionais. Web 3.0. Mediação. Usuários. *Design thinking*.

JITA: IK. Design, development, implementation and maintenance

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1 INTRODUCTION

It is already commonplace to treat the web environment as a gigantic informational ocean, where navigators are often adrift, lacking compasses, routes, paths. Many of these aids will serve as mediators for their users' navigation and need to be conceived and created by professionals from different areas, such as design and technology. For Rodrigues (2018), Information Science, in turn, emerged in its interdisciplinary vocation with the purpose of organizing the informational explosion, even before the creation of the web, and, today, it can contribute to the organization of this environment, especially if dialogue is established with the areas of technology and design. This article, based on an narrative exploratory literature review, presents the design thinking approach as a methodological alternative to approach information practices of information users in the context of web 3.0.

The construction of this paper's underpinnings involves the presentation of the web environment evolution, placing the web 3.0 as a provider of mediating artifacts and mindfacts of the construction of the users' daily information practices. In the next section, the web evolution is presented, highlighting the characteristics of the web 3.0, and the concept of dismediation that accompanies its evolution. It is proposed, in sequence, to resume the approach to users from the perspective of information practices as a key element for the construction of scientific knowledge that can understand the social context of the construction of informational resources on web 3.0. Finally, it is proposed that the design thinking methodology is appropriate for transdisciplinary work in IS aiming at the construction of mediating artifacts and mindfacts, as it constitutes an excellent methodological alternative to give life to the modeling of information practices of users in and for the web environment.

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2 THE WEB

In Information Science (IS), the rapid changes that information organization, records, access and circulation have undergone with the dissemination of the internet have been discussed. Concepts such as web 1.0, web 2.0, web 3.0 and web 4.0 have been presented to refer to the continuous evolutions with which data have been presented on the web.

In web 1.0, information dissemination predominated, with the web as a large catalogue. The web 1.0 environment was mostly static data, in an unidirectional flow (from the content holder to the end user) and which served for queries passively and stored in files, an experimental move. Business-owned pages which occasionally featured forms and pop-up screens dominated, and other features, such as search engines, began to develop, notably the Netscape browser. (SANTOS; NICOLAU, 2012; NOH, 2015)

According to Coutinho and Bottentuit Júnior (2007), the web 1.0 environment was very expensive for its users; the vast majority of services were paid for and controlled through licenses, the systems were restricted to those who had the purchasing power to fund online transactions and purchase the software for creating and maintaining websites.

Noh (2015, p.792) presents the following relationships regarding the application of web 1.0 tools aimed at information use and retrieval in the library: technologies linked to HTML, access to publication data through keywords with the library-centric provision for reading; carrying out queries by users on PC terminals centralized in libraries with the development of metadata for structuring bibliographic records. Using the metaphor of navigation, in web 1.0,

the user has static navigation maps that can be consulted by automatic mechanisms activated by queries using keywords.

Web 2.0, a term coined by O'Reilly, appeared in 2004 and experienced an explosion of websites, as it changed the way users use the Internet with the emergence of various service platforms and tool facilities such as webmail, photo albums, social networks, blog or podcasts that made it dynamic. (BRESSAN, 2009) Web 2.0 allows collaboration and information exchange, enabling active user participation in content production and dissemination. Communication becomes bidirectional, allowing users to disagree with content and spread their opinion on different subjects. At that moment, the environment noticeably turns to writing, aimed at communities and people. The web begins to be used as a platform that relies on usability of search engines to retrieve information in terms of effectiveness, efficiency and satisfaction for carrying out tasks. According to Palliyaguruge (2021) Wireless technology emerges as the connection between mobile or fixed devices without the use of cables, to be able to connect to another device, also equipped with wireless technology. This technology encompassed a number of others: IrDA use of an infrared adapter for sending and receiving data; BlueTooth exchanges information easily at close range; Ronja data transmission by light beam and the best-known Wi-Fi which access is through a point known as Hotspot, and it is possible to access any device through its network. Wireless is limited by the maximum speed the router supports, and the number of devices connected at the same time.

In web 2.0, the rise of the browser Google stands out, which soon gained great support from users, due to its excellent performance, which gradually became a great platform. Wiki platforms also stood out, which, according to Blattmann and Silva (2007), enable users to socialize information in interactive and participatory environments, such as Wikipedia.

Regarding web 2.0 and the library, Noh (2015, p.792) affirms a bidirectional, participatory, shared and public interaction, related to technologies available on the web, with the expansion of internet catalogs, use of XML/RDF structure and networked systems, including mobile. Returning to the metaphor of the ocean, in this environment, it was as if the user could navigate interacting with other users, and helping to improve navigational maps.

Web 3.0, in turn, was a term referred to by journalist John Markoff from the New York Times, and also known as the semantic web. It became operative in 2006, proposing to make sense of the data spread over the network, according to Okada and De Souza (2011). The web environment now incorporates the ability to interpret its own content, and also offer personalization and optimization of the users' online experience, even faster, which makes the browsing experience more targeted.

> Technological evolution with Web 3.0 sees that the process of searching and retrieving informational resources must be facilitated with technological tools and better information representation, building a network of interconnected knowledge while respecting the type of user or community present in each environment. Technologies have contributed to modifying social life, so that digital environments in which there is interaction between users allow them to access, manipulate and transform information, creating their own world and a field of reflection, since it is composed of private companies, public bodies, ordinary citizens and the scientific and academic communities. (PALETTA; PELISSARO, 2016, p.19, our translation).

Web 3.0 brings improved connection to users, ubiquity and enables new ways to visualize the web, with spaces configured to the user's taste in a more interactive way and based on a much more customized user experience and in three-dimensional forms, considering the axes data, information and context. (OLIVEIRA; MAZIEIRO; ARAÚJO, 2018). The idea is not only to present data or information, but contexts through more

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intelligent systems, equipped with artificial intelligence (AI) algorithms. The network's own computational resources scour the web, dealing with a large volume of documents and data, and treat them according to the user's browsing context. With technological evolution, information is organized in such a way that machines can decipher content and point out solutions without human intervention. Still on the ocean metaphor, it was as if navigating users were only provided with the maps and the map spots that interest them for navigation, in a dynamic way, without necessarily requiring them to interact with other navigation colleagues or the need to make an effort to propose queries.

According to Breitman (2005), relevant points in web 3.0 must be considered in the internet progress: the web language that allows greater machine processing in information interpretation, formal and explicit specifications of concepts within a shared domain, better recognition through metadata of the searched information and of interest to the user, in addition to the use of agents/artifacts, presented by the author as software, which functions to gather, organize, select and present information to the user in a customized way. For the navigation system to work, maps and routes are anticipated by systems that understand the language of those who navigate the informational ocean beforehand. For each browser, different maps and routes can be created.

In this context, it is important to highlight the development and use of artifacts to transform the web into a space of specialized information environments with personalized content based on facilitating navigation and information access, information reliability and device interconnection to better serve users.

However, for adjusting to users, web organization and data retrieval structure needed to be transformed. At this time, it is important to have information in an organized way both to serve and understand humans, but also to collaborate with machines by helping to answer queries and surveys in a more correct, customized and optimized way for the user, these are the center of the information. In web 3.0, "machines" (such as search engines, bots or other resources) are articulated based on user's usage profiles, built by algorithmic analysis of their individual interaction tracks, such as photo posting, keyword usage, passing of opinions, research trends etc. Oliveira, Mazieiro and Araújo (2018) state that in addition to information retrieval ease and efficiency, web 3.0 facilitates the use of information recommendations and user profile tracking systems to provide and direct information customized for users.

Given the list of semantic web resources (web 3.0) that can be used in library actions, Furtado (2019, p.3-4) highlights the synergy across software, hardware, emerging technologies, brands, models, resources and information systems through languages that dialogue offering qualitative benefits, disclosing the use of the SSDL and RFID structure.

> Its applicability will be something innovative, adding value to services aimed at users. With it, the effects of searches will be more precise, saving time and understanding the context of the Internet user, providing results according to the needs of each individual (SANTOS; NICOLAU, 2012, p.10, our translation).

In the scenario of cooperation between people and computers, inherent to web 3.0, Information Science context of the informational subject is identified as a fundamental link in information exchange and processing. Subjects are assisted in their navigations by the algorithmic mechanisms of the semantic web, which constitute mediating artifacts. Returning to the metaphor of navigation, the user often leaves the boat operating automatically, in this case, the user is guided by the system, or he/she can take over, but always receiving the help of an astute co-pilot who anticipates his/her practical navigation needs.

With the advance of mobile technologies and the expansion of the various machines present in everyday environments (cameras, cell phones, all kinds of smart devices), web 4.0 emerges in 2016, aimed at facilitating people's daily lives in a context of mobility and ubiquity. The objective is to provide users with contextualized social and semantic data through technologies and intelligent applications focused on connections that involve various social practices mediated by technological artifacts endowed with autonomous actions (FORESTI; RADOS, 2019).

According to Noh (2015, p.790), "the representative features of Web 4.0 are referred to as a symbiosis web, reading, writing and executing simultaneously a web OS [operating system], middleware and a massive web allowing intelligence interaction just like a human brain".

Web 4.0 is described as a pragmatic web, as it focuses on behavior deduced or understood from the user's previous information, data or actions, to provide what the user wants or asks for, optimizing the experience and proposing improvement in their decision making. Some of its paradigmatic tools are: voice implementation as a way of intercommunication through the understanding of natural language; interconnection of different objects with access to networks (Internet of Things - IoT), with data exchange between them, aiming at actions in the environment. The term "Pragmatics" used for this layer of the web stems from the fact that Web 4.0 has to deal with meaning in context, the trend in the Information Technology area is to develop increasingly more context-sensitive applications (WEIGAND; PASCHKE, 2012).

By connecting objects with different resources to a network, in this case the internet, the innovation of new applications is enhanced. The idea is that, increasingly, the physical and digital worlds become one, through devices that communicate with each other. IoT should be understood as a means of achieving something larger as ubiquitous computing, with information flowing across different agents, which include people and artifacts that dynamically communicate to achieve their function or purpose.

The use of technologies such as Machine Learning and Deep Learning are the contribution to information processing in this environment, intended to be assertive through resources similar to people's cognitive practices. Applications that run on the various smart devices equipped with these technologies constitute artifacts that can take the form of more complex bots which interact with their users to carry out their daily activities:

> In this way, the instantaneity experienced by new technologies increasingly popular with the consolidation of the ubiquitous and pervasive web 4.0, which allow real-time communication through audio and video, for example, contribute to those involved, even if not physically in each other's presence; they work cooperatively to together maintain coordination to sustain the action in development, which brings them closer to a co-presence relationship. (KRAMER 2020, p.73, our translation).

The use of Big Data, the Internet of Things (IoT) and Artificial Intelligence (AI) on the Web 4.0 are the guidelines for data storage and processing and request both from machines to each other and from machines and their users. A path towards a symbiotic human-machine informational subject relationship can be thought of. The idea of web 4.0 is related to assistance in actions with more complex and customized interactions, such as when, in a day-to-day situation, a person commuting to work detects traffic jam that will delay their appointment, a message is automatically processed, warning of the reasons and events, as well as providing guidance on a different path to get around the problem. Returning to the metaphor of the ocean, a ship that moves forward can send a message to the ship operated by

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its user, and have its route automatically corrected, without the need for direct human operation on the vessel.

Library 4.0 defended by Noh (2015, p. 792-794) based on the analysis of the information environment and information technology is grounded on intelligence, on massive data, contextualized, an environment equipped with recognition capability, capable of relating virtual elements with real-world screens, interconnecting playful and creative spaces with library services as an organic system.

From web 1.0 to web 4.0, the regular use of its resources, such as social networks, websites, various applications, contributes to shaping people's behavior: people's behavior and interests are guided in part by what happens on the network, and the network, in part, is guided by people, in a recursive relationship. However, as web technology has evolved, the ways users interact with the network and with each other have changed, as well as the characteristics of the artifacts mediating the relationship with the network, an aspect that will be discussed below. The cut in the environment was directed to the study of web 3.0, which is more consolidated in its informational practice and use of mediating artifacts in relation to web 4.0 which, due to technological innovations and diversities, does not yet have its use and resources understood scientifically.

3 DISMEDIATION AND WEB 3.0

In the context of web 3.0, and which also extends to web 4.0, websites, tools and devices have become endowed with capabilities to predict user behavior, often dispensing with human intermediation and mediation in various processes. People have been increasingly interacting with applications that act as recommendation systems, simulating human mediation behavior in various activities. In IS, the dismediation process has been discussed, which, with the advancement of web 3.0, has been dramatic for the role of information professionals in their role as mediators.

If, on the one hand, dismediation has been discussed, on the other, the construction of applications, systems, devices and smart objects is work that requires implicit mediation activities, knowledge of users' needs and context of these applications, systems, and from their translation to creation, by application developers.

Creating smart devices that interact with people in different social contexts is challenging. The internet evolution with the incorporation of the principles of the semantic web and the Internet of Things only becomes a reality when users are able to employ them in their daily lives in an intuitive way. The development of interactive devices must consider emotions, cognitive processes and creation of meaning (sense making) and situational in the social context of their users.

Semantic web devices function as artifacts and, as Suchman (2007) well reminds us: without social interrelationships, roles, norms, culture and politics, there would be no meaning in using artifacts.

> Cognitive phenomena have a necessary relationship to a publicly available, collaboratively organized world of artifacts and actions and, […] the significance of artifacts and actions, and the methods by which their significance is conveyed, have an essential relationship to their particular, concrete circumstances. (SUCHMAN, 2007, p. 50).

For D'Ambrosio (2007) two links are related to represent the action in the reality in the use of artifacts: ideologies and science as knowledge manifestations. Artifacts are tangible

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and inform, through the senses and communication, individuals who understand them and translate them as mindfacts. For the author, the artifacts and mindfacts that result from the action, and that, when incorporated into reality, come to modify it. That's where technology lies, as a synthesis of artifacts and mindfacts.

> The human species transcends space and time beyond the immediate and sensitive. The present extends into the past and the future, and the sensitive extends into the remote. Human beings act as a function of their sensory capacity, which responds to the material (artifacts) and their imagination, often called creativity, which responds to the abstract (mindfacts). (D'AMBROSIO, 2007 p. 27 – 28, our translation).

Cole and Engestrom (1993) consider that the artifacts of a context are relevant, and therefore they claim that the structural basis of human cognition results from the mediation of natural and artificial artifacts, not only by their use in a certain context, but by different practices and forms of activities provided in the sociocultural environment. The mediator plays a more ambitious role, accompanying the construction of significance.

For Lalueza and Camps (2010), manmade artifacts provide different experiences and contribute to promoting collective goals, social relationships, daily practices and different behavioral expectations. Smart devices, such as those on the semantic web, support everyday practices and must be built to expand human potential in different social and community contexts, expanding the capacity for action, functioning as artifacts, and for creation, abstraction and problem solving, functioning as mindfacts.

For the construction of human communication mediating artifacts and information retrieval, the use of language is crucial. As an illustration, by making the system a query, the subject works as a sender and the computer as a receiver. On the other hand, the computer, when presenting its results, becomes the sender and the subject the receiver. The retrieval system therefore worked as an information retrieval mediating artifact through the query language.

For Silva (2009), mediation, the link between enunciator and recipient, is important in the mediating process inherent to artifacts, as it links the coherence and continuity of communication and formalizes information retrieval. There will always be a mismatch between the information retrieval system language (documentary language) and the users' language at the moment of retrieving information. To improve the approximation process between the conceptual universe of the user and the system, implicit mediation work involved in the construction of the documentary language needs to take into account the users' information retrieval context.

On the web 3.0, the user-system interaction process becomes more sophisticated. The system adapts as user interactions are performed. Mediation is manifested in the practical context, in the language shared between human-human or human-non-human, engagement in the exchange of actions/messages, agreement - which is social, collective, of thoughts, of relationships, of life - and transactions in the logic of filiation and subjectivity.

Artifacts can be implemented in this context as information retrieval mediators in IS, focused on information appropriation that fully or partially satisfies the informational need and, therefore, users must be studied to be provided with what is suitable for their demand considering the social paradigm of IS, which considers the entire context of the daily process and practices.

One of the ways of accessing technological language is the use of technological artifacts, understood as a constituent element of culture and not merely a tool. By appropriating technologies, human beings intensify their uses and build new forms of expression and language (PRETTO, 2011, p. 105-106).

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According to Riecken (2006), the user and the content are at the center of IS's concerns and not the technologies. However, IS can make use of modeling and notation practices derived from software engineering and computing to facilitate the operationalization of computer systems, such as information retrieval systems, their databases and networks, from the models and conceptual representations. Therefore, it is necessary to understand users' information practices from the social perspective of user studies, a subject that will be presented in the next section.

4 INFORMATION PRACTICES

The construction of technological artifacts, particularly informational ones, is strongly linked to information representation, organization, use and retrieval, which, in turn are inextricably intertwined. These topics are traditionally coped by Information Science.

In the web 3.0 environment, user interaction is better as better designed the structure, organization and usability aspects, which, must aim to streamline and facilitate subjects' practical actions. In this context, IS objectives are directed towards the study of the receivers' needs (users), with the purpose of adapting the information to their needs. In this context, the relationships between the subject and the informational environment include dialogic exchanges across users, and also their interactions with the interfaces of different devices in digital environments, which can take the form of pseudo-dialogue. As new demands and social practices require or demand the search for problem solutions in practical life, there is a shift and adjustment in Information Science which, according to González de Gómez (2000), has presented as a set of knowledge aggregated by questions rather than by theories since its first manifestations.

The question of how to facilitate the information subjects' daily activity performance in a network stands out. A question that even challenges the concept of user, and evokes a deeper understanding of what context is and how it configures interactions on the web. On the first point - the role of the user - it is necessary to think about their role as a subject in the informational environment, not only using services, but also producing content, and being questioned in their interactions. In this view, informational subjects are social actors whose actions are amplified and shaped by computational artifacts. To understand actors in context,

> Information science has moved towards the consolidation of perspectives based on aspects of the so-called social paradigm. This shows a trend, which is also a closer look at the complexity of phenomena, the interrelationship of their elements and dimensions, as well as new aspects of empirical realities that demand new explanatory models. (ARAÚJO, 2018, p.93, our translation).

Understanding the phenomena and social actors in context evokes the problematic of context as discussed by Courtright (2007), for whom four ways to define and study context are pointed out: a) container; b) construction of meaning; c) social organization; d) relational entity. A semantic web device such as a recommendation system is a container, taking the characteristics of its users and encapsulating content for delivery, in line with an approach taken as traditional in the field of information user studies. In turn, such device provides support for the construction of meaning by its users, given specific situations, and the users' cognitive characteristics, aspects that are usually addressed by the alternative approach of studies of information users. However, devices can encourage certain forms of social organization and the achievement of practical goals; or they can be taken as a relational entity, promoting the construction and reconstruction of social and/or community relationships.

From these last two perspectives, it is necessary to evoke studies on the social approach of information users, among which information practices stand out.

For Da Silva et al (2020), analyzing information practices in virtual environments corresponds to the search for a better understanding of how subjects deal with information in these environments to also consider the intricate social instances that build their perception of the world.

Understanding the informational subjects' everyday interactions on web 3.0 is increasingly challenging, once social organization and relationships change as artifacts are used and (re)created. But, without such an understanding, especially on the social context, producing computational artifacts that mediate the users' actions in a network is impossible. A fruitful approach to understanding the subjects' everyday actions with information has emerged in the field of information user studies - it is the approach to information practices. Savolainen (2007) identifies the theoretical roots of the concept in sociology and anthropology, working on collectivity and singularity. According to assumptions from the perspective of information practices, we conceive an individual who not only uses, but appropriates, creates and shares information.

Rocha, Gandra and Rocha (2017) report that the study of everyday social and cultural practices and context is necessary to see the implicit information practices beyond objects and minds, which build, interact, use and modify informational relationships in a dynamic way. The authors highlight that,

> the senses and meanings of the practices (everyday-life activities) are intersubjectively constructed, as the social order would be revealed by indicial elements present in the discourse of the actors and the activities carried out by the individuals [...] The practice would be seen as the result of work negotiated by the community and which requires continuous updating efforts, through the work of mediators and intermediaries in social groups that have been formed or are to be formed. (p. 100 – 102, our translation)

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Considering that artifacts build the subjects' interactions with the world, looking at the context as a social construction and relational entity concerns the study of information practices in digital environments. According to Araújo, Duarte and Dumont (2019, p.91, our translation),

> the adoption of the terminology information practices and the sociocultural stance to undertake studies of what we have come to call no longer information user, but an informational subject (thus emphasizing their character as actors) is consistent with the historical moment of valuing the context in investigations, considering the dialogical relationships between subject and context.

Important bases of theoretical elements for the debate around the concept of information practices are based on the understanding of the subjects' actions within the social sphere. Tuominen, Talja and Savolainen (2009) point to the concept of information practices, as all human practices are social, and originate from interactions, from various groups and communities that constitute the context of their mundane activities. Araújo (2018) highlights the diversity and dynamics in the field of information practices, which, according to the author, aggregates "informational action", "information uses", "mediation of information" and many others.

As the web established itself as the best known and most widespread system, presented as a digital environment that enables different forms of interrelationship of content, people, information flows, channels or information sources, this diffusion and insertion of the web in everyday life and in personal and professional relationships have opened the way for thinking

about information practices in the digital context, considering both everyday life and institutional aspects (RABELLO, 2017).

It can be said that as people interact and place themselves on the web environment, information practices are configured in these environments - social practices routinely shaped and constructed with the support of computational artifacts and with meanings shared and constructed by the subjects. If one of the purposes of IS and the study of the social approach to information users is to understand these practices, it is necessary to adopt a methodology, a way of analyzing them to learn them.

Possible approaches to the study of information practices include the adoption of theories such as social constructivism, social constructionism, phenomenology and others. However, studies are often focused on understanding existing practices and their significance. An important question remains: how to study information practices to design interactive artifacts?

This study bets it is possible to study users' information practices through the adoption of some design approaches, such as the design thinking approach, which will be presented below.

5 DESIGN THINKING AS A METHODOLOGICAL ALTERNATIVE FOR BUILDING WEB 3.0 ARTIFACTS

Researchers, especially in the information systems field in the 1990s, began to develop an interest in research that emphasized the creation of artifacts to serve human purposes. In this scenario, the development of Design Science (DS) stands out. "Design Science is the science that seeks to develop and design solutions to improve existing systems, solve problems, create new artifacts that contribute to better human performance, whether in society or in organizations" (DRESCH, 2013, p.85, our translation), and additionally, it can be tested as a method capable of uniting fields of knowledge in favor of common goals, using the best that each one of them can offer to achieve such goals (RODRIGUES, 2018).

For Bax (2015), Design Science has been updated and adapted to contemporary technological tools, and is linked to some of the best-known modern management practices, such as design thinking, agile development, customer development and lean startup, but also to the best practices aimed at analyzing the context problem and developing artifacts, making it a fertile moment for application by information science researchers.

Innovation-driven Design emerged in the process of technology transformation and evolution, moving towards new meanings, centered on the human aspect and on users' needs to provide good experiences (emotional, cognitive or aesthetic) in the iterations. In this new perspective, a design process emerges, called Design Thinking (DT). The term can be translated as "think as designers does", not configuring a unique approach to solving problems in the design area. The concept is best represented as "[...] a set of principles that can be applied by different people to a wide variety of problems" (BROWN, 2010, p. 6, our translation).

In the Brown's conception (2010), design thinking is a systematic approach that allows for innovation and goes beyond the need to produce a product or a service, as it is assertive to the point of entering directly into the consumer's life, and may even dictate certain behaviors, adding value to the business when applied in market contexts.

Design Thinking is considered a humanistic approach to innovation and creativity, centered on collaborative work and based on a multidisciplinary perspective based on principles of engineering, design, arts, social sciences and discoveries in the corporate world

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(PLATTNER; MEINEL; LEIFER, 2011, apud CAVALCANTI, 2014). The stages of the design thinking process are: 1) Observe, listen and understand - stage in which designers seek to understand how people perform their daily tasks and how the system can help them (strategic challenge). At this stage, observations, interviews, rapid ethnography, or any other techniques that allow immersion in what users are experiencing are carried out; 2) Define, Idealize, Create - an abstract stage in which one seeks to understand the meanings experienced by people, the meaning of their actions so that insights on how to transform and create new possibilities for products and services for users emerge; 3) Prototyping, Testing, Implementing - stage that seeks to build prototypes of products or services that make sense to users, involving them in the testing and implementation phase for solutions.

According to Cooper, Junginger and Lockwood (2010), Design Thinking is a tool that helps to project future states, to idealize through the design process, as well as to develop and/or create real products, services and experiences. Design thinking seeks to find the most suitable solutions for its target audience; and this is done through experimentation, valuing empathy and creativity.

Based on the above, DT is identified as a tool for innovation in any user-oriented context, giving them the necessary importance, considering their beliefs and ideas for improving products and services or processes that will be improved for them. Through a set of strategies and a series of steps, information and ideas are organized. In this context, importance of DT is understood within Information Science as DT contributes with the focus on the user. In the case of user studies, in the information practices developed in this area of knowledge, DT can be seen as an excellent methodological alternative to be able not only to identify the users' needs, but to create better services, that is, the mediating artifact for them. The initial DT questions that arise especially in phase 1 - understanding users' actions, and in phase 2 - understanding the meaning routinely attributed to them - are addressed by studies of social context and the meaning of actions routinely performed by people, conducive to the approach of informational practice studies. By extending the scope of the study to social transformation, in relational contexts, the DT proposal allows us to glimpse the context of the intersubjective construction of reality and new contours for social relations, familiar to the study of information practices.

DT applicability initially occurs for realizing its innovative character and for believing that the used techniques can be efficient to make new ideas tangible, to more accurately meet the users' needs and the way to capture the best to build a mediating artifact.

The DT pillar seeks to answer questions based on information collected during the observation of the context that permeates the problem. The solution does not derive from the problem, but transforms it, as is characteristic of a mediating artifact, enabling the construction of new meanings.

Design Thinking is not a fixed approach, it only works for those who have the ability to put others on the same level. Learning to listen, collaborate, build together, experiment, take risks, test, put oneself in the other's shoes are some of the elements that support the DT's values: empathy, collaboration and experimentation. Regarding empathy, DT is about the ability to understand other people's experiences and social contexts, it is having a better understanding of choices and behaviors, it is putting the human being experience in the foreground when creating products or processes. In order to gather different perspectives and to create a more comprehensive strategy, collaboration is articulated through different visions that can add, modify, complement, and innovate solutions. Typically, it is necessary to test, experiment and adjust, so experimentation is the third of the DT pillar - the more customized the strategy, the more efficient the result.

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For Nogueira (2014) design thinking processes appropriate cognitive procedures that lead to innovation. In this cognitive context, the foundations for the construction and development of a mediating artifact based on the articulation and constant validation of exchanging experiences is identified. It exercises adequacy and improvement, analysis and tension in the search for assertiveness between the subject and the object in the context that permeates the problem.

> Practicing design thinking means being aware that the objective of the project is not just to fulfill a goal or simply to solve a problem, but it is to think about the means for the changes to be reflected, it is to allow the people for whom it is designed to have the tools to move forward and become the main responsible for the changes in their lives. (NOGUEIRA, 2014, p. 48, our translation).

According to Kimbell (2009, p. 8) for the purposes of this Design Thinking discussion, three aspects are highlighted: the first points to the way that situated and distributed practices constitute technologies and structures. Technologies are constituted recursively as a function of their users' appropriation modes and communities for practical problems' solution. The implications of usage transcend the individual's limits and cognitive style. The design activity must consider the different understandings and appropriations of technological artifacts both to design them and to modify them over their time of use. Another aspect, the second one, focuses on practice. Objects are necessary components, as indispensable as mental and bodily activities. Paying attention to objects, whether they are objects in the natural world, instruments or objects produced within a knowledge practice, is a way of distinguishing between the definition of practice as a ground rule or embedded skill routines, and a notion of practice that it is more dynamic, creative and constructive, according to Kimbell (2009), an individual process. The third and last aspect is based on knowledge that can be studied in different ways. The contribution of the practice perspective is to avoid the alternatives present in other theories that focus exclusively on what goes on in people's minds, or on the level of social norms, or what goes on in language, for example.

In this same perspective, Cox (2012 apud Rocha, Gandra and Rocha, 2017, p.99) treats practice as an emerging approach that interconnects different elements such as the body, mental activities, objects and their use involving perception, skill, emotion and motivation that:

> Taking the theories of practice as a whole, this approach appeal lies in capturing the context that social life covers, without taking the context as the totalizing structure, enabling the individual's action to be considered, and also suitable for change and the contingency. The individual performs the practice, neither autonomous nor doped by social culture. The vocabulary of practice communicates a sense of knowing as social, incorporated and embedded in routines and material objects and their disposition, intimately associated with purposes, feelings and tastes, transitory and situated. This is the radical challenge of the assumptions of the common sense of knowledge, founded on rationalism and cognitive thinking (our translation)

Given these statements, the pragmatism that considers practical consequences or real effects as vital components of both meaning and truth is verified. In everyday problems, subjects who have issues or pains that need to be resolved will always exist. And DT contributes to the ability to understand and deal with behaviors, feelings and reactions in experiences, in their social context and life stories, in a shared or added way. The purposes of design thinking are allied to the study objectives of situated practices of technology appropriation by users, as they are individually and socially constructed. In this sense, Araújo (2020) understands that the approach to informational subjects' everyday practices must take

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place under the paradigmatic orientation of the social paradigm in Information Science and, more specifically, under the perspective of studying the information practices of information users. In this way, it is possible to think about the establishment of transdisciplinary[1] interactions between IS and design.

This article argues, based on the understanding of its concept and applicability, that design thinking is a transformative and pertinent strategic tool in the context of mediating artifacts, as it is a methodology centered on the context of human interactions and that allows professionals from different areas to appropriate it to transform and improve people's daily lives. Practices involve bodies, minds, things, knowledge, speech, structure/process and, most importantly, cannot have one of these elements in isolation. Both DT and IS information practices approach seek to understand people's routine behavior and their shared meanings, seeking to understand various elements, interconnected to each other: forms of bodily activities, forms of mental activities, things and their uses, a knowledge in depth in the form of understanding, know-how, states of emotion and motivational knowledge.

In the context of web 1.0, all the aforementioned elements of people's routine behaviors did not need to be fully understood for the construction of information retrieval system interfaces, which were limited to interactions in few form fields combined with Boolean operators. Having evolved greatly in the possibilities of its technical infrastructure for web 3.0, and even more for web 4.0, it is necessary to think about the possibility of creating information retrieval environments integrated to the user performance of daily tasks, in a customized way, as it would be, for example, the case of thinking about a system to retrieve recipes to make a dinner when arriving at home, which is integrated to the Internet. The format of this information retrieval system would likely be conversational and innovative. Demands for innovations facilitate emerging everyday activities, (re)building and (re)formulating knowledge prior to new situations that will eventually occur. Thinking about customizing the user experience when retrieving information in context, such as in the case of the smart home, is a challenge. The process of searching and retrieving information in such diverse contexts is not restricted to carrying out structured and keyword-oriented searches, so the need to understand the integration of digital tools to ways of thinking and acting in everyday environments that hybridize with the digital. In other words, the elements of users' practice need to be understood - forms of bodily activities, forms of mental activities, things and their uses, in-depth knowledge in the form of understanding, know-how, states of emotion and motivational knowledge - to produce more flexible and fluid informational environments for locating and retrieving information in everyday activities. Still on the example of retrieving a recipe for dinner in a smart home, perhaps the routine elements of tiredness (body), motivation to be accompanied or not, to be or not a special day, to know or not to cook, to contain or not certain ingredients, when considered by the good designer observing the user's practice, can lead to insights about an information retrieval system integrated into the home, with its intuitive and innovative interface for the user. Considering that Design Thinking is premised on the promotion of innovations through the knowledge of such elements, involving its users, the bet is that it will be possible to revolutionize the production of information retrieval systems that are effectively integrated to their users' mind, body and heart.

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[1] The relationship between IS and design can be seen, from the perspective of this article's authors, as a transdisciplinary approach, as it allows ID to expand the contact frontiers with fields that are beyond scientific, such as the field of technological artifact development in the field of design and engineering. A deepening of this position is not the objective of this text.

In the tension worked by the designer in this text, it is possible to make a connection with some conceptual discussions from information science, more precisely with information practices. information practices seek to understand the subjects' actions in line with their decisions and self-government, but which are directly related to embedded cultural and social patterns. As Araújo (2020, p.50, our translation) puts it, this perspective promotes the "Understanding that social life exists and is updated, always within a context, it is imbricated in it to articulate different varieties of actions, inserting itself in the dynamics of individual and collective action".

6 CLOSING REMARKS

The approach to the study of information practices in Information Science concerns the understanding of the construction of significance in the everyday social practices of informational subjects. Some of the subjects' everyday actions and interactions with information have a stage on the web 3.0, which are supported by automatic computational artifacts that mediate various processes of using the network. To conceive such artifacts, it is necessary to place the users' understanding at the center of the design process for and in this environment, requiring the adoption of a user-centered methodology that maintains the focus on the users' needs, desires and limitations.

The hypothesis raised and worked on in this article is that the construction of mediating artifacts on the web 3.0 requires approaches to study the users' information practices that can be carried out through the adoption of the design thinking methodology.

Through the design thinking methodology, the development of artifacts with greater awareness, participation and humanization in the creation process, during all stages of the study is enabled. This methodology seeks to understand the meaning of the actions performed by the subjects in their daily lives, aiming at solutions, such as artifacts, which, transform the organization and social relations, that is, they are constitutive of the context of users and their relationships.

For future studies, creating a conversational environment in the context of web 3.0 is challenging, considering that Information Science has not traditionally approached an environment of this nature with an innovative approach that takes into account the richness of its users' everyday practices. The way to face this challenge is to seek to model the subject's context and daily life, being closer to reality and to everyday communicational interactions, through design thinking, involving users in the constructive process in a collaborative and multidisciplinary way.

In the gigantic informational ocean of the web, to place new ships, maps, routes and navigators, design thinking would seek to understand navigators and their everyday interactions, more or less autonomous or automated, for who knows, create new tools and objects that, socially appropriate, allow to explore seas that have never been navigated before.

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