INFORMATION DESIGN, SCIENCE, TECHNOLOGY AND SOCIETY: AN ENCLAVE OF THE DIGITAL

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Abstract: Information Design is a field that focuses on addressing issues related to message comprehension, with a particular emphasis on communicative efficiency and effectiveness. Concepts such as graphic language, information organization, and user experience are central to the discourse of this discipline. These concepts advocate for a systematic approach to creating these tools when applied to digital interfaces. However, when Information Design intersects with Human-Computer Interaction, conflicts may arise due to technological components. This article seeks to incorporate insights from Science, Technology, and Society (STS) studies to offer a critical perspective on the role of Information Design in interface development. It provides an overview of the disciplinary discourse within Information Design and uses this as a foundation to examine the validity of the commonly cited arguments in the literature that justify the relationship between Information Design and technology, namely multidisciplinarity and innovation. By framing the discussion within the context of STS, the article proposes various potential avenues for future research.

Keywords: Information Design; Human-Computer Interaction; Science and Technology Studies.

DESIGN DA INFORMAÇÃO, CIÊNCIA, TECNOLOGIA E SOCIEDADE: UM ENCLAVE DO DIGITAL

Resumo: O Design da Informação se distingue como uma área que aborda os problemas de compreensão de mensagens: questões como eficiência e eficácia comunicativa são tomados como o aspecto central da atuação do designer. O discurso disciplinar formado em torno disso é composto por noções de linguagem gráfica, organização da informação e experiência de uso. Esses conhecimentos passam a ser aplicados às interfaces digitais, sugerindo uma abordagem científica para o desenvolvimento desses

artefatos. Todavia, no diálogo entre o Design da Informação e a área da Interface Humano-Computador, existe o elemento tecnológico como ponto de tensão. O presente artigo visa introduzir conceitos dos estudos das Ciências, Tecnologia e Sociedade (CTS) para elaborar uma visão crítica sobre o papel do Design da Informação no desenvolvimento de interfaces. Um panorama do discurso disciplinar do Design da Informação é descrito e, a partir dele, propomos uma discussão acerca da pertinência dos argumentos comumente utilizados na literatura da área para justificar sua relação com a tecnologia: multidisciplinaridade e inovação. Trazendo a questão para a perspectiva das CTS, sugerimos diferentes abordagens possíveis para futuras pesquisas.

Palavras-chave: Design da Informação; Interação Humano-Computador; Ciências da Tecnologia e Sociedade.

DISEÑO DE INFORMACIÓN, CIENCIA, TECNOLOGÍA Y SOCIEDAD: UN ENCLAVE DE LO DIGITAL

Resumo: El Diseño de la Información se distingue como un área que aborda los problemas de comprensión de mensajes: cuestiones como la eficiencia y la eficacia comunicativa son tomadas como el aspecto central de la actuación del diseñador. El discurso disciplinario formado en torno a esto está compuesto por nociones de lenguaje gráfico, organización de la información y experiencia de uso. Estos conocimientos pasan a ser aplicados a las interfaces digitales, sugiriendo un enfoque científico para el desarrollo de estos artefactos. Sin embargo, en el diálogo entre el Diseño de la Información y el área de la Interfaz Humano-Computadora, existe el elemento tecnológico como punto de tensión. El presente artículo tiene como objetivo introducir conceptos de los estudios de Ciencia, Tecnología y Sociedad (CTS) para elaborar una visión crítica sobre el papel del Diseño de la Información en el desarrollo de interfaces. Se describe un panorama del discurso disciplinario del Diseño de la Información y, a partir de él, proponemos una discusión acerca de la pertinencia de los argumentos comúnmente utilizados en la literatura del área para justificar su relación con la tecnología: multidisciplinariedad e innovación.

Palabras clave: Diseño de la Información; Interacción persona-computadora; Ciencia Tecnología y Sociedad.

1. Introduction

Recent research on the intersection of Information Design and technology reveals an intriguing trend. Meta-analyses by Sant'Anna (2019) and Winkelmann and Mager (2023) indicate a common practice among studies in these fields to embrace multidisciplinarity as a critical approach in addressing technological innovation. This is, nevertheless, a particularly significant dimension. It echoes the insights presented by Portugal (2010), highlighting the interdependence of Information Design and emerging technologies: there is a crucial role for design in making tangible to individuals the cultural output of society. As suggested by the author, Information Design emerges as a design domain with immense potential for integrating diverse knowledge disciplines to tackle new communication challenges effectively. Portugal's argument aligns with the notion that Information Design functions as a "super-discipline," adept at maintaining design coherence across various knowledge domains in the face of intricate technological advancements.

The trend can be succinctly summarized as follows: when technology assumes a central role, the scholarly foundation of Information Design, represented by published research and studies, reflects a dual approach that reinforces itself. Firstly, Information Design evolves in response to technological advancements, and secondly, owing to its multidisciplinary nature, Information Design can offer solutions for emerging technological trends. This interdisciplinary fusion is not just theoretical, but also has practical implications, as highlighted in Information Design literature (Pettersson, 2006). However, focusing solely on the innovative aspect of technology poses a challenge of false equivalency, implying a synonymous relationship and overlooking nuanced technical and social implications (Edgerton, 1999).

The development of digital artifacts (applications, software, websites) presupposes a degree of complexity: they implicate projects that involve the joint efforts of developers (programmers,

software engineers and information technicians) and designers (who deal with the design of the interface, sensory characteristics and elements of the user experience) — the *back-end* and the *front-end*, in technical jargon. These artifacts therefore become fertile ground for exploring the relationship between design and technology in applied contexts. Among these, interfaces stand out as a key area of focus: to quote Bonsiepe (1997), these components of digital artifacts provide the "space where structures and objectives of human action are presented." (*Ibid*, p. 12).

This chapter presents a consideration of the relationship between Information Design and technology beyond the well-established scope of innovation and multidisciplinarity. We leverage the Science and Technology Studies (STS) framework to cultivate a critical viewpoint. Information Design nurtures a disciplinary interest in digital interfaces, recognizing them as expressive spaces where the arrangement of elements influences behavior and usage decisions. The literature on Information Design is tailored to rationalize this aspect through scientific foundations. Consequently, within the realm of Human-Computer Interaction (HCI), there emerges a network of knowledge aimed at enhancing the effectiveness and efficiency of interface usage, exemplified by usability heuristics (Nielsen and Loranger, 2006) and Garrett's elements of experience (2010).

It is plausible to posit that we are dealing with an established discourse in understanding HCI: in Foucault's words, the "practices that systematically form the objects of which they speak" (Foucault, 2014, pp. 49) create the objects of study, as well as the parameters by which they are observed, quantified, examined and judged in an area of knowledge.

It is in this sense that Krippendorf (2005) characterizes the idea of discourse as an extension of possible design considerations to its disciplinary boundaries. The author sees discourse as a network that presupposes valid practices, concepts, tools and even forms of expression, which manifest themselves through language, but are not restricted to it — they can also be represented by artefacts,

organizational mechanisms, historical treatises, etc. Design discourse is therefore "a social system with a life of its own" (Ibid, p. 44), within which artifacts are produced, and professional practices are established.

To embark on an exploratory journey within this discourse, we structure our argument as follows: we initially elucidate how the tenets of Information Design (ID) underpin the comprehension of Human-Computer Interaction as a subject of analysis. Subsequently, we introduce a critical perspective from Science, Technology, and Society studies to offer fresh insights beyond innovation and multidisciplinarity, thereby broadening the horizons of research opportunities for future scholars and investigators.

2.   The Interface Design: A Multidisciplinary Endeavor

The "Information Design" concept emerged with significance towards the end of the 1980s, defining a specialized design field focused on enhancing communication effectiveness. According to Bonsiepe (1997), Information Design stands out from other design realms by prioritizing efficient action, specifically by aiding in the recognition and comprehension of information, even at the expense of reducing the economic potential of the communication medium. Notable authors in the field, such as Horn (1999) and Waller (2016), view Information Design as a method to streamline and guide graphic design choices toward the goals of the communication process, with a strong emphasis on visual elements, audience interests, usage context, and the medium involved.

According to Horn (1999), the defining skill of an information designer lies in their ability to systematically describe and analyze a situation's *subject matter* based on the audience's specific needs. In the realm of Human-Computer Interaction (HCI), as highlighted by Dillon (2017), this capacity draws upon assumptions rooted in behavioral psychology, Gestalt theories, communication theories, and

cognitive psychology. HCI studies, however, typically follow a "design-test-repeat" approach, where results stem from an iterative process involving user participation, relying less on psychological studies and more on observing interactions. Pettersson (2006) emphasizes the necessity for multiple rounds of revisions in all research stages of Information Design, citing testing as a crucial foundation due to the emergence of unforeseen behavioral possibilities with each new interaction.

Hence, a drawback of this approach is the lack of guarantee for "scientific" results in the traditional sense, as stated by Dillon (2017). This poses an interpretative challenge, wherein "User-Centered Design," as commonly known, bridges cognitive theories and empirical usability studies. Despite being guided by principles, designers are compelled to test various alternatives continuously, given the ever-evolving landscape of technological solutions, which necessitates a forward-looking design function involving envisioning future scenarios and devising viable strategies for them (Vallgårda and Sokoler, 2010). Dillon (2017) notes that scientific validation takes a back seat in design, as internal validation of project requirements tends to hold more decision-making weight.

The pivotal criterion that delineates the relationship between Information Design and technology is the imperative to differentiate design activities from a purely "planning science," where an analysis informs decisions of technological trade-offs. "Trade-off" is an expression used to describe the situation in which it is necessary to choose between two or more development options, knowing that each one has advantages and disadvantages — opting for one necessarily implies giving up the advantages of the other. Weinberg (1972) would call this the "trans-scientific problem": design, in its applied nature, assumes a compensatory role for scientific approaches, since they cannot extrapolate prototype behavior to the systems on real scales.

This does not imply a lack of foundation for design decisions. Instead, it underscores a distinct type of knowledge embedded in design that transcends scientific understandings of technology,

entering the realm of social problem-solving. Project requirements are no longer solely technical dilemmas; they must be balanced with social, political, and economic considerations to undergo validation before implementation stages. These decisions necessitate a holistic project outlook, relying not just on scientific assumptions about technological functioning (Galle and Kroes, 2014). Epistemologically, by mediating between technical-scientific rationality and the creation of interfaces, design assumes the role of facilitating a "social exercise of reason" (Kroes *et al.*, 2009), shifting the focus from an assumed objective reality to resolving project trade-offs within the context of use.

There is a well-delineated suggestion for this approach recently made by Portugal and Hagge (2023). The authors seek to present a theoretical foundation for an interpretative design, stemming from the "epistemic multiplicities of the human sciences" (*Ibid.*, p. 120). This places the design practice against any framing of a universal method in the Cartesian sense of accessing the world via observation or empirical analysis to find a limited variety of observable situations. The authors propose that, as a social science, design should not depart from a "given world" of well-mapped phenomena – in this case, the specific paradigm of the information sciences, or from any specific paradigm whatsoever, but from an open field of "interpretative possibilities" (*Ibid.*, p. 119).

From an engineering perspective, the "sciences" of Information Design are expected to minimize ambiguities, establish clear guidelines, and justify trade-offs based on technical feasibility (Lindell, 2014). In this way, design acts as an "intelligent action that consists of proposing a novel idea for an artefact, so as to enable yourself or others to make one or more artefacts according to that idea" (Galle and Kroes, 2014, pp. 216).

Dorst (2006) illustrates how, like an architect translating a problem into requirements through house models, designers interpret vague interaction problems into project requirements that developers and technology experts can implement. This process involves creating models that traverse various knowledge domains communicating

attributes through visualizations, diagrams, mock-ups, and other resources (Galle and Kroes, 2014).

Since the system interface is one of these models, what summarizes the discourse of Information Design could be a return to the way Herbert Simon ([1968] 1996) concludes that the role of design is: to present a series of viable alternatives for the project, as well as the parameters by which one could point the better suited of these alternatives, considering the requirements and trade-offs of the given problem-situation. Instead, as a reviewer of the present chapter suggested, Information Design tends to tailor its alternative-making processes to the stakes of capitalist contexts. The interface often becomes a profit-maximization scheme for enterprises, eliminating other viable solutions that are less focused on the economic aspects of the project. Through the screen, users are enchanted by the experiences of digital environments, steering the interaction away from critical and emancipating possibilities.

3. Technology and Information Design in the Real World: A Critical Examination

Let us now present a counterpoint to the prevailing discourse by exploring the insights offered by the studies of Science, Technology, and Society (STS) concerning interface artifacts.

The STS perspective offers a holistic view of scientific advancement, interpreting it as cultural knowledge intertwined with various other forms. Technology is a practical application of scientific knowledge through structured systems that integrate individuals, materials, means, and objectives. Society emerges as a crucial third element in this dynamic, shaping technological systems and their repercussions (Palacios *et al.*, 2003). De Morais (2002) elaborates on STS as an approach that seeks to comprehend technology not merely in terms of its overt functions (tools, objects, etc.) but also in terms

of its latent functions: encompassing economic implications, social repercussions, and political ramifications.

Adopting a critical and philosophical stance towards technological advancements sheds light on the interdependence among science, technology, and societal factors in Human-Computer Interfaces. Bardzell and Bardzell (2013) argue that the realm of HCI represents a pivotal area for exploring the ethical obligations of design. They emphasize that envisioning interaction spaces entails establishing boundaries and guidelines for the technological impact on human behavior – essentially delineating what individuals can or cannot do with these machines.

Such ethical obligations are suggested by Flusser (2010), as the author notes that the pragmatic dimension of any technological project, such as the usefulness of an intended artifact, is no longer sufficient for a strong ethical standpoint for design. The responsibilities for the outcomes of the use of such artifacts become too diluted along the complexities of its fabrication: decision-making stakeholders, automated processes and unforeseen adaptations no longer admits the design-phase to be a "pre-ethical activity" (*Ibid.*, pp. 71).

Ignoring this critical perspective reveals a potential issue of technological determinism within the discourse of Information Design, a concern that could be addressed through the critique offered by STS. Krippendorf (2005) expresses this concern by noting how design is susceptible to submission to the well-established imaginary of developers. In this context, the chances of design playing a "remediation" role increases, focusing solely on standardizing new technologies to enhance public acceptance. This inclination was initially highlighted by Heilbroner (1967) when he identified a flaw in the historiography of technology: the assumption that technological progress is inherently predictable – as if every advancement were an inevitable outcome of previously established technologies. He advocates for viewing the relationship between society and technology not through a deterministic lens but through a relational perspective, where changes in one sphere trigger changes in the other and vice versa.

The literature on HCI has a broad field of investigation evidenced through the possible "levels of analysis" thoroughly demonstrated: starting from a first level in which the direct relationship between people and technology would be in focus, it is possible for HCI studies to expand to observable work aspects around this relationship, reaching social and technical systems in their more strategic organizational factors (Preece *et al.*, 2015). This expanded scope inevitably creates discursive tensions, challenging preconceived notions such as the dichotomy between designers and users, which become problematic constructs in light of historical notions of technological impositions (Gonzatto and Van Amstel, 2022). Kroes *et al.* (2009) propose that design's role transcends the conventional understanding of technology within engineering, as it unveils the inherent social dimensions of artifacts.

Dunne and Raby (2001) delineate design projects as either affirmative, reinforcing existing values and shaping technical and social landscapes, or critical, rejecting the *status quo* to prioritize social, economic, and cultural values. According to Bardzell and Bardzell (2013), this design approach is a tool for cultivating critical sensibilities within technological projects. For design to be truly critical, however, it must propose a change of perspective on phenomena from a holistic viewpoint: through dialogical methodologies, design "improves the public's cultural competence, and is reflexively aware of itself as an actor — with both power and constraints — within the social world it is seeking to change." (Bardzell and Bardzell, 2013, p. 3304).

As the authors propose, the defining characteristics of critical design involve interactive processes that empower individuals to actively construct meaning, engage in co-creation, and emancipate perspectives of use (*Ibid.*). Bødker (2006) refers to this set of factors as the "Third Wave of HCI," which replaces traditional participatory design methods with alternatives emphasizing transparency and plurality in technological artifact development. Particularly during the prototyping phase, this approach advocates for a design methodology that explores transparency and operationalization of interactions

and fosters controlled reflexivity. The Third Wave of HCI represents a fresh theoretical approach to technology, focusing on its cultural and emotional dimensions with an emphasis on located concepts of experience.

One catalyst for the emergence of this Third Wave, as per Bødker (2006), is the advent of technologies whose consequences of use are not fully comprehended. The critical aspect lies in accepting that these new artifacts do not operate in isolation but are embedded within a contextualized framework of lifestyles and social interactions. Hence, comprehending technology necessitates understanding its operational context (Bødker, 2015). The vision that Verbeek (2005) suggests is that of technology as a mediation between human beings and the world around them. Through their presence, technologies shape people's understanding of themselves and the real world: both become technological products, phenomena that emerge from interactions.

By presuming that technology is a matter for innovation alone as a factor supposedly solvable in multidisciplinary terms, we are at the same time accepting that the technological discourse on interfaces does not need to be questioned. It is by its nature of social conciliation, however, that design has the power not to treat HCI as a predetermined set of statements about where interaction begins and ends.

4. Final considerations

This study has identified the foundational assumptions that underpin the discourse of Information Design and its interplay with technology, particularly within the realm of Human-Computer Interaction (HCI). In contrast to the studies in Science, Technology, and Society (STS), we have demonstrated that the comprehension of Information Design's role in technological initiatives is rooted in a theoretical framework that rationalizes design possibilities by balancing the trade-offs between available technologies and their practical applications.

Within this rationalization framework, particular challenges arise, such as a tendency towards technological determinism. However, there are also potential solutions, notably in exploring the social dimensions of projects. While innovation and multidisciplinarity are frequently cited as critical arguments, it is essential to recognize that there are alternative avenues through which design can engage with technological challenges. Ethical considerations, redefinitions of the relationship between usage and development, and an appreciation of technological design as a form of mediation (Escobar *et. al*, 2022) represent some of the diverse pathways that Information Design can pursue.

An interesting development would be to evaluate how the divisions between "UI" and "UX" design are established as a popular way of segmenting project operations: the multidisciplinary potential of Information Design is growing in the discursive domains to the point of actually transforming it into different disciplines, increasingly focused on specific aspects of experiences. The question remains whether the concept of "Information Design" is anchored in its abstract principles or if the assumptions inherited from graphic design confine it to the sensory realms of interfaces, which are increasingly influenced by new, highly customizable technologies.

Furthermore, this investigation into the intersection of Information Design and technology presents an opportunity to challenge the prevailing technological discourse. Viewed as a realm of mediation, technology exhibits a certain malleability. By fostering a relationship between Information Design and technology, through a non-deterministic bias, makes us question whether what is interesting is not what is necessarily innovating or "advancing" the area, but what, by design, would be socially better resolved.

5. Acknowledgements

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