

Artificial intelligence in UX/UI design: a survey on current adoption and [future] practices

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Abstract:

Artificial Intelligence (AI) technology has been disseminated across various industries, and algorithm-based activities are becoming common in design disciplines. Despite high expectations of collaborating with intelligent systems, whether designers are actually interested in working with algorithms has been little discussed. This paper summarises ongoing research findings that have probed the use of AI features in design practices. A survey of Brazilian UX/UI professionals was conducted to map their AI-supported activities and explore their perspectives on interacting with AI systems and future adoption scenarios. The findings indicate a low usage rate of AI tools in the Brazilian UX/UI industry and a limited operational perspective regarding the role, application, and impact of intelligent technologies on design. Surveyed UX/UI designers are more prone to adopt AI as a virtual assistant to facilitate practice and increase process efficiency rather than as a creative collaborator.

Keywords: UX/UI design; artificial intelligence (AI); adoption; design tool

1. Introduction

In his seminal paper on computer systems and design practices, Cross (2001) suggests that one should pay attention to human design cognition to probe issues related to machines' ability to deliver designs. This research builds upon this direction and explores design practitioners' perceptions of adding Artificial Intelligence (AI) technologies to their practices. Even at their early stages, AI systems are becoming accessible for designers and changing design practices without undermining fundamental principles of design (Verganti, Vendraminelli and Iansiti, 2020).

According to Boden (2016, p. 1), "AI seeks to make computers do the sorts of things that minds can do." Russel & Norvig (2016) further clarified that intelligent systems' operation encompasses thinking and acting humanly and rationally. Among the five types of AI—classical, artificial neural networks, evolutionary programming, cellular automata, and dynamical systems (Boden, 2016)—, currently,

design practitioners primarily have classical AI and machine learning features available for working and explore neural networks (Pfeiffer, 2018).

Despite anecdotes regarding AI threats to design disciplines (Girling, 2016, 2017), research on AI-based design is gaining ground. It has already covered topics such as AI's impact on design practices (Cautela et al., 2019; Liao et al., 2020; Verganti et al., 2020) and practitioners' roles in interacting with AI (Angell, 2019; Liu & Nah, 2019). While investigating these complex issues, scholars listened to design practitioners (Main & Grierson, 2020; Pfeiffer, 2018) such as UX designers (Churchill et al., 2018; Dove et al., 2017).

Our paper follows this latter path and summarises findings of an ongoing project investigating designer practices associated with AI. More specifically, we focus on UX/UI professionals aiming to understand how they are currently using intelligent systems and obtain their perspectives on AI adoption.

We surveyed Brazilian UX/UI designers to map current practices supported by AI tools. Although designing with algorithms is not widely popular currently, we delved into individual perceptions on AI capabilities and applications and their impact on UX/UI design activities. In addition, we examined a scenario where AI tools evolve into systems functioning as AI design assistants and explored designer's perspectives on their role when interacting with AI technologies.

The findings reveal that the Brazilian UX/UI design industry is in the early stages of adopting algorithms to support design practices. Practitioners lack understanding of AI potential but had few opportunities to experience intelligent systems. They thus perceive AI as an operational tool that facilitates developing stages of the UX/UI design process and impacts design efficiency. However, from a medium-run perspective, individuals reckon AI features to be a common approach when developing design activities. Although currently viewing AI systems as virtual assistants, they suggest that they would be open to working collaboratively with intelligent technologies.

AI's diffusion among design practitioners involves understanding algorithms not only as a new design material (Dove et al., 2017) but also changing attitudes towards creative collaboration with AI technologies (McCormack et al., 2020). Despite the study's limitations, we expect these findings to provide avenues for further investigation of the challenges designers face when embracing technologies that add to their natural intelligence.

2. Background

Computational systems have significantly impacted design disciplines. Bernal et al. (2015) investigated computers' roles in design practices and proposed categorising design processes as computer-aided, computer-based, and computer-augmented. However, in the context of the Fourth Industrial Revolution, a profound impact is expected to come due to the expansion and integration of computer systems used by designers (García Ferrari, 2017).

AI systems are still in development and not fully available to designers. But a computer-augmented approach tends to challenge design activities, and AI is expected to play a critical role in the future. In a so-called 'AI design' context, solutions are delivered through intelligent systems during the design process. Notwithstanding, current approaches are restricted to employment of generative algorithms to support the creative process (L. Chen et al., 2019) or apply algorithms to automatise design tasks that used to require intense manipulation (Cautela et al., 2019). Since humans still mediate these processes, AI-empowered design (Verganti et al., 2020) might better describe the contemporary use of AI in the design area.

Research on AI in design practices has taken different directions. Cautela et al. (2019) pointed out that AI can facilitate teamwork, empower research development, and automatise test and feedback phases. They expect AI algorithms to fit intelligent data processing activities, including image and language processing, virtual assistance, and recommendations for solutions. Examining current AI systems, Liu and Nah (2019) refer to the AI functions and advantages that affect practitioners. According to them, design efficiency is improved by data processing and automation, communication is promoted by concept visualisation and solution generation and a generative design approach expands the imagination.

Main and Grierson (2020) surveyed designers to investigate AI capabilities that might support the design process and enhance creativity. They suggested that tasks related to creativity—generating, reviewing, selecting, and translating concepts into final design outcomes—are less tackled by AI tools compared to tasks as project planning and management, problem research, and testing and feedback. Conducting extensive research in three continents, Pfeiffer (2018) interviewed designers to explore attitudes toward AI-based creative assistants. The results showed that a majority of respondents valued AI for its streamlining of the operational aspects of practice, such as reducing drudgery. As Main and Grierson (2020) found, they had little expectation that AI will provide creative solutions.

Despite practitioners' perception of AI as enabling improved performance, scholars show room to explore creative issues. Liao, Hansen and Chai (2020) proposed a framework of AI-augmented design support for early stages where AI's role in ideation is related to creating representation, triggering empathy, and promoting engagement. Similarly, McCormack *et al.* (2020) characterised AI as a creative agent system that provokes, challenges, and enhances human creativity. Verganti, Vendraminelli and Iansit (2020) further claimed that AI reinforces design principles such as people-centredness, leading to potentially more creative solutions.

As AI evolves, it goes beyond being a design tool and becomes integrated into systemic solutions such as Adobe Sensei (Adobe, n.d.). In this context, the role of designers in the design process will change. McCormack *et al.* (2020) described AI as systems that allow creative collaboration with designers. Similarly, Churchill, Allen and Kuniavsky (2018) presented AI as collaborators in delivering shared outcomes. Main and Grierson's (2020) research proposed that AI can perform as an assistant, collaborator, researcher, or facilitator but might also play the role of future co-creator. As AI comes to be actively embraced in design tasks, Angell (2019) pointed out that practitioners need to include data science in their skillsets. Conversely, Girling (2017) observed that designers would become curators and not necessarily be creators in future AI contexts.

2.1 Analytical framework

To address issues related to the adoption of AI tools not fully developed and available to all designers, we draw upon Marketing literature that explores the adoption of soon-to-be-launched products. Of the new product adoption literature (e.g., X. Chen et al., 2019; Nguyen & Joo, 2019), we built upon Ma, Gill and Jiang's (2015) research investigating the effect of innovation depending on whether it is core (e.g., when it is integrated with a base product) or peripheral (e.g., when it is a detachable accessory).

We extended this approach to the context of AI in design practices to help designers understand the AI systems currently available. We have characterised Adobe Sensei (Adobe, n.d.) as a core tool because it is integrated into Adobe software. We designated tools such as Remove.bg (Kaleido AI, n.d.) as a peripheral tool because it removes an image background as a detachable accessory

powering the design process. To clarify differences between AI tools, we use 'AI-integrated design tool' to refer to a core tool and 'AI-powered design tool' to refer to a peripheral tool.

3. Methodology

This study was devised to probe the current context and perspectives on AI adoption by UX/UI designers. The research design followed Dove *et al.* (2017) and Main and Grierson's (2020) approaches and was based on an online survey conducted among Brazilian UX/UI practitioners. Connected via social media, professionals working in cities with an established design industry answered a questionnaire encompassing 47 questions, of which 29 are covered in this paper.

As a survey strategy, no prior definition of AI was provided to avoid influencing respondents when obtaining their understanding of the topic. Conversely, multiple-choice and open-ended questions elaborated on current literature regarding AI in design practices and covered topics such as AI's role, capability (Main & Grierson, 2020) and application (Cautela *et al.*, 2019); they also explored perceptions of future scenarios for the use of AI features.

The survey reached 132 practitioners during December 2020 and January 2021, and 123 respondents were selected for the sample (Figure 1) under the criterion of a minimum of one year of professional experience developing UX/UI-related activities, either as a hired worker or as a consultant/freelancer. This criterion was assessed by an open-ended question where the respondent was required to describe her/his main UX/UI designer activity. After responses were translated into English, a mixed-method research approach (Creswell, 2009) guided their analysis. In addition to using descriptive statistics to examine the survey results, we adopted a Grounded Theory (Corbin & Strauss, 1990) procedure to interpret the answers to open-ended questions.

3.1 Participants

The strategy of sending a personal invitation via LinkedIn helped reach practitioners working in the Brazilian UX/UI design industry. Based on Figure 1, we may characterise the participants as Millennial designers (on average 31 years old) with educational backgrounds or training in a design-related area. They are employed in large companies in the Southern part of Brazil and have worked (on average five years) in-house UX/UI design departments, mainly in mid-level positions.

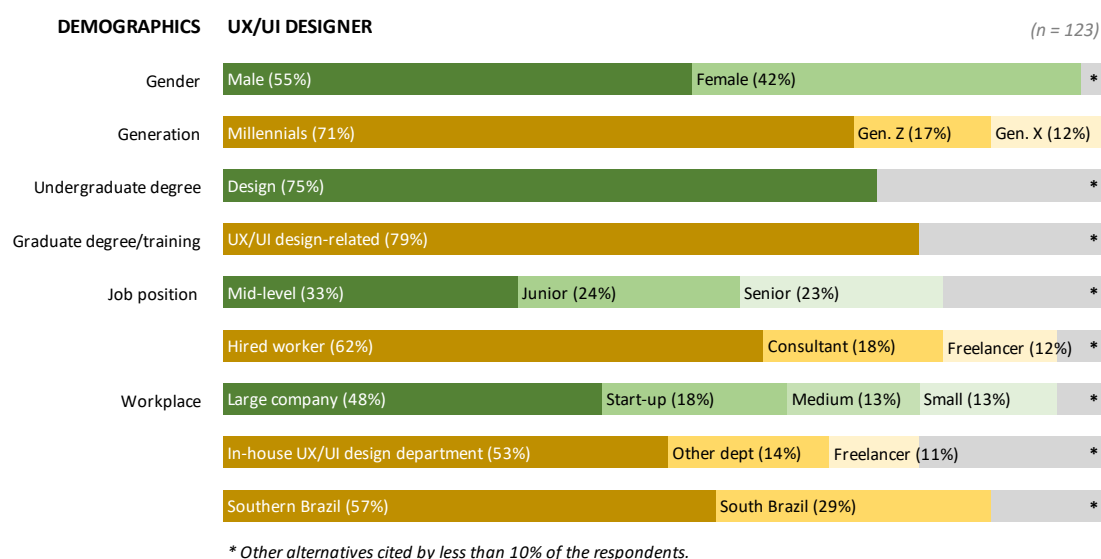


Figure 1. Respondents' profile.

4. Results

4.1 UX/UI designer's AI awareness

The questionnaire initially explored UX/UI designers' knowledge of AI by asking for a brief definition. Essentially, they described AI based on two contexts. The technology-oriented answers centred on the computational system, highlighting features such as programming and training algorithms to recognise patterns within a machine learning process. Conversely, responses focusing on AI operation and application referred to autonomous systems able to analyse data emulating human reasoning to help problem-solving and decision making.

4.2 AI adoption in UX/UI design's current practices

To date, as shown in Figure 2, Brazilian UX/UI practitioners had few opportunities to develop projects where AI either supported the design process or was embedded in the solution. Also, the adoption rate of any AI design tool has been low. When an open-ended question investigated regular use, Remove.bg was the most cited feature by the 22 respondents who had adopted AI-powered tools. Regarding the use of AI-integrated systems, only six respondents referred to Adobe Sensei.

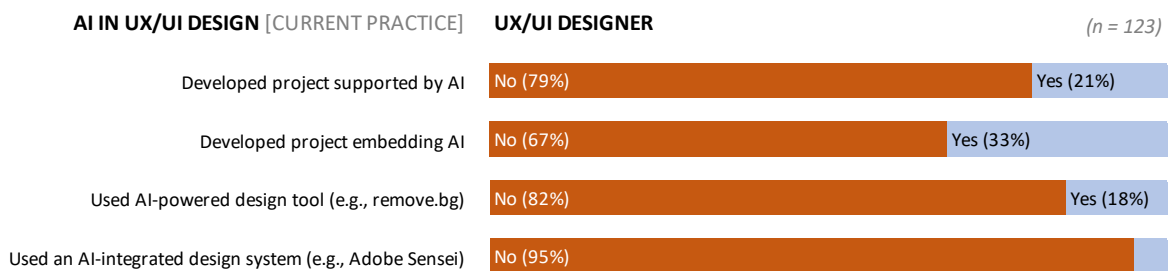


Figure 2. Current AI adoption in UX/UI design

4.3 Future adoption of AI in UX/UI design

The questionnaire investigated participants' perceptions about adoption within a decade. The majority considered that they would be familiar with AI features. Besides, when asked which AI design approach they would choose in such a context, most professionals leaned toward adopting AI-integrated design systems in their practices rather than AI-powered tools.

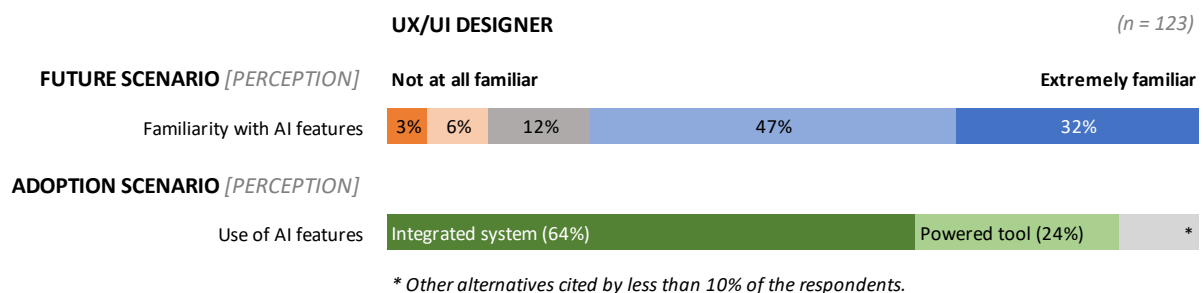


Figure 3. Perception on future AI adoption in UX/UI design

4.4 Perspectives on AI-based UX/UI design

Figure 4 summarises the designers' perspectives on topics elaborated on in research literature and explored through multiple-choice questions. Concerning the primary role of AI in UX/UI design practices, most respondents suggested it is related to optimisation (47%) and automatisisation (40%)

of processes and tasks, disregarding aspects such as the generation of design solutions. A similar attitude was shown concerning AI applications. The majority of the respondents (63%) emphasised data processing rather than generating designs (18%) or virtual assistance (13%).

When exploring specific activities in the UX/UI design process where AI might be helpful, participants suggested that AI would support planning (21%) and research (23%) but primarily refer to the testing and feedback phases (37%). Again, AI elements related to the generation of design concepts and solutions were not regarded as valuable. Such an operational perspective on AI was confirmed concerning the impact of AI systems in design activities. The majority of the respondents (74%) considered that AI would affect design process efficiency, but few suggested that it would influence the solution quality (11%).

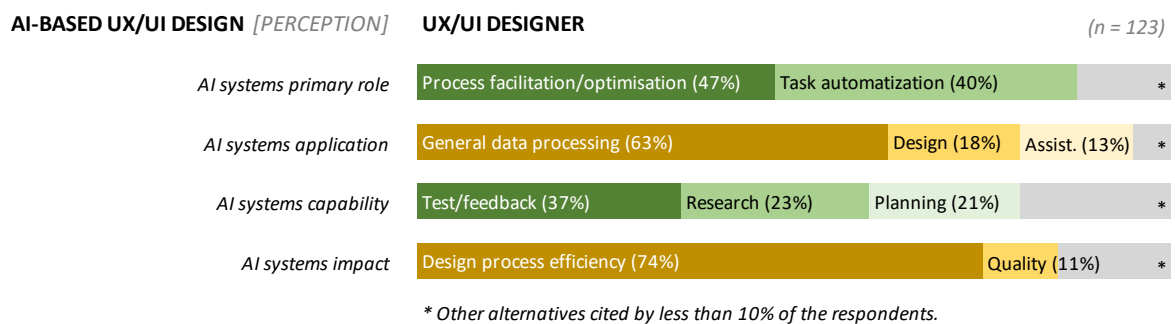


Figure 4. Perspectives on AI-based UX/UI design

AI-based UX/UI design was also touched on in open-ended questions. One investigated the types of projects that might include intelligent systems as tools to develop the design process. Overall, the respondents did not name a specific project type. Instead, they cited AI features that benefit project development. Their answers covered AI's role in automatising, optimising, and facilitating tasks and processes and its applicability to data processing. Practitioners also commented on particular UX/UI design steps that might use AI tools and their answers endorsed findings from the multiple-choice questions presented in Figure 4.

A second question elaborated on projects that might include AI as a feature in a UX/UI solution. Although the suggestions encompassed general or customised projects, most respondents referred to virtual assistants, and some addressed a voice-use interface (VUI) or the digital accessibility features of such AI devices.

4.5 Perspectives on the role of UX/UI designers

The questionnaire explored perceptions of the UX/UI designer's role when interacting with AI-integrated design systems. The majority of respondents considered they would co-create or collaborate with intelligent systems to deliver solutions. This perspective aligns with participants' self-evaluations regarding working style. Most practitioners assumed an interdependent approach to their practices, i.e., collaborating with other designers to develop UX/UI projects.

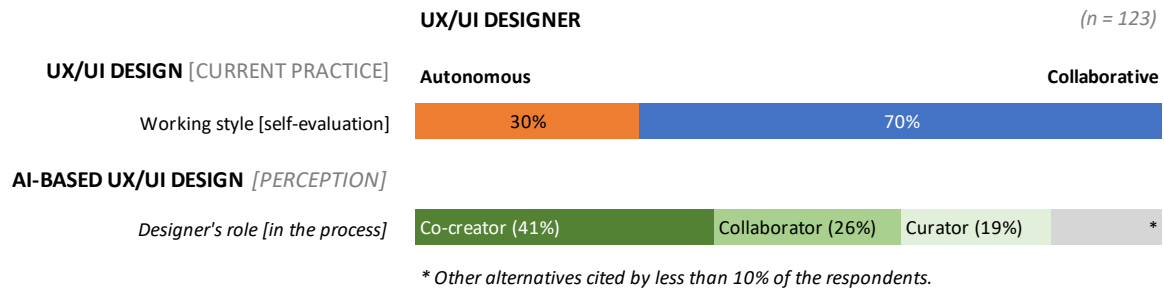


Figure 5. The role of UX/UI designers working with AI-integrated design systems

5. Discussion

Reviewing the participants' profiles (Figure 1), we believe that the survey gathered the perceptions from a representative sample of Brazilian UX/UI designers. Most of their demographic characteristics are confirmed by the Panorama UX 2021 (Leslie et al., 2021), an annual survey on the Brazilian UX industry developed since 2015 and well regarded among local professionals. Our survey respondents demonstrated reasonable knowledge about an AI system's operation and application; however, their answers lack an awareness of how to work with AI. Similar results were obtained by Dove *et al.* (2017) and Main and Grierson's (2020) surveys.

Notwithstanding, in the context of our research, when probing UX/UI practices, we suggest Brazilian practitioners face a primary challenge regarding AI: the lack of opportunities to work with it. Our findings revealed that most respondents did not touch on AI issues in their workplaces (Figure 2), either in connection with the development of an AI-based project (67%) or using any AI tools as supports (79%). These numbers contrast with Dove *et al.*'s (2017) findings in the US, UK, and Scandinavia, where 63% of the respondents claim to have worked with AI. This context is evidenced by Brazilian practitioners' low usage rate of AI-powered design tools (18%) or AI-integrated ones (5%). Although the local UX/UI design industry follows global practices, we observe that AI in Brazil does not reach half of civil society and the business ecosystem (Mont et al., 2020).

Despite the current limitations to accessing and working with intelligent systems, we claim design supported by AI is a one-way ticket for designers. As a new design material, professionals will be required to manage AI's quirks and opportunities (Holmquist, 2017). For instance, concerning machine learning, challenges will arise in understanding its capabilities and purposeful use (Dove et al., 2017). Nonetheless, Brazilian designers shared favorable perspectives when the survey investigated future adoption scenarios (Figure 3). In total, 79% expect to become moderately or extremely familiar with AI tools and features. These results are consistent with findings identified among UK designers in Main and Grierson (2020). In the UK, 68% of the practitioners considered that AI would have a high or very high impact on their work.

Regarding future AI-based UX/UI design, we noticed practitioners apply similar operational lenses to describe general AI systems. They perceive AI primarily as a functional tool in design (Figure 4) aimed at data processing that would facilitate and optimise processes and tasks such as planning, research, testing, etc. Main and Grierson (2020) identified a similar orientation when exploring activities to be shared with AI systems. This perspective is reinforced in our study participants' comments about the kinds of UX/UI projects that might include AI as a feature of solutions. The limited awareness of AI systems' potential led most designers to cite virtual assistance and data processing projects as the primary AI application. Only a few referred to AI's application to specific areas, such as finance, healthcare, urbanism, etc. Curiously, these findings stress the perception that AI systems will change

design practices by empowering practitioners (Verganti et al., 2020) on operational processes (Cautela et al., 2019; Liu & Nah, 2019) rather than creative ones.

In contrast, when exploring the designer's role in AI-based design practices (Figure 5), Brazilian UX/UI designers' perceptions seemed to overcome AI application boundaries. In total, 41% suggested they might consider co-creating, and 26% would collaborate with AI systems. These findings reflected Pfeiffer's (2018) research that 62% of respondents were willing to work with AI-based creative assistants. Nonetheless, considering most practitioners are still getting introduced to intelligent systems' potential and AI-integrated design tools are not fully accessible, we doubt they can make sense of AI as a creative agent (McCormack et al., 2020). In this sense, at present, designers can only understand AI systems as virtual assistants.

Exploring the topic further, we argue that even Brazilian designers favourably perceive co-creating with AI, their approach to co-creation does not necessarily encompass computational creativity (McCormack et al., 2020) that might lead to conceiving solutions together with AI. Main and Grierson (2020) showed that designers tend to rank AI low in terms of capability to generate concepts or final designs. Analysing individual comments about future AI-based UX/UI design practices, we found most practitioners refer to AI assistance in the context of automatising tasks and processing data to facilitate several steps in the design process. In essence, such an approach refers to collaborative work. However, few respondents referred to AI's recommendation of a design solution, or more specifically, to generative design with AI, in a co-creation context.

As for future research, we opened the door to investigate the effect of designers' working practices on AI technologies' adoption. The survey results show that most respondents define themselves as collaborative in work style (Figure 5), and in a future AI scenario, they would use core systems as Adobe Sensei (Figure 3). In sum, collaborative working designers embrace AI-integrated design tools. Note that we viewed Adobe Sensei as more innovative than Remove.bg because the former offers an integrated AI approach, whereas the latter is a peripheral AI tool that can be applied to specific tasks.

Interestingly, however, this is inconsistent with the findings of a marketing study about new product adoption. Ma, Yang and Mourali (2014) demonstrated that independent mindset customers are prone to adopt really new products, whereas interdependent ones lean toward incrementally new products. Although this research did not probe correlations, our findings seem to oppose marketing scholars' inferences. We identified that expectations of collaboration-minded UX/UI design practitioners about AI-based tools are related to an innovative [and integrated] AI assistant that goes beyond current applications.

6. Concluding remarks

Our research mapped UX/UI designer's perceptions of AI in Brazil. It expanded coverage of the topic previously developed by similar surveys in the mainstream of the design industry (Dove et al., 2017; Main & Grierson, 2020; Pfeiffer, 2018). Although it employs a distinct approach and recruited different participants compared to previous research, it illustrates Brazilian professionals' perspective on AI adoption in their design activities.

However, even while providing a glimpse of AI's insertion into the design domain, this paper is constrained to UX/UI activities. Further research might explore AI issues in other design disciplines. In addition, this research covers a specific geographical region lacking AI diffusion. Such aspects of the study limit comparisons with the existing research. Future initiatives should encompass countries

with different design industries and technological backgrounds to provide a comprehensive map of the topic.

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