Article

The Contribution of Design Thinking to Museum Digital Transformation in Post-Pandemic Times

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Abstract: With this article, I would like to present a critical examination of my position on the role of design in museums by focusing on the influence of human-centred design practices (also known as design thinking) in the context of digital transformation in museums, a transformation that has been accelerated by two years of the COVID-19 pandemic and its restrictions. The article aims to offer a set of propositions about the contribution of design thinking (DT) to the main challenges museums are facing in a moment of digital transformation. A rigorous evaluation of the value of DT on museums is beyond the scope of this article, however, there is a sufficient body of academic and professional literature to hypothesise the contribution of DT in addressing digital transformation challenges. My argumentation is supported by evidence from the literature review in the museum sector and academia. Firstly, through a critical examination of facts (museum initiatives during the pandemic) and a critical reflection of existing literature, I will identify a set of key museum challenges. Secondly, by critically looking at design literature, I will suggest a set of propositions by discussing the contribution of DT practices in addressing those challenges.

Keywords: design thinking; museum digital transformation; cultural digital heritage design

1. Introduction

Two years of pandemic considerations and lockdowns have accelerated the digital transformation process in many museums. The term digital transformation designates a transformative contemporary condition for museums in which digital thinking, practices, and tools have assumed a normative presence that penetrates all levels of their operations and functions [1]. This process is closely related to the concept of the postdigital museum [2], in which the digital era has begun to reveal itself through museums' missions, organisational structures, and working practices wherein digital tools, processes, and ways of thinking are embedded into strategy, operational workflows, and skill sets. According to the recent research conducted by Culture24 and Europeana [1] (p. 7) "digital transformation is the act of adopting digital technology or digital thinking to significantly transform an organisation's operation, and/or the reframing of the organisation to be inherently digital in its purpose". The pandemic has accelerated the process of digital transformation, which was already taking place in this sector [3], as the lockdowns forced many museums to quickly adopt and rely on digital tools to continue engaging with their audiences. This condition has given rise to new challenges for museums that human-centred design (HCD) seems particularly suitable for addressing.

The following are the guiding questions I considered when searching for literature and its review, and during the analytical process of the selected publications. The answers I uncovered are discussed and presented in this article.

The guiding questions for the literature review were:

- What are the main challenges emerging (from the current publications) for museums post-pandemic?
  - How are these challenges related to the museum's current digital transformation? What has changed?

○ Are these new challenges or did the pandemic amplify and/or accelerate ongoing transformative processes that were already occurring in museum organisations before the pandemic?

The following questions guided the investigation of design thinking in museums:

○ How could HCD practices—such as design thinking (DT) and service design (SD)—contribute to supporting museums' digital transformation?

○ What studies from other fields—such as management and organisational studies—and research about the adoption of HCD design methodology within those organisations can be applied to the cultural heritage sector?

Museums have begun to embrace a trend that sees HCD practices—already booming in those innovative industries where digital transformation requires new competencies and capabilities, and novel ways of thinking, experimenting, and making [4]—used to design for effective visitor experiences [5] and services-based experiences [6], envisioning new organisational strategies [7,8], and enhancing organisational working practices [9]. Design finds itself playing an increasingly integral role across the everyday working culture of museums today, as advocated by museum managers through professional fora such as MuseWeb conferences, e.g., [10,11] and journals, e.g., [6,12]. Its result is that HCD practices can be seen to infuse museums more profoundly and underwrite their ability to react and respond to the emerging context of digitally mature museums. Interestingly, there are signs of how design brings into organisational practices new mindsets, capabilities, and practices that help museums embrace and deliver change and pursue (digital) transformation. Mason and Vavoula [9] point out how "design practices are both shaping and shaped by the integration of the digital within museum practices and, therefore, inevitably results in and emerges out of the organisational change that ensues". In particular, HCD promotes a creative and explorative culture and collaborative working practices, where museum professionals are called upon to actively participate in design activities in collaboration with digital specialists, design consultancies, and stakeholders (including visitors and communities). This changes internal working practices and design activity, where knowledge is created and shared in new ways, in which new tools are introduced, and workplaces are re-configured [9].

It is beyond the scope of this article to discuss the nature of these emerging practices in depth (I refer to specific literature (cited in the rest of this article) about design thinking, e.g.: Kimbell, 2011; Giacomin, 2014; Liedtka, 2017; Mason and Vavoula, 2021). Instead, I want to draw attention to how the fundamental principles of HCD (e.g., empathy; experimentation; holistic approach; problem framing) can help address the main digital transformation challenges. This article is divided into four sections. In the first, I introduce digital transformation in the current museum context (Section 2.1). In the second, I will offer a general description of human-centred design and design thinking terms that I use interchangeably in this article (Section 2.2). The third describes the methodology (Section 3). The last section is where I identify the five digital transformation challenges museums are currently facing (Section 4). For reasons related to content readability, this section combines the findings that I identified from the literature review (i.e., the five challenges) with the discussion (i.e., the contribution of HCD in addressing each challenge). The conclusion summarises the ideas discussed throughout the article.

2. Context

2.1. Museum Digital Transformation and the COVID-19 Pandemic

The pandemic has pushed many museums to enter into a postdigital condition [2], which can be defined by the integration of digital thinking, practices, and tools into existing museum practices [2]. It has pushed museums to rethink (some of) their practices, such as digital interpretation [13]. The pandemic has reinforced the role of museums as a shared space with their communities [14], both at the national and global level, as a result of the proliferation of online platforms to reach audiences beyond local communities during the lockdowns. The forced closure of on-site visits encouraged new opportunities for online

platforms—in particular social media—that before the pandemic were mainly used as promotional means to advertise museum programmes and exhibitions, but which now can be used as narrative spaces co-created with visitors [15]. For example, O'Hagan [16] had to transform a planned physical exhibition—*Prize Books and Politics: Rethinking Working-Class Life in Edwardian Britain, 1901–1914*—into a digital exhibition through the platform of Instagram, where social media was used "as an exhibition space and demonstrated its potential as a tool to enhance museum experiences and create more interactive and visitor-centred exhibitions".

Crooke [14] (p. 3) reminded us that it is important to revisit "museum purposes as well as their roles in the community" in light of the combined impact of the pandemic, racial injustice in North America (e.g., the Black Lives Matter movement), and a financial crisis in the museum in the years to come. During the pandemic, we have also seen an amplification of audience participation and collaboration through numerous digital initiatives that, for example, have seen cultural institutions strengthening practices that foster interactions with the community and relationships through social media [17,18], as well as paying attention to diversity and inclusion [14], without making any distinction between the online and on-site worlds. For example, there have been initiatives that promoted inclusivity amongst blind and partially sighted (BPS) visitors, with positive experiences from participating in museum activities from home [19] and by producing audio-descriptive content specifically designed for BPS online experiences [19]. Additionally, during the pandemic, there have been interesting projects that explicitly recognise the importance of harnessing museum online platforms to enhance community health and wellbeing [20].

It is not just the offer that has been affected by the pandemic but also the organisational practices. For example, the Georgia O'Keeffe Museum in Santa Fe and The Newark Museum of Art [21] presented two specific cases that provide significant examples of the rapid transformation of museum practices that, following the pandemic, are more human-centred, agile, collaborative, integrated and hybrid (i.e., physical/digital), and responsive to change. Similarly, the Art Fund report [22] presented findings on how the pandemic has influenced many aspects of museum work, such as, for example, "the future of collections and exhibition programming, the agile and adaptable digital skills and infrastructure needed to open up collections and reach audiences now and in the future; and how to support an expert and passionate workforce through a period of continued uncertainty".

In this article, I would argue that HCD approaches—such as Design Thinking e.g., [23] and Service Design e.g., [24]—can be agents of digital transformation, for which new competencies, capabilities, and novel ways of thinking are required to put people at the heart of digital transformation; think in terms of human experience, not technology; deal with complexity and uncertainty; develop effective (digital) strategies for digital transformation; and be responsive to (rapid) change.

Design can be a driving force within a wider landscape of the transformative museum. However, what do we mean by HCD and DT (terms that I use interchangeably here)?

2.2. Introducing Design Thinking

In this article, I embrace an HCD paradigm that the literature and the practice commonly refer to as design thinking [25,26]—or, sometimes, with other terms, such as design-led innovation [27] or design-driven innovation [28]. According to Giacomin [29], HCD is amongst one of the three paradigms defining the major design moments today, together with technology-driven design and environmental and sustainable design. In the last two decades, organisations of all sorts have applied design thinking to address novel, more complex challenges. They have seen a growing interest in embedding HCD into models and practices and DT has become a means of innovation in business companies (e.g., IKEA, Toyota, Apple, Samsung Electronics, PepsiCo, Nike, Bank of America), and within a wide range of public and non-profits fields from education [30] to policy-making [31] to health care [32]. Cultural heritage organisations are not exempt as they have seen growing attention to HCD practices, but only recently. For example, *designthinkingformuseums.net* is

one of the first professional forums that has promoted and documented design thinking approaches in cultural heritage institutions, in the US and UK in particular.

According to Mason and Vavoula [9], museums that embed forms of HCD into their digital cultural heritage design practices tend to adopt "methods and tools for understanding human visitors and their needs and feeding that understanding into the design of socio-technical systems that support their creative explorations of the physical and digital spaces we inhabit". In a previous paper [33], I attempted a description of DT for the museum sector that tried to include its main characteristics, which I described as: "a human-centred practice that aims to develop a deep and empathic understanding of visitor experience. Also, it is a collaborative practice carried out by multidisciplinary teams and, often, with users, which follows an iterative process that helps them to move from generating insights about end users to idea generation and testing and finally, to implementation and an approach. Prototyping is considered an integral practice within the iterative process, in which a large-scale adoption of visualisation methods accelerates learning and fosters collaboration" [33] (p. 58).

However, it is not easy to find a common definition, perhaps even impossible [34] because DT is a polyhedric phenomenon that has been described with many different definitions and according to different perspectives, for example, it has been described as a methodology [35], as a process [36], as a framework [30], as a social-technology [37], as "management fashion" [38], and as a practice [9,39]. A variety of definitions and different conceptualisations of DT have created some confusion, especially amongst museum operators who have recently approached these practices, which they are trying to introduce into existing museum practices. Additionally, within the practice itself, there are different HCD processes and ways of calling them, such as design thinking, Stanford; Dervice Design 101; Double-Diamond, British Design Council; LUMA; IBM Design Thinking; agile; and lean; etc. (See Figure 1). This might create confusion because museums might use similar approaches without naming them with a "label" or only using some aspects, not being aware they are actually implementing HCD. Luckily, all these concepts and approaches share common principles:

- *People-centred, in contrast to a technology-driven approach*: HCD starts with an understanding of people's needs, behaviours, and motivations (people = visitors, museum staff, and stakeholders) by developing empathy with people, for example, through empathic, ethnographic methods, such as in-gallery observations, interviews, empathy maps, user journey maps, scenarios, etc. (see Hanington and Martin [40] for a description of all these design methods).
- *Problem framing, in contrast with "problem-solving"*: HCD does not start by solving a given design problem (e.g., designing a mobile app) but, on the contrary, by understanding the context, questioning the problem and the assumptions (e.g., what museum people think a visitor wants), it re-frames the problem in human-centric ways.
- *Highly collaborative, co-creative, and visual*: By communicating visually and inclusively (e.g., with tools, such as post-its, sketches, mind maps, paper prototypes, personas, scenarios, etc.), members of interdisciplinary teams (educators, designers, as well as curators, etc.), and visitors and communities can be actively involved in thinking, ideating, and, ultimately, gaining a shared understanding of the problem and ideas.
- *Ideation/Creative/Explorative*: A highly iterative (and collaborative) process based on a set of different prototype methods (to "make and experiment" and test towards the final design solution); from sketches and paper prototypes to storyboarding and visitor journey maps to digital prototypes.

Furthermore, all of these approaches share similar processes that can be reduced to common phases, such as: (1) start with the empathic observation of the problem(s) through data gathering—mainly qualitative and ethnographic data—about the people's needs and their context (called the understanding phase); (2) which then are analysed and "translated" into insights to be used to question and define the problem (e.g., defining phase; framing phase); then, (3) ideas and possible solutions are ideated through, for

example, brainstorming and conceptualisation activities (ideation phase); finally, (4) these ideas are iteratively tested and developed through rapid prototypes (developing phase); and (5) eventually one is implemented as the best solution (implementation phase).
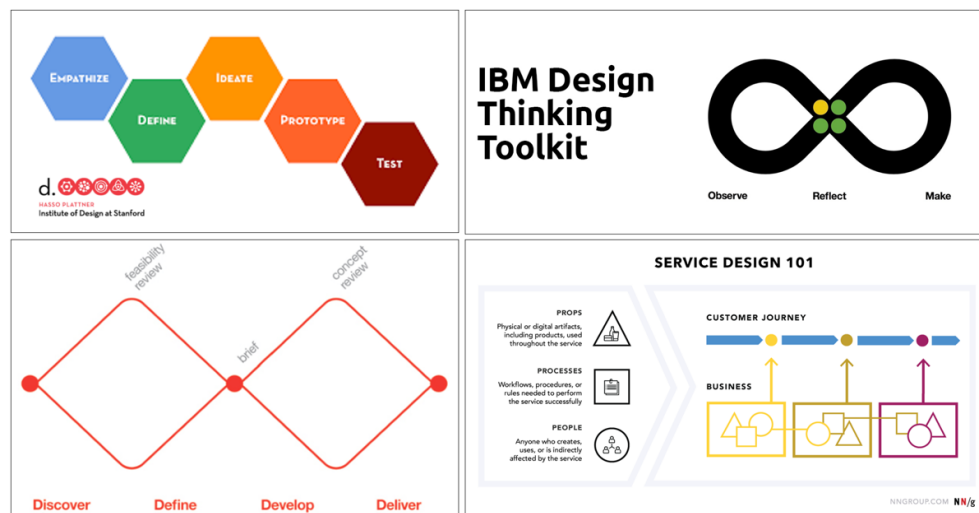

Figure 1. Examples of some human-centred design frameworks. From the top-left: design thinking, Stanford; IBM Design Thinking; double-diamond British Design Council; service design 101.

The position of this article is that DT can be an agent for museum digital transformation. The five challenges identified in the next section offer the opportunity to share some reflections on the contribution HCD can have on museum digital transformation.

3. Methodology

The aim of this article is twofold, with two mutually interrelated objectives: (i) to identify the main challenges and long-term changes the pandemic has contributed to bolstering museum practices, and (ii) to suggest how HCD practices can contribute to addressing them. To achieve the former objective, a review of the literature on "museum digital transformation" and "museum and COVID-19 pandemic" was conducted; then, significant publications were selected; and a following thematic analysis (TA) identified emerging themes. I adopted a classical approach for thematic analysis drawn from Clarke and Braun [41], through an inductive process of coding, generating themes, reviewing themes, defining and naming themes, and writing up. I first manually coded the articles to find early (general) themes. Then I used these early, emerging themes in a piece of computer-assisted qualitative data analysis software called NVivo 10 [42]. NVivo supported the work of reviewing themes, defining and naming themes, and helping refine the themes toward the final five discussed in this article. The themes are placing people at the heart of digital transformation; thinking in terms of human experience, not technology; dealing with complexity and uncertainty; strategising digital transformation; and being responsive to (rapid) change.

In particular, this paper reports the results of a TA involving an examination of 4 databases (ACM Digital Library; Arts Full Text; Google Scholar; JSTOR) and three museum studies journals (*Museum and Society*; *Museum Management and Curatorship*; and *Curator: The Museum Journal*). Additionally, I searched in MuseWeb repository of research and professional papers (see: https://www.museweb.net/, accessed on 2 May 2022). I limited the searches to only articles containing the keywords museum *, pandemic, and covid * in the manuscript title or abstract.

I conducted a review of the literature drawing from scoping review methodology [43] to provide a 'map' of the available evidence around challenges museum have faced as a result of the pandemic. I adopted this approach as I considered it suitable for finding emerging evidence, considering that my research question was still general because I had

not formulated more specific questions (such as those needed for a systematic review) due to the exploratory nature of this study. However, my review can work as a preliminary exercise to conduct a future systematic review [44].

I read almost 300 abstracts, to eventually identify 26 core articles that provided the current state to discuss issues around the COVID-19 pandemic in museums; A total of 21 have been cited in this article (five were not cited in this paper because they contributed to the coding and analysis, but were not particularly useful as references). With the overarching question in mind ("What are the main challenges emerging (from the current publications) for museums post-pandemic?"), I selected the 26 articles that presented in their abstracts, more or less explicitly, initiatives that contributed to transforming organisational practices to react to particular problems or challenges resulting from the pandemic. For example, abstracts that mentioned aspects, such as: "transformation" due to the pandemic limitations [21], "Museums are changing how they interact with the communities they serve" [45], "contribution and challenges" of digital technology during the COVID-19 crisis [46], "impact of COVID-19 into digital practices" [47], and "benefits" brought from the pandemic for the museum practices. Additionally, I adopted exclusion criteria to exclude all the articles that were (clearly) not relevant for this study. For example, articles that did not engage with issues relating to museum digitality had the words "museum" and "pandemic" in their abstracts but were not related to the cultural heritage sector; presented only functional and/or technical descriptions of digital technology design or informatics; were not written in English (only the abstracts were in English); and, on a few occasions, were very poorly presented and written.

Subsequently, to achieve the second objective, I explored the relationship between these challenges and designs. These emerging themes offered the opportunity to discuss the potential contribution of HCD (also called design thinking) in addressing these challenges. In particular, I critically intersected the post-pandemic museum literature (from which I identified the five challenges) with extant literature on DT. The latter type of literature has been collected during my (more recent) AHRC research project (see p. 8. Funding section at the end of the article) and includes publications from design studies, design management studies, and organisational studies. This body of written works is added to the literature I collected and the experience I gained while conducting three research projects on cultural digital heritage design ((1) European UnionMarie Curie Actions International Outgoing Fellowships for Career Development under the EU Seventh Framework Program 2011 (grant agreement: PIOF-GA-2011-302799); (2) European Union Marie Skłodowska-Curie Actions under Horizon 2020—Individual Fellowship 2015 (grant agreement: 703682); and (3) UK Research and Innovation (AHRC): "Designing in the Digitally Mature Museum: Refocusing Design From Technology To Human Practice" (project reference AH/V008013/1)). Results and discussion for each challenge are presented together to facilitate readability by directly linking the relationships between the challenge and design thinking. Table 1 summarises the relationships between digital transformation challenges and HCD.

Table 1. The five digital transformation challenges and the potential contributions of HCD.

Challenge	Digital Transformation	Value of HCD Practices
Challenge 1: Place people at the heart of digital transformation	Digital transformation is not (only) about technology, but about people. For example, adoption of human-centred models vs. mere technological advancement; understanding visitors and stakeholders' needs.	HCD is a deep understanding of human needs and their alignment with the technological and social context. For example, empathy to understand people's needs—such as ethnographic methods.
Challenge 2: Thinking in terms of human experience, not technology	The pandemic has pushed museums to quickly adopt digital technology. Museums are at risk when prioritising the attributes of "X" technology at the expense of human experience.	Designing for the visitor experience requires a more holistic approach, as the visitor experience is an intertwining of physical, digital, virtual, and organisational dimensions. Designing for visitor experiences and service-based experiences becomes central to museum practices. HCD approaches are best suited to seamlessly mesh the different elements of visitor experiences (Mason 2020c).

Table 1. *Cont.*

Challenge	Digital Transformation	Value of HCD Practices
Challenge 3: Dealing with complexity and uncertainty	Museums face increasingly complex problems. For example, the pandemic has reminded us of the complexity of the multi-faced nature of museum communication (Choi and Kim 2021) that sees content communicated through multiple platforms across physical, digital, and virtual environments. Digital culture and practices are woven into a multi-cultural ecosystem that is part of an increasingly networked and connected society.	Design thinking is particularly effective in dealing with complexity, in particular "Wicked problems". When museums design for a (digital) system or a digitally enhanced visitor experience, much of the attention is usually on the "solution space" by generating ideas or finding solutions to solve problems. However, often, museum teams do not spend enough time in order to understand why they are solving the problem and for whom, and even if the problem is worth solving.
Challenge 4: Strategising Digital Transformation	Museums had to quickly develop new (digital) strategies to promptly respond to this transformation. For example, the pandemic has required a greater need for hybrid online/onsite approaches to: - engage audiences and provide meaningful visitor experiences; - develop additional digital programmes and services, as well as support the widespread offer of social media strategies as a part of strategic responses to the lockdowns.	Design can help a museum identify strategic opportunities for innovation. HCD helps to identify, collaboratively, strategic problems that museums face by framing them and inventing strategies to solve them. Museums can use HCD to approach digital transformation at a strategic level by concentrating on (and bringing in) organisational culture and values, people, and day-to-day activities.
Challenge 5: Being responsive to (rapid) change	Digital transformation has been associated with the ability to constantly make changes (Kane et al., 2015) to respond not only to the continual emergence of new digital technologies but also to changes asked of museums by emerging social contexts, not to mention the rapid changes imposed by the pandemic. The pandemic has brought additional uncertainty to museum operations, within the ever-evolving digital landscape it brings with it.	HCD can offer effective practices to reduce the consequences of failure, therefore, encouraging museum people to experiment. For example, this uncertainty in taking action as a consequence of the risk of failure is (drastically) reduced by multiple iterations of rapid prototyping that allow multidisciplinary teams to actively manage risk (by doing) rather than being stuck with the fear of failure.

4. Results and Discussion

4.1. Challenge 1: Place People at Rhe Heart of Digital Transformation

4.1.1. Description of the Challenge Identified in the Review

The COVID-19 pandemic has greatly accelerated the process of digital transformation. A central aspect of the digital transformation discourse is the centrality of people [1]. Both museum professionals and academics agree that digital transformation is not about technology, but about people. It is about "people and it's about humanity and we ought to understand humanity and how to include people within our projects to actually be meaningful" [1] (p. 26). The attention to humans is not limited to visitors but, also, extends to museum staff and other stakeholders.

For example, for the Georgia O'Keeffe Museum in the US, the disruption caused by the lockdown turned out to be an opportunity to expedite the shift towards a human-centred model [21]. The museum, instead of simply moving educational activities online, had to first invest resources to empathise with their communities and truly understand their needs. They understood that they were not facing a technological problem (the mere creation of a digital platform to convey content to remote audiences) but rather social and psychological issues related to emotions and people's needs. In fact, their audiences were feeling isolated and, therefore, they re-framed the design to how to "mitigate the separation by helping people feel connected to others and the museum" [21]. The design process, therefore, focused on mitigating social isolation, and a new storytelling channel, called Stories from the O'Keeffe, was developed and fully integrated into a communication ecosystem for relationship-building with the (online) audience.

The emotional needs of audiences have been considered central to creating "entry points for engagement and innovative connections" [17] (p. 345), as reported by the UK Museums Association and US Museum Computer Group surveys of digital initiatives, such as "collaborative video game sessions, games such as crossword puzzles, art prompts, and learning materials and tools" [17] (p. 345).

These are just two of many other examples of museums that emerged from the literature that put communities and audience needs at the heart of their projects by investing

resources into understanding feelings and needs in the difficult time of the pandemic and finding solutions to meet those needs. What clearly emerged from the literature is that digital transformation is not a race towards the adoption of the latest cutting-edge technology but, instead, first and foremost, a condition that has at its centre the understanding of people's needs.

4.1.2. Consideration for Design: How the Challenges May Be Considered via the Use of Design Thinking

Bringing this discussion into the design field, DT is commonly recognised as a human-centred approach in which a deep understanding of human needs and their alignment with technological and social contexts are the main drivers of innovation [48]. Museums embracing HCD approaches in their practices can draw from a toolkit of empathic methods usually available to designers. For example, ethnographic-type observations to gain insight into visitor behaviours, attitudes, frustrations, etc.; or informal interviews to understand motivations and needs. All these methods have the common intent of viewing the world through people's eyes, from their viewpoints [49].

Therefore, a central dimension for HCD is empathy. As empathy forges the relationship between audiences and their museum context and socio-technical systems, HCD offers a process that results in a solution that is shaped by relationships between visitors, the museum, and the socio-technical system (e.g., the online platform used by the museum's online communities). According to Villari [50], "it is precisely through relationships that value is created". Firstly, an empathic approach to design means museums achieve a better understanding of who their audiences actually are, want, and feel, versus what the museum practitioners think the visitors are, want, and feel (i.e., reality versus assumptions). For example, Grohe and Mann [12] underlined the disconnection between staff assumptions and real visitors' needs in the service design project they conducted at the Isabella Stewart Gardner Museum: "There was a real disconnect between what visitors said and how our internal teams think about the visitor experience". Secondly, as elaborated by Liedtka [25] in one of her seminal studies on design thinking for organisations, empathy development is one of the major practices for an organisation to build "emotional engagement" amongst key stakeholders. In other words, an advantage of pursuing and promoting empathetic practices (e.g., using empathy maps or visitor journey maps) is to "engage" the different team members around the visitors' needs. Each professional in a museum has their own way of satisfying visitors' needs, for example: the curator by providing content; the educator by creating learning experiences; the digital designer by developing effective interactions and good user experience; or the marketer by attracting visitors to visit the museum.

In addition to practices that draw from ethnography, museum and design teams can adopt approaches that involve visitors directly in the DT process. Museums are not new to co-design practices with visitors [51] and communities [52] and, during the pandemic (see V&A "Play in the Pandemic" co-design project ("Play in the Pandemic" is an online exhibition celebrating children's creativity and resilience during the pandemic that has been co-developed with designers and artists, and visitors by Young V&A: https://www.vam.ac.uk/blog/projects/the-value-of-co-design, accessed on 4 May 2022), the value of involving visitors in the design processes have been largely demonstrated [46,53]. For example, in a very recent article conducted in line with this current special issue, Koutsabasis et al. [54] conducted a study of the co-participatory design thinking process adopted for co-designing the user experience of location-based games, in which they presented an interesting articulation of methods "on long-term involvement of professionals, local experts, and visitors (players, users) in various phases (empathize, define, ideate, prototype, test, and implement)" [54] (p. 27).

Whatever approach is taken, placing the visitors' needs at the centre of the design discussion, "align[s] team members' perspectives and motivates the different voices to bring their own contribution and find a shared solution to improve the visitor experience" [25] (p. 11).

4.2. Challenge 2: Thinking in Terms of Human Experience, Not Technology

4.2.1. Description of the Challenge Identified in the Review

The pandemic has pushed the museum to quickly adopt digital technology. There is a risk here in prioritising the attributes of "X" technology at the expense of human experience. I have noted how authors paid greater attention to the fulfilment of human instances of the technology. The emergence of technologies (e.g., web platforms, social media software, VR) has been instrumental in offering a valuable experience to visitors, and designing at the level of experience considered, first of all, the set of interconnected experiences that can satisfy visitor needs, feelings, and expectations. Not losing this attention to experience was crucial for communication between museums and audiences that was (almost) completely remote during lockdown periods [55]. The pandemic has shown numerous examples of museums that have benefited from digital platforms in listening and responding to collective needs, which has opened the way for advanced experiences [56] that were participatory [16], immersive [57], and enhanced by storytelling [21]. Some museums have also continued to integrate online and physical experiences [19,52,58]. For example, Explora re-configured "do-at-home" science activities as virtual events with "visitors" from home using common household and recycled materials [20].

This attention to visitor experience is in line with what Hassenzahl [59], a leading user experience designer and researcher, points out about how a post-materialistic orientation has led to an "Experience Economy" [60]. According to Hassenzahl, within this paradigm, effective technological designs—e.g., products, systems, or services—are not about the quality of the (digital) product itself—for example, a technologically advanced interactive system—but rather it is about "creating a meaningful experience through a [product, system, or service]" [60]. Only by giving primary attention to experience can we have "the potential to advance the way we will design future technologies". It results in us achieving this level of design by "transcending the material" by considering the experience before the tangibility and functionalities of the digital products, systems, or services [5]. This is echoed by Macleod, Dodd, and Duncan [11] (p. 323), who co-conducted a research project, in collaboration with the Imperial War Museum North in Manchester, in which one of the central aspects was the importance of moving the focus of the design process "from curating objects to curating experiences".

Virtually all the literature presented in this article considers the digital transformation within the "experience economy" [60] and the socio-economic context in which we have found our society. This attention was already affirmed by museum experts, such as, for example, the French [10] who underlined "the impact of Pine and Gilmore's work [...]" and how "museum visitors expect increasingly seamless experiences with an institution or brand [...]". The French [10] continued by stating that "for museum strategists, it is worth remembering that the visitor enters and exits the museum space (physical and digital) with a complex set of desires, values, and needs. To truly understand visitor needs and desires, organizations must evolve strategies and practices that trace the visitor experience before, during, and after a museum visit".

4.2.2. Consideration for Design: How the Challenges May Be Considered via the Use of Design Thinking

In this new scenario, designing for visitor experiences and service-based experiences becomes central to museum practices. Designing for visitor experiences means holistically considering the interplay of visitors' needs, values, and meanings, how visitors can (inter) act within museum information spaces, the narratives that articulate contexts and content, as well as the visual components, sounds, and form factors of physical/digital interfaces [5]. Furthermore, embracing a holistic approach to design means integrating perspectives and knowledge from different stakeholders, in particular from cultural heritage professionals, as they are increasingly involved in the cultural digital heritage design process. Maye et al. [61] conducted a study to understand the ways cultural heritage professionals—such as educators, curators, visitor service staff, exhibition designers, etc.—engage

with the design thinking process and how technology can assist their design activities. The authors expressed how cultural heritage professionals indicated a variety of reasons for including technology in the design of exhibitions to support established and novel interactive strategies. For example, using videos as storytelling techniques to deliver personalisation to fulfil specific curatorial and interpretation goals; or tools to integrate material and digital dimensions into the design of visitor experience (a practice that was also recently discussed by Mason 2020, [5]).

Mason [62] studied four exhibition projects that embraced a holistic approach to the design of visitor experience; in each project design, specialists and cultural heritage professionals adopted different prototype methods to create, transfer, combine, and embody knowledge throughout the entire design process.

Designing for the museum experience of visitors requires a more holistic approach, as the visitor experience is an intertwining of physical, digital, virtual, and organisational11 dimensions. In other words, focusing on experiences rather than technology is an effective way of intertwining digital and virtual components into museum practices. HCD approaches are best suited for seamlessly meshing the different elements of visitor experiences [5], and we can see an increasing number of museums that promote (and are aware of the importance of) a holistic approach to design for service-based experiences. For example, Villaespesa demonstrated the benefits of applying a set of service design methods at the Museo Nacional Thyssen-Bornemisza Madrid, in which the practice of journey mapping was used "to provide a view of the whole ecosystem of the museum visit, and potentially use it to design a better visitor experience" [6] (p. 126). In another example, Vavoula and Mason [63] describe how user experience methods, such as meta-narratives and experience flowcharts, can offer effective tools for designing at the "level of experience".

The advantage of adopting an HCD approach is that it starts from a different position that does not see the visitor interacting with the museum through technology but, instead, through an experience (or service-based experience). It is the experience that mediates the relationships between visitors and museums; and enhancing the human experience is at the heart of developing museum exhibitions and communications. A critical aspect is that HCD establishes insights and perspectives about the visitor experience and how this might be augmented by good service design as well as digital elements. Additionally, in this case, as we saw above (see Challenge 1: "Place people at the heart of digital transformation"), designing for experience starts with the understanding of human needs, motivations, and emotions, not digital technology.

4.3. Challenge 3: Dealing with Complexity and Uncertainty

4.3.1. Description of the Challenge Identified in the Review

Museums face increasingly complex problems. Many other organisations and cultural institutions live in an era in which practices are multi-disciplinary and problems are complex. The entangled problems museums are facing rise from different challenges, often exacerbated by the pandemic [56]. For example, museums have to develop new business strategies to adapt to new needs and changes in visitor habits [64], conditions, and contexts, which can be classed as complex because they involve decisions about audiences, museum people and practices, financial issues, and museum vision (just to mention a few). Additionally, the COVID-19 pandemic—which was unprecedented, highly uncertain, and unpredictable—exacerbated this complexity. The pandemic has reminded us of the complexity of the multi-faced nature of museum communication [56] that sees content communicated through multiple platforms—reprising the concept of "distributed museums" [65,66]—across physical, digital, and virtual environments. Additionally, the "new museology" [67] has brought novel ways of interacting with audiences in society by contributing to social development and museum social innovation [68] and by using cultural heritage and museum practices to understand and transform society. This has seen museums contributing to social change in which "digital platforms are facilitators for the debate, activism and amplification of profound societal issues such as Black Lives

Matter and environmental campaiging" [1] (p. 27). Digital culture and practices are woven into a multi-cultural ecosystem that is part of an increasingly networked and connected society [1]. All these examples echo Cameron and Mengler's study of museum complexity, in which they described cultural institutions as part of a hyper-complex world, "characterized by mobile, global networks, flows and fluids of culture producing new levels of interconnectivity and interaction" [69] (p. 189). A condition that poses new challenges for museums.

4.3.2. Consideration for Design: How the Challenges May Be Considered via the Use of Design Thinking

As museums struggle to address problems that are becoming more open, complex, and increasingly networked, an increasing number of museums are looking to DT as a way to achieve some sort of solution and promote innovation [10,12]. Paraphrasing Dorst's description [70] of the "open, complex, dynamic, and networked" nature of problems, the kinds of design problems the post-digital museum faces are: "open", because they will not be confined within a specific context of expertise (as they involve areas that span from curatorial practices to education to technology to visitor service); "complex", because they will be entangled with different connections that must be "approached as whole, in all their complexity"; "dynamic", because the problem space can change over time as new elements modify the problem's complexity (just think of the constant evolution of the digital media landscape or sudden changes caused by the pandemic); and "networked", as the problems are interdependent and cannot be really isolated, therefore, they influence each other (for example, the problem of developing a museum online platform cannot be separated from the problem of understanding how different museum practices will shape that platform, and cannot be isolated by the problem of reaching different online and onsite communities, while also fulfilling the museum's mission).

As has been discussed at length by many design theorists [71–73], these kinds of complex problems are more specifically described as "wicked problems", referring back to the term coined by Rittel [74,75], who suggested that the term refers to a "class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing" [74]. To solve these problems, conventional design approaches are not sufficient, therefore, it is here that HCD can make a significant contribution.

According to Dorst [76], one of the major shortcomings of organisations (including museums) is to approach the problem from a technological view and to not recognise that a large part of the complexity originates from human issues and social challenges. Dorst stated that design (thinking) works as "a natural bridge-builder between technology and humanity" [76] (p. 119) therefore, a human-centred approach can greatly contribute to addressing the problems. Thus, Dorst called for a paradigm shift in more traditional design approaches (often adopted by museums) that should no longer be considered as a problem-solving process but, first of all, as a problem framing practice. Paraphrasing Donald Norman (watch Donald Norman's interview: https://www.interaction-design.org/literature/topics/complex-socio-technical-systems, accessed on 3 May 2022), to deal with wicked problems, a combination of a deep understanding of people and society, technology, and cultural heritage organisations—as well as the capacity for framing problems—is necessary because more traditional, still largely used, problem-solving approaches can no longer handle wicked problems.

Are museums equipped to work in these problematic spaces? When museums design for a (digital) system or a digitally enhanced visitor experience, much of the attention is, usually, given to the "solution space" by generating ideas or finding solutions to solve problems. However, often, museum teams do not spend enough time on understanding why they are solving the problem and for whom, and even if the problem is worth solving. What the design thinking process and tools bring is much more attention to exploring the

problem, understanding the complexity of the problem, and ensuring a focus on solving the right problem for the right visitor.

Mason [9,33] pointed out that another important contribution of HCD practices in dealing with complexity in cultural organisations is in their iterative nature. According to Dorst [76,77], to successfully deal with "wicked problems", it is not possible to formulate the full problem and then find a final solution, as it happens in some technical domains where it is feasible to reason from problems to solutions in a relatively controlled and orderly way. DT proceeds with iterative steps in which there is a constant alternation of the understanding of a portion of the whole problem and testing possible solutions for that specific problem towards the final design that results from such evolution. This is because a wicked problem is not [well] understood until after the formulation of a solution [78], and it is very hard to completely define the problem at the beginning and then move to the final solution.

The creative design process repeats itself at different times as it moves toward the final best solution (It is important to consider that, according to the 6th principle of "wicked problems" formulated by Horst Rittel and Melvin Webber (1974), "There is no end to the number of solutions or approaches to a wicked problem". Therefore, we can only arrive at a "best solution" (amongst the many possible)) [74]. Dorst and Cross [79], in their seminal experiment, showed that the problem-solving process of facing "wicked problems" adopted in DT is non-linear and can be described as a "co-evolution of problem and solution spaces". According to the authors, the design process facing "wicked problems" is a continuous process of learning, "trying out", and testing:

> *"It seems that creative design is not a matter of first fixing the problem and then searching for a satisfactory solution concept. Creative design seems more to be a matter of developing and refining together both the formulation of a problem and ideas for a solution, with constant iteration of analysis, synthesis and evaluation processes between the two notional design 'spaces'—problem space and solution space". Dorst and Cross [79] (p. 425).*

In such "co-evolutionary" design processes, where problems and solutions evolve together, HCD practices, such as, for example, prototyping (e.g., low-fidelity, rapid, paper prototypes) play a fundamental role in deepening the understanding of a solution throughout each iteration [62]. Prototyping allows for the evaluation of a possible solution and then uses the feedback to create a new prototype, advancing the design toward the final best solution.

4.4. Challenge 4: Strategising Digital Transformation
4.4.1. Description of the Challenge Identified in the Review

The acceleration of change across the digital landscape, the beginning of the adoption of Artificial Intelligence in some museum practices [80], an emerging sociocultural context that promotes diversity, equity, and inclusion [81], and a new sociotechnical context that has seen the growth of virtual worlds, are all forces that are transforming the nature of visitor experiences. Museums have had to quickly develop new (digital) strategies to promptly respond to this transformation that has been accelerated by the pandemic [82]. For example, the pandemic has required a greater need for hybrid online/onsite approaches to engage audiences and provide meaningful visitor experiences, to increase accessibility online [17,18], to reduce risks on-site [83], to find different ways to manage communication [84], to develop additional digital programmes and services, as well as to support the widespread offer of social media strategies [17,64] as a part of strategic responses to the lockdowns.

A strategy is the plan that allows a museum to fulfil its vision, which is its purpose, values, and overarching museum objectives [8]. A strategy is inspired, nourished, and guided by the museum's vision. Also, a digital strategy is informed by people's needs, behaviours, and values—including staff and volunteers, audiences and internal/external stakeholders [8]. This is because digital transformation is about people not technology and, therefore, a digital strategy should go beyond implementing technologies, however

important they may be. Deloitte-MIT's 2015 report [85] stated that strategy, not technology, drives digital transformation and that digitally maturing organisations "are more than five times more likely to have a clear digital strategy than are companies in early stages".

According to Mason [8], a digital strategy sets particular objectives and principles for digital programmes or for a digital presence within existing and future museum programmes and gives direction to implement them. A digital strategy is the document that defines how a museum can move forward using digital activities across its programmes. To fulfil this, a set of specific strategies are developed to give direction to the overarching strategic objectives (for instance a visitor engagement strategy, a collections management strategy, a public spaces strategy, a marketing strategy, a social media strategy or a digital engagement strategy). The digital strategy can either be a separate strategic plan or integrated into all of them. In spite of the specific definition of strategy, what is significant for our critical reflection is that strategies serve the museum to help identify and plan opportunities.

4.4.2. Consideration for Design: How the Challenges May Be Considered via the Use of Design Thinking

DT can help a museum identify strategic opportunity for innovation. It helps to identify, collaboratively, strategic problems that museums face, frame them, and ideate strategies to solve them. DT offers ways of seeing opportunities differently [86] and exploring them by learning, for example, through empathic understanding of all stakeholders. When contributing to the implementation of strategies, design principles, practices, and methods are used to define direction and horizons for the organisation [87] and tactics and behaviours to achieve goals. HCD can support the development of museum strategies by informing using insights from empathic practices aimed at understanding audiences and museum staff needs. For example, Grohe [11] described how the Isabella Stewart Gardner Museum embarked on a service design process based on a journey mapping practice "to better understand the current visitor experience and to design new experiences that meet visitor needs and advance the Museum's strategic objectives". What started as a design process focusing on just a single project then become a practice that informed the museum strategy with significant impact on other (future) projects aiming to enhance visitor experiences. Also, the introduction of service design thinking had impact on the Isabella Stewart Gardner Museum's internal working process that promoted new ways of working that were human-centred driven, more collaborative, iterative, and [qualitative] data-informed. Dorst demonstrated how design (thinking) facilitates the "framing" of problems [70] with visualisation tools—such as the visitor journey mapping used at the Isabella Stewart Gardner Museum—that help museum teams to question, reframe, and challenge assumptions and, therefore, open new opportunities for effective and novel (digital) strategies.

Museums can use HCD to approach digital transformation at a strategic level by concentrating on (and bringing in) organisational culture and values, people, and day-to-day activities. HCD can align museum core values to strategic design principles guiding the design of visitor experiences and services in the museum. For example, Mason [7] showed a working example of how Derby Museums Trust adopted HCD as an effective approach to embedding museum vision and core values, as well as audience, museum staff, and internal/external stakeholders, needs and practices, into strategic decisions for the Derby Museums. Mason worked closely with senior staff at Derby Museums and they conducted a significant amount of research and consultation with museum staff through two mutually informed phases of understanding and defining, as part of a HCD approach. This process allowed the Derby team to access interesting insights from across the organisation, embedding audience needs and staff needs and activities, strategies and organisational values within the design of the online platform. These insights informed this process, which was a close collaboration between Derby Museums and an external design consultancy, driven by HCD. This participatory action research project showed how

a deeper understanding of the people involved in the museum and their digital and non-digital activity is absolutely critical. This is because, to truly transform an organisation's relationship with its visitors, museum staff must change their practices rather than just changing the technology they are using [8].

4.5. Challenge 5: Being Responsive to (Rapid) Change

4.5.1. Description of the Challenge Identified in the Review

Digital transformation has been associated with the ability to constantly make changes [85] to respond not only to the continual emergence of new digital technologies, but also changes asked of museums by emerging social contexts, not least the rapid changes imposed by the pandemic. In order to navigate the challenges of an evolving digital landscape, the museum sector has been seeking more sophisticated ways to foster a culture of experimentation [1]. The digitally-mature museum must be innately adaptable and responsive to a steady stream of new technologies and platforms, and to the changing expectations of visitors that are fuelled by these changing conditions. We have seen different examples of this so far in this article. Experimentation breeds this necessary resilience.

The overall response of cultural heritage institutions to the pandemic is, in itself, the clearest example of this need to adapt to rapid (and sudden) changes dictated by our unstable sociocultural and socio-technical landscape. For example, the Newark Museum of Art that took the pandemic as "an opportunity to experiment with new ideas and test the capabilities of their departments and then used what they learned to inform their larger strategic efforts" [21].

The value of experimentation was receiving increasing attention in the museum sector even before the pandemic. For example, *Let's Get Real* (https://www.culture24.org.uk/lets-get-real, accessed on 22 May 2022)—the innovative programme for museums organised by Culture24 to promote digital transformation—showed how "experimentation can be a safe and contained way to conceive, plan, track and analyse a new idea where you can create and iterate within a culture that is okay with learning from failure". A concept reaffirmed by the MIT-Deloitte study [85] that brought evidence of how organisations that are more comfortable embracing failure (one of the essential conditions for experimenting) are those that dare to take more (manageable) risks which, according to the study, is a sign of being digitally mature organisations.

4.5.2. Consideration for Design: How the Challenges May Be Considered via the Use of Design Thinking

The pandemic has brought additional uncertainty to museums operations, within the ever-evolving digital landscape it brings with it. It has been shown in different studies [23] how HCD can offer effective practices to reduce the consequences of failure and, therefore, encourage museum people to experiment. For example, this uncertainty in taking action as consequence of a risk of failure is (drastically) reduced by multiple iterations of rapid prototyping that allows multidisciplinary teams to actively manage risk (by doing) rather than being stuck in the fear of failure. Mitroff Silvers [88] showed how the adoption of low-fidelity prototyping is not only a cheap practice for museums but also created a "safe" conversational space around easy-to-understand prototypes. Also, as "agility" has been recognised by museums as an important capability in dealing with the pandemic, a more agile approach based on small scale experimentation supported by rapid prototyping makes museum managers more comfortable (and less worried) of taking risks. This is because the iterative nature of design approaches—e.g., prototyping-testing-refining—allows for small scale experimenting without requiring museums to invest significant economic and human resources for a single, large initiative. According to Lietdka [37], this fosters the "willingness to act by reducing the consequences of failure". For example, storytelling techniques such as design scenarios and storyboards can encourage museums to explore plausible and original scenarios that they can relate to, intellectually, emotionally, and empathetically.

All in all, design can not only reduce the fear of failure but also push people to act and move away from the "safely in the debate space", in which people are stuck in trying to discuss possible solutions without really taking action to explore and envision future scenarios.

5. Conclusions

Crooke reminded us that "this time of unprecedented change might be seen as an opportunity for innovation" [14] (p. 1). We have seen how the embedding of digital into organisational thinking, practices, and tools is a fundamental part of the innovation process for museums and their digital transformations. The pandemic has accelerated this process. Digital thinking, technologies, competencies, and capabilities are rapidly impacting the nature of collecting, learning, and services on audience behaviour and expectations and on the ways in which museums can fulfil their (new) missions. This transformation presents opportunities and challenges for museum organisations, leading to changes in their practices and the emergence of a new organisational working culture that is more human-oriented rather than technology-driven.

This article focuses on the challenges by identifying those that—according to the many academic and professional publications I analysed—seem to be amongst the most significant for museums presently. Firstly, museums are required to put people at the heart of transformation because a fundamental aspect of digital discourse is the centrality of people. Second, museums have to think holistically in terms of visitor experience and service-based experiences. This requires the integration of multiple disciplines, different knowledge and practices, and technologies that place enhanced visitor experience at the heart of fostering digital transformation. Third, museums have to deal with more complex problems and uncertainty as a result of new audience needs and changes in visitor habits, novel socio-technical contexts, new missions, and not to mention increasing financial issues. In addition, as Zygmunt Bauman [89] wrote, we are "living in an age of uncertainty", as are museums. This condition challenges museums that need to be prepared to react to unpredictable situations. Dramatically, Europe (and the whole world) is now facing additional uncertainty because of Russia's merciless and inhuman war, which will have inevitable consequences in our society and economy and for which museums will be called, again, to react and, I would say, help heal a moral wound that Europe and the civilized world thought would not occur again. Fourth, as a consequence of these challenges and changes, museums are called to develop effective (digital) strategies to guide them to fulfil new objectives, while new principles for digital programmes and for a digital presence within existing and future museum programmes provide direction to implement them. The fifth challenge asks cultural heritage institutions to be responsive to (rapid) change as an inevitable consequence of the present world, the ever-evolving digital landscape, and the different digital needs of new generations.

The thesis I propose for this article is that human-centred design—such as DT and SD—plays a crucial role in museum practices in order to address these challenges. The article refers to different design studies—especially within organisational and management fields—that show how HCD practices are "strategic resources" for twenty-first-century organisations and their digital transformations.

There is a causal relationship as the digitally mature museums are setting fostering design practices that are human-centred and for which HCD is well equipped to support, for example, by offering empathic tools for understanding in-depth visitor needs and their socio-technical context.

Designing for visitor experiences and service-based experiences has become central to museum practices. Designing for the museum visitors' experience requires a more holistic approach, as the visitor experience is an intertwining of physical, digital, and organisational dimensions. HCD approaches are best suited to seamlessly integrate digital elements with analogue experiences, services, and an organisation's strategic mission in more refined and nuanced ways, as part of a whole visitor's experience.

What the DT process and tools bring is more consideration to explore the problem, understand the complexity of the problem, and ensure solving the right problem for the right visitor.

When contributing to the implementation of strategies, HCD methods help to define direction and horizons for the organisation. DT offers ways of seeing opportunities differently and, therefore, uses this understanding to shape and develop new strategies.

Finally, DT can bring into the organisational practices new mindsets, capabilities, and practices that help museums to embrace and deliver change and pursue (digital) transformation. The digitally mature museum has to be responsive to change, as museums today are faced with the challenge of navigating a digital landscape that is rapidly evolving and asking for experimentation and (human-centred) creative practices with newly introduced platforms and technologies.

6. Limitations and Further Research

This article is a critical review of the challenges of digital transformation of cultural heritage institutions in post-COVID times. It also critically reflects (in the form of propositions) on the contribution HCD can offer to the sector—as well as research—to consider the challenges and benefits stemming from the adoption of HCD approaches. However, inevitably, the article presents some limitations, for example, on the adoption processes and evaluation approaches of such HCD practices.

Firstly, I did not find any mention of these two issues in the literature review, relating to museums and post-pandemic, though, there is a growing body of literature on "embedding HCD practices" in design management and management studies [90,91]. It is worth noting that there is a significant lack of specific studies that aim to shed light on the complexity of embedding HCD into museums. I am currently leading an AHRC research project that aims to advance our understanding of human-centred design practices within museums that are moving toward a digitally mature condition (see p. 18 "Funding" below), including how museums (try to) embed these practices. I will wait for more findings to emerge from this piece of research and its dissemination before discussing it in an academic article. Similarly, I did not discuss how museums approach evaluation to understand whether their digital offerings succeed in visitor engagement. As our AHRC research is still ongoing, we do not have enough data yet to support a discussion. One aspect we are investigating is whether or not museums are adopting formal evaluation approaches, such as the MUSETECH model [92] and/or other forms of evaluation when it comes to products, systems, services, and strategies as the outcomes of HCD processes and practices.

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