Self-Determination Theory Applied To Museum Website Experiences: Fulfill Visitor Needs, Increase Motivation, and Promote Engagement

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ABSTRACT

The rise of online experiences in the domain of cultural heritage offers new forms of interaction that are no longer limited by the physical presence of museums. However, sustaining online visitors' engagement is challenging, and museum professionals seek to understand how to increase motivation. We conducted a user study (N = 32) of three museum websites to investigate users' intrinsic motivations to engage with the sites through observation, questionnaires, and semi-structured interviews. Building on self-determination theory, we identified design characteristics that meet users' psychological needs, such as autonomy, competence, and relatedness, and increase their intrinsic motivation to interact with the interface. Our results show that this could consequently lead to higher user engagement. We contribute new empirical insights into the intrinsic motivation mechanisms of museum website visitors, which have relevant implications for the design of museum websites to improve user engagement.

CCS CONCEPTS

• **Human-centered computing → Empirical studies in interaction design**.

KEYWORDS

digital cultural heritage, user experience, self-determination theory, psychological needs, motivation, engagement

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1 INTRODUCTION

Research and knowledge development in the digital cultural heritage (DCH) domain requires multidisciplinary collaboration to maintain the heritage's authenticity and integrity, and to communicate CH content in a clear, vivid, engaging, and accessible manner [10]. The development of new technologies enables museums to provide innovative on-site and online experiences. To reach wider audiences, galleries, libraries, archives, and museums expand their digital offer. Their efforts include digitizing cultural heritage objects into image, audio, video, or 3D representations [35]. The challenge for DCH curators lies in designing experiences that effectively engage casual users.

This study introduces an approach to DCH experience evaluation that couples user experience (UX) research methods and theory from psychology: the Self-Determination Theory [26]. We apply it in a mixed-method, between-subject study during which 32 casual users interact with the interfaces of three digital collections. The study fills the gap regarding a lack of user studies in the DCH domain by evaluating what motivates casual users across multiple interfaces. We contribute empirical insights on design aspects that potentially promote user engagement with digital collections. The findings support ideation in DCH interface design.

2 RELATED WORK

Curators of DCH seek to design representations that visitors engage with. User engagement can be characterized by "actor's cognitive, temporal, affective and behavioral investment when interacting with a digital system" [19]. An engaging interface motivates people to interact with it and encourages continuous use. Encounters with artworks, whether in museums or digital environments, are rarely guided by pure information-seeking. Museum visitors have diverse motivations to engage with CH representations, as represented by Falk's museum visitor types: explorer, facilitator, professional/hobbyist, experience seeker, and spiritual pilgrim [6]. Among them, the *explorers* are guided by curiosity and the desire to expand their intellectual horizons. *Professionals/hobbyists* are more interested in how the information is conveyed than the information itself. The absence of a solely utilitarian agenda shifts the experience focus from the perceived utility to the perceived

enjoyment [23]. Entertainment, learning, and gaining a deeper understanding of a topic [32] reflect what motivates users intrinsically to engage with DCH representations.

Designing for engagement and motivation can be explored through the prisms of psychological theories [22, 27]. Self-Determination theory (SDT) is a "real-world" theory about "how biological, social, and cultural conditions either enhance or undermine the inherent human capacities for psychological growth, engagement, and wellness", which can be applied in "virtual worlds" [27]. It is widely used in Human-Computer Interaction to explore users' motivation while interacting with video games, well-being applications or during learning [36]. According to SDT, the two types of motivation, extrinsic and intrinsic, represent a spectrum mediated by the motivation regulation: external, introjected, identified, integrated, and intrinsic regulations [26]. Users are extrinsically motivated by actions that lead to a separable result (obtaining a reward, achieving feelings of self-worth), or recognized as personally important or matching personal values. Although extrinsic motivation is a powerful driver, its effect is usually short-term [27]. The intrinsic motivation is "the inherent tendency to seek out novelty and challenges, [...] to explore, and to learn" [26]. Users are motivated by activities perceived as satisfying, interesting, or enjoyable. Therefore, the casual browsing of DCH websites highly depends on intrinsic motivation. Intrinsic motivation is promoted by the fulfillment of basic psychological needs: autonomy (sense of willingness or volition), competence (sense of capability and efficiency), and relatedness (sense of belonging). Interfaces designed to support these needs should yield a better experience [22].

The SDT framework lends itself well to the investigation of users' motivation when designing engaging experiences. However, while the user experience of DCH sites is receiving growing attention [17], Windhager et al. [35] showed that less than half of 50 reviewed papers on the visualization of DCH collections mentioned a user study; a quarter of those did not report the results. Additionally, more evaluations were undertaken on prototypes for experts instead of casual users who constitute the majority of museum visitors [33].

New research increasingly offers design interventions that extend beyond the traditional task-oriented elements of user interaction with museums and cultural collections. Studies of playful experiences with paintings [29] connect interaction with art in museum spaces to Fogg [7]'s model of persuasive design and indicate that playful experiences can lead to positive emotions. Related studies [16, 30] correlate particular cultural heritage experiences with emotions or instances of *meaning* [13], deepening the theoretical landscape of heritage, affect, and behavior. They offer new insights into the relationship between museum interaction design, technology, and visitor behavior but do not address the digital-only context.

Technologies outside the physical museum space have primarily focused on experiences that connect visitors to their previous visits through, for example, bookmarking or creating private museum collections [12]. Despite initial motivation of users to take part in these experiences, Marty [12] ultimately found that specialized bookmarking fails to maintain interest on the long term.

Fewer studies explore the cognitive and UX aspects of DCH collections exclusively on the Web, yet recent literature describes the design space of DCH collections [15], identifies the key elements of their UX [11], and establishes new forms of information seeking behavior [9]. Central to these evolving ideas is the notion of generous interfaces [31, 34], in which the overview becomes the starting point of the exploration. It reflects the richness of the collection and prompts investigation and interpretation while the classical search by keyword, suitable for expert users, is identified as a limitation to the free discovery for casual users [34]. In the same vein, Ruecker et al. [25] proposes a rich-prospect design framework with key features: representation, organization, depth, availability, multiplicity, coherence, and selection (named by Morse et al. [14]). Following those recommendations, design implementations that respond to casual visitors' needs start to materialize. Speakman et al. [31], however, point out that the design of generous interfaces primarily seeks to increase visit duration through novel interactions, which is not a reliable indicator of user engagement. They hypothesize that what users initially encounter is more relevant for their further engagement.

Building on these recommendations and their increasing materialization in DCH interfaces, we seek to investigate **what design approaches promote casual users' engagement**. We expose casual users to three DCH websites and evaluate their experiences with the interfaces based on the Self-Determination Theory's [27] building blocks: engagement, motivation, and fulfillment of psychological needs. We ask the following research questions:

> RQ1: What design characteristics of DCH interfaces enhance or hinder the fulfillment of casual users' psychological needs?
> RQ2: What design characteristics of DCH interfaces impacts casual users' motivation?
> RQ3: What design characteristics increase or impede casual users' engagement with DCH?

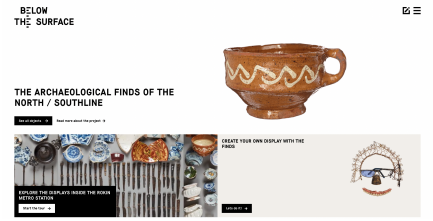
3 METHOD

3.1 Study material

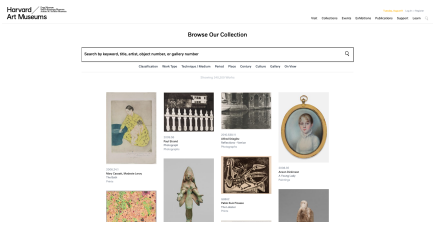
The authors selected three existing museum websites through an expert evaluation performed on a pool of interfaces using the assessment framework by MacDonald [11] . The co-authors sought comparable interfaces in terms of user experience characteristics, including aesthetics, system reliability, depth of metadata, uniqueness of the experience, and a holistic experience on-site without complex branching. This resulted in the selection of three digital museum interfaces with similarly high UX scores that represent a variety of content ranging from paintings and sculptures to everyday objects (Figure 1). Each study participant was assigned to one of the museum interfaces on a rotating basis.

3.2 Participants

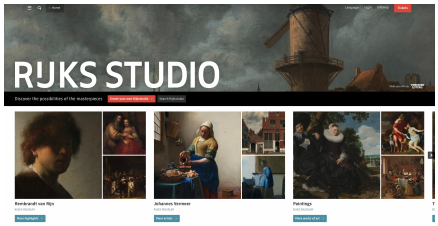
We recruited 32 participants (19 female, 13 male) using social media announcements and the University's Moodle platform, targeting an adult audience living in (anonymized). The average age was 30 years (SD 7.5). They had sufficient English skills to navigate the interfaces but could choose between English and French as interview and survey language (English=20, French=12). All declared having visited a museum at least once in the past five years. The participants



(a) *Below the surface* [1] (n=11) is a site that shows archaeological findings surfaced during a Metro Line construction in Amsterdam. Visitors can explore the objects freely or follow a proposed chronological order. Additionally, they can assemble and publish their own creations made of the objects and view others' creations.



(b) *Harvard Art Museums' Collection* [18] (n=11) is a traditional online museum collection, represented in a scrollable mosaic view. It contains a search bar and a wide variety of filters above the collection. Each object is clickable and provides access to object details, including the artist's name, object provenance and related metadata.



(c) *Rijksmuseum's Studio* [24] (n=10) holds the digital collection of masterpieces from the Dutch Rijksmuseum. The studio provides access to official collections of the museum but also to collections assembled by the website users. It integrates social media features such as counters for "likes" and "views".

Figure 1: Screenshot and introduction for each of the three museum websites from the study.

self-identified with one of Falk's [6] museum visitor types adapted by Morse et al. [17]: experience seeker = 5, explorer = 22, facilitator = 3, professional/hobbyist = 2. Approval from the University ethics board was obtained before data collection. All participants gave their informed consent and received fair compensation.

3.3 Study protocol

We applied a mixed-method approach, combining standardized questionnaires, observation, and semi-structured interviews. The study was conducted in two sessions, two weeks apart, through Webex[1], which allowed video and screen recording. The first session lasted 1 hour. The participants were presented with a prompt that suggests casual browsing: *"Imagine you are sitting in front of your computer and you learn that your friend is late for your online appointment – now you have some free time. While waiting, you browse the internet and come across this website. Explore the website freely for 10 minutes."* They shared their screen and were encouraged to articulate their thoughts and impressions (think-aloud technique). Participants filled two standardized questionnaires through Limesurvey:[2] the User Engagement Scale (UES) [8, 20] and the Technology-Based Experience of Need Satisfaction–Interface questionnaire (TENS-Interface) [22]. We conducted a semi-structured interview to discuss critical incidents.

The second session followed about two weeks after to see if the participants revisited the website without being prompted. The session lasted 30 minutes and consisted of a semi-structured interview about the remembered browsing experience. The participants filled the User Motivation Inventory (UMI) [3].

3.4 Measures and data analysis

The interview recordings were transcribed and thematically analyzed [4] with MAXQDA,[3] through a combination of deductive and inductive approach. Keywords from the UMI questionnaire [3] and basic psychological needs became the codebook foundation. Two researchers double-coded five randomly selected interviews and topics were adapted. The final codebook had the following parent categories: experience, interaction, and motivation.

Qualitative data was combined with three standardized questionnaires to identify design characteristics that enhance or hinder psychological needs, motivation, and engagement of casual users (RQ1, RQ2, RQ3). The TENS-Interface questionnaire [22] assessed psychological needs satisfaction via 15 statements on a 5-point scale. The UMI [3] measured motivation types and obtained scores were calculated per subscale. The UES [8, 20] assessed engagement with the interface on four subscales via 31 statements on a 5-point scale. Mean score and standard deviation per interface were calculated for all these questionnaires.

The participants' interactions with the interface were observed and the scope of feature interaction was noted for each participant. To allow for comparison, we selected the 10th and the 90th percentiles of feature usage to mark the borders between the groups: high (n=6), medium (n=19), and low usage (n=7). While the number of participants in extreme groups was small, they still warrant analysis as they fall within acceptable ranges for full sample size [2]. In addition, the results of the participants who self-identified as *explorers* were looked at separately because their curiosity-driven behavior presumably makes the intrinsic motivation, which we seek to understand in the context of casual browsing, dominantly present.

[1] https://www.webex.com/
[2] https://www.limesurvey.org/
[3] https://www.maxqda.com/products/maxqda-standard

4 RESULTS

We present the results by answering the research questions, starting with psychological needs (RQ1), moving on to motivation (RQ2), and concluding with engagement (RQ3). The quotes from participants include the abbreviated names of the interfaces: B for *Below the surface*, H for *Harvard Art Museums*, R for *Rijksmuseum*.

4.1 The basic psychological needs of casual users in the context of DCH

To answer RQ1, we used the TENS-Interface questionnaire and participant interviews. The obtained questionnaire scores show a high level of need satisfaction, with interface means ranging from 48.1 to 54.5 (corresponding to medium-high scores). No statistically significant differences were detected between the interfaces (*Below the surface* (M = 54.5, SD = 11.1), *Harvard Art Museums* (M = 53.7, SD = 12.3), *Rijksmuseum* (M = 48.1, SD = 12.2)) or individual needs. To better understand how the interfaces promoted or hindered psychological needs, we looked into the interviews of all participants and analyzed what topics coincided with psychological needs.

4.1.1 Autonomy. Similar to other digital experiences, feelings of agency and control over the navigation were essential for the participants. **Autonomy** was most frequently associated with *exploration* and *active manipulation*. The *Below the surface* interface was praised for its freedom of exploration (*"It's cool because we can explore it however we want"* (p22-B)), and participants appreciated the opportunity to set items aside. Specifically, the *explorers* positively commented on the facility of actions: *"I can go through this really rich collection and there is a lot of detail about the objects"* (p13-B).

In contrast, the infinite scroll in the *Rijksmuseum* was criticized for limiting autonomy and compared to *"falling from the top of the mountain"* (p6-R). Participants missed the *serendipitous discoveries* of physical museums having to actively search on the *Harvard Art Museums* website. *"It was interesting, but not like going to a museum because [in a museum] you see what you didn't expect, here this spontaneous part was missing"* (p23-H).

Participants felt overwhelmed when interacting with the *Rijksmuseum* collection (*"I had a hard time finding where I am"* (p12-R) because of the great number of items present on the screen and sub-optimal screen dimensions *("It's not great to have to scroll up and down to see the image and the comments"* (p12-R)). This experience imposed limitations to *explorers*: *"I had to scroll three times before I could see a certain category"* (p15-R).

4.1.2 Competence. **Competence** was most frequently associated with *usability* and *comprehension*. The lack of usability led to feelings of low competence, while comprehensible content increased the sense of competence.

The participants reported mixed perceptions of their **competence** with the *Rijksmuseum* interface with some feeling overwhelmed (*"If I decide that I want to see Rembrandt specifically, I can click here, but otherwise it's just too much"* (p9-R)) and others feeling lost (*"ended up on some pages by accident and wouldn't know how to get back"* (p15-R)). One participant found the *Harvard Art Museums* interface unhelpful for building **competence** (*"It didn't help me structure the information"* (p14-H)), and others reported frustration with the search and filter functionalities (*"I realized I did something wrong, that's why they are not showing the results"* (p32-H).

4.1.3 Relatedness. **Relatedness** most frequently associated with *interest/enjoyment* of art, with **social** features such as user-created collections, likes, and view counts eliciting varied reactions: some found it bothersome, while others would be inclined to view a collection shared on Facebook. Some users were looking for potential interaction aspects but did not find them despite their presence on the website. Others were not expecting to see the presence of other people on the museum websites and did not consider these contents as relevant or interesting.

To this end, interactions that encourage free exploration, serendipitous discoveries and active manipulation with the objects seem beneficial for promoting autonomy, whereas unclear website structure and infinite scroll may undermine the sense of competence. While physical museum visits often involve social experiences, this aspect is less explored in the digital realm. Social features receive controversial feedback on the sense of relatedness and require further study.

4.2 Motivation during casual interaction with DCH

Interested in design characteristics that enhance or hinder casual users' motivation (RQ2) to engage with DCH, we assessed the prominence of different motivation types with the UMI inventory.

Before filling the UMI in the follow-up session, participants were asked if they had come back to the DCH website. Five out of 32 participants did (*Harvard Art Museums* (n = 3), *Rijksmuseum* (n = 2)), they declared being driven by *curiosity* (desire to explore more content) and *instrumental interest* (desire to understand how a certain functionality works). The relatively low number of spontaneous re-engagement may be explained by the short time between the sessions. Most participants indicated not visiting a museum more than ten times per year, which is once a month at most. One of the participants who did not re-engage with the website mentioned that they probably would have revisited the site later.

Intrinsic motivation (IMO), the most autonomous types of motivation associated with the person's values and inherent enjoyment of the activity, was the most prominent among all the participants.

A statistically significant difference between the interfaces was detected for the introjected (INJ) type (referring to *"external regulation which has been partially internalized but not truly accepted as one's own"* [3]) of motivation across all participants ($F(2) = [4.918]$, $p = 0.0145$). The mean value of the introjected motivation score was significantly lower for *Below the surface* than for *Harvard Art Museums* (Tukey's HSD Test: $p = 0.011$, 95% C.I. = [0.284, 2.44]). This might indicate that those who interacted with *Harvard Art Museums* felt more inclined to do so because they "should" [22]. In the group of *explorers*, the mean value of the introjected motivation score was significantly lower for *Below the surface* than for *Harvard Art Museums* ($p < 0.001$, 95% C.I. = [0.395, 2.41]), and significantly lower for *Rijksmuseum* than for *Harvard Art Museums* (Tukey's HSD Test: $p = 0.0365$, 95% C.I. = [-2.08, -0.0617]. The intrinsic motivation score was significantly higher for *Below the surface* than for the *Rijksmuseum* interface ($p = 0.0175$, 95% C.I. = [-3.23, -0.291]). Overall, when describing their experience, the participants frequently used

words that can be associated with intrinsic motivation, such as *"enjoyable"*, *"interesting"*, *"curious"*, *"playful"* (as highlighted in Ryan et al. [26] or as it transpires in the employed questionnaire [3]: e.g., "I use [X] because it is enjoyable" belongs to the Intrinsic motivation subscale).

The participants evoked *sense-making* in a positive way *("It was intriguing because I expected a story behind it"* (p18-R), but a hindered sense of *competence* deteriorated their motivation *("I didn't find interesting information because I didn't know how to search for it"* (p15-R)). *Negative pragmatic aspects* of experience also lowered their motivation *("I wouldn't like to interact with such a website again because of the problem of bad organization"* (p15-R)). The *richness of the interface* solicited the negative reaction of feeling overwhelmed *("If I don't really know what I want to see, then it's just a lot. I don't know which decisions to make"* (p9-R).

A strong positive correlation was detected between the TENS-I score and IMO score ($r(30) = .72$, $p = 0.002$). This result is consistent with the SDT framework, suggesting that the user motivation inventory is applicable for a one-time-only context. However, more work remains to confirm the consistency of these findings.

In summary, design elements that support sense-making can promote intrinsic motivation, while the representation of all available content can have an overwhelming and demotivating effect.

4.3 Engagement during casual interaction with DCH

Addressing RQ3, we found that user engagement was equally high across the three tested interfaces. The UES scores show a mean group score ranging from 14.2 to 16 (*Below the surface* ($M = 16$, $SD = 2.06$), *Harvard Art Museums* ($M = 14.2$, $SD = 3.1$), *Rijksmuseum* ($M = 14.3$, $SD = 2.59$)). A statistically significant difference was detected in *aesthetic appeal* between the groups ($F(2) = [4.287]$, $p = 0.0291$) for *explorers* ($N = 22$), with the score significantly higher for *Below the surface* than the *Rijksmuseum* interface (Tukey's HSD Test: $p = 0.0258$, 95% C.I. = [-2.05, -0.112]). The visual aspect was a standout interface feature for *explorers* who interacted with *Below the surface* more than for those who interacted with the *Rijksmuseum* interface. The *explorer* type participants highlighted the *"clean look and feel"* (p13-B) in *Below the surface*. Experiences with the *Harvard Art Museums* website were mixed, some finding it *"boring"* (p20-H) and others *"inspirational"* (p8-H). Boredom stemmed from a mismatch between participants' personal interests and a collection, and the absence of interactive experience. For those who could see the art pieces corresponding to their personal interests, the experience felt more engaging. The large amount of non-structured information presented in the digital *Rijksmuseum* was challenging for some. The high quality of the images promoted interaction with the content: *"You can look at the picture without any noise, open it in full screen"* (p18-R). *Attention* and *scope* topics were frequently evoked by participants who had interacted with many features. The "likes" feature in the *Rijksmuseum* interface was identified as a way to guide *attention*: *"I am not an art expert, but when I see that there are collections that are "liked" very often, the chances are high that they are good and I will go in details"* (p21-R). The diversity of objects on *Below the surface* website was highlighted as curiosity-inducing: *"I'm curious how many kinds of things there are: car thing, the mobile phone – there is no relation <...> so I want to know: what else is there?"* (P13-B).

Among the topics more present among participants who had interacted with few features were *usability* and *visual support*. No easy way to go to the previous page, a *usability* issue, hindered their sense of autonomy on the website: *"I just had to re-do my search from the search bar again"* (p5-H). Putting the objects of choice together when making their individual collection in *Below the surface* provided *visual support*: *"It is convenient to be able to choose the objects, give them a title and have access to all information about them"* (p25-B).

A Pearson correlation test detected a strong positive correlation between *need satisfaction* and *reward* component of engagement, specifically between the general TENS-Interface score and *reward* ($r(30) = .80$, $p < 0.001$), *autonomy* and *reward* ($r(30) = .59$, $p < 0.001$), *competence* and *reward* ($r(30) = .83$, $p < 0.001$). The perceived value of experience, expressed through the *reward* subscale, is potentially gained through the satisfaction of *psychological needs*, which concurs with the SDT theory.

To sum up, attention-guiding features are arguably more salient for users who engage more with the interface features. Usability aspects may be more critical for the users who engage with the interface sparingly.

5 DISCUSSION

Consistent with UX literature [22], our findings show that good usability induces the feeling of competence, and having control over the interface provides a feeling of agency. We also contribute insights specific to DCH web interfaces. For instance, interfaces that have users browse through an endless list of images in a collection make them feel overwhelmed and impede autonomy. This confirms an earlier finding by Morse et al. [17]: high-level representations of museum objects, such as image lists or visual overviews, do not inherently elicit *cognitive reassurance*, a sense of satisfaction brought about through unimpeded visual access to a collection.

For participants with low feature usage, usability and visual support were important factors, while for high feature usage participants, website elements that captured their attention and fostered curiosity took precedence. Thus, the design for DCH websites may benefit from adopting the *low floor, high ceiling* concept [21]: design multiple entry points so that the interfaces are accessible to all but also engage users who seek higher levels of challenge. Usability is therefore important during those crucial initial moments of use to bestow users with a feeling of competence and control. Curiosity features can then draw people in further. This approach also supports different use contexts, such as an art historian searching for an object within the collection (pragmatic quality of interaction), or a non-expert art admirer looking to discover something new (hedonic quality of interaction).

All visitor types reacted similarly positively to each DCH website, but trends were stronger for the *explorer* users. The high frequency of themes related to basic psychological needs in this user group suggests that looking into psychological needs can be a relevant approach for evaluating DCH experiences for casual users. Indeed, our study results demonstrate that *autonomy* and *competence* are positively related to *user engagement* in the context of casual browsing,

specifically, its *reward* component, which evokes facets of engagement such as curiosity, fun, and the perception that an experience was a success. Coherent with Falk [6] museum personas, the results confirm that the *explorer* museum visitor type is associated with curiosity-driven behavior. Digital museum experiences would most benefit from design that targets creating moments of curiosity.

Alignment of the results with the SDT [27] and its argument that need satisfaction leads to engagement and indicates intrinsic motivation shows the applicability of this framework in the context of casual experiences with DCH websites. The satisfaction of the need for autonomy is a regulator of motivation [28], and curiosity is positively related to exploratory behavior [36]. Translating this into DCH experiences would mean designing for exploration, ensuring choices' autonomy: the exploration format is up to the user (e.g., the alternatives and clear options to access the collection are provided: timeline, grid view, filters).

A surprising finding was that social features were perceived as less useful on DCH websites than for physical museum visits. Their adoption following social media conventions is highly tempting but needs to be well thought through: the integration of social features does not safeguard relatedness and may even be detrimental to user experience [22]. Moreover, social features may impede the experience of casual users who do not necessarily have a particular interaction goal in mind, but rather wish to freely explore the collections.

A recent framework for the experience of meaning in HCI [13] has been applied in the context of identifying and evaluating meaningful museum experiences [16], in physical and digital realms together. Taking into account its relation to the self-determination theory (satisfaction of psychological needs as potential to create meaningful experiences), we consider it a promising lens to frame and elevate our future research.

Based on our insights, we derive the following design recommendations for DCH ideation by associating the psychological needs with experiential, motivational, and interactional aspects:

- Usability is crucial for promoting users' sense of *competence*. In the context of DCH websites, a rich overview of available content should be well structured so as not to hinder the sense of competence and engagement. The widespread feature of infinite scroll should be used with caution since it may cause disorientation, hinder a sense of competence when integrated into the digital museum collection, and quickly bore users [31]. In support of this, designing the experience with a thematic visual overview in mind, followed by a structured yet flexible dive into the depths of the respective collections, may guide visitors more intuitively, enhancing their sense of competence throughout exploration.
- Active exploration and manipulation of objects should be supported by the interface design to promote *autonomy* and, ultimately, curiosity to engage with the collection through a personal user journey, while a lack of serendipitous experiences may hinder the sense of autonomy. Design for autonomy should be well-structured, lest it hinders usability and, as a result, competence.
- Social interactions are less expected in the digital spaces occupied by museum websites, which brings opportunities to explore and develop this facet of experience. Aside from the common appearance of social sharing buttons alongside museum content, DCH websites generally remain largely insular, drawing careful attention to the museum and its physicality rather than positioning it as a hub for digital social interaction. However, the SDT framework may offer new insights into designing social spaces that take into account the fundamental nature of the casual browsing experience and the museum's evolving role as cultural and social facilitators.

6 LIMITATIONS

We sought to understand key factors of long-term user engagement and motivation. A period of two weeks between the sessions turned out too short, with only five participants returning to the website. It is not conclusive whether more participants would have returned if the period had been extended. Therefore, we don't consider these results to be alarming for the museums whose websites we used in the study. The user motivation inventory (UMI), originally validated for continuous usage of technology, was applied with caution. The results detected strong positive correlations between need satisfaction and more intrinsically regulated types of motivation, corresponding to the expectations within the SDT framework. Thus, UMI application might potentially be extended to single-use scenarios, though additional work is necessary to validate this use.

The number of participants was relatively low for a between-subjects design, potentially distorting the quantitative results. The quantitative instruments did not detect any statistically significant difference in user engagement or need satisfaction. However, we discovered differences in the salient themes derived from the qualitative analysis. These results highlight the value of the mixed-methods approach. Users interact very differently with the same interfaces, and more insight into the quality of individual experiences is needed to determine how to design optimal experiences than quantitative instruments alone allow for.

Building on these findings, a further study could employ a more detailed observation technique and result in creating user journey maps. Such an approach would bridge quantitative interaction measures and qualitative user experience insights. It might allow to isolate the moments in the user journey which facilitate motivation internalization (shift from extrinsic to intrinsic motivation) To increase ecological validity and allow for analysis of sustained engagement with the websites, future research could be designed as a field longitudinal study [5].

7 CONCLUSION

The present study reports on the design characteristics of DCH presentations that enhance users' motivation to engage in casual browsing of digital museum collections. The results suggest that users' psychological needs satisfaction is positively related to higher user engagement. The qualitative analysis provides insight into design characteristics required for building DCH experiences that promote users' intrinsic motivation: in particular, the need for autonomy can be addressed through designs that support users' exploration and active manipulation of the interfaces and their objects.

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