

To Go or not to Go?

A Participatory Approach to Digitally Augmenting Museum Experiences

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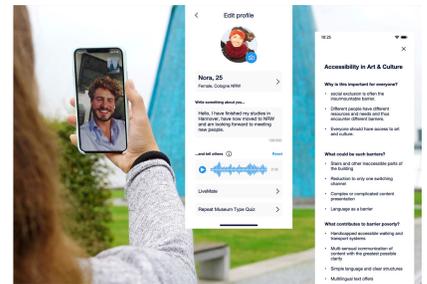
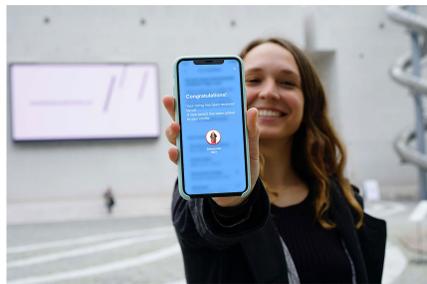


Figure 1: artMate – an app that connects museum visitors with one another, regardless of whether they visit physically or virtually. Includes a matching section (a), an achievement system (b) and a matching platform for visually impaired users (c).

ABSTRACT

In this paper, we present the results of a participatory design research project conducted together with the Art and Exhibition Hall of the Federal Republic of Germany. In this collaborative design research project, we set out to create new, location-independent ways of making museums more accessible and approachable to people who would or could not otherwise attend them, in particular

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those of younger age groups. We present three novel approaches that integrate diverse educational and participatory concepts into the museum visit. All are based on existing technology, allowing for easy and low-cost implementation through cultural institutions. These include a new way of discovering people with whom to attend the museum, a new way of contributing remotely to a collaborative exhibit and a new way of connecting school classes to prepare jointly for a visit to the museum, including a digital co-curation process. We explain our collaborative research and design process and present the results developed in exchange with our project partners and through input from participating users. We conclude by discussing our findings and by outlining future research opportunities.

CCS CONCEPTS

- Human-centered computing → Interaction design.

KEYWORDS

museum, interaction design, participation

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1 INTRODUCTION

Historically, museums have presented themselves as a service to the public as a whole, offering access to artefacts of culture for everyone. For some time now, the modes and means of exhibiting and mediating traditionally practised in museums have been subject to criticism from many perspectives, among other reasons, for their exclusivity. Thus, museum culture is undergoing a massive transformation. Museums ought no longer to be understood as high-cultural institutions, but instead should develop into more open spaces for socially and culturally diverse groups of the population [43, 51]. This development is in line with demands for accessibility [14], inclusion [23], and radical democracy [48] as well as with a new understanding of the museum as an informal space of learning [9]. At the centre of this new take on museums are the people [43, 51].

Participation has thus become a central topic for current museum research, museum management and exhibition design [8, 43], including the use of corresponding interactive technologies [20, 22, 49].

According to Simon [43, 44], participatory design formats can be used to engage with a diverse and heterogeneous public, thereby making them relevant to different kinds of life-worlds. Opening up to more diverse audiences over the long term is thus essential to maintaining the social and cultural relevance of museums. Sketching the new relationship between institutions and citizens clarifies one of the central questions of participatory design projects, namely that of *who is interested in strengthening participation, and who should and can benefit from it?* [31, 45] In the case of our project, the answer is: both sides – the museum and the public alike.

In the future, it will therefore be necessary to address the special needs, demands and concerns of different demographic groups. The younger segments of the population will be of particular interest here because it is precisely for them that today's museum world, especially those parts that tend to present themselves as high-cultural or avant-garde, has little relevance to their socially and culturally diverse lives [13, 51]. Today, these age groups are more likely to engage in digital experiences and other spare time activities than to attend a physical museum. However, Calmbach et al. note that children and teenagers, although increasingly engaged in digital communication, nevertheless also seek to balance their digital activities with physical hobbies [6]. Consequently, the potential for combining the benefits of a digital experience with a physical museum visit, to channel these dual interests towards museums, appears to be great.

To leverage this potential, we set out on a project together with the Art and Exhibition Hall of the Federal Republic of Germany,

funded by the German Minister of State for Culture and the Media. The Art and Exhibition Hall of the Federal Republic of Germany – the *Bundeskunsthalle* – is devoted to art, culture and science. The program of the *Bundeskunsthalle* includes exhibitions of art from all periods, and additionally presents an independent performing arts program including theatre, dance and music. As is usual for this type of exhibition hall, the *Bundeskunsthalle* has no standing collection of its own. The *Bundeskunsthalle* faces challenges in attracting visitors, in particular younger groups. Thus, key research interests were the development of location-independent participation opportunities, and combinations of analogue and digital formats.

Our project was funded by the German Minister of State for Culture and the Media, to remedy the negative effects of the COVID-19 pandemic. It was our task to develop new, less location-dependent museum experiences. We sought to combine the benefits of physically attending a museum with the potentials of digital platforms, seeking to leverage the emergent synergies to improve accessibility to the museum, especially for young people. We aimed for technological approaches that would be easy to implement for cultural institutions; thus we favoured approaches that leverage existing technology, but do so in a way that allows for new, innovative user experiences. However, our project's scope was limited to creating new concepts and at evaluating these with people, so a fully functional implementation was neither planned nor achieved.

2 BACKGROUND

Fortunately, making museums relevant and accessible to non-visitors is an active field of research. Likewise, bringing new experiences to museums is a growing field of HCI research. In the following, we present a brief overview.

2.1 Going to the Museum – or not?

In general, it is remarkable that despite the considerable theoretical, empirical and practical work, there are still individuals and groups who are not being reached by (high) cultural offerings. According to a recent non-visitor study, 'Schwellenangst' (literally 'threshold anxiety') still plays a role in this regard because people will avoid going to an event where they fear they will feel 'out of place' or simply bored [51, 52]. One reason here may lie in the fact that the core audience for museums continues to be people from well-educated population groups and of a higher average age [4]. However, although age, background and socialization play a central role in the development of one's cultural habitus, they are not determinant because non-visitors can be found across different demographic groups [51]. On the other hand, the study does show that non-visitors are difficult to address through the media typically used by high-cultural institutions such as museums, theatres or opera companies: newspaper feuilletons, newsletters or websites. This applies to youth culture in particular. Furthermore, 96 percent of interviewees in the study stated that they do not want to go to institutions such as classic theatres or museums without company [51]. Visitor research confirms this by presenting the exhibition visit as a communicative social practice [39, 52] which is often practised by friends and couples or in groups.

Sociality (i.e. experiencing something together with other people) in the museum can also be created purposefully. This is particularly interesting regarding younger population groups. Young people base their leisure activities primarily on their friends and the social media channels they share. Accordingly, they are more likely to choose new activities if friends or peers recommend them. Further, for young people, it is particularly important that cultural productions of whatever kind can be linked to their everyday worlds. Here, studies show in addition that teenagers strongly wish to identify with the themes of art and want to be touched emotionally by them. [13, 51]. Or to put it in the words of Tröndle: ‘The closer art is to young people, the more likely they are to visit cultural institutions’ [51] (own translation).

Research in this field actively investigates people’s reasons and motivational backgrounds for attending museums – and for not attending them. It suggests that new technology-mediated interactions among people can be of great benefit when addressing the aforementioned issues.

2.2 Digital Experiences in and around the Museum

Museum experiences are increasingly being augmented in a variety of ways by digital connectivity between visitors and exhibits. Regarding the exhibits themselves, Belluci et al. [3] propose a see-through display to digitally augment exhibits with additional information. Beyond purely visual augmentation, tangible interfaces have also been used successfully to increase the interactivity of museum exhibits [7, 21] – one approach to this is the provision of digitally enhanced replicas of the exhibits for the visitors [26]. Often, the motivation behind increasing an exhibition’s interactivity is to improve its learning effects [2]. This has been demonstrated to be the case in several projects, often in combination with aspects of gamification [54]. For example, increases in learning have been observed in terms of memorization [25] and exploration [61]. It has been argued that physically interacting with contents, as opposed to interacting with screen-based, hand-held versions of them, fosters learning [40]. In this context, some innovative feedback mechanisms for young visitors have been proposed, such as Nicol and Hornecker’s concept of eliciting feedback on interactive museum exhibits via children’s drawings [32]. Co-curation processes (i.e. curating the content of an exhibition together with other people, regardless of their level of expertise, and potentially even without the official curators of the museum) are often considered to be a promising area for crowdsourcing, and research in this area is promising, such as, for example, ‘WeCurate’ by Hazelden et al. [19] and Roussou et al.’s work on children as designers in the museum [41]. Digital experiences, both in and around the building, can also improve the museum’s accessibility. Asakawa et al. [1] use digital localization and navigation techniques to lower the barrier to museum visits for visually impaired people. Robots, as well as exhibits ‘awoken to life’ [27], have also been proposed as a ‘digital-physical’ bridge in the museum. Their roles vary, but they include welcome guides [55], free-roaming guides [42] and learning assistants [37]. Often, they are viewed with both curiosity and scepticism [36]. Most of this work focuses on the physical world, enhancing it with digital capabilities, but there are other approaches, including the

creation of 3D versions of museums [30] and the use of Augmented Reality technology to enhance the interactivity of museum exhibits, as, for example, proposed in the ‘Interactive Antarctica’ project [10]. Brown et al. [5] investigate mixed-reality visits to a museum, Wolf et al. [57] explore the gains and losses of virtual exhibitions. Despite this potential, we focused in this project on a ‘physical/digital’ hybrid approach, as we believe that this approach offers the most promising opportunities to appeal to a younger audience, in line with Paananen et al. [34], who highlight the importance of multi-sensory and interactive experiences. In the following, we discuss further considerations for our project’s aim of designing sociality into and around the museum. Some examples presented here come directly from the field of museum communication and education or exhibition design, while others are currently popular social media tools that provide compelling starting points for us.

2.2.1 Meeting and Connecting in and around the Museum. The social aspect is important for people in the context of a museum visit. The ability to share cultural experiences through social interactions such as casual conversation, inspirational exchanges, or through discussions with others is crucial to whether people decide to visit a museum or not. The quality of the shared interpersonal experience also significantly influences the museum experience. Therefore, central questions are: *How can we meet people with whom we can share museum experiences? How might museums help people to find suitable companions?* Looking to other domains, *Tinder* [50] could be a valuable inspiration. Its matching algorithm provides a good starting point for the development of opportunities to connect in and around museums. Its ease of use, especially the characteristic swiping and predominantly image-based structure, allows users to quickly get a feel for a potential match in a low-threshold way. Other platforms, such as *Twitch* [53] and *LinkedIn* [24], use different mechanisms to engage users. *Twitch* allows for the addition of shared audio commentary to live streams, whereas *LinkedIn* rewards completion of the user’s profile with collectible badges and social recognition.

The *Badisches Landesmuseum* in Karlsruhe, Germany has launched a project with the museum app *Ping!* [35], a mix of the platforms described above, which aims to improve the visitors’ engagement with the artworks by using the swipe motion. With the current exhibitions and collection of the museum, the app provides a selection of artworks that can be keyed to the individual interests of the visitors. Interaction between artwork and visitor can take place directly on site, but also online from home or elsewhere. As in a chat, users can ask and respond to questions, and thus get to know the artwork better playfully by digitally collecting objects etc. This type of app offers human-object interaction, but its basis of changing editorial content can be demanding for the museum staff. To adopt an inclusive approach from an educational perspective, we looked at tools, digital extensions and plugins. *GuidePilot* [18], for instance, enables museums to provide prerecorded audio content to visitors with physical or cognitive impairments. To further enhance such experiences, other works use sensor technology – such as gaze tracking [59] and movement tracking [60].

2.2.2 Contributing to the Museum. The ways in which we gather, organize and validate information are rapidly changing – and so are the ways in which exhibits find their way into museums. One

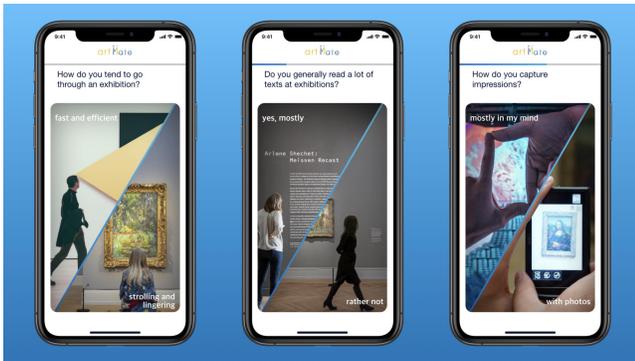


Figure 2: artMate’s museum type quiz, using a simple swipe-based interaction technique to assess the user’s preferred style of visiting museums.

example for this is *gather.town* – a virtual meeting place that also enables the collaborative design of a virtual environment, including exhibition spaces [15]. Such endeavours foster the co-curation of virtual exhibitions. Further examples of co-curation can be found in other fields. The *Global Art Project* [38], for example, provides a global network to people keen to express themselves through art.

Besides such collective approaches, many promising apps and challenges have been introduced recently, especially through the museums’ lockdown during the pandemic. One example worth mentioning is the challenge *#dubistkunst* (*#youareart*) which the Austrian TV show *kulturMontag* launched in 2020. It was a call to action to visually reconstruct and mimic famous or canonical paintings, playfully turning contributors into classical portraitists. The Paul Getty museum in Los Angeles launched a similar challenge under the hashtags *#gettychallenge* or *#gettymuseumchallenge*, inviting users to reinterpret famous works of art and post the results online, often to great comic effect. These challenges were not only successful in terms of the sheer numbers of people engaged, but were also of great marketing value and created a point of contact between the world of the art gallery and that of social media. An illuminating insight into how museums can manage their transformation successfully is provided by the Cooper Hewitt Interaction Lab. The guide ‘Tools and Approaches for Transforming Museum Experience’ [8] provides thoughts on why internal transformation in museums is desperately needed and gives insights into approaches and tools that can be used to effect the transformation successfully. The toolkit is based on the merging of interactive design and museum practice and shows strategies which have been designed in an open process focusing on cross-disciplinary thinking, transparency and a regard for both internal and external audiences. In conclusion, the main challenge for museums lies in understanding the necessity for change led by the shift in visitors’ needs, enabling the necessary agility and flexibility to react to these changes and, overall, developing into entities that are continuously developing by placing the visitors at the centre of their focus.

2.2.3 Education in the Museum. Education is a key element in the DNA of a museum. One initiative in the context of education is

‘*Neue Oberstufe*’ (or ‘new high school’) [33]. This questions the current mode of learning in schools and aims to establish a more vibrant means of knowledge transfer through workshops and projects. The second project in this field is ‘*Digital Sparks*’ [46]. The idea of *Digital Sparks* is that of an online workshop for students from different schools. This new educational format is focused on one theme, but combines several school subjects. The third example is ‘*Minecraft Babel*’ [28]. This is a competition which anyone can join, initiated by three German Bible institutions. Participants first have to read the Babel story and then build their own interpretation of Babel in the online game *Minecraft*. The playful approach of using a digital game platform appears promising. At the same time, the competition is limited to one topic and is driven by a religious rather than a purely educational initiative. A project in the context of museums is ‘*The Xponat Database*’ [58]. This is a collection of methods for educators and teachers which enables the transfer of the content of a museum exhibit in a creative way. This project is a living database, but it does not give advice on how to integrate it into a project or a school lesson. ‘*Digiclass:lab*’ [11] is a more technical project. This digital app works as a tool for a participatory museum experience. Teachers or curators can create questions and tasks around an exhibition. Connecting people online is an important aspect of our project. The question is how to transfer the content users have generated digitally into a larger group.

Research in this field provides great inspiration for how museum visits can be augmented with digital experiences. However, it is mostly aimed at active museum visitors, not at motivating non-visitors to attend the museum. However, the two areas presented above – motivating non-visitors to come and new, digital museum experiences – are rarely combined. The combination is what we set out to achieve in this project.

3 DESIGN AND EVALUATION

After the initial brief (formulated together with our research partners from the *Bundeskunsthalle*), we set out into a three-weeks *research phase*, conducting desk research about people’s motivations to attend museums (or not), as well as about new, digital enhancements of the traditional museum experience. Then, we identified the biggest potentials to be leveraged. Here, we focused our efforts at non-visitor, even though it was the goal to create interactions that also cater to existing visitors, enriching their experiences. After that, a four-weeks *concept phase* followed. Expert interviews were conducted in this phase to further sharpen our concepts. Three sub-projects were developed. During the four-weeks *design phase* that followed, numerous prototypes were built and tested with different participants (see below). Lastly, a two-weeks *documentation phase* wrapped up the project and led to the production of a short video prototype for each of the three concepts. We sought to answer one central research question: *How can digital experiences be used to make educative museum experiences for non-visitors richer and less dependent on physical presence?*

3.1 Methodology

All three concepts were designed in accordance with participatory design methodology [47] with potential users in semi-structured interviews and co-creative conversations, including *Thinking Aloud*



Figure 3: The mynd map system, a way of contributing location-based content to an exhibition. Contains a chatbot-based interface (a), a digital world map of contributions (b) and an exploratory walk-on exhibit (c).

sessions. In this following, we give an overview of this process and the users' reactions.

The selection of our participants was done in accordance with the principles of theoretical sampling, i.e. in an iterative process between empirics and theory [16]. We augmented the young participants with individuals from other age groups to widen the range of perspectives on our designs: even though we designed for a young target audience, we wanted to include a wider social context (parents, grandparents, etc.) in our interviews.

However, initially, our project began with co-creation sessions of the core project team, consisting of nine strategic design master's students and three members of the Bundeskunsthalle team (management, curatorial and social media department), guided by two design professors. The overall project lasted for 20 weeks. The challenge was to involve our project partners from the museum as informants and collaborators at the same time. Thus, specific team sessions were conceptualized using creative methods such as the 'What, if ...?' question method and various other methods from the GameStorming collection [17] but also using visual stimuli (photographs, drawings) to structure communication and foster inspiration. Only once we had decided together on three concepts for further development were three corresponding working groups formed.

Due to the constraints of the Corona pandemic, we were unable to invite people for on-site participation in the research and design process, but had to conduct almost all co-creation workshops, interviews, group discussions, prototype testing, and Thinking Aloud sessions online via Zoom and Miro board. In the following, we present the three design subprojects that we conducted. Each addresses a different aspect of our research question, all three were conducted with different test user group setups and constellations. For all three subprojects, we narrowed down our target group to young people aged 16-25, even though we also included individual experts from other age groups in the process.

3.2 artMate

ArtMate (Fig. 1) is a matching app, allowing people to meet and explore art and exhibitions that match their interests. To start, users complete a 'museum type quiz' (Fig. 2), aimed at assessing what kind of visitor they are. It contains questions like 'How do you tend to go through an exhibition' and 'Do you generally read a lot of text at exhibitions?', providing two possible answers to every question. Based on their answers, users are assigned one of eight 'visitor types' (e.g., the 'silent observer' or the 'adventurer'). After that, users browse through a catalogue of personal recommendations, indicating which exhibitions they have seen already, and which they'd like to attend (Fig. 1a). Based on their choices, the system recommends another user they can jointly visit an exhibition with. ArtMate also provides an achievement system for adding and validating tags, recommendations and other metadata about exhibitions after visiting them (Fig. 1b). This mechanism is intended to crowdsource the maintenance of the database. In addition, artMate serves as a platform to connect people who might be unable or unwilling to physically visit an exhibition – for example, because of impairments or because of the necessary travelling – with volunteers, who offer to walk through an exhibition as a visual guide while being remotely connected through the artMate app's live audio connection (Fig. 1c). This may be especially relevant in the context of pandemic-related limitations to physical presence.

3.2.1 Reactions. ArtMate was developed in three research steps, involving eight participants. The process started with five semi-structured interviews, each with one external participant (average age 25 years) and a research tandem of two students. Core to this research step was the presentation of a visualized user journey. Participants were invited to discuss the criteria they felt necessary for the creation of so called 'museum types' to elicit characteristics for the matching algorithm, such as art preferences, but also individual habits, such as walking speed or conversational preferences. In addition, participants were asked whether they would go to the museum more often if such an app existed. One significant quote is: 'I believe this is an innovative feature that will allow like-minded individuals to come together and bond over similar interests.' Surprisingly, users would also like to have a 'solo mode' as they would like to discover new exhibitions on their own from time to time. Further, and to learn more for the subsequent design and refinement process, a click dummy of the matching process was tested by using the Thinking Aloud method. In so doing, two further

participants were asked to spontaneously share their impressions aloud with the student researchers while testing the matching app dummy via an online white board. A good sense of the desired guidance through the matching process was gained. A particularly interesting outcome of these sessions was a strong reaction to the option of visiting exhibitions remotely with the help of an ‘art mate’ who is physically present in the museum and likes to share their experiences: ‘It’s also something for introverts to have an easy way to get in touch.’ We found this insight to be particularly relevant to Tröndle’s finding that *Schwellenangst* needs to be addressed with particular focus on the individual’s needs regarding sociality [51]. In addition, one expert (52 years old), who acted as an advisor regarding the special needs of people with visual impairments, was asked to comment on the user flow. We verbally guided him through the app. He brought it to our attention that audio functions of apps often lead to difficulties when they overlap with the phone’s own read-aloud function. It would be good to take this difficulty into account when programming. Although this participant personally prefers buttons, he stated that people with visual impairments usually prefer the swiping function because then they don’t have to search for the button.

3.3 mynd map

Mynd map (Fig. 3a-c) is an interactive digital and analogue map, allowing people to visually share and experience location-based stories and thoughts on a variety of cultural and social topics. The Bundeskunsthalle does not have a standing exhibition – mynd map changes that, allowing people to create a piece of art that is on permanent display at the Bundeskunsthalle. It is a generative exhibit, fed and shaped by an open, international community. To begin, users initiate a conversation with a WhatsApp [56] chatbot. In a short, colloquial interview, the chatbot poses a simple question (e.g., ‘What is your favourite place?’), to which users respond with a simple photo. The chatbot then asks for further details, such as a caption line. Then, the photo – alongside the other material contributed – is added to a digital world map. Technically, this is achieved through the Miro [29] platform. In the museum, the exhibit is continuously updated with content from users around the world. A zooming and panning map (Fig. 4) is projected on the floor. By walking up to a pinpoint on that map, visitors can trigger a projection of the associated content on a nearby wall.

3.3.1 Reactions. In developing the mynd map concept, we worked together with seven potential users. In the early concept phase, two students (aged 16 and 17) responded verbally to our storyboard in separate sessions. Responses included: ‘It’s cool that you can participate and that you end up being part of a piece of art,’ ‘It’s great to be able to look at things that weren’t made by any old people,’ and ‘Awesome that it’s live and renewed at all times.’ To improve the concept on the technical side, participants suggested aiming for a solution with existing platforms. Also, they wanted the app to run on mobile devices to enable participation while on the move. On the content side, one respondent said that it would also be exciting to repeat topics to compare how people’s contributions change over time. Next, we invited five additional users to test experience prototypes of the chatbot, the landing page, and the map on the Miro platform. The main focus was on users with

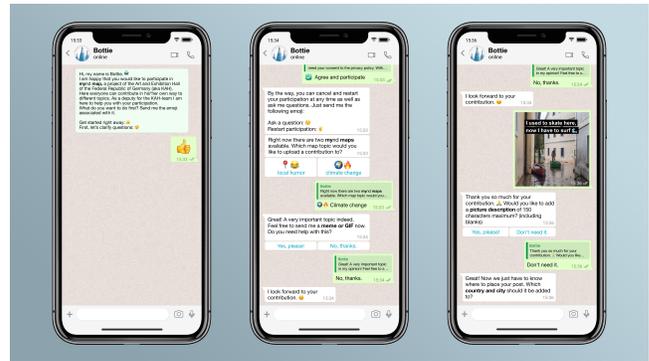


Figure 4: The mynd map chatbot, accepting the participants’ contributions to the system and asking for more information about them.

an average age of 25, but also users of an age of up to 62 were included, to cover the social context of parents and grandparents. Users were asked to spontaneously express general thoughts as well as to evaluate individual components. Responses included: ‘I think the idea is super cool, especially [...] because you can also participate from home,’ ‘[...] I immediately want to take a closer look and add something and I would totally like to go to the exhibition,’ and ‘I think that’s totally awesome, that’s something I would definitely take part in.’ To improve the concept, participants suggested enhancements for the chatbot, such as a reminder and a delete function, and they expressed their wish to share posts directly with friends and family. Surprisingly, younger users said that they would prefer to attend the project in the museum, while representatives of the parent’s and grandparent’s generation said they would want to use it primarily online. Following the non-visitor research cited above (Section 2.1), connecting people to mynd map’s topic will be crucial to participants’ interest in using it. The topics preferred by our participants are sustainability, world politics, the future and equality.

3.4 NewMuseum

NewMuseum (Fig. 5) is a school learning program based on a playful approach, where teenagers can digitally co-create, co-curate and share content with their peer group. Visiting a museum with a school class can be exhausting – for teachers and students alike. For teachers, it can be hard to identify aspects of the exhibition that the students will perceive as relevant to them – and for the students, it can be hard to see this relevancy. NewMuseum aims at changing that by putting the task of curating relevant aspects of the exhibition into the hands of the students. In addition, it matches one school class planning to visit with another school class, each preparing materials for the other. To begin with, the teacher signs up on the NewMuseum platform (Fig. 6). They enter information about the class they are planning to visit the exhibition with, such as their current grade, the associated other classes, and potential overarching topics. They also provide possible time frames for a visit, and for a preceding project week. This project week is one of NewMuseum’s core features: after matching two school classes, both are provided with material to prepare for the museum visit

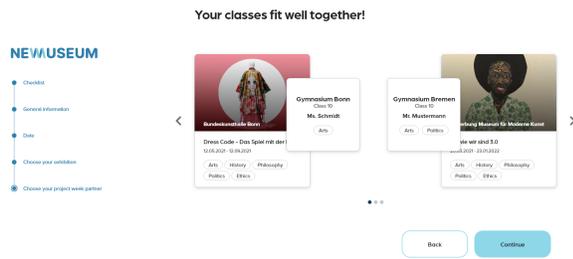


Figure 5: NewMuseum's matching system, connecting two school classes.

(which marks the finale of the project week). During this week, both school classes prepare material using the gather.town [15] platform, including micro-exhibitions about the topics at hand (Fig. 7).

3.4.1 Reactions. To develop the NewMuseum project, we repeatedly invited a total of 11 students (aged between 16 and 17) to give us feedback on our concepts and help us to improve them in separate semi-structured interview sessions. In different group combinations, the participants were invited to respond spontaneously to the current status of the project based on design sketches and storyboards. As the designs became more concrete, a prototype was discussed on the website and a joint visit was made to the gather.town platform to get feedback. Their various responses were analysed, bundled and compared with experiences from other studies. One reaction during the joint gather.town visit was: "Building is particularly appealing to me - fitting out the space and creating content myself." (participant, 16 years). In an iterative process between theory, empiricism and design, the project was further developed and refined. In total, we had four iteration loops, each of which included rounds of interviews and discussions with 2-3 students. The main lessons for us were: From the students' point of view, planning a use case around a project week is warmly welcomed by the students because it would break the monotony of everyday school life. In particular, they liked the idea that they would be able to work independently during the week and network with other young people from other schools in the digital space. One participant, 17 years, said, "I think it's cool to get to know people outside your own school." Briefly, these findings can be summarized in the keywords 'autonomy', 'innovation' and 'connectivity'. Participants also thought a project week combining analogue and digital work with others was innovative, as they had not seen such a combination in their school context before. The fact that they could visit an exhibition on site and combine it with digital exhibition work was well received. Furthermore, the students saw the digital platform as a very valuable way to create and curate their own content. They valued the ability to interpret exhibits in their own way and share those results with other students.

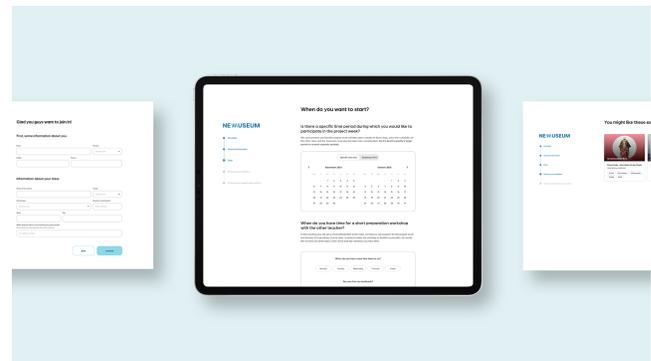


Figure 6: NewMuseum's planning tool.

4 DISCUSSION

In this section, we discuss our findings. Although the designs presented have different emphases in their approach to improving visitor-museum interactions, they share overarching topics of accessibility, inclusivity, democratization, and program diversification.

First, they add a social dimension to the museum visit - through connecting with other like-minded (and previously unknown) visitors as the artMate project would like to make possible; but also through a new social togetherness that offers new visiting opportunities for the visually impaired or mobility-impaired (who cannot or do not want to travel, for example) through the projects' extra features. Here, the social aspect of design is increasingly related to the co-creation of interpersonal relationships [12]. The social dimension is also evident in the collaborative creation of a collection and an exhibition through mynd map, creative processes that can have a community-building effect, and in the mutual curation of one school class for another through the NewMuseum.

Second, all three designs create opportunities to connect to the life-worlds of different groups of possible visitors, both in terms of the topics addressed (e.g., sustainability, autonomy, equality, and diversity) and the media used (e.g., chatbots, video conferencing, matching platforms). ArtMate does so by asking people about their interests and museum-related habits, and by connecting users to other real people. Mynd map does so by relating its content to actual locations from the users' everyday lives, and by inviting them to share photos and stories that link art and everyday life. NewMuseum connects to the life-world of schoolchildren by bringing the museum to their respective learning environments, where they are then responsible for using their own content to create what they see as a relevant museum experience for other schoolchildren.

Third, they add location independence to the museum visit. ArtMate allows users who do not live in the same area to meet and interact with people digitally or in person before, during, and after a museum visit. Most importantly, it enables people to visit an exhibition together, where only one of the two people needs to be physically present (sharing their physical museum experience) while the other is connected through video or audio conferencing. Mynd map does this by enabling users to contribute content from anywhere. Yet, it is also present on-site at the museum in the form of an interactive exhibition installation, providing a distinct place

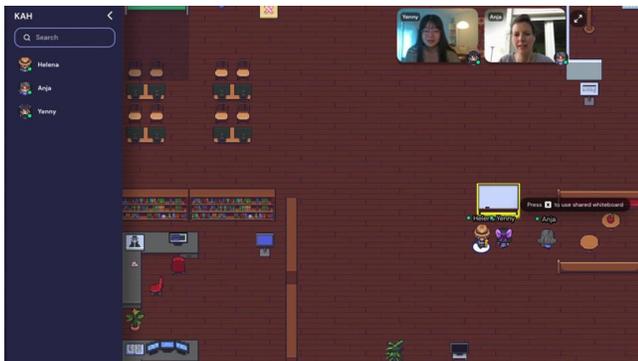


Figure 7: The NewMuseum virtual exhibition space based on gather.town

where the contributors themselves as well as previously uninvolved new visitors can explore, reflect on, and further develop the contributions. NewMuseum helps school classes, regardless of where they are physically located, to prepare jointly for a museum visit and to make nationwide as well as international acquaintances.

Fourth, all three designs build upon a combination of digital and physical content, balancing relevant content with existing and working technology and a motivating mechanism to take part as a user. All three designs combine physical and digital museum experiences, linking younger age groups' increasing affinity for social media with incentives for physical activities that can be shared with others.

5 CONCLUSION AND OUTLOOK

Our project was based on the idea that combining the physical richness of a museum visit with the opportunities offered by digital communication could lead to a new mode of engaging with museums that might be particularly well tailored to the needs and expectations of teenagers and young adults – an age group in which the proportion of non-visitors is comparatively high. First, we presented artMate, a matching platform for museum visitors, enabling them to find people who attend museums of a style similar to those they prefer. Furthermore, it provides a way for people who cannot or do not want to visit the museum physically for various reasons, to connect with visitors on-site to participate in a shared semi-virtual visit. Second, we presented mynd map, a collaborative, chatbot-moderated exhibit that people from around the world can contribute to, providing the exhibiting museum(s) with a continuously updated piece and collection. Third, we presented NewMuseum, which enables school classes to prepare jointly for a visit to a museum through a digital, student-curated exhibition. All three projects were designed in a collaborative and participatory process. They have different emphases, but all aim to contribute to the current structural change in the museum worlds in the following ways: by adding a social and interpersonal dimension to the museum visit; by connecting to the life-worlds of (younger) citizens - in terms of content as well as in terms of media and technology; and by offering the greatest possible independence of location, not merely by virtualizing the museum visit but by

combining digital and physical activities in and around the museum. Although the project brief was to create new interactions for museum (non-)visitors that go beyond enabling a museum visit during the COVID-19 pandemic, our research underlines the need for location-independent, hybrid interactions that do not require physical presence. Some questions remained unanswered – in particular, while all the presented designs address the interaction of *people* with one another while at the museum or while preparing for a visit, none of them directly addresses the interaction with the museum's physical exhibits. This is an area with great potential that was outside the scope of our project, but it may be a great starting point for future investigations.

Furthermore, our interviews focused on younger groups of users and visitors. However, non-visitors are, of course, not limited to these groups. It would be interesting to see how the presented designs would be perceived by other demographic groups, which may, for example, be less savvy about interaction with digital technologies. Here, care must be taken to avoid, while making the museum visit more inclusive for one group, inadvertently making it exclusive for another. We conclude that participatory design projects may be beneficial to further strengthen the relationship between citizens and their art institutions, such as museums. Designing access and participation opportunities for all those who want to take part will continue to be a relevant topic, and one which might help museums what they aspire to be: an offer open to everyone.

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