The design of a phygital tool to support introduction workshops organised by the Royal Museums of Fine Arts of Belgium (KMSKB) for residents of residential care and day centres

Jana Elst

Supervisors: Bastiaan Baccarne, Isabel Vermote

Abstract – **Barely 20 percent of individuals aged 85 years lives in residential care centres. There is a significant chance that they might experience social isolation.**

By using art as a connecting element, this study aims to facilitate connections among elderly people. Through this approach, not only is social isolation alleviated, but inhabitants of residential care centres and attendees of day centres also have the opportunity to (re)explore the realm of visual art. The investigation makes use of the collection housed within the Royal Museums of Fine Arts of Belgium (KMSKB). This research aligns with the broader initiative 'Art and Care in Dialogue', a project devised by 'Museum op Maat', an endeavor under the umbrella of the KMSKB's public mediation department. As part of this project, participants are provided with an introductory workshop followed by a customised tour.

The research process draws inspiration from Design Thinking principles, incorporating research methodologies from User-Centred Design. A combination of desk and field research are conducted. Conceptual ideas are validated through user testing.

The outcome is a phygital introductory workshop for residents of residential care centres and visitors of day centres. Throughout the workshop, visual art is explored inclusively and in a user-friendly manner, engaging various senses through techniques drawn from reminiscence therapy.

I. Introduction

A. Well-being and elderly

Ageing is a global phenomenon. In 2022, approximately20.9% of the Flemish population was 65 years or older. [1] By 2032, this figure is projected to increase to a quarter. [2] The ageing trend is driven by various factors, including the baby boom generation, rising life expectancy, and a declining birth rate. [3] It is expected that by 2070, the number of 85-year-olds will double. [2] Curently, nearly one-fifth of 85-year-olds reside in residential care centres. [1] Social isolation is an insidious problem for them. [4]

Art museums have the potential to combat social isolation and enhance the well-being of the elderly by offering activities for this target group. [5] Multiple studies suggest that art-based activities yield positive effects on cognitive processes, communication, and engagement. [6] According to Nathalie Bondil, the director of the Institut du Monde Arabe, art enriches the well-being of all individuals. She firmly believes that culture in the 21st century will play a role in health similar to what sports played in the 20th century: cultural experiences will contribute to our well-being just as sports contributed to our physical condition. [7]

Given the ageing population, the number of people with dementia is estimated to rise by 40 percent by 2030. [8] Staying actively engaged in society is crucial to proactively slow down dementia. Museums can also play a role in contributing to this cause. [7]

B. Culture and inclusion

An inclusive museum aims to provide permanent accessibility for all visitors. The first step towards achieving inclusivity in a museum is by ensuring its accessibility. An accessible museum is a museum that is accessible to specific target groups during designated times. [9] Various hurdles, including physical, sensory, and cultural barriers, can discourage museum visits. [10] Museums strive to eliminate these obstacles by establishing wheelchair access, offering tactile and auditory guides for individuals with visual impairments, and creating conversation cards for non-native speakers. [11]–[14]

An illustrative example of an inclusive museum is the multi-sensory exhibition "Dwarsverbanden" at the Van Abbemuseum (Eindhoven). The creation of this exhibition involved collaboration with numerous experts in the field of physical accessibility and inclusion advocacy groups. [15]

The journey toward inclusive museums is gradual and necessitates ongoing efforts to render the museum accessible to the broadest possible audience. [16]

C. Digitalisation and museums

Around the world, museums are digitising their collections. This endeavour ensures the preservation of cultural heritage, even in cause of potential damage caused by humans, animals, or natural events. [17] Moreover, digitisation can provide a solution for distributing museum content to a broader audience. An increasing number of museums are expanding access to their digital collections for a wider public. Smaller museums are also delving into the realm of virtual and interactive exhibits. [17]

J. Elst is with the Industrial Engineering and Product Design Department, Ghent University (UGent), Gent, Belgium. E-mail: Jana.elst@ugent.be.

Portal sites like Europeana[1] and Google Arts & Culture[2] collect digitised collections from diverse institutions and offering for free to the users. On these websites, individuals can explore artworks, share their findings, and even curate their own collections.

The Covid-19 pandemic expedited the provision of digitised heritage. Museums attempted to bring their cultural assets to visitors amid this challenging period. [18] As an example, the Getty Villa Museum[3] in Los Angeles introduced an interactive experience, enabling virtual visits to Persepolis within a 3D online environment. [19]

In Belgium, the Royal Museum of Fine Arts of Belgium (KMSKB) maintains an ongoing commitment to digitise its collection. [20] The KMSKB's digital repository can be accessed through various platforms, including Europeana, the KMSKB website[4], and Google Arts & Culture.

II. Methodology

In this project, the Design Thinking methodology is employed, along with methods from User Centred Design. [21], [22] The design process follows four key steps: discovery, definition, development, and delivery. These stages are built upon the foundation of the Double Diamond model. Throughout this process, the Double Diamond approach is deduplicated to encourage greater divergence and convergence. In the divergent phase, various possibilities are explored, while the convergent phase involves making decisions and conclusions.

The discovery phase focuses on research, encompassing both desk and field research. The objective is to identify users' needs, wishes, and experiences.

The define phase revolves around generating concepts based on insights gathered in the discovery phase. Brainstorming sessions are conducted to collect ideas and formulate concepts. Through a survey involving multiple stakeholders, one concept is ultimately selected.

The development phase focuses in on a detailed development of the chosen concept. This stage includes prototyping and user testing. Through iterative processes, the aim is to achieve a solution that seamlessly aligns with users' needs and desires.

In the final phase, the delivery phase, a final prototype is developed.

III. Discover

A. Design for elderly

Technology continues to evolve. Ensuring access to these new products for as many individuals as possible is crucial. However, they are often designed with an 'average person' in mind. [23] The existence of such an average individual is questionable. Consequently, specific groups often escape attention during the design process, even though they are the ones who require products tailored to their specific needs. The target groups of this research, including people with non-congenital brain injuries and the elderly, often fall into this 'overlooked' category. Within these research target groups, just like in the broader population, there is extensive diversity in terms of social backgrounds, mental conditions, and physical states. When designing for these target groups, an understanding of the opportunities and challenges these target groups face is required. The challenges faced by these target groups can be categorised into five domains: physical, cognitive, sensory, technological, and social challenges. [24]

Elderly individuals often lack significant experience with technology, which poses design challenges. [24] They rely on text and require clear visual support. [25] Sensory and physical obstacles, such as limited vision and tremor require simple interfaces. Addressing memory changes in the elderly necessitates a design approach focused on consistency and simplicity. [24], [26]

B. Reminiscence

A reminiscence, as defined by Van Dale, is ‘phenomenon that evokes the memory of something corresponding to the past.’ [27]

A more comprehensible term for ‘phenomenon’ is a trigger. A trigger can include music, songs, stories, and even visual art. [28] Depending on the trigger utilised, different senses are engaged. The sense that triggers the most vivid memories varies from person to person. [29], [30]

In the context of reminiscence therapy for older individuals, the emphasis is on positive life experiences. Through sharing stories of their pasts, elderly individuals can clarify their own identity. This bolsters their self-esteem and self-awareness. This therapy can be conducted in groups or individually, and it encourages social interaction. [28]

C. Observations

Two activities, a guided tour and a workshop, of Museum op Maat were observed using the 'shadowing' observation technique. The goal of these observations is to gain a comprehensive understanding of how ‘Museum op Maat’ functions.

A guided tour designed for blind and visually impaired individuals at the KMSKB is observed. During the tour, an average of five paintings are discussed. Tactile plates are utilised to enable a tactile engagement with the artworks. The tour unfolds in a relaxed and informal ambiance, with anticipatory responses of participants' preferences. For instance, if participants mention that they've recently encountered a particular artwork in another tour, a different artwork is discussed upon their request.

Additionally, a workshop conducted by 'Museum op Maat’ at Zonnelied, a service for individuals with disabilities, was attended. The workshop involved six participants, each with their unique challenges.

A 'Museum op Maat' workshop adheres to a structured sequence: participants introduce themselves (1), the museum

[1] https://www.europeana.eu/nl
[2] https://artsandculture.google.com/
[3] https://persepolis.getty.edu/
[4] http://www.opac-fabritius.be/airwebopacfabritius/www.main.cls

is introduced (2), participants' interests are gauged using visual aids (3), art from various museums is presented (4), a decision is made about the museum to be visited (5).

Artworks are displayed in both A5 format and on an iPad. However, both formats prove inadequate for showing the works to all participants simultaneously. Consequently, artworks need to be circulated among the participants. er. Some participants struggle to express themselves. This suggests the need for other communication techniques. The workshop relies on personal stories. A welcoming and open atmosphere fosters the sharing of personal stories. Finally, a Magritte hat in the workshop facilitates engaging interactions.

D. State-of-the-art

There are numerous interactive tools available to enhance the educational, accessible, and engaging aspects of the museum experience. Extensive research is being conducted on this topic, leading to results that can be categorised into three main areas: the interactive museum, the inclusive museum, and the digital museum.

In recent years, many museums have developed a wide range of interactive tools, including digital discovery tours of their collections, virtual reality (VR) experiences, immersive installations, and audio guides. Some museums have even embraced artificial intelligence (AI) technologies. While these interactive tools add an element of playfulness to the museum experience, they often fall short in terms of inclusivity.

Furthermore, a considerable number of museums are also dedicated to enhancing the inclusivity of their exhibits. They organise accessible tours for people requiring additional assistance, develop workshops tailored to specific target groups, and curate exhibitions that offer multi-sensory experiences. Additionally, digital tools are being developed to enable remote visits to the museum.

To evaluate these different initiatives, eighteen projects falling within these distinct categories were compared using twelve evaluation criteria established based on design principles (refer to x). The five projects with the highest scores were charted on a radar diagram. Some projects were grouped together due to their significant similarities. The five projects visible on the radar diagram are as followed: "Meet Me" (Moma)[5], "Reminiscence Cases" (Tapijtgeest in Kortrijk[6] and Reminiscence Case Industriemuseum in Gent[7]), "Discovery Boxes" (CoGent Box[8] and Bauhaus Archiv[9]), "Discovery Tables" (Huis van Alijn in Gent[10] and MAS in Antwerp[11]), and "Van Gogh Meets" (Amsterdam)[12].

Upon analysis, it seems that museums are experimenting with technology to create unique museum experiences, but for inclusion projects, technology is rarely used.

IV. Define

A. Design requirements and goals

From desk research, from various conversations with stakeholders and from the observations described above, four goals and several design requirements are defined. After regrouping the design requirements, 12 evaluation criteria are formulated. The objectives can be found in table 1.

1.	Expression	The product should allow participants to express themselves in ways other than language.
2.	Emotional experience	Het product moet ervoor zorgen dat de deelnemers over zichzelf en met elkaar praten met kunst als bindmiddel.
3.	Relinking	The product should cause participants to talk about themselves and with each other using art as a binder.
4.	Shared experience	The product should allow participants to see (part of) the artwork, picture or object at the same time.

Table 1: goals

B. Concept development

Initial ideas are generated through two brainstorming sessions and an interaction modality scheme [31] . Subsequently, seven concepts are formulated based on these ideas. These concepts are then evaluated against the previously established twelve evaluation criteria. The three concepts with the lowest scores are excluded.

The remaining four concepts undergo additional development via storyboards and are presented to a group of museum staff members. Following their feedback, one concept is discarded. This concept displayed a predominantly individualistic approach and appeared better suited for a purely digital environment.

The three concepts that remain will undergo further refinement before being presented to diverse stakeholders through a survey.

C. Concepts survey

The survey is conducted with a participant pool of eight individuals. Although this sample size is insufficient for a statistical study, it provides an adequate basis for drawing conclusions for this research.

The three remaining concepts are presented to various stakeholders through a survey. The goal is to determine the optimal concept. When evaluating both the overall scores and the total scores obtained through the calculation of different weighted averages, the outcomes for the three concepts are

[5] https://www.moma.org/visit/accessibility/meetme/

[6] https://faro.be/blogs/gregory-vercauteren/tapijtsgeest-een-expo-aan-huis

[7] https://www.industriemuseum.be/nl/het-industriemuseum-komt-naar-je-toe

[8] https://www.collectie.gent/cogent-box

[9] https://www.bauhaus.de/en/programm/7432_bauhaus_infinity_archive/

[10] https://huisvanalijn.be/nl/personen-met-dementie

[11] https://pers.mas.be/de-collectie-van-het-mas-trekt-erop-uit

[12] https://www.vangoghmuseum.nl/nl/bezoek/agenda-en-activiteiten/workshop-op-locatie-70-plus

closely aligned. Given the marginal score differences among the concepts, an additional consultation is organised with select museum stakeholders.

Following the consultation, one concept is excluded due to the presence of pre-existing technology. Consequently, the concept 'The Sensory Palette' is chosen as the preferred option. This concept introduces novel elements to the existing workshop and is deemed more innovative compared to the other remaining concept.

V. Develop

A. Digital design

The chosen concept undergoes further development using a customer journey map. This map visualises the 'art and care in dialogue' journey in five key steps: workshop preparation (1), workshop (2), guided tour preparation (3), guided tour (4), and post-processing (5). This study primarily focuses on step two, the workshop.

The fundamental user interaction of the product proceeds as follows:

A participant places a cube with a painting or texture on the RFID reader. The corresponding painting is displayed on both the projection screen and the app (1) or the guide selects an artwork in the app. The chosen artwork is displayed on both the projection screen and the app (2).

1) Art cube

The basis of the workshop is to scan art cubes with artworks, textures, sounds, or smell using NFC tags. These tags are read using an Arduino and RFID reader. In the initial development stage, the read information is transmitted to Processing, where it is transformed into a visual output. In the subsequent phase, Protopie is utilised. This software facilitates communication between multiple components (the projection, the app, and the RFID reader).

2) App

Utilising Figma, a design program for creating wireframes, and Protopie, a digital prototype is generated. The initial iteration of this digital prototype concentrates on the layout, diverse functions, and positioning of various buttons.

Upon launching the app, users are presented with three options: conduct a workshop (1), prepare a tour (2), or add material (3).

This study centres on supporting workshops, hence the 'give workshop' option is developed.

Within the 'give workshop' mode, the guide can include participants, access and project artworks, and re-project artworks previously shown. All of these actions are easily accessible through the dashboard (see figure 1).

The first version of the app is shared with a Dutch-speaking guide, Digital Museum staff, and the museum's graphic designers. Based on their feedback, the app undergoes adjustments and refinements during the second iteration. The KMSKB house style is applied, and minor tweaks, such as the nomenclature of buttons and tabs, are implemented.

Ultimately, the app is tested by two individuals, revealing that the flow for adding participants is not intuitive. As a solution, the plus sign for adding new users is relocated. Newly added participants appear to the right of the plus sign, arranging participants from most recent to oldest. This adjustment also enhances consistency with the other tabs. To avoid confusion among participants' art selection, the projection of the artwork chosen by the previous participant is paused when a new participant is added.

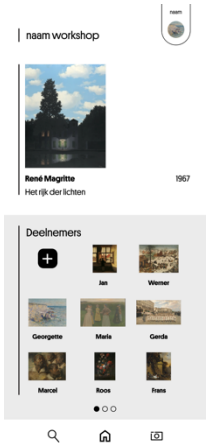

Figure 1: Dashboard

3) Projection

The projection comprises a solitary frame where the artwork is displayed without any supplementary visual components. Insights derived from user research indicate that supplementary information is unnecessary as long as the guide provides verbal explanations.

During a subsequent iteration, a starting screen and a search screen are incorporated into the projection.

B. Physical design

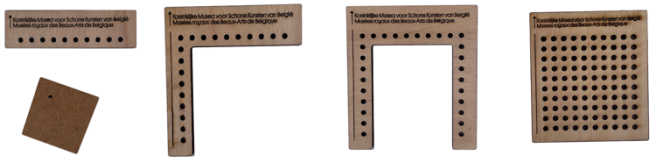

Figure 2: Different sizes of texture blocks

Incorporating physical elements into the product captures participants' attention and fosters direct interaction without digital barriers. Art cubes are developed as tangible elements for this purpose. These cubes are linked to (digitised) artworks via NFC tags, engaging participants through their senses. Art cubes catering to four different senses are crafted: sight (1), touch (2), smell (3), and hearing (4). For instance, painting cubes and texture cubes are currently in development as illustrative examples.

The design of these art cubes is streamlined to allow easy realisation or modification by the museum itself.

In the creation of the texture cube, inspiration is drawn from sensory blocks designed for children and material presentations at the Industrial Design Centre (Kortrijk). Through brainstorming and a morphological map, numerous

options arise. Options involving a surplus of materials and those restricting textures to irregular shapes are discarded. Five options remain viable after elimination. Among these, materials are fixed to a plate with the tag on 1, 2, 3, or 4 sides. In the fifth option, no plate is utilised, and the material is directly connected to the tag. (See Figure 2)

A user test reveals that the L-shaped option, which entails attachment on 2 sides, is the preferred choice.

C. *User tests*

The test serves a dual purpose. On one hand, it compares the user preference between the old and new workshop concepts. On the other hand, it identifies potential areas for enhancement in the new workshop. Participants are recruited via social media and personal connections; only retired individuals are eligible to take part in the test.

The user test comprises four components: introduction (1), prototype texture cubes review and a socio-demographic survey (2), a comparison between the existing and new workshop (3), and questions regarding the new concept (4).

Eight participants with varying levels of digital proficiency partake in the study. Four participants are tested in pairs, while the other four do are tested individually. No notable differences in results are observed between the two testing methods.

Both oral responses and survey data indicate that the new workshop is perceived as more enjoyable. The incorporation of various sensory elements is highly praised. Irrespective of their art expertise, most participants found it easier to share memories during the new workshop.

The workshop - in both old and new forms - doesn't work for everyone. Some individuals do not require a redirection through reminiscence or sensory experiences. They would rather just look at art.

VI. Deliver

A. *Final prototype*

The final prototype is an introduction workshop that explores art through various senses. This prototype utilises several paintings from the KMSKB's collection.

An Arduino connected to an RFID-RC522 module is linked to the computer, which is connected to a projector. By holding the art blocks against the RFID reader, information is transmitted to the computer. Via an internet connection, the information is sent from the computer to the smartphone and from the smartphone to the computer. Prototypes developed in Protopie run on the computer and the smartphone.

The prototype consists of two types of art cubes: painting cubes and texture cubes. (see Figure 3)

The painting cubes measure 95x105 mm and comprise a printed painting, a 1.2 mm plywood sheet, an NFC tag, and a label.

The texture cubes include a material, a ball chain, a 40x40x1.2 mm plywood sheet, an NFC tag, and a label.

The label displays the artist's name, the work's title, the year of creation, and the inventory number (following the KMSKB inventory) or the texture's name and ID number.

Figure 3: Art blocks

B. *Final product*

The final prototype utilises prototype materials, which will require adjustments as the project progresses.

For the prototype, a computer and an RFID reader are used. For the final product, a smartphone with NFC reader can replace the computer and RFID reader. This reduces the required equipment. The smartphone can then be connected to the projector using a USB-C to HDMI cable. The other essential devices remain consistent with those used in the prototype.

Depending on the available budget, the production of the art cubes can be carried out entirely in-house (resulting in cubes resembling those used in testing) or outsourced. If the creation of the art cubes is outsourced, the material can be fixed to laser cut L-shaped art cubes by the museum. The cubes featuring paintings can be printed on PVC, a light and durable material that is resistant to scratches and shocks.

VII. Conclusion

This research aims to design a phygital tool for an introduction workshop at the KMSKB for visitors with non-congenital brain injuries from day centres and residents of residential care centres. This tool not only supports but also enriches the workshop experience.

Approximately 20% of the Flemish population is aged over 65, and for residents of residential care centres maintaining an active lifestyle can be challenging, it often led to social isolation. Museums can play an active role here. In order to reach this target group, inclusion is a key word. The transformation of a museum into an inclusive space occurs in stages. The task of an inclusive museum is to gradually remove all possible barriers for various target groups.

Numerous museum collections have been digitised and made accessible to the public. However, Digital collections are often limited to a purely visual overview.

The general design methodology is founded on the principles of the Double Diamond. Within this design methodology, principles from user-centred design are applied. The insights garnered from desk and field research lead to four main goals, a series of design requirements, and 12 evaluation criteria.

From ideas generated in two brainstorming sessions and the interaction modality schema, seven concepts are formulated and assessed based on the 12 evaluation criteria. The four best rated concepts are presented to various stakeholders, who evaluate them through a survey. Given the closely scores of these concepts, an additional consultation with select stakeholders leads to the decision to further develop the "sensory palette" concept. This innovative concept involves experiencing art through different senses.

Both physical and digital prototypes are created, refined, and evaluated with input from stakeholders. User testing reveals that the new concept is perceived as offering greater variety and unexpectedness compared to the existing workshop.

This research culminates in the redesign of an introductory workshop at the Royal Museums of Fine Arts of Belgium, where art is (re)discovered through the engagement of different senses. The newly developed concept encompasses both physical and digital tools, providing a sense of familiarity and lowering the barriers for participation.

VIII. Future work

A few final steps are still required to make the product fully operational. The current prototype does not yet include all the senses. The digital aspect could be further refined to not only facilitate workshop preparation and conducting but also serve as a tool during guided visits.

Further engagement with creative therapists can furnish additional insights to improve the product. It's also essential to conduct further testing. While trials were conducted with retired individuals, testing within care centres and with groups of eight people remains crucial. Insights from these supplementary tests could significantly contribute to fine-tuning the product.

The demand for a bilingual version remains unaddressed in this study. In the final development phase, this concern should certainly be addressed. Additionally, when working with the KMSKB database, a solution should be devised to enhance the quality of the photos available in the database. Presently, the artworks are only accessible in low resolution.

Exploration of methods for storing and transporting the material hasn't been undertaken. The possibility of using a small suitcase or a flight case with separate compartments could be considered.

Finally, consideration could be given to packaging the refined workshop as a kit for day and residential care centres, similar to the reminiscence kits that some museums presently offer.

IX. References

[1] "Bevolking naar leeftijd en geslacht," Jun. 05, 2023. https://www.vlaanderen.be/statistiek-vlaanderen/bevolking/bevolking-naar-leeftijd-en-geslacht#vlaamse-bevolking-vergrijst-1-op-5-is-65-plusser (accessed Aug. 10, 2023).

[2] S. Devriendt, "Omgevingsanalyse in het kader van het beleidsplan 2021-2025 van Okra."

[3] E. Schokkaert *et al.*, "De gezondheids-en zorg-beroepen van de toekomst," Jan. 2023. [Online]. Available: www.kuleuven.be/metaforum

[4] A. Morlett Paredes *et al.*, "Qualitative study of loneliness in a senior housing community: the importance of wisdom and other coping strategies," *Aging Ment Health*, vol. 25, no. 3, pp. 559–566, Mar. 2021, doi: 10.1080/13607863.2019.1699022.

[5] U. Tymoszuk, R. Perkins, D. Fancourt, and A. Williamon, "Cross-sectional and longitudinal associations between receptive arts engagement and loneliness among older adults," *Soc Psychiatry Psychiatr Epidemiol*, vol. 55, no. 7, pp. 891–900, Jul. 2020, doi: 10.1007/s00127-019-01764-0.

[6] R. Young, P. M. Camic, and V. Tischler, "The impact of community-based arts and health interventions on cognition in people with dementia: a systematic literature review," *Aging Ment Health*, vol. 20, no. 4, pp. 337–351, Apr. 2016, doi: 10.1080/13607863.2015.1011080.

[7] K. N. Cotter and J. O. Pawelski, "Art museums as institutions for human flourishing," *Journal of Positive Psychology*, vol. 17, no. 2, pp. 288–302, 2022, doi: 10.1080/17439760.2021.2016911.

[8] "Dementie," *Alzheimer liga vlaanderen*. https://doi.org/10.1080/13607863.2019.1699022 (accessed Aug. 12, 2023).

[9] E. N. Van Abbemuseum, "Tik-Tik: hoe een app in combinatie met multi-zintuiglijke interventies bijdraagt aan een inclusief museum." https://studio-inclusie.nl/cases/tik-tik-hoe-een-app-in-combinatie-met-multi-zintuiglijke-interventies-bijdraagt-aan-een-inclusief-museum/ (accessed Aug. 10, 2023).

[10] M. C. Ciacherri, "Welcoming people is removing barriers." https://www.museumsforpeople.com/the-idea (accessed Aug. 10, 2023).

[11] "In dialoog: gesprekskaarten voor anderstaligen MSK", Accessed: Aug. 10, 2023. [Online]. Available: https://www.mskgent.be/programma/in-dialoog-gesprekskaarten-voor-anderstaligen

[12] Koninklijke Musea voor Schone Kunsten van België, "Programma Museum op Maat."

[13] "Audiodescripties voor blinden en slechtzienden MSK." https://www.mskgent.be/programma/audiodescripties (accessed Aug. 10, 2023).

[14] "Voelplaten MSK." https://www.mskgent.be/programma/voelplaten (accessed Aug. 10, 2023).

[15] Van Abbemuseum, "Dwarsverbanden, Multi-zintuiglijke collectiepresentatie", Accessed: Aug. 10, 2023. [Online]. Available: https://vanabbemuseum.nl/nl/zien-en-doen/tentoonstellingen-activiteiten/dwarsverbanden

[16] Lkca, "Code Diversiteit & Inclusie."

[17] L. Yulifar, "DIGITALIZING MUSEUMS: A BIBLIOMETRIC STUDY," 2021. [Online]. Available: http://pajek.imfm.si/doku.php

[18] K. Bonneure, "Virusvrij en virtueel naar het museum: zo kan het," *VRTNWS*, Mar. 19, 2020. Accessed: Aug. 10, 2023. [Online]. Available: https://www.vrt.be/vrtnws/nl/2020/03/18/virusvrij-en-virtueel-op-museumbezoek/

[19] "Inspiratie: 5 keer digitale transformatie in de cultuur," *den*, Nov. 29, 2022. https://www.den.nl/kennis-en-inspiratie/inspiratie-5-keer-digitale-transformatie-in-de-cultuur (accessed Aug. 10, 2023).

[20] "Digitaal Museum, Projecten." https://fine-arts-museum.be/nl/onderzoek/digitaal-museum (accessed Aug. 10, 2023).

[21] "User Centered Design," *Interaction Design Foundation*. https://www.interaction-design.org/literature/topics/user-centered-design (accessed Aug. 10, 2023).

[22] "The Double Diamond," *Design Council*. https://www.designcouncil.org.uk/our-resources/the-double-diamond/ (accessed Aug. 10, 2023).

[23] G. Paul and C. Stegbauer, "Is the digital divide between young and elderly people increasing?," *First Monday*, Oct. 2005, doi: 10.5210/fm.v10i10.1286.

[24] I. Iancu and B. Iancu, "Designing mobile technology for elderly. A theoretical overview," *Technol Forecast Soc Change*, vol. 155, p. 119977, Jun. 2020, doi: 10.1016/j.techfore.2020.119977.

[25] T. Marquine Raymundo and C. Da Silva Santana, “Fear and the use of technological devices by older people,” *Gerontechnology*, vol. 13, no. 2, Jun. 2014, doi: 10.4017/gt.2014.13.02.191.00.
[26] J. Pirhonen, L. Lolich, K. Tuominen, O. Jolanki, and V. Timonen, “‘These devices have not been made for older people’s needs’ – Older adults’ perceptions of digital technologies in Finland and Ireland,” *Technol Soc*, vol. 62, p. 101287, Aug. 2020, doi: 10.1016/j.techsoc.2020.101287.
[27] C. Kruyskamp, *Groot woordenboek der Nederlandse taal*, Tiende druk., vol. Deel II. ’s-Gravenhage: Martinus Nijhoff, 1976.
[28] H. Dely, “4. Reminiscentie bij personen met dementie: (niet) zomaar terug naar het verleden?,” May 2016.
[29] J. Paay, J. Kjeldskov, I. Aaen, and M. Bank, “User-centred iterative design of a smartwatch system supporting spontaneous reminiscence therapy for people living with dementia,” *Health Informatics J*, vol. 28, no. 2, p. 146045822211060, Jan. 2022, doi: 10.1177/14604582221106002.
[30] P. J. Matusz, M. T. Wallace, and M. M. Murray, “A multisensory perspective on object memory,” *Neuropsychologia*, vol. 105, pp. 243–252, Oct. 2017, doi: 10.1016/j.neuropsychologia.2017.04.008.
[31] J. Saldien, “INTERACTION MODALITIES.”