Deliverable 6.2

Concept/Specification paper for narration & learning approaches.

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Objective(s) of D 6.2

The document gives a high-level conceptual overview of visualization-based storytelling tools that are developed within the MEMORISE project. We introduce a triangular definition of visualization-based storytelling for Heritage of Nazi Persecution (HNP)—visitor-driven, expert-driven, and witness-driven—and explore design challenges and opportunities. The design concept for each MEMORISE tool is then described addressing these definitions and challenges. By leveraging digital innovation, the document seeks to connect past experiences with future generations, fostering a deeper understanding of Holocaust history and its significance in the collective human experience.

Content

Introduction

The rise in anti-Semitism has been discussed in a diversity of realms in the past years [1,2,3,4]. The level of anti-Semitism has risen even more sharply since the start of the Israeli-Hamas war in October 2023[5]. As part of this latest conflict, we witness implicit and direct references to the history of Nazi persecution and accusations that Israel allegedly commits genocide in Gaza. Such accusations prove the importance of increased historical education that sheds light on crimes related to the Holocaust in particular, and on Nazi persecution in general. Considering the recent discourse about the potential failures in Holocaust education, conveying the heritage of Nazi persecution (HNP) is more relevant than ever. As survivors age and witnesses become fewer and fewer, there is an urgent need to preserve their memories and ensure that the lessons of this chapter in history are not forgotten. In response to this challenge, we design and craft novel digital tools that aim to make victims' and survivors' memories accessible to future generations.

In this document, we delve into the rationale behind the development of these digital tools within our project. Our focus is not only on preserving historical narratives but also on transmitting these memories to a contemporary audience, especially the younger generations, who will inherit the responsibility of maintaining the memory legacy.

Central to our endeavour is an examination of existing digital representations of HNP. In our initial investigation (D6.1), we examined how HNP has been portrayed digitally to date, and we created a design space that built on previous work on storytelling for cultural heritage data[6]. Based on this review, we are currently developing a set of narrative visual interfaces, which we will describe in reference to the design space in D6.1.

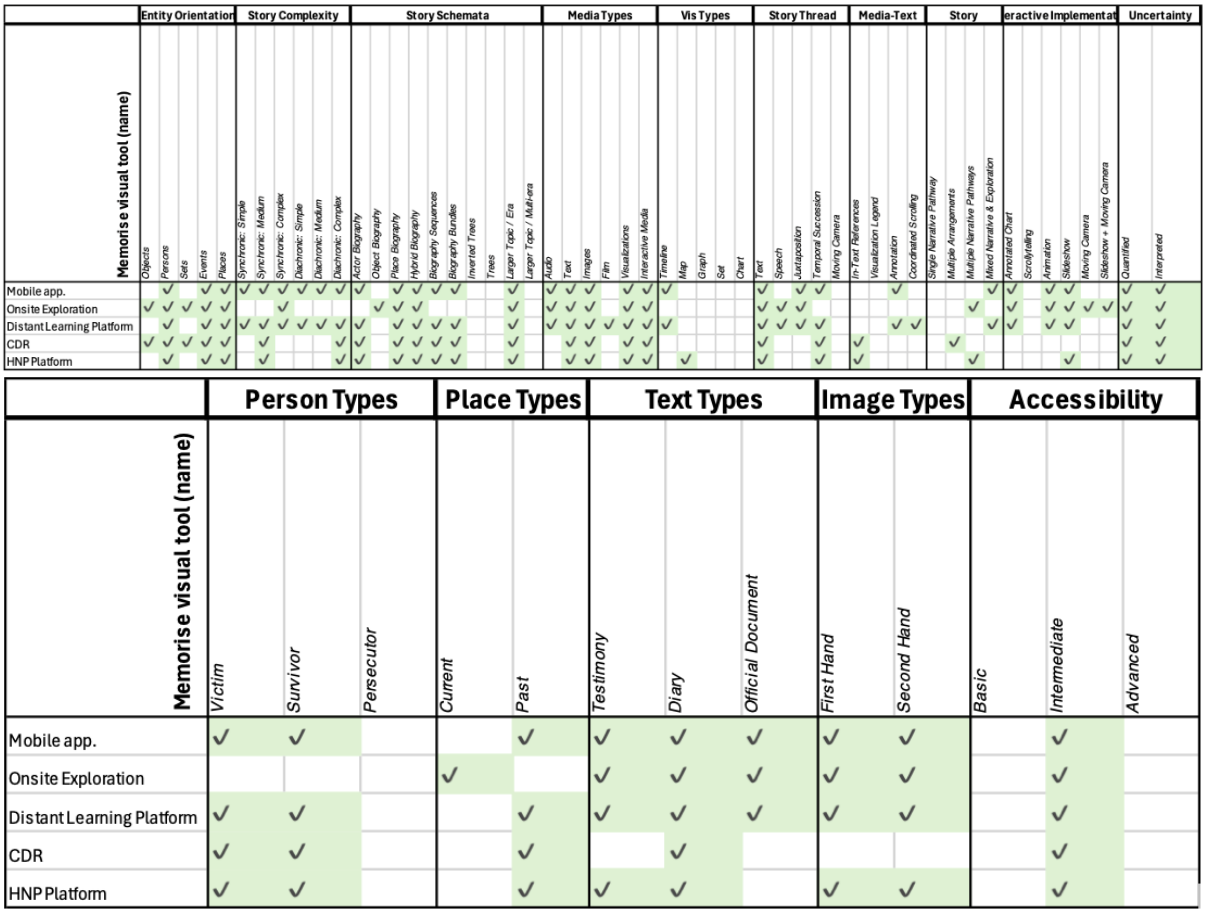
As we navigate the intersection of technology, memory, and historical awareness, an important goal is to ensure that voices are not lost to posterity. By harnessing the power of digital innovation, we strive to bridge the gap between past and future and between people and memories, fostering a deeper understanding of HNP and its enduring importance in shaping the collective human experience.

This document first introduces a triangular definition of visualization-based storytelling fit for HNP, introducing visitor-driven, curator-driven and writer-driven storytelling. Secondly, we describe design challenges and opportunities that are crucial for the development of narrative visualizations for HNP. Thirdly, we describe the design concept for each visualization-based storytelling interface we aim to develop in MEMORISE and refer to these design challenges in relation to HNP.

1 Goldhagen, D. J. (2013). The devil that never dies: The rise and threat of global antisemitism. Hachette UK.
2United Nations (2021). Rise in antisemitism during pandemic shows we can never let down our guard: UN chief. URL: https://news.un.org/en/story/2021/01/1082872. UN News Global perspective Human stories.
3 Booth, Robert (2022). Anti-Jewish hate incidents hit record high in UK. URL: https://www.theguardian.com/news/2022/feb/10/anti-jewish-hate-incidents-hit-record-high-in-uk. The Guardian.
4 Steinacher, G. J. (2023). 20. The rise of racism and antisemitism in the age of globalization. Research Handbook on the Sociology of Globalization, 225.
5 Keaten, J. and Kellman, L. (2023). With antisemitism rising as the Israel-Hamas war rages, Europe's Jews worry. URL: https://apnews.com/article/israel-hamas-antisemitism-europe-massacre-war-protests-1d26266dfd9b2b8dd4c795f420abab47. The Associated Press.
6 Kusnick, J., Jänicke, S., Doppler, C., Seirafi, K., Liem, J., Windhager, F., and Mayr, E. (2021). Report on narrative visualization techniques for opdb data. Technical report, European Commission

Visualization-based Storytelling in MEMORISE

Our report on narrative presentation techniques (D6.1) builds on previous work about visualization-based storytelling for cultural heritage data [7]. We analysed existing storytelling approaches for HNP in light of the proposed design space, and we extended the design space with dimensions that are particularly crucial for developing narrative visualization strategies for HNP. This extension includes detailed discussions about accessibility (basic, intermediate or advanced), text types of source materials (testimonies, diaries, and official documents), image types (first and second-hand images), person types distinguishing victims, survivors and persecutors, and place types that we classified into current, past and those that acknowledge the transformation of geographical locations over time. Figure 1 provides an overview of how we classify the storytelling tools we develop in MEMORISE according to the extended design space for visualization-based storytelling for HNP.



Memorise visual tool (name)	Person Types			Place Types		Text Types			Image Types		Accessibility		
	Victim	Survivor	Persecutor	Current	Past	Testimony	Diary	Official Document	First Hand	Second Hand	Basic	Intermediate	Advanced
Mobile app.	✓	✓			✓	✓	✓	✓	✓	✓		✓	
Onsite Exploration				✓		✓	✓	✓	✓	✓		✓	
Distant Learning Platform	✓	✓			✓	✓	✓	✓	✓	✓		✓	
CDR	✓	✓			✓		✓					✓	
HNP Platform	✓	✓			✓	✓	✓		✓	✓		✓	

Figure 1: Classification of MEMORISE storytelling tools according to extended design space for visualization-based storytelling (D6.1).

[7] Kusnick, J., Jänicke, S., Doppler, C., Seirafi, K., Liem, J., Windhager, F., and Mayr, E. (2021). Report on narrative visualization techniques for opdb data. Technical report, European Commission.

Visualization-based storytelling triangle for HNP

Kusnick et al[7]. based their discussions on visualization-based storytelling on the definitions of reader-driven and author-driven storytelling[8]. Whereas reader-driven storytelling is unguided and thus resembles visual exploration, author-driven storytelling stands for a purely scripted story without the ability for users to interact. Kusnick extended this definition with a discussion on "Story Composition" to account for the diversity of storytelling approaches through single narrative pathway, multiple narrative pathways, multiple arrangements, and mixed narrative & exploration. However, these story composition definitions as well as the original definitions by Segel & Heer[8] lead to confusions when dealing with HNP materials since they do not fully capture the methodology we actually work with. Author-driven storytelling typically refers to instances where a domain expert (e.g., narrator, content creator, historian) controls how a story is presented and navigated. Our data repository largely consists of personal documents such as diaries, testimonies and letters that already have an author. When discussing storytelling approaches in our context, we require a more precise terminology that recognizes the original contribution of the author, but also the curatorial role that the content creator plays in restructuring and presenting the content. To clarify our methodology, we introduce the visualization-based storytelling triangle for HNP (Figure 2) to distinguish contributions from different types of story authors.

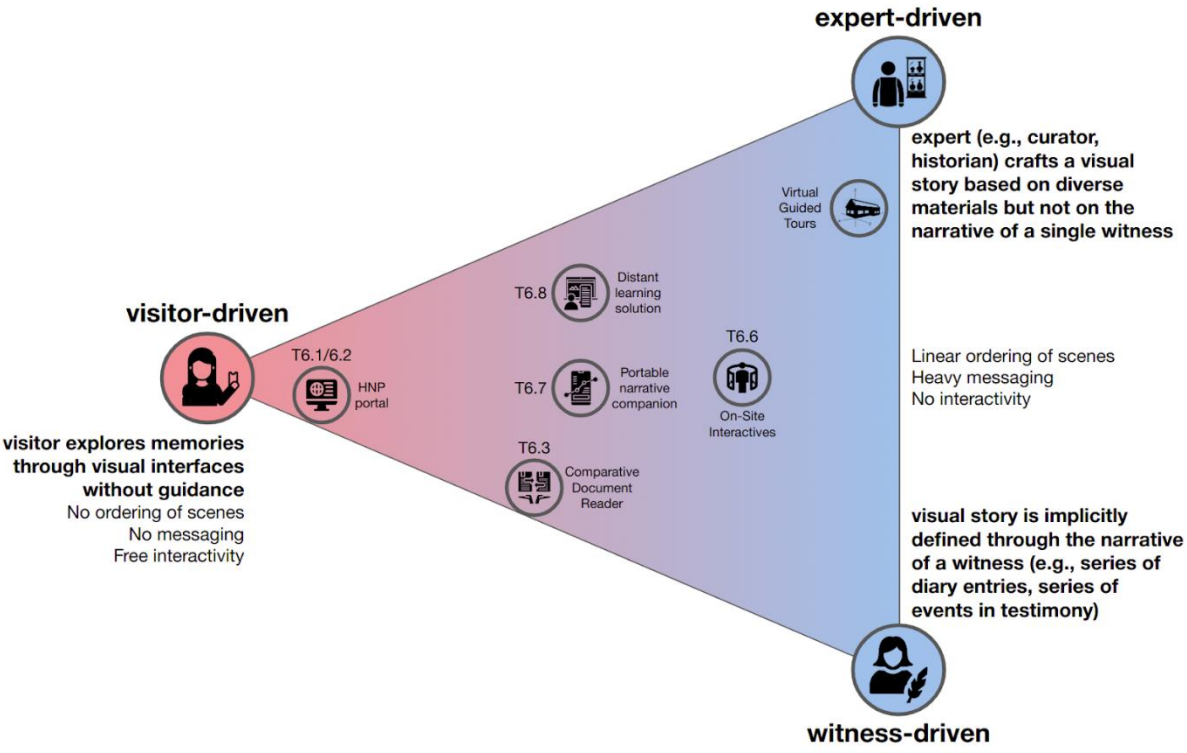


Figure 2: Visualization-based storytelling triangle for HNP, a three-dimensional continuum from visitor-driven to expert- and witness-driven storytelling.

[8] Segel, E., & Heer, J. (2010). Narrative visualization: Telling stories with data. IEEE transactions on visualization and computer graphics, 16(6), 1139-1148.

The triangle distinguishes three types of storytelling extremes involving three actor types:

- **Visitor-driven storytelling:** Like reader-driven storytelling[8], onsite or online visitors create their own stories through operating unguided visual exploration tools.
- **Expert-driven storytelling:** Experts may include curators, historians, teachers and related actors that restructure and retell stories based on original HNP data. This allows for a more flexible and interactive presentation, such as scrolly-telling or other innovative navigation methods, where the expert decides how and in what order one or more diary contents are presented to the user.
- **Witness-driven storytelling:** Witnesses report their experiences in personal documents such as diaries, testimonies or letters. Those inhere a narrative that can be used for visual storytelling purposes. A purely witness-driven visualization-based storytelling would be a straightforward visual representation of a diary in the form of a graphic novel or a film adaptation, or the visual narration of an automatically extracted narrative from a testimony.

The distinction between experts and witnesses is important to clarify the difference between presenting a story as originally authored by a witness and presenting a story that has been reworked and conveyed by another actor. It also creates a three-dimensional continuum that allows us to classify storytelling approaches according to the degree of user interaction (x-axis) as well as according to the influence of different types of authors (y-axis). Figure 2 exemplifies this with the visualizations developed in MEMORISE.

Design Challenges

Despite providing a comprehensive overview of the new augmented design space in D6.1, it is important to emphasize that there are crucial challenges that have to be addressed when designing and developing storytelling visualizations for HNP.

Historical Accuracy & Integrity

Incorporating data-driven elements into narratives about Cultural Heritage (CH) sites poses a challenge in preserving historical accuracy and integrity[9,10,11,12]; see MEMORISE ethics guidelines: https://memorise.sdu.dk/guidelines/. It is essential to stay true to sources, ensuring that both tangible and intangible historical assets, once digitized, genuinely mirror history instead of unintentionally distorting it[11,13,14,15]. There is also a risk of oversimplification when translating these assets into data

8 Segel, E., & Heer, J. (2010). Narrative visualization: Telling stories with data. IEEE transactions on visualization and computer graphics, 16(6), 1139-1148.

9 Bradley, R. (2005). Digital authenticity and integrity: Digital cultural heritage documents as research resources. Portal (Baltimore, Md.), 5(2):165–175

10 Müller, K. (2002). Museums and virtuality. Curator (New York, N.Y.), 45(1):21–33.

11 Manžuch, Z. (2017). Ethical issues in digitization of cultural heritage. Journal of Contemporary Archival Studies, 4(2):4.

12 Ebbrecht-Hartmann, T. and Stiassny, N. (2023). Ethics and Best-practice guideline for virtual engagement with HNP. Technical report, European Commission.

13 Boyd Davis, S., Vane, O., and Kräutli, F. (2021). Can i believe what i see? data visualization and trust in the humanities. Interdisciplinary science reviews, 46(4):522–546.

14 Koller, D., Frischer, B., and Humphreys, G. (2009). Research challenges for digital archives of 3d cultural heritage models. Journal on computing and cultural heritage, 2(3):1–17.

15 Brown, A. and Waterhouse-Watson, D. (2014). The future of the past: Digital media in holocaust museums. Holocaust studies, 20(3):1–32.

or visualizations[14,16]. Many historical records offer data that are either ambiguous or incomplete[17], either because the records only have a narrow focus or parts of them have been lost due to deliberate destruction[15]. Consequently, they only reveal a small part of a bigger context. Interpreting this data demands precision[14,18,19] and a heightened awareness of how contemporary biases might influence our perceptions of the past[20].

Ethical Representation

Beyond accuracy and integrity, CH sites must also consider the ethical dimensions associated with digitizing and representing tangible and intangible historical assets[11,21]. When curating displays or constructing narratives, it is typically necessary to approach the subject with respect. This is particularly true when recounting events that may have traumatic histories[22]. Digital recreations of tangible/intangible historical assets demand a balance between shedding light on historical facts and avoiding unintentional bias or misrepresentation[12], which could arise from an unintentionally biased perspective of the creator of the digital recreations[23] or due to uncertainty related to the underlying historical assets. To minimize these biases, creators need to reflect upon their own biases and transparently reflect these to the reader. Ultimately, an ethical obligation towards the recipients is associated with the representation of digitized tangible and intangible historical assets, and it is crucial in digital storytelling at heritage sites, where there is a need to respect the complexities and sensitivities of heritage narratives[24,25] and to safeguard and certify historical knowledge, particularly in the face of increasing misinformation and falsification of historical facts (see MEMORISE ethics guidelines: https://memorise.sdu.dk/guidelines/).

11 Manžuch, Z. (2017). Ethical issues in digitization of cultural heritage. Journal of Contemporary Archival Studies, 4(2):4.

12 Ebbrecht-Hartmann, T. and Stiassny, N. (2023). Ethics and Best-practice guideline for virtual engagement with HNP. Technical report, European Commission

14 Koller, D., Frischer, B., and Humphreys, G. (2009). Research challenges for digital archives of 3d cultural heritage models. Journal on computing and cultural heritage, 2(3):1–17.

15 Brown, A. and Waterhouse-Watson, D. (2014). The future of the past: Digital media in holocaust museums. Holocaust studies, 20(3):1–32.

16 Quintero, M. S., Awad, R., and Barazzetti, L. (2020). Harnessing digital workflows for the understanding, promotion and participation in the conservation of heritage sites by meeting both ethical and technical challenges. Built heritage, 4(1):6–18.

17 Vancisin, T., Clarke, L., Orr, M., and Hinrichs, U. (2023). Provenance visualization: Tracing people, processes, and practices through a data-driven approach to provenance. Digital Scholarship in the Humanities, 38(3):1322–1339.

18 Windhager, F., Salisu, S., and Mayr, E. (2019). Exhibiting uncertainty: Visualizing data quality indicators for cultural collections. Informatics (Basel), 6(3):29.

19 Liem, J., Slingsby, E., Goudarouli, E., Bell, M., Turkay, C., Perin, C., and Wood, J. (2023). Visualising the uncertain in heritage collections: understanding, exploring and representing uncertainty in the first world war british unit war diaries. Literary Geographies, 9(1):101–123.

20 Prutsch, M. J. (2013). European historical memory: Policies, challenges and perspectives. Technical report, EPRS: European Parliamentary Research Service.

21 Rich, J. and Dack, M. (2022). Forum: The holocaust in virtual reality: Ethics and possibilities. The Journal of Holocaust Research, 36(2-3):201–211.

22 Fisher, J. A. and Schoemann, S. (2018). Toward an Ethics of Interactive Storytelling at Dark Tourism Sites in Virtual Reality, volume 11318 of INTERACTIVE STORYTELLING, ICIDS 2018, pages 577–590. Springer International Publishing, Cham.

23 Thompson, E. L. (2017). Legal and ethical considerations for digital recreations of cultural heritage. Chap. L. Rev., 20:153.

24 Hargood, C., Millard, D. E., Mitchell, A., and Spierling, U. (2023). An Ethics Framework for Interactive Digital Narrative Authoring, pages 335–351. The Authoring Problem. Springer International Publishing AG, Switzerland.

25 Trichopoulos, G., Alexandridis, G., and Caridakis, G. (2023). A survey on computational and emergent digital storytelling. Heritage, 6(2):1227–1263.

Physical & Temporal Constraints

Spatial and temporal considerations inevitably influence storytelling in the physical domain of heritage sites[25]. The spatial arrangement of a heritage site can guide or even dictate the narrative flow[26,27]. Moreover, the narrative must be crafted considering visitors' limited time at a site. The challenge is to ensure that, within this brief window, visitors gain a coherent and enriching understanding of the narrative being presented.

Embracing Technology & Engaging the Senses

CH sites have the unique potential to craft multisensory experiences, unlike many traditional storytelling mediums. For example, multi-sensory interactions can enhance visitor immersion, emphasizing the shift towards emotive virtual experiences through personalized storytelling[28]. Multimodal personalized, interactive digital storytelling experiences can significantly elevate visitors' experience[29]. While the potential of emotive virtual experiences in heritage sites is vast, there are also inherent challenges. An overemphasis on technology can overshadow genuine historical value, potentially reducing the experience to mere entertainment[21]. Some visitors might also feel that digital augmentation hinders a direct connection with tangible heritage[11]. As narratives become more emotive, there is also a risk of modern biases affecting the representation[20].

Educational Ambitions & Audience Diversity

Heritage sites operate at the intersection of engagement and education. While the narratives must be compelling, an underlying educational approach seeks to inform and enlighten visitors about historical, cultural, or scientific facets. Complicating this mission is the vast diversity of the audience. With visitors spanning different age groups, cultural backgrounds, and levels of prior knowledge, the storytelling needs to be inclusive and universally accessible. Communication models at heritage sites have traditionally emphasized a unilateral approach, where the heritage professional sends a singular, one-way message to the visitor. However, such a method is limiting. For narratives to resonate with visitors, they should be formulated with a holistic understanding of the visitor's context. This encompasses their background, including prior experiences and knowledge, learning styles, interests, and motivations; the sociocultural backdrop of their visit; and their interaction with the heritage site's spatial and tangible aspects and related personal memories[27].

11 Manžuch, Z. (2017). Ethical issues in digitization of cultural heritage. Journal of Contemporary Archival Studies, 4(2):4.

20 Prutsch, M. J. (2013). European historical memory: Policies, challenges and perspectives. Technical report, EPRS: European Parliamentary Research Service.

21 Rich, J. and Dack, M. (2022). Forum: The holocaust in virtual reality: Ethics and possibilities. The Journal of Holocaust Research, 36(2-3):201–211.

25 Trichopoulos, G., Alexandridis, G., and Caridakis, G. (2023). A survey on computational and emergent digital storytelling. Heritage, 6(2):1227–1263.

26 Benouaret, I. and Lenne, D. (2015). Personalizing the museum experience through context-aware recommendations. In 2015 IEEE International Conference on Systems, Man, and Cybernetics, pages 743–748. IEEE.

27 Lombardo, V. and Damiano, R. (2012). Storytelling on mobile devices for cultural heritage. The new review of hypermedia and multimedia, 18(1-2):11–35.

28 Katifori, A., Roussou, M., Perry, S., Drettakis, G., Vizcay, S., and Philip, J. (2018). The emotive project-emotive virtual cultural experiences through personalized storytelling. In Cira@ euromed, pages 11–20.

29 Katifori, A., Karvounis, M., Kourtis, V., Kyriakidi, M., Roussou, M., Tsangaris, M., Vayanou, M., Ioannidis, Y., Balet, O., Prados, T., Keil, J., Engelke, T., and Pujol, L. (2014). Chess: Personalized storytelling experiences in museums. In Mitchell, A., Fernández-Vara, C., and Thue, D., editors, Interactive Storytelling, pages 232–235, Cham. Springer International Publishing.

High-level Concept for Narration & Learning

Based on the survey on narrative visualization techniques for HNP, MEMORISE develops a set of novel narration and learning tools to enhance visitor experiences. Through our definition of visualization-based storytelling for HNP, this includes, next to explicitly labelled narration and learning tools, visual exploration tools such as the HNP portal and the Comparative Document Reader. In addition, we include a brief discussion of virtual guided tours as prime examples for expert-driven storytelling.

HNP Platform

The web-based HNP portal serves as a comprehensive platform that makes HNP accessible through both text-based and visual interfaces (T6.1). This includes advanced search and filtering features so that users can efficiently navigate through the many resources available through the MEMORISE knowledge graph. By leveraging modern web technologies, we aim to create a dynamic and intuitive interface that meets a wide range of user needs and preferences. An important feature of the HNP portal is its role as a display medium for geo-temporal information (T6.2). This will enable users to explore data in spatial and temporal contexts, providing a powerful tool to visually investigate temporal and geographical relations. Interaction means will enable users to focus on specific regions or time periods and to uncover patterns and relationships that may not be immediately apparent through traditional text-based exploration. Additionally, the HNP portal design will prioritize usability, diversity and accessibility, ensuring that these advanced tools are intuitive and easy to use for all users, regardless of their technical expertise. By providing a seamless and engaging platform, the HNP portal aims to support a diverse user base (users of different age, origin, profession and personal interests) in their quest to analyze and understand complex historical and geographical data. Although the HNP platform is a purely visitor-driven storytelling solution, users can switch to close reading mode to read and follow the narrative of a single witness.

Description of the visual design

The HNP platform is considered to be the main visual representation of the MEMORISE knowledge graph. It is designed as a dashboard that follows the definition to be "a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so that the information can be monitored at a glance" [30]. It is important to have all views visible at once on a screen to ensure that relations among different metadata being visualized are easily understood through brushing and linking [31]. The HNP portal is composed by well-known, customizable visual interfaces and views:

- A map to allow browsing the distributions of different types of places such as places of birth, places of death, concentration camps and ghettos. Any extensions are possible, e.g., the places mentioned in testimonies.
- A timeline to allow browsing the distributions of temporal information such as years or dates of birth, years or dates of death, events (which could be references in personal documents like diary entries). Any extensions to other temporal dimensions are possible, e.g., the deportations by time.

[30] Few, S. and Edge, P. (2007). Dashboard confusion revisited. Perceptual Edge, pp. 1–6.

[31] Keim, D. A. (2002). Information Visualization and Visual Data Mining, *IEEE Transactions on Visualization and computer graphics*.

- A word cloud to allow browsing textual information of different kinds such as occupations of witnesses, named entities or topics. Any extensions to other types of textual information is possible, e.g., most frequent sentiment words used.
- A result list that shows the total of personal documents with descriptive information, lists individual entries, and allows users to select a personal document to be read in close reading mode. From here, users can switch to the Comparative Document Reader, so that they can compare and analyse the resources they view geographically and temporally with related text resources.

The views as they appear in the current prototype are shown in Figure 3. Filters can be applied in all views. Each applied filter reduces the number of documents in the result list and is supposed to help users to find those stories they are interested in. To achieve this, all views allow to filter for information relatable to personal interest, e.g., the place of residence of a user to personalize spatial browsing, or the user's occupation to personalize text-based browsing. Filter can be dynamically added and also removed.

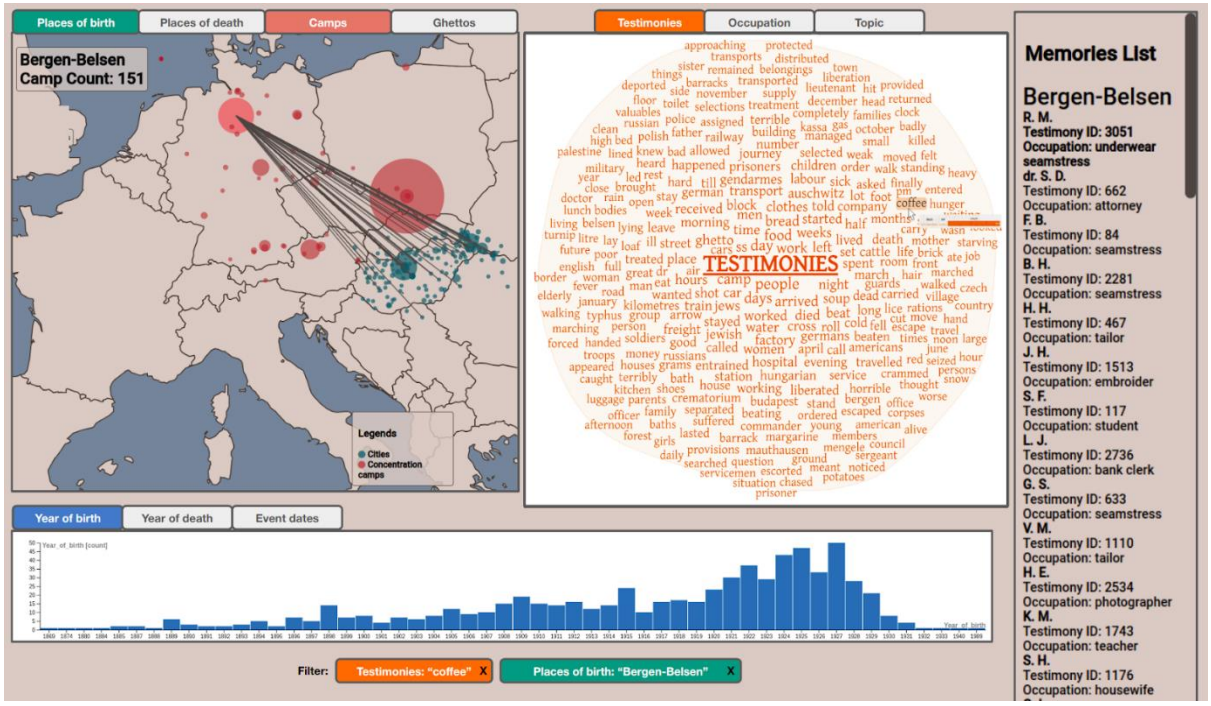


Figure 3: Screenshot of the HNP prototype (beta), which is designed as a dashboard that allows to filter testimonies by place (birth, death, imprisonment), descriptive data (e.g., occupation, content, topics), and time (year of birth/death, events). Individual testimonies can be read in a close reading view.

Relationship to design challenges

Historical accuracy and integrity

Quantitative visual representations of metadata and the victims'/authors' memories bear the risk of simplification and distortion of the original sources when inaccurate transformation metrics are applied. We are developing the visual design of the HNP platform and its components in close collaboration with expert users (MEMORISE partners and members of the stakeholder forum) to mitigate this problem. In addition, we ensure that the original sources are accessible through any

visual representation in close reading mode (respecting copyright restrictions), so that users can investigate, confirm and verify any potential curiosity during a session. A particular focus will be on the visual communication of uncertainties (e.g., spatial, temporal, transcription ambiguities) inherent in the data, for which we will develop accurate visual indicators.

Ethical representation

The HNP platform will inform users on the underlying data transformation processes that influence the visual representation in a particular view. Legends will assist users to decode the visual language, and for each visualization we will provide an information box, in which its visual design is explained (e.g., which and how many words are displayed in a word cloud, or what size and color of dots mean in a map view). Thereby we enhance the transparency of the system for the user as emphasized in D 7.1. In close reading mode, we will integrate the original source as authentic as possible, e.g., by juxtaposing machine-readable personal documents with original document scans, or by offering videos or audios next to transcribed testimonies. By doing so we secure the integrity of the historical sources as proposed in our ethical guidelines.

Physical and temporal constraints

The main purpose of the HNP platform is remote utilisation, which does not pose crucial challenges with regards to physical space and time. However, although browsing based on HNP metadata will be possible from all locations, remote access to individual HNP resources may be disabled due to copyright restrictions. Nevertheless, the HNP platform will include derivatives of the data like quantitative statistics of text or short citations, whose use is not restricted. This will enable accessibility for users from different ages, with different pre-existing knowledge and will have different social backgrounds, physical abilities and technical skills.

Embracing technology and engaging the senses

The development of the visualisations that constitute the HNP platform follows well-established visual design guidelines[32]. This ensures that the distraction induced by the visual design itself is limited and the human vision capacity is utilised to the maximum. This way, users can better focus on interpreting the quantitative figures showing metadata distributions and to drill-down to individual memories that can be accessed through the visual interfaces. Despite the limitations of a desktop application, the HNP portal aims to utilise different senses through its multimodal structure by including audios and videos next to the plain text versions of memories.

Educational ambitions and diversity of target user group

The ease of use is of utter importance for the HNP portal to maximise its educational potential. The unguided exploration of memories related to Nazi persecution will be as intuitive and self-explanatory as possible. For the HNP portal as a whole and for each individual visual component we will add information popups explaining the visual output. In addition, we will create manuals for using the HNP portal for different educational settings. Diversity is inherently addressed by the offer of visual interfaces based on the diversity of biographical details of victims/authors (e.g., places of birth/death/imprisonment, profession, age) and the content of the memories themselves (e.g., personal interests, topics discussed, places referred to). A sophisticated interaction design will ensure dynamic, diversity-aware exploration of a collective memory corpus.

[32] Munzner, T. (2014). *Visualization analysis and design*. CRC press.

Example use case

Rebecca is a high school teacher from Norway, and she spends her vacation in Southern Italy. Since she teaches history, she decides to visit the Ferramonti memorial. Through a virtual interface installation, she gets aware of the MEMORISE project and its HNP portal that provides access to a large corpus of personal documents. Back in the hotel, she enters the online HNP portal and starts browsing the data using the visual interfaces. Those provide interesting entry points for her. Rebecca is a huge Italy fan, so she is interested in finding testimonies from teachers with a relation to Italy. Through the map, she selects dots in Italy, then she clicks "teacher" in the profession word cloud. Both interactions filter a data set of several thousand personal documents to 27. The corresponding documents are listed in a separate view. Rebecca clicks a dot on the map at the place she currently resides (Naples), which highlights two testimonies. By clicking one of the testimonies in the list, the whole testimony is shown. She can highlight words in the text, for example topics, named entities, or sentiment words. By doing so, the word "coffee" gets highlighted. She can click the word, which acts as a filter for the 27 documents, but she can also choose to remove existing filters to browse the entire collection for references of "coffee". Rebecca is impressed by the utility of the tool and decides to make use of the HNP portal in her history lessons.

Implementation Plan of Concept in MEMORISE

The HNP platform is developed iteratively following a participatory visual design approach[33]. After developing an initial design sketch, we developed an alpha-prototype of the HNP portal for a data set of 500 English testimonies and its metadata. We are in the process of extending the prototype by integrating more data resources, focusing first on the testimonies in the USC Shoah Foundation Visual History Archive, and later on other resources like letters and diaries. The HNP portal will be regularly used and evaluated by experts in the project (Figure 4), and, after a beta release in the third project year, by user groups representing different scenarios for unguided visual exploration of the MEMORISE knowledge graph through the portal. While we aim to keep the visual design intuitive and the complexity of interacting views limited, we may add additional views to the HNP portal (e.g., a network graph visualization to highlight similarities among personal documents).

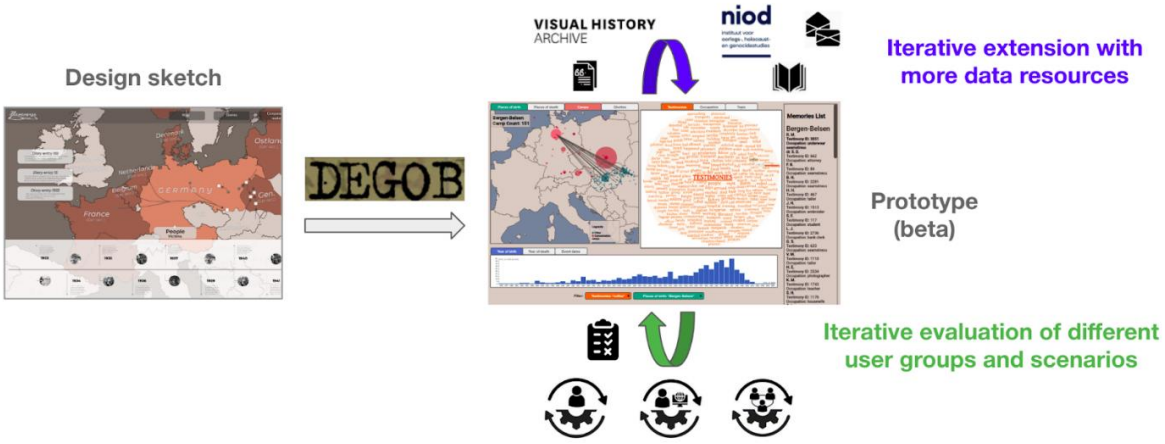


Figure 4: Participatory visual design approach for the HNP portal in MEMORISE.

[33] Jänicke, S., Kaur, P., Kuzmicki, P., & Schmidt, J. (2020, May). Participatory Visualization Design as an Approach to Minimize the Gap between Research and Application. In *VisGap@ Eurographics/EuroVis* (pp. 35-42).

Comparative Document Reader

The aim is to develop a reading environment designed to facilitate comparative reading and analysis of various HNP-related text-based resources, such as diaries, letters, and official documents. Our comparative document reader (CDR) will arrange content vertically according to chronological order, allowing for seamless exploration of historical documents. Text components from different resources will be juxtaposed horizontally, allowing users to see patterns, connections, and differences across different accounts. Key features of this CDR include a well-designed search interface with two uses. Firstly, it allows users to reduce the vast number of document sources available towards a relevant subset. This may be through specifying types of sources of interest (only diaries as example) or a filter on biographical information (only authors of a selected nationality or being imprisoned in a defined camp). Also, features of the sources like language or topics can be used to generate a subset. Secondly, a text-based search allows users to efficiently find specific words, named entities, or topics within the previously selected text corpus and can reduce single pages of each included source. These search functionalities improve accessibility and enable focused analysis, ensuring users can find relevant information in the vast repository of HNP resources.

By presenting an easy-to-use user interface and a series of advanced technical capabilities, we aim to make the CDR a central tool for the Memorise project's overall mission to preserve and disseminate HNP memories. We aim to develop an intuitive interface and a set of comprehensive search functions that will enhance the way researchers can work with and find information among the many text resources held by the various HNP stakeholders. With reference to the visualization-based storytelling triangle, the CDR is located between visitor-driven and witness-driven storytelling since an analysis session starts with visual exploration, but the user recurrently faces narratives of witnesses. Thus, there is a steady switch between visual exploration and reading.

Description of the visual design

Our initial work on the CDR has involved collaboration with domain experts, whose insights have shaped the tool's functionalities and usability. The core mission of the CDR is to allow users to explore and compare HNP text resources effortlessly and accurately. We envision a dynamic, flexible user interface that allows users to juxtapose different materials. A screenshot of an early prototype that exemplifies this is shown in Figure 5.

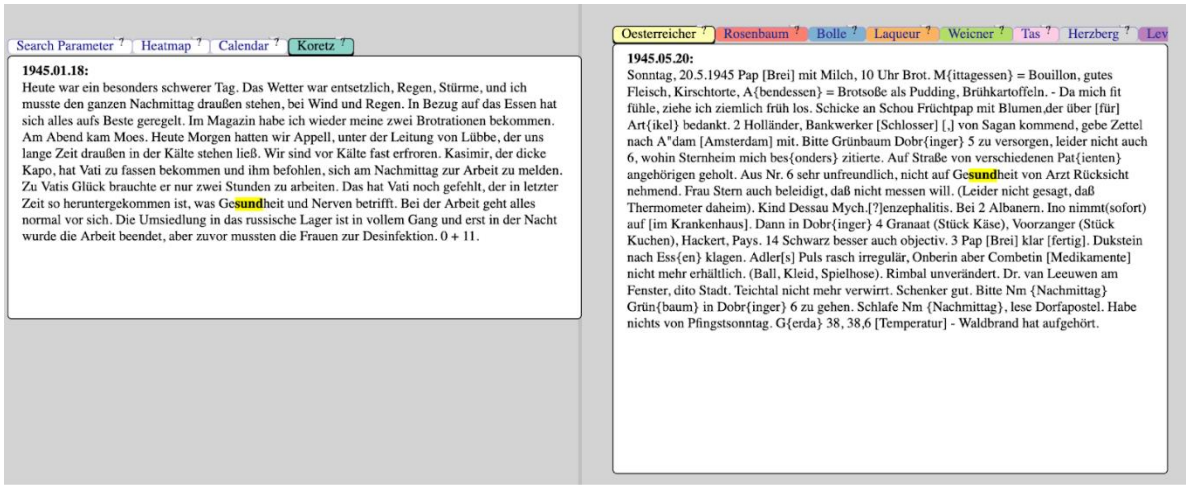


Figure 5: Screenshot of early CDR prototype shows juxtaposed contents of diaries. The number of horizontally juxtaposed documents will be user-configurable (not limited to 2).

Users can select a set of documents (e.g., German diaries written in Bergen-Belsen), which are juxtaposed chronologically in tabs. Users can also search for particular words which are highlighted in all relevant entries. These entries are also organized chronologically under separate author-specific tabs that appear on the right side of the interface. Additionally, users can select a heatmap view on the left-hand side, which visually represents the frequency of the searched word across records by author and date. This color-coded heatmap makes it easy to compare records. Another tab includes the diary calendar visualization tool published by Khulusi et al. (Khulusi 2022) that gives a visual overview of frequencies in which authors wrote as well as information about the availability of texts for specific dates.

Users can customize their viewing experience by moving author tabs from the right side of the screen to the left and aligning diaries side-by-side for comparative reading. Semantic scrolling synchronizes entries by date and helps with nuanced comparisons. The tool's design maximizes information display on a single screen and emphasizes practicality and functionality while remaining user-friendly. Collaboration with domain experts ensures the tool meets the needs of the target audience and promotes deep engagement with HNP.

Relationship to design challenges

Historical accuracy and integrity

Ensuring the accuracy and integrity of the CDR is crucial, especially when dealing with historical data. The tool's detailed review and comparison features allow users to think critically about historical representation. Keyword highlighting and chronological organization of records help maintain historical credibility. Further, context and biographical information about the authors can be obtained quickly by clicking the question mark button next to the names, helping in putting the written texts into perspective.

Ethical representation

Transparency in data curation and display protects against bias and misinterpretation and is consistent with ethical standards for representing digital cultural heritage[11,21]. This commitment increases the scientific value of the CDR and ensures a credible and respectful presentation of historical narratives. Even if the whole premise of our data is that it is subjective or questionable, as diaries and letters will naturally be subjective and may even have been subject to self-censorship and restrictions to avoid reprisals should they fall into the wrong hands. Furthermore, we know that even official documents were both created and used with less surveillance and more leniency than is hopefully the case today.

Physical and temporal constraints

The CDR addresses physical and time constraints by enabling remote access to historical data, thus overcoming the limitations of physical site visits. The design allows for efficient navigation through

11. Manžuch, Z. (2017). Ethical issues in digitization of cultural heritage. Journal of Contemporary Archival Studies, 4(2):4.

21 Rich, J. and Dack, M. (2022). Forum: The holocaust in virtual reality: Ethics and possibilities. The Journal of Holocaust Research, 36(2-3):201–211.

large datasets, making it convenient for researchers to quickly find and compare relevant records. However, we must be aware that we may run into issues with data protection laws.

Embracing technology and engaging the senses

The CDR leverages technology to increase user engagement through interactive visual data representation. Features like a heatmap viewing and keyword highlighting can make exploring historical narratives more engaging without overwhelming users. During our iterative design process, we will evaluate the effectiveness of different visualization strategies for quantitative textual data.

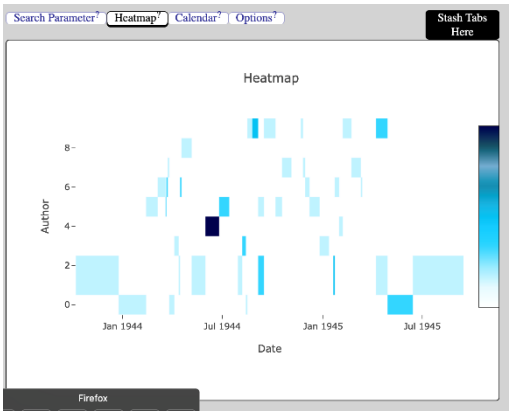


Figure 6: Heatmap to visualize frequency of terms across diary entries.

Educational ambitions and diversity of target user group

Although primarily intended for researchers, the CDR supports broader educational ambitions by providing a sophisticated tool for in-depth engagement with HNP. The partially customizable interface meets diverse user needs and makes it accessible to users with different levels of expertise, and differences in the interest to compare multiple text resources.

Example use cases

Utilizing the functionality of the CDR, a researcher can compare the conditions described in diaries between women of different nationalities. Similarly, this approach can be used to inspect how men and women of the same nationality were treated differently. It can also be used to follow happenings and changes inside the camps' ecosystems like expanding subcamps and destructions of parts of a camp[35].

In general, a user can tune the CDR to meet the current and specific needs to read through the vast amount of textual data and use it to answer a wide range of research questions.

Implementation Plan of Concept in MEMORISE

In the initial phase, we researched and gathered requirements and ideas in close collaboration with other members of the MEMORISE consortium, ensuring active involvement of, among others, representatives from memorial sites. We developed a working prototype of the Comparative Document Reader and designed an interface to make detailed comparison of historical documents light. Our approach emphasized creating an intuitive user experience that allows users to easily juxtapose different documents and highlight key similarities and differences.

[35] Khulusi, R., Billib, S., & Jänicke, S. (2022). Exploring life in concentration camps through a visual analysis of prisoners' diaries. *Information*, *13*(2), 54.

As work throughout the project has progressed, we have endeavored to integrate actual data from the MEMORISE knowledge graph into the prototype to improve the realism and usability of the Comparative Document Reader. This phase will be followed by thorough testing with the target users where we collect feedback to further refine the tool. Through continued user testing and dialogue with the tool's future users, we will continue to develop the concept and try to create a reader that benefits a wide range of users in terms of design, intuitiveness, and functionality within the tool.

Our final step involves the development of a fully functional prototype that is developed through cycles of building, testing, and evaluation (including domain experts and consortium members). This approach will ensure that the Comparative Document Reader will be a robust tool that complies with the goals and ethical guidelines of the MEMORISE project and provides users with effective means of exploring and comparing historical documents.

Portable Narrative Companion

Our aim is to improve user experience and engagement using mobile solutions both inside and outside the memorial. The portable narrative companion is right in the center of the visualization-based storytelling triangle, providing a mix between unguided visual exploration and narrated content, with a stronger focus on witness-driven storytelling.

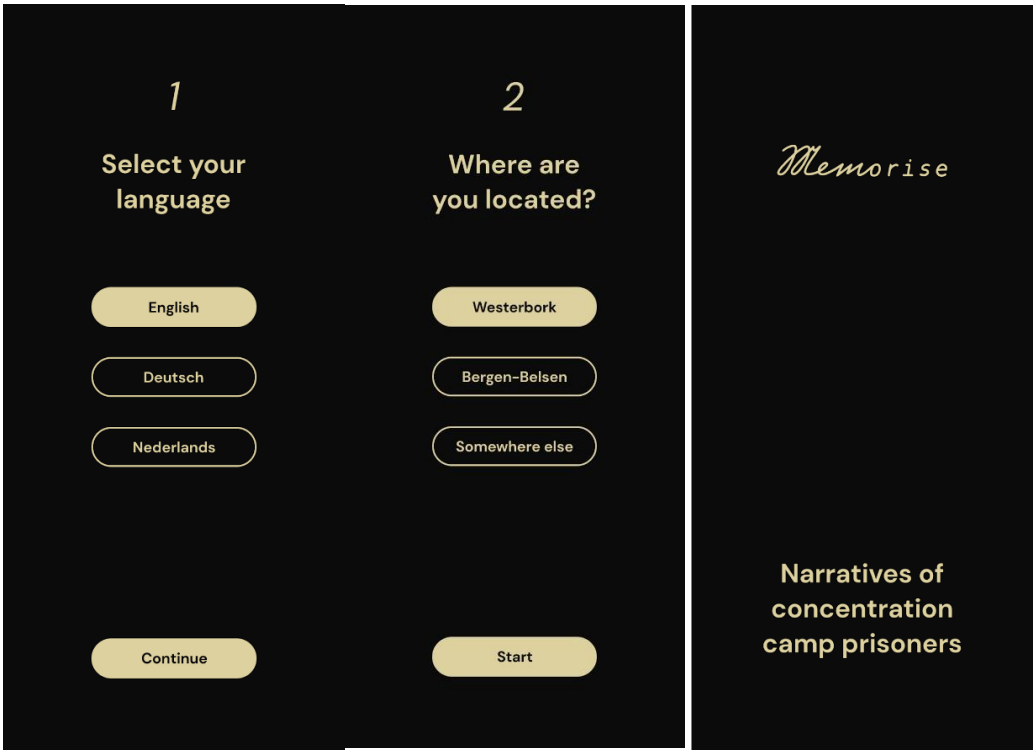
Description of the visual design

Primarily intended for the general public, the design work for the Mobile Companion revolves around the key concept of “Humans Take Center Stage.” To make serious topics accessible, especially to younger generations, the Mobile Companion’s design work strives to put people and their voices at the focus. For this reason, we incorporate pictures of victims from the NIOD archives to make the stories even more tangible and graspable. Another central aspect of the Mobile Companion is to evoke empathy in users (D7.1). The platform’s design aims for a human, personal experience that highlights the authors of diaries.

As far as the visual design language is concerned, we opt for a clean and modern user interface that lets users dive into the main part of the Memorise data corpus – the stories, with as little distraction as possible. To make the visual design domain-specific, we used an old-photo aesthetic with ornamental borders around the portraits and selected a color profile that bears the resemblance to paper, while still catering to younger audiences. Another adjacent highlight color appears after personalizing the experience, serving as a similarity indicator.

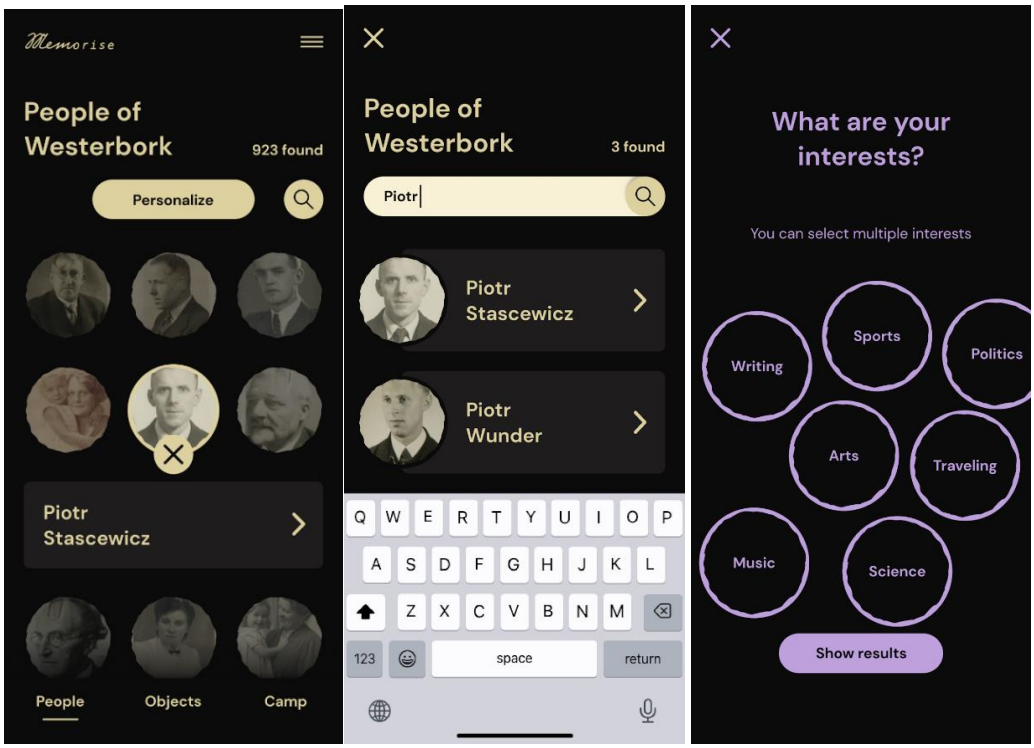
Workflow

When opening the Mobile Companion, users are guided through a set of selections: preferred language and the respective CH sites of interest (refer to figure 7-9). These choices are crucial, as some platform features might depend on them in the future. Users can now view all authors from the selected CH site. Currently, the initial options feature the Bergen-Belsen and Westerbork memorials. Please note that the number of authors will continue to grow, with only a smaller subset included in the first iterations of the Mobile Companion.



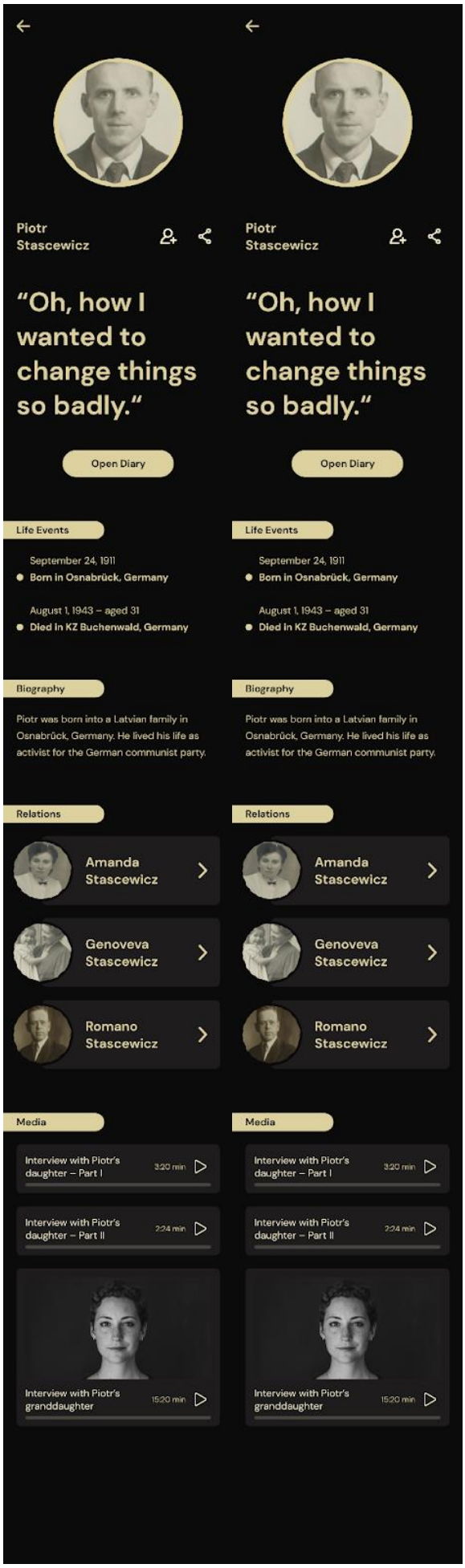
Figures 7 - 9: The initial settings / onboarding screens for the Mobile Companion.

From a long list of authors, users can select the stories they are interested in. They also can search by author name. To narrow down the list of the start page, users can personalize content (refer to figures 10 and 11). It works as follows: Users are presented with a string of questions, and each selection influences the sorting of authors of the start page. This way, users can engage with topics of personal interest. The personalization questions will undergo continuous revision and iteration, informed by new findings from the MEMORISE Surveys and evaluations, consortium and knowledge-graph-factors such as data quantity and underlying metadata.



Figures 10 - 12: From left to right: Different ways to access authors: (10) Selection from a list or (11) search by author name. (12) Personalization is realized via a string of questions to select people of interest in a more granular way.

Upon selecting an author of interest, users can explore personal stories in greater depth through the author profile page. This section provides a concise overview of the author's biographical information, presented with basic information visualisations. The primary goal of this page is to offer insight into the personal background of the author (refer to figures 13 and 14).


Piotr Stascewicz
"Oh, how I wanted to change things so badly."
Open Diary
Life Events
September 24, 1911
Born in Osnabrück, Germany
August 1, 1943 – aged 31
Died in KZ Buchenwald, Germany
Biography
Piotr was born into a Latvian family in Osnabrück, Germany. He lived his life as activist for the German communist party.
Relations
Amanda Stascewicz
Genoveva Stascewicz
Romano Stascewicz
Media
Interview with Piotr's daughter – Part I
3:20 min
Interview with Piotr's daughter – Part II
2:24 min
Interview with Piotr's granddaughter
15:20 min
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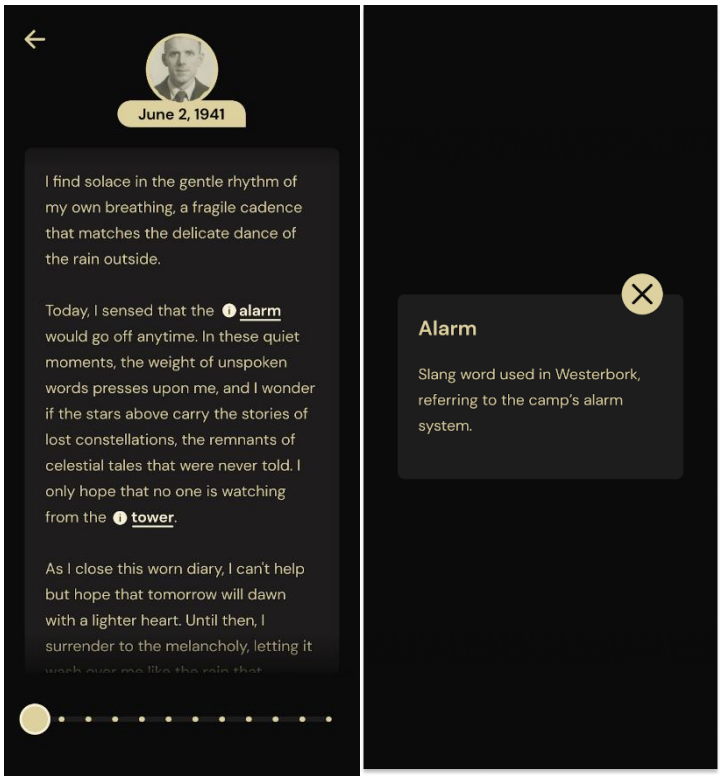
Figures 13 - 14: Left: Author profile page before opening the diary of the person. Right: The author profile page in its scrolled state reveals more contextual information such as accompanying media files and relations to other people whose stories can be further explored.

The diary reader is another central element of the Mobile Companion. It features an intuitive navigation for mobile use as well as a glossary view for camp slang, curated by domain experts. The Mobile Companion is designed in a modular way, allowing for easy addition of additional features. For instance, on-site guiding features, a map of the CH site or an object viewer.



Figures 15 - 16: Left: Diary viewer for mobile screens. With the slider, the diary transcriptions can be navigated quickly and intuitively. Right: Popups explain certain slang words that were used.

Soundbites are direct quotes that are curated from the diaries in the knowledge graph. They serve as concise insights into the daily lives of concentration camp prisoners and are displayed on the author pages. Other immersive features currently under investigation and analysis for the Mobile Companion include weather sounds or dynamic day/night themes to enhance its visual appearance.

Relationship to design challenges

Historical accuracy and integrity

Maintaining accuracy and integrity to the source data in this sensitive historical context is paramount. Diaries, diary entries, biographical information, and diary metadata are directly sourced from the knowledge graph and are represented as easily readable transcripts tailored for mobile device usage. This commitment extends to providing translations in multiple languages. By upholding these

standards for historical accuracy and integrity, the platform ensures that users can engage with a nuanced and respectful portrayal of deeply personal history and stories.

To provide deeper exploration of the original source in a different use case and context of usage, diaries will be linked to the corresponding entries in the CDR. Additional curated content will be exclusively conducted by domain experts, such as staff from the Bergen-Belsen and Westerbork memorials.

Ethical representation

The Mobile Companion exhibits, at least to some extent, aspects of a Digital Storytelling Authoring Tool, with personalisation aspects from the end-user perspective[36]. Since personalization can never be entirely neutral – any design decision, such as wording, UI placement, or color choices, can possibly introduce bias – personalization features must be carefully reviewed and discussed with ethics and domain experts to mitigate this risk see MEMORISE's ethical guidelines.

Physical and temporal constraints

Similarly to the CDR, the Mobile Companion addresses physical and time constraints by enabling convenient remote access to diary data, offering browsing, filtering, and searching features for a more personalized experience. For physical site visits, the Mobile Companion aims to enhance or augment the memorial site visit.

Embracing technology and engaging the senses

The Mobile Companion embraces technology support and sensory engagement by providing ample visual space for the author's words, ensuring their stories are presented clearly and impactfully. Furthermore, enhancements of the text with the help of a glossary are envisioned. Possible future iterations that will augment the user experience include multi-modal information (like audio files, videos, images, interactive infographics etc.)

Educational ambitions and diversity of target user group

Although primarily intended for the general public and visitors to the memorial sites, the Mobile Companion offers customization and personalization options to accommodate varying levels of interest.

Example use case

A female day tourist, aged 45, visits the Westerbork memorial site with her 15-year-old daughter on a sunny June day in 2025. They use the Mobile Companion to explore the camp's map, selecting a specific barrack they wish to learn more about. Upon selecting the barrack on the map, related individuals and objects associated with its history are displayed on the screen. The woman identifies several people and items of interest and bookmarks them within the app for future reference. Her daughter is impressed by a room in the permanent exhibition at Westerbork memorial site. Here, a portrait wall with photos of murdered men, women and children, as well as survivors is being exhibited. The sheer number of people leaves a great impression on her. A sign tells her that she can "meet" these people in the Mobile Companion, bringing the stories behind the faces on the wall to

[36] Trichopoulos, G., Alexandridis, G., and Caridakis, G. (2023). A survey on computational and emergent digital storytelling. Heritage, 6(2):1227–1263.

life. On the wall, she discovered a photo of a young man she is particularly interested in. She wants to find him now in the Mobile Companion.

Implementation Plan of Concept in MEMORISE

Beginning with the analysis phase, we gathered requirements and conducted thorough research in close collaboration with the MEMORISE consortium, emphasizing active engagement with memorial site representatives. Through workshops within the consortium, we connected the user stories with personas, enriching our understanding during the user research phase.

Drawing on insights from the analysis phase, we proceeded to conceptualize the Mobile Companion, crafting an experience that is based on the above mentioned principle “Humans Take Center Stage”. This involved creating initial wireframes and designs to lay the groundwork for the user interface and experience.

Throughout this iterative process, we ensure alignment with the educational and engagement goals set by the MEMORISE project. As we progress, our aim is to seamlessly replace mocked-up test data with the knowledge-graph-data, enhancing the user experience with real-time information and the full potential of MEMORISE.

Distant Learning Platform

We are working on developing a prototype of a remote user experience and engagement using a web-based distant learning platform (DLP). The goal is to show the potential of presenting the project's data and services globally without being tied to a specific location, making it possible to serve users regardless of their geographical location and connect data from multiple memorials. We will analyze a concrete scenario based on the results of Task 6.2 that explores and visualizes all available material within MEMORISE, and from there we will develop specifications for a prototype that we will continuously implement and test. This will allow us to evaluate and refine the user experience and functionality of the platform over time. Just like the mobile companion, the distant learning platform is right in the center of the visualization-based storytelling triangle, since it also provides a mix between unguided visual exploration and narrated content. However, the distant learning platform puts a stronger focus on expert-driven storytelling based on the narratives of witnesses.

Description of the visual design

Similar to the Mobile Companion, the main design philosophy for the DLP is also anchored around the concept “Humans Take Center Stage”. Again, this is reflected in the usage of portrait images and the choice of color schemes that mimic the look of aged paper, creating a familiar and evocative aesthetic. The navigation paradigms within the DLP remain largely consistent with the Mobile Companion; story modules on the DLP are swipeable. The main difference is that the DLP follows a desktop/tablet-first approach, whereas the Mobile Companion utilises mobile-specific features.

The DLP differs from the Mobile Companion by combining an author- and topic-based approach. It is designed exclusively for off-site use, serving as a fully functional narration platform for use at home. Specifically, stories are selected and created around an author writing about a particular personal topic that interests the target audience and evokes empathy.

Each story featured in the DLP consists of an arrangement of story-building blocks or modules, examples can be found in Figure 17. Currently, three different modules are envisioned:

- Yellow Content Type (Figures 18 and 19): A representation of an author's view on certain events, e.g. diary entry for a single day, providing the original words of a person on a particular day. Another example could be a direct quotation from a diary entry, offering a glimpse into the writer's personal thoughts, feelings, or experiences. For the sake of brevity of text, this is the preferred variant for the platform. Written from the author's perspective.
- Red Content Type (Figure 20): Multimodal additional content. Adds context to a diary entry, e.g. by describing what took place on a particular day in a camp. Written in neutral language.
- Blue Content Type (Figure 21): Thought-provokers – Encourage users to reflect more deeply on the story. For more details, see the section "Embracing Technology and Engaging the Senses."

In the future, additional story-building blocks can be designed and added to the DLP. Each story can feature multiple instances of each story-building block in desired order.

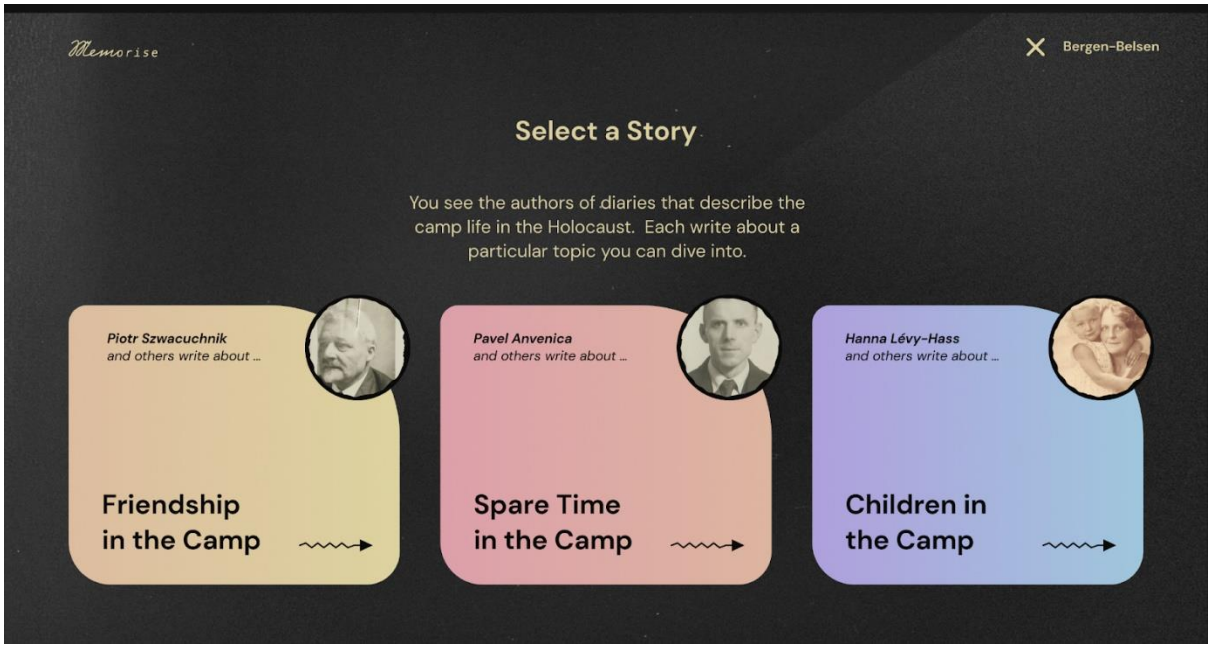


Figure 17: The start page to select a story for the selected memorial site. In this example, three narratives are selected and presented for the user to explore for the Bergen-Belsen memorial site. These stories act as curated entry points to the vast dataset.

Figure 18: The story outline users see before opening the story.

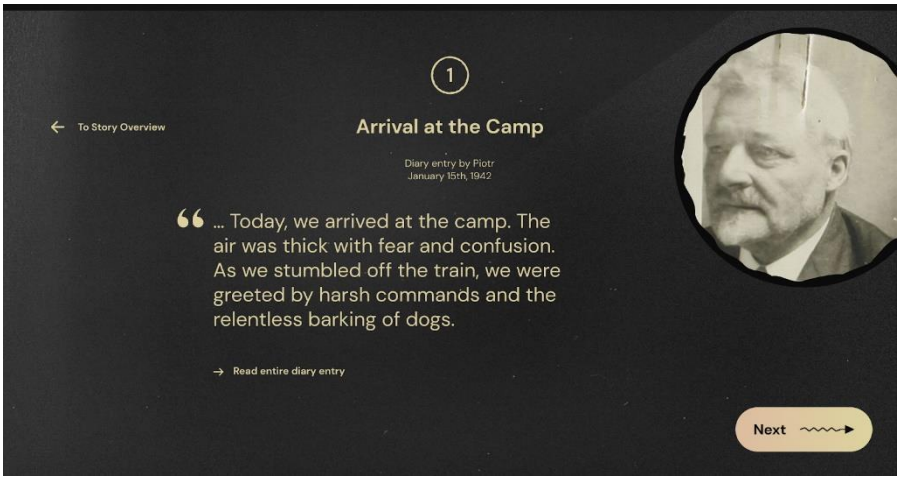


Figure 19: Example for a yellow content module. Here, users are presented with a diary quote. The diary entry can be accessed via a link. Or, users can choose to navigate to the next slide.

Figure 20: Example for a red content module. In this example, users are confronted with an image-gallery. Instead, text or videos could be presented here as well.

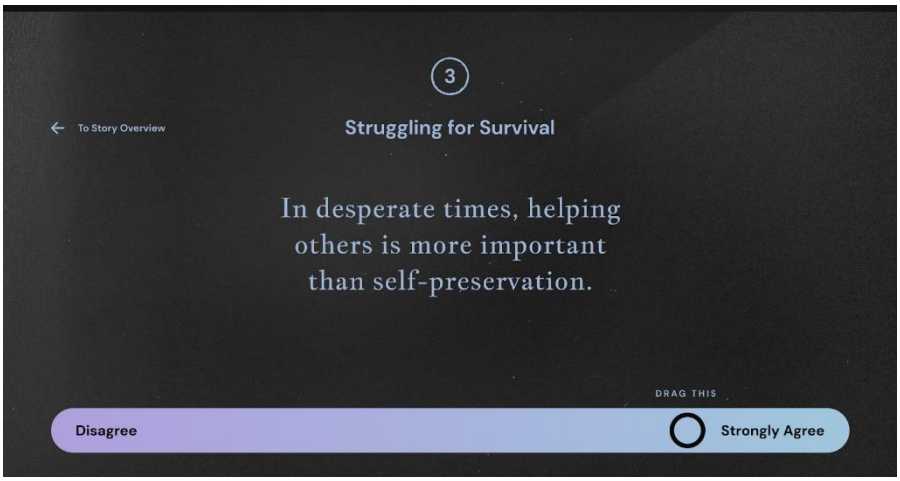


Figure 21: Example for a blue content module. In this example, users can give an answer to a thought-provoking question by dragging the slider handle.

Relationship to design challenges

Historical accuracy and integrity

On the Distant Learning Platform (DLP), we provide learners with access to primary sources embedded in engaging stories. Learners decide for themselves which story they want to use to approach a person. Primary sources are essential for any meaningful exploration of the motivations, thoughts, feelings and actions of people in the past and for any serious attempt to understand why people made the decisions they did or why events happened the way they did. The guided stories about the authors, alternating between diaries, original quotes and background information, enable learners to give examples of how behind each "statistic" are real people with a life before the Holocaust who existed within a social framework of family, friends, and community.

Ethical representation

The Holocaust challenges many perceptions that young people may have about the nature of society, progress, civilisation or human behaviour. Pupils may exhibit defensive reactions, negative feelings or reluctance to delve into the history of the Nazi era or the Holocaust. Their reactions may also include alternative views and attitudes. Therefore, the learning platform should initially provide a positive and trusting learning environment based on rigorously researched and curated source msterial in the digital space that fosters curiosity, empathy and engagement. The role of the teacher is to encourage learners to take an active role in their own learning process, rather than merely building knowledge passively.

Physical and temporal constraints

The DLP addresses the above mentioned challenges by providing an inclusive digital environment that transcends physical boundaries and adjusts to the users interests and. needs. Through interactive and sequentially organised content, users can explore narratives at their own pace, without the constraints imposed by physical space, abilities or time limitations.

Embracing technology and engaging the senses

Learners can be taught the history of the Holocaust in a more immediate, interesting, and more relevant way by focusing on the stories of individuals, moral conflicts, and decisions. This is why we deliberately aim to use so-called "thought-provokers", such as questions like "Have you ever…?" or

“Can you think of a personal situation where you would behave this way?” These questions encourage learners to reflect on the fact that human behaviour is complex and changeable.

Educational ambitions and diversity of target user group

The web-based DLP is designed to facilitate teaching and learning about the Holocaust in the digital space within both formal school settings and extracurricular education for young people. It is designed to support teachers in the following ways:

- Promoting knowledge about the Holocaust by providing precise linguistic explanations of terms and activities to avoid generalisations.
- Creating a positive and motivating remote learning environment for studying the Holocaust, utilising a new self-guided experience.
- Evoking empathy through engaging with personal stories and human experiences.
- Fostering critical and reflective thinking about the Holocaust.

The aim of the educational setting is to create a positive learning environment with an active pedagogy and a learner-centred approach.

Use of Micro-Content Learning

The way in which the content is conveyed is implemented according to the latest didactic guidelines and edutainment principles. Specifically, this involves presenting storylines in sequential “micro-content” sequences. This approach assures that content related to an author’s story is not delivered as a lengthy text or audio file or through a complex menu or selection screen. Instead, it is presented in an interactive rich-content narrative format.

This setup enables the dynamic compilation of different storylines for different authors. The storytelling consists of individual micro-units that the user can navigate sequentially and adjust to their own pace. Interactivity is facilitated through swipe-gestures and/or directional controls (arrows), allowing users to consume interconnected experience modules based on context and at their preferred speed of learning or engagement. The concept, known as “micro-learning”, has long been established in e-learning and effectively delivers content in an engaging and impactful manner, particularly on mobile devices.

We are currently developing initial concepts to expand the learning platform with additional mechanisms for learner participation (See D7.3). For instance, one envisioned feature is the ability for users to save and collect individual content or question cards to create personalised memo boards or posters. This concept draws inspiration from the Comenius Award-winning “Next Click Nirvana” learning platform project at the Museum Rietberg in Zurich. More about this project here: https://klicknirvana.rietberg.ch/clicks/board.

Example use case

A 14-year-old female student explores the DLP from her home, continuing her studies from school on life in concentration camps during the Holocaust. In class, her teacher asked the students to select an author/topic, click through the presented story and prepare a presentation. Now, at home, the student clicks through many more stories presented at the DLP. Using her tablet, she engages with these stories that capture her interest, including points of views from a young author's perspective. Immersed in personal reflections from that era, centered on themes of friendship amidst adversity, she encounters glossary entries for context. With intuitive swipe-gestures, she navigates through

poignant quotes and insights, deepening her understanding of the human experience during the Holocaust.

Implementation Plan of Concept in MEMORISE

Beginning with the analysis phase, we collected requirements and conducted thorough research in close collaboration with the MEMORISE consortium, focusing particularly on engaging closely with memorial site representatives. During workshops within the MEMORISE consortium, various project stakeholders formulated a diverse array of user stories as part of our user research efforts. Building upon the findings from the analysis based on the use cases phase, we conceptualized the interactive DLP, developing story-building blocks, and creating wireframes and designs to shape the user experience.

Our next steps include creating a clickable prototype and continuously refining it based on feedback. Following prototype testing with target users, we will define the feature scope for the initial development release, followed by iterative building, refining, testing, and evaluation in the months ahead.

This iterative approach ensures that the final product aligns with the educational and engagement objectives established by the MEMORISE project.

On-Site Interactive Learning

We are also developing a solution for on-site interactive learning within MEMORISE, in the form of a physical installation. The goal is to create an engaging and immersive experience that allows visitors of the memorial sites to explore the historical content closer to its original context. As described in detail below, this installation combines a large interactive touchscreen with projection panels, designed to enhance both individual and group interactions with the material. By leveraging modern digital technologies, we aim to improve the way historical narratives are presented, making them more accessible and impactful.

Description of Visual Design

The proposed on-site interactive learning installation within MEMORISE features a combination of a large touchscreen and one or more projection panels. This setup is designed to enhance the visitor experience by integrating interactive technology with visually engaging displays. The touchscreen serves as the central interactive element, providing an interface that allows visitors to explore a 3D visualisation of the memorial site with geolocalized annotations corresponding to the multimodal MEMORISE content, which includes photographs, personal stories, 3D models, and the rest of material in the system. This material will be presented in large-scale format screens using the panels in front, making the content accessible to everyone around (see Figure 22).

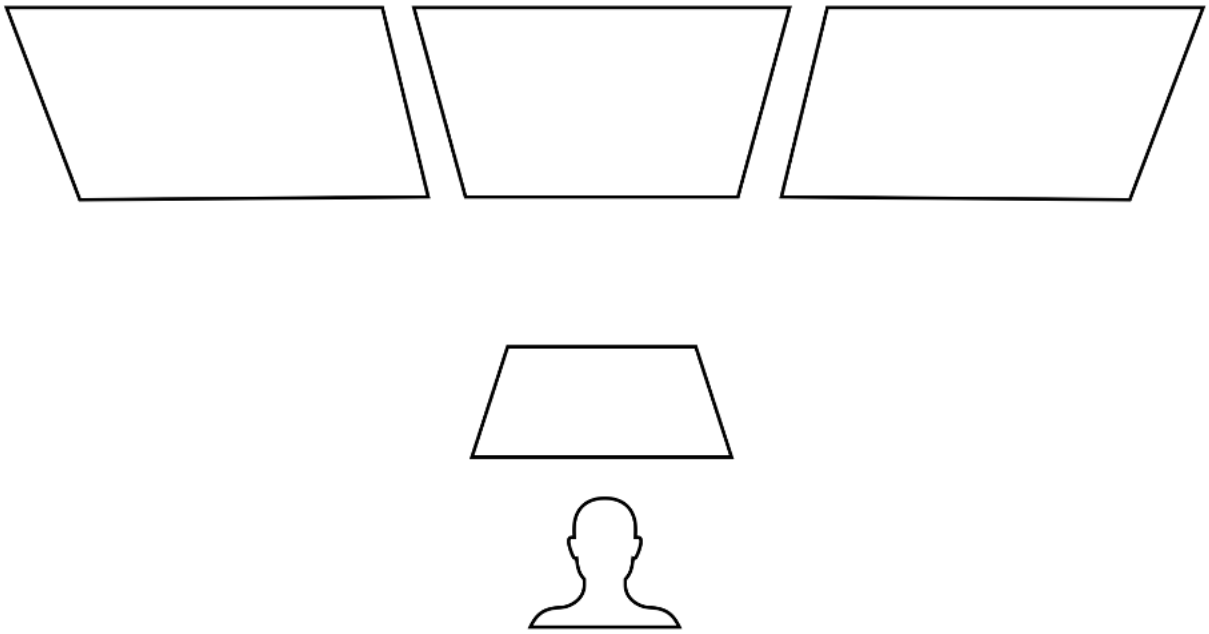


Figure 22: Schematic representation of the screen layout of the proposed installation, using a touchscreen and three presentation panels.

The choice to project information onto these panels serves multiple purposes. Firstly, it allows for the information to be presented in a visually striking and attention-grabbing manner, captivating the audience's interest from afar. Secondly, it ensures that even those not actively engaged with the touchscreen can glean insights and knowledge from the content, promoting a more inclusive and informative atmosphere within the exhibition space. We are aiming at developing a flexible and modular system, in which this installation can be adapted to use just one panel or more, depending on the physical space available and on the specific needs.

This setup fosters a sense of community by enabling group interaction and shared exploration of the content. Visitors can gather around the touchscreen, collaboratively engaging with the information while the projection panels provide additional context that supports group viewing and discussion. This arrangement encourages visitors to interact with each other, share insights, and engage in conversations, thereby enhancing the educational experience. By making the information accessible and engaging, the installation ensures that visitors of all ages and backgrounds can connect with the historical narratives effectively.

Relation to Design Challenges

Historical Accuracy & Integrity

The installation prioritises historical accuracy by ensuring that the digitised materials presented are rigorously researched, meticulously verified and curated. The large touchscreen and projection panels allow for a detailed and comprehensive display of documents, images, and stories, ensuring visitors receive an accurate representation of the HNP material. By presenting the information in a dynamic and engaging manner, the installation also helps preserve the integrity of the historical narrative, making it both accessible and impactful.

Ethical Representation

Ethical representation is a cornerstone of the project, given the sensitive nature of the Holocaust. The design incorporates thoughtful storytelling techniques that respect the dignity and experiences of the victims and the integrity of the historical sources, including the sites represented in the 3D models. The use of large-scale projections ensures that the information is visible to all, promoting a respectful and inclusive atmosphere. Interactive elements are designed to facilitate empathy and understanding, encouraging visitors to engage deeply with the material in a way that honours the victims' memories.

Physical & Temporal Constraints

The installation addresses physical and temporal constraints by creating an accessible and user-friendly interface that can accommodate varying visitor schedules and physical abilities. The touchscreen is designed to support multiple users simultaneously, reducing wait times, enabling collaboration and cooperative learning, and enhancing the visitor experience. Additionally, the projected content ensures that even those not directly interacting with the touchscreen can engage with the material, maximising the educational impact within limited time frames.

Embracing Technology & Engaging the Senses

Embracing advanced technology, the installation uses interactive touchscreens and high-quality projection systems to create a multi-sensory experience. This approach not only captivates visitors' attention but also enhances their understanding and retention of the material. The synchronisation between the touchscreen and the projection panels allows for dynamic storytelling, making the historical content more immersive and engaging.

Educational Ambitions & Audience Diversity

The educational ambitions of the project are reflected in its design, which aims to cater to a diverse audience of on-site visitors, physically present at the memorial sites engaging with local and personal history individually and collaboratively. The intuitive interface and inclusive design principles ensure that visitors of all ages and backgrounds can easily navigate and understand the content, which can be adapted based on their personal information.

Example Use Case

An example use case would be a school group visiting the memorial site. The students gather around the large touchscreen, where they start exploring the content in the MEMORISE system. As they interact with the touchscreen, related images and information are projected onto the surrounding panels, allowing all students, even those standing further back, to participate in the learning experience. This setup encourages group discussion and collective learning, making the history more relatable and impactful. Figure 23 shows an illustration of the potential result based on previous installations.

Figure 23: Reference from a previous installation (at Hollandsche Schouwburg, Netherlands) using a touchscreen and projections, as proposed here. The touchscreen is displaying the main interactive user interface around a map of the site, while the visualisation panels are displaying a 3D view of the camp with contextualised content.

Implementation Plan of Concept in MEMORISE

The implementation of the on-site interactive learning installation within MEMORISE began with thorough planning and research considering the objectives of the task. This initial phase involved collaborating with the memorial site representatives to ensure that the content is presented adequately.

Once this was completed, the design and development phase commenced. The interactive touchscreen interface is created with a focus on usability and accessibility, ensuring that visitors can easily navigate and engage with the content. The projection system is developed to provide high-quality and synchronised displays of information, enhancing the visual and interactive experience. Dynamic storytelling elements are integrated to leverage both the touchscreen and the projection panels, making the historical content more immersive and engaging. This is the current phase.

Testing and feedback are critical components of the implementation plan. A prototype of the system will be installed in the Bergen-Belsen memorial site as part of a wider exhibition, to test its functionality and user experience. Feedback will be collected from the visitors, including both explicit and implicit measures, in collaboration with WP5 and WP7. This feedback will be used to refine and improve the system, ensuring it meets the needs and expectations of all future visitors.

The final design will then be implemented in the two collaborating memorial sites, with careful attention to seamless integration with the existing infrastructure. The memorial site staff will be trained on how to assist visitors in using the new system and how to troubleshoot common issues. This training ensures that staff can provide effective support, enhancing the overall visitor experience. Following the launch, the system's performance will be monitored, and visitor feedback will be collected to make continuous improvements. Regular updates to the presented content by

the memorial site in an accessible manner will ensure that the installation remains relevant and engaging, offering a dynamic and evolving educational experience for all visitors.

Virtual Guided Tours

Although not the main focus for our storytelling developments in MEMORISE, we developed narrations for 3D models of memorial sites. However, virtual guided tours have proven to be important assets in times of the Covid pandemic[37,38,39], and since that they also belong to the offer of memorial sites to their visitors (e.g., virtual tour of Terezín Memorial and Art Dachau). Thus far, we focused on two approaches:

3D Prisoner Artworks as innovative multimodal entry points to engage with HNP: Selected prisoner paintings are manually turned into a 3D version, aiming to extend 3D models of entire campsites with visual narratives of imprisoned artists. An example of an Otto Birmann painting is shown in Figure 24.

3D modeling of contemporary states memorial sites: One example is the Bernburg 3D project (Figure 25), in which we combined LiDAR scanning with CAD modeling to extend the contemporary 3D model with non-existing historical objects (dissection table, crematorium).

Both approaches are driven by curators, who craft a guided tour using SketchFab, which means that these storytelling tools are placed in the top right corner of the visualization-based storytelling triangle. Irrespective of their utility for memorial sites, curating stories requires a huge amount of time, and predefined stories also do not provide sophisticated entry points for a diverse audience.

[37] Ebbrecht-Hartmann, T. (2021). Commemorating from a distance: the digital transformation of Holocaust memory in times of COVID-19. *Media, Culture & Society*, *43*(6), 1095-1112. https://doi.org/10.1177/0163443720983276.

[38] Meinecke, C., Hall, C., & Jänicke, S. (2022). Towards enhancing virtual museums by contextualizing art through interactive visualizations. *ACM Journal on Computing and Cultural Heritage*, *15*(4), 1-26.

[39] Ebbrecht-Hartmann, T. And Divon, T. (2023). #DigitalMemorial(s): How COVID-19 Reinforced Holocaust Memorials and Museums' Shift Toward Social Media Memory. https://doi.org/10.1007/978-3-031-34597-5_13

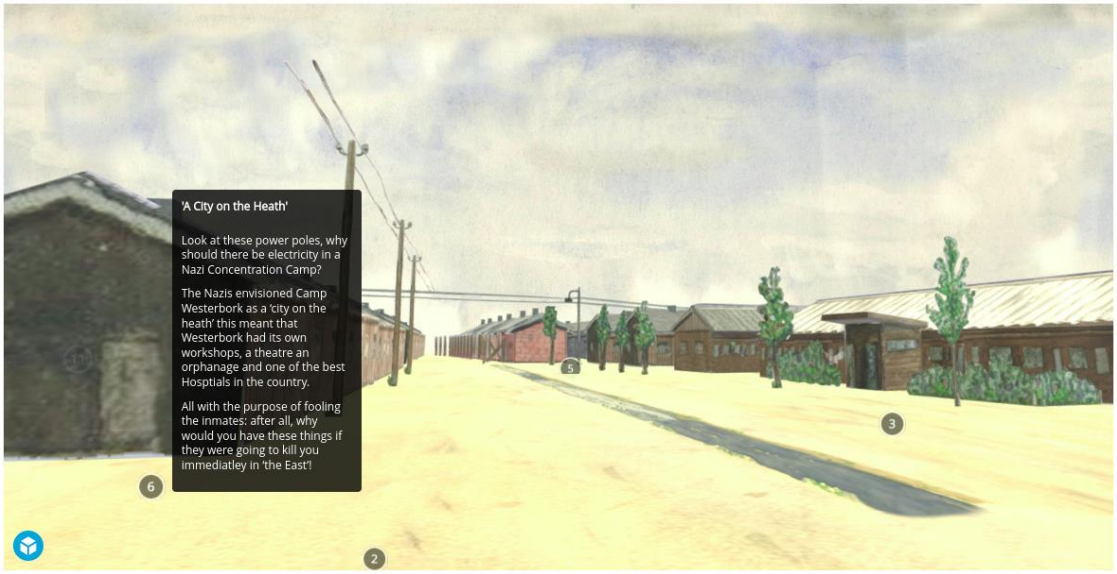


Figure 24: Screenshot of 3D prisoner artwork storytelling with the story of Otto Birmann selected.

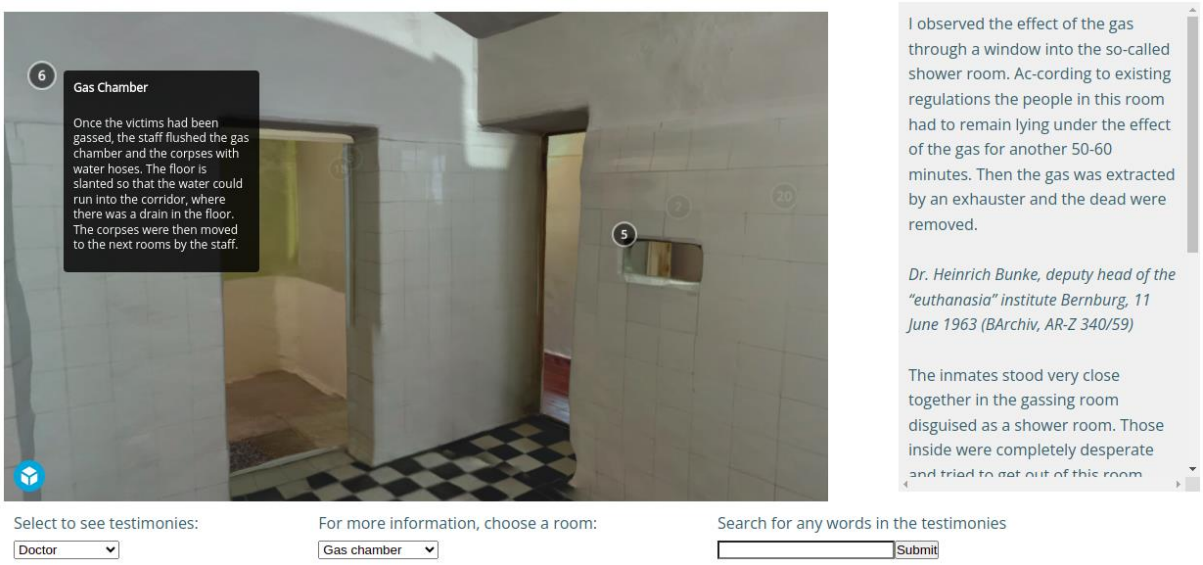


Figure 25: Screenshot of Bernburg 3D highlighting the user's ability to filter for narratives that relate to a user-selected occupation and location.

Bernburg 3D shows us however, how we can use 3D models to map a diversity of narratives. By selecting an occupation and/or selecting a location in the model, snippets of persecutor testimonies are filtered and shown in the right-hand panel. This semi-automated creation of visitor-informed storytelling will be further explored in MEMORISE.

Conclusion

Keeping the stories of victims of Nazi persecution alive is the main focus of MEMORISE. It is our mission to develop storytelling tools that do a better job to educate especially younger generations on the past and the consequences of racism, prejudice and discrimination, which continues to be one of the major social ills in the world. By limiting the amount of curated narratives (expert-driven storytelling), we aim to encourage users to engage with HNP more deeply and to reflect their own experiences with respect to the social ills mentioned above. With our particular focus on diversity which plays a crucial role in all our tools, we hope to reach a large audience that is itself diverse concerning personal profiles and interests, type of visit (e.g., onsite/online, individuals/group), etc.