

# Promoting Transparent and Consistent Frameworks for Interactive Digital Testimonies: A Case Study on Preserving Zilli Schmidt’s Story

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## Abstract

Interactive Digital Testimonies (IDTs) combine digital archives of purpose-made recordings, conversational agents, and immersive display technology to preserve and recreate interactive conversations with contemporary witnesses in a lifelike manner. IDTs represent a specific subcategory of (Embodied) Conversational Agents (ECAs) due to the constraint of not including AI-generated or otherwise synthetic responses or actions. While numerous IDTs have been developed over the last few years, the descriptions of these systems and their respective evaluations frequently lack consistency and transparency, which has led to considerable heterogeneity and a lack of comparability.

To counteract these developments, we present the IDT of Holocaust survivor and member of the German-speaking Romani community Zilli Schmidt, which we developed since 2021. We transparently share both content-related and technical features of this IDT.

## Introduction

Over the last decade, Embodied Conversational Agents (ECAs) of contemporary witnesses have emerged as a novel and promising format in education and oral history. These ECAs are, among other terms, referred to as “Interactive Digital Testimonies” (IDTs) (Heindl 2021; Gloe 2021; Kolb 2022). The format enables users to interact with digital representations of contemporary witnesses, allowing them to direct individual questions to these digital personas. Using Natural Language Processing (NLP), these questions are matched with suitable answers from a vast pool of pre-recorded interview data (Kolb 2022; Ma, Coward, and Walker 2015). IDTs employ exclusively pre-recorded content since using artificial intelligence to generate synthetic answers bears the risk of producing imprecise or factually wrong responses, which is particularly dangerous in contexts like Holocaust education (Makhortykh 2024).

Since the early 2010s, the dominant use case of IDTs has been Holocaust Education. Dimensions of Testimony, the largest producer of IDTs, has developed at least 50 IDTs (USC Shoah Foundation 2022), at least 22 of which are known to feature Jewish Holocaust survivors (USC Shoah Foundation 2021). However, with the emergence of other

projects such as “The Forever Project” in the UK (Schultz 2021), “Learning with Digital Testimonies” (LediZ) in Germany (Ballis and Gloe 2020), or “Histories from Belene” in Bulgaria (Sofia Platform Foundation 2022) over the past years, the landscape of developing ECAs for educational purposes is expanding. Due to the lack of documentation and publications on their technical aspects, there is no standardization in the development and implementation of IDTs, leading to significant differences between these projects.

Robotics research commonly informs research on ECAs - and thus also on IDTs - and vice versa. While physical robots may be perceived as more favorable and persuasive than virtual agents (Li 2015), there is significant overlap between the objective of (and corresponding challenges for) social robots and ECAs: To socially interface and interact with humans by exhibiting appropriate behaviors (Cassell et al. 2000) and following social rules (Leite, Martinho, and Paiva 2013). Consequently, our work on IDTs contributes to the collaboration and exchange between these research fields and can help uncover potential synergies, inspire use cases, and invite alternative approaches.

In this paper, we showcase the IDT of Zilli Schmidt, a member of the German-speaking Romani community and a Holocaust survivor born in 1924, and discuss the underlying design decisions. This IDT was developed by a team of researchers at Ludwig-Maximilians-Universität in Munich (LMU) and the Leibniz Supercomputing Centre (LRZ) as part of the LediZ<sup>1</sup> project. Our goals are to enhance transparency in the development and implementation of IDTs for educational purposes and to demonstrate how the format could be suitable for more diverse use cases than those covered by currently existing projects. This also illustrates the need for a standardized and unifying framework for the development of and reporting on applications of computer-based social actors in sensitive contexts, such as Holocaust education or preserving and relaying memory post-mortem.

## Related Work

### Commonalities between Social Robots and Embodied Conversational Agents

Social robots and ECAs both draw on the Computers are Social Actors (CASA) paradigm (Nass, Steuer, and Tauber

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<sup>1</sup><http://www.edu.lediz.lmu.de/wordpress/main-page-en/>

1994), which states that humans interact with computers as if they were also human social actors. Users apply social norms and behaviors to these interactions and expect the same from their computerized counterparts.

Numerous CASA-related concepts play significant roles in both human-computer and human-robot interactions. These include co-presence, i.e., the feeling of sharing a physical space with others (Goffman 1963), which is influenced by the agent's representation, whether physical or graphical (Almeida, Menezes, and Dias 2022). A similarly shared factor is the ability to evoke social presence (Biocca, Harms, and Burgoon 2003), which enhances users' trust (Toader et al. 2019) and acceptance of the system (Heerink et al. 2010).

The CASA paradigm applies even when users know they are interacting with machines. Realistic, human-like designs and consistent behaviors can improve the enjoyment and credibility of agents (Gratch et al. 2002; Aljaroodi et al. 2019; Rheu et al. 2021) and robots (Haring et al. 2016; Castro-González, Admoni, and Scassellati 2016). However, respective designs must be equally careful not to victim to the detrimental effects of the Uncanny Valley (Mori 1970; MacDorman and Ishiguro 2006), which originated in the field of robotics but has also found common application in the way virtual humans are graphically represented (Tinwell et al. 2011; Nissen, Conrad, and Newman 2023): almost, yet not quite realistic representations may appear eerie and cause feelings of revulsion, aversion, and distrust.

### **Romani People, Antigypsyism, and Related Educational Efforts**

The presence of Romani people in Europe dates back to at least the 14th century. Throughout history, they have faced widespread prejudice, discrimination, and persecution across various countries and regions (Bogdal 2023; Sierra 2024). Notably, it is estimated that between 250 000 and 500 000<sup>2</sup> Romani individuals were murdered under the National Socialist regime (Sierra 2024). Today, members of Romani communities frequently report discrimination in many aspects of daily life (European Union Agency for Fundamental Rights 2023). This phenomenon, known as "antigypsyism", is defined as "a historically constructed, persistent complex of customary racism against social groups identified under the stigma 'gypsy' or other related terms" (Alliance against Antigypsyism 2017). To combat antigypsyism, the EU published a strategic framework in 2020, recommending various countermeasures and urging its member states to implement national strategies accordingly (European Commission 2020).

Efforts to increase the representation of Romani people in educational contexts and address antigypsyism are common cornerstones of such strategies. However, research on the current state of education and suitable methods and formats remains scarce. Currently, the primary source of reliable knowledge stems from studies evaluating the represen-

<sup>2</sup>As Sierra (2024) notes, the estimated number of victims varies significantly and remains a topic of ongoing debate due to insufficient records and research.

tation of Romani people in school curricula and textbooks. These findings indicate a lack of commitment to providing systematic information, with existing portrayals often reproducing antigypsyist stereotypes and narratives. Notably, Romani people are rarely given agency (Council of Europe 2020; Pecak, Spielhaus, and Szakács-Behling 2022).

We developed the IDT of Zilli Schmidt to enhance the public visibility of Romani people and Holocaust survivors within the educational context. This initiative aims to provide users with the opportunity to gain knowledge through personal experiences and biographic information.

### **Interactive Digital Testimony of Zilli Schmidt**

The IDT's development began in 2021 in collaboration with the Foundation Memorial to the Murdered Jews of Europe<sup>3</sup>, who had been in contact with Zilli Schmidt for several years and suggested creating an IDT to share her story (Schmidt 2020). Given the numerous legal and ethical implications of projects within the context of oral history, remembrance culture, and postmortem applications (Smith and Watson 2012; Hollanek and Nowaczyk-Basińska 2024), we took several precautions. These included obtaining active and written consent from Zilli, who was thoroughly informed about the nature and purpose of the project. Importantly, Zilli<sup>4</sup> retained the right to refuse any questions or prohibit the publication of recorded answers at any time without stating a reason. Additionally, any further use of the recordings beyond the IDT required her consent.

After obtaining informed consent, we developed a pool of interview questions by combining questions from previous projects with new ones based on biographical research and informal surveys among students. We removed duplicates and categorized the questions as follows: general information (i.e., "What is your name?"), discrimination (i.e., "In what ways have you been discriminated against in your life?"), family (i.e., "How would you describe the family you come from?"), society (i.e., "How has Germany changed in the course of your life?"), Holocaust (i.e., "Which concentration camps were you in?"), identity (i.e., "Are you religious?"), life (i.e., "How would you describe your childhood?"), and fallback intents<sup>5</sup> (i.e., "Could you please repeat that?"). In total, we gathered 747 questions and fallback intents at the end of this process. Due to the limited time frame of four days for filming, we ranked the questions by priority to ensure a balanced distribution between all categories. For this, seven core project members each individually ranked all questions from 1 to 5 based on their perceived importance. The questions were then sorted by total score, with ties broken by lower standard deviations in individual rankings.

Filming took place in July 2021 in cooperation with

<sup>3</sup><https://www.stiftung-denkmal.de/en/>

<sup>4</sup>Since Zilli Schmidt passed away in 2022, all rights were transferred to her heirs.

<sup>5</sup>Fallback intents serve as answers in case no appropriate match has been identified during an interaction. To maintain immersion, the answers are therefore recorded as statements by the interviewees themselves.

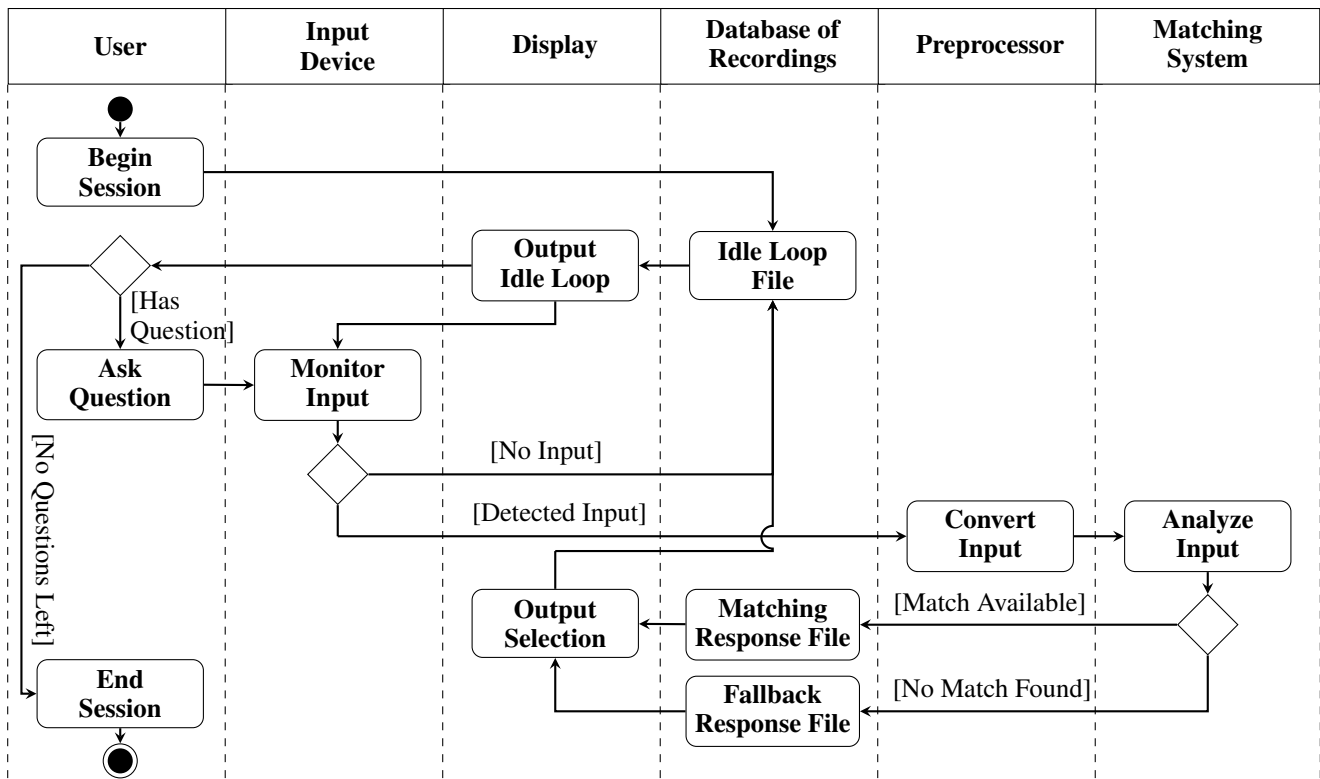


Figure 1: Partitioned UML 2.5.1 Activity Diagram of an example interaction with the IDT of Zilli Schmidt.

Stereoscopic Technologies (Stereotec), who used native stereoscopic 3D technology to record all answers. This choice was made because 3D presentation may potentially increase learning and immersion (Loup-Escande et al. 2017) during interactions with the IDT. Due to Zilli Schmidt’s advanced age, a hotel conference center in her hometown of Mannheim, Germany, was transformed into a makeshift film studio. Over four days and several sessions, we recorded 437 answers and fallback intents, including a short biographical introduction given by Zilli herself. The interviews were conducted by project members from the Foundation Memorial to the Murdered Jews of Europe due to their already-established relationship with Zilli.

During post-production, no answers were edited for their original content, nor was new content generated. Recorded answers were only removed in cases of duplication or unsolvable technical issues. All final answers were subsequently archived at the LRZ and embedded within the developed software framework. To ensure the authenticity of the IDT, the database of responses and reactions of the IDT contains exclusively these recordings and forgoes generating any responses with AI.

To later improve the matching process between user input and output selection (see Figure 1), we employed an approach based on linguistic variations and supervised learning (Ballis and Gloe 2020; Duda 2021; Ma, Coward, and Walker 2017; Stegmaier and Ushakova 2021). Initially, we developed intuitive syntactic and semantic variations of each original question upon completion of the post-production

phase. Using a prototype of the IDT, we conducted several training sessions in which we manually monitored the matching process, reviewed the results, and corrected unsuitable matches. As our NLP platform, we chose to employ Google Dialogflow ES due to its accessibility and previous use for educational purposes (Reyes et al. 2019). After refining the system, we cleared the IDT for release. To this date, sessions are logged, and we continue to manually review and correct the matching processes as necessary.

The complete IDT consists of the modular components input device, display, database of recordings, preprocessor, and matching system. The input device (e.g., a microphone) allows users to input their individually phrased questions. The preprocessor prepares the detected input for the matching system by converting it into an appropriate format (e.g., speech-to-text). The trained matching system is responsible for analyzing the received input and identifying the most suitable response within the database of recordings. If a sufficiently matching response is found, the corresponding file is selected and displayed (e.g., audio-visually with the help of a stereoscopic 3D screen and a system of loudspeakers). If no potential response meets the matching system’s confidence threshold, a fallback response is displayed instead. The current threshold is set at 0.3 but can be adjusted as needed. Additionally, specific fallback responses may be triggered when speech-to-text input is undetected, such as “Could you please repeat that?”. This indicates a possible issue with the input devices or the user’s pronunciation.

The IDT was released at the end of 2021 and is currently

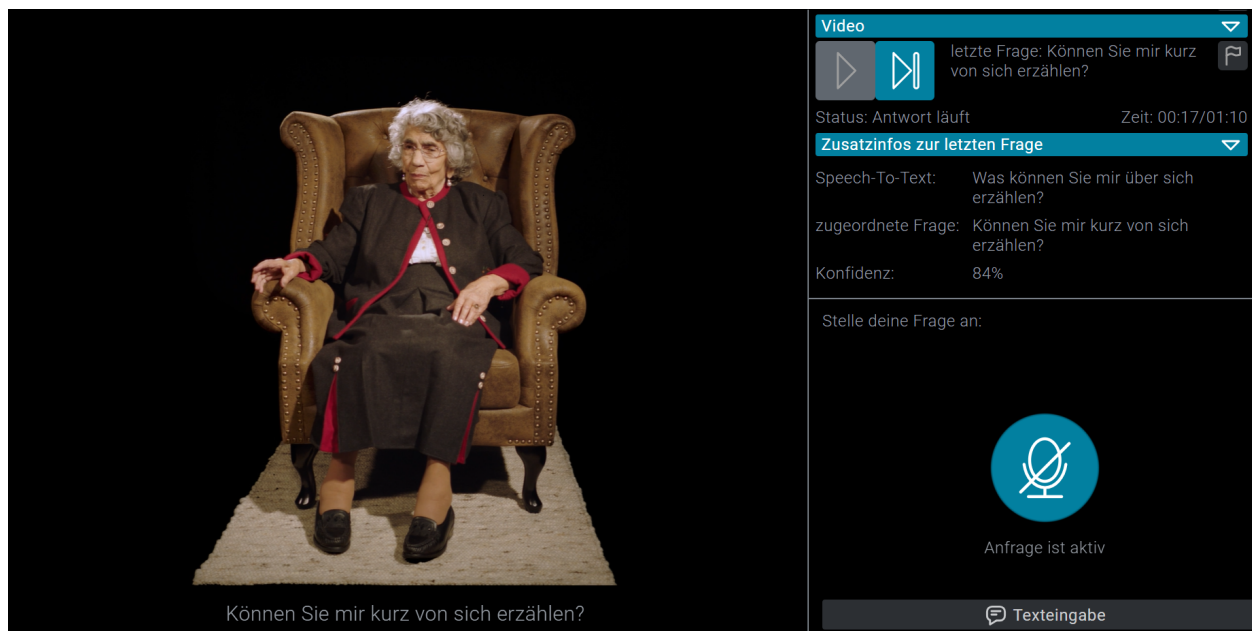


Figure 2: Facilitator’s view of Zilli’s IDT within the browser application. In addition to the currently displayed recording of the witness, it presents additional details and diagnostics, such as the detected input, the phrasing of the original interview question that elicited the matched response, and the confidence value of the matched response.

available in German as part of a browser application. This application offers various functions, including adjusting the resolution quality, displaying the original interview question for each matched answer, reviewing information about the recognized speech-to-text content and allocated match (including the confidence value), and managing devices present in a session (see Figure 2). Facilitators (i.e., project members, teachers, educators) may alternatively provide users with a restricted version that prevents them from making individual adjustments or accessing additional functions. Additionally, the IDT is accessible through a mobile setup and a special theater at the LRZ, both of which offer the option to present Zilli’s IDT audiovisually in either 2D or stereoscopic 3D. We created this variety of setups to accommodate multiple different use cases as well as the diverse needs of users, from remote schools that may not be able to travel to a location where a presentation of the IDT is available, to visitor groups who may wish to interact with the IDT as part of a general visit to the LRZ as well as stereo-blind users. Furthermore, an open-access booklet for educators was published on several LediZ projects, which contains information on Zilli’s biography, access to the browser application, and suggestions for implementation in educational settings (Ballis, Gloe, and Schwendemann 2023).

As part of a guided presentation, we determine in advance whether visitor groups prefer to interact in 2D or 3D. We then briefly introduce users to the historical context, nature, and purpose of the project and provide basic instructions on how to interact with the IDT. We demonstrate the interaction by triggering Zilli’s answer to the question, “Could you tell us something about yourself?” using a smartphone that displays a microphone button and an optional text input func-

tion. Once the answer is complete, we hand over the smartphone to the visitor group, allowing for as much individual interaction as possible. Guidance is provided only upon request, including suggestions for potential questions if visitors struggle to come up with ideas. It is important to note that this procedure may vary slightly according to the purpose, nature, and structure of each particular presentation. However, the strategy of minimalist facilitation to maintain user autonomy is a guiding principle of all presentations.

## Conclusion and Future Work

In our paper, we presented the IDT of Zilli Schmidt and detailed the procedures during its development. Our work aims to increase transparency surrounding the development of IDTs and to motivate and facilitate further interdisciplinary approaches and collaborations so that the stories and memories of contemporary witnesses can be experienced interactively even after their death.

To enhance future research, standardized frameworks and guidelines for describing and reporting IDTs are essential. These should detail, among other things, the components, interactions, procedures, and ethical considerations involved. Encouraging stronger collaboration and exchange between different projects working on IDTs or social robots can help establish these standards and increase transparency. Importantly, future studies should also include empirical evaluations of IDTs, examining the effects of individual design features and their application in educational contexts. Additionally, exploring potential applications with other target groups (i.e., contemporary witnesses of other historical events) would be valuable.

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