

Dancing through Time: Walking through a Dance Audiovisual Archive

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Abstract

Dancing through Time is an interactive installation created to discover the Prix de Lausanne archive, a collection of dance performance recordings over fifty-one years. It consists of a 4k-touch screen mounted on a twelve-meter rail, allowing visitors to walk through the fifty-one editions of the Prix de Lausanne dance competition. This paper presents the installation and the results of an extensive evaluation of users' questionnaires. Our main findings validate Dancing through Time in terms of User Experience and User Engagement, indicating that receiving prior instructions only affects the latter. Furthermore, the interaction logs with the application inform us of the benefits of browsing through the entire collection thanks to the affordances of the interactive system. Finally, we extracted different users' interaction behaviours to understand better how visitors engaged with Dancing through Time in the situated context of the 2024 edition of the Prix.

CCS Concepts

• **Human-centered computing** → Human computer interaction (HCI); • **Applied computing** → Performing arts;

1. Introduction

UNESCO's *Convention for the Safeguarding of the Intangible Cultural Heritage* defines Intangible Cultural Heritage (ICH) as the practices, representations, expressions, knowledge, and skills recognized by communities as part of their cultural heritage [UNE03]. It includes performing arts like music, dance, and theatre. Particularly relevant for this paper is UNESCO's call for measures on 'promotion, enhancement, transmission [and] revitalization'. In recent years, Digital Humanities scholars and Galleries, Libraries, Archives and Museums (GLAM) practitioners have developed methods to safeguard ICH. In particular, interactive technologies can facilitate intuitive access to digital materials in museums, transforming visitor experiences [MA21].

Our research addresses the main research question of "**how to enhance the discoverability of the Prix de Lausanne archive in the situated context of the week of the festival**", a collection of audiovisual recordings of dance performances since 1973. For the Prix's 50th anniversary in 2023, we created an interactive installation, *Dancing through Time*, showcased annually during the competition. This paper details the design and creation of the installation and presents results from a user evaluation conducted in-situ during the competition in 2024. We believe our contribution is thus two-fold, as both the interactive installation design and how to fully evaluate it in a situated context are relevant to the research community.

2. Related work

Recent scholarly inquiries have spotlighted a perceptible shift towards documenting, elucidating, and showcasing the living essence of dance practices by transmuting ephemeral practices into tangible choreographic entities. Initiatives such as *i-Treasures* (2013-2017) or *Terpsichore* (2016-2020) have leveraged digital means to collect, digitize, document and enhance the discoverability of dance practices. Famous choreographers have also followed similar approaches, with projects like *Living Archive*, a web-based platform to explore a digital landscape of all the human poses in Wayne McGregor's repertoire of performances. We also refer the reader to Clarisse Bardiot's extensive analysis of the relationship between digital technologies and performing arts [Bar21]. These endeavours are clear indication of a growing interest in the use of digital means to enhance access to performing arts archives.

Such vast digital repositories can indeed turn into 'dark archives' inaccessible to the public, due to challenges faced by the GLAM sector [Jai22]. [F*12] further highlights how non-expert audiences are in need of more intuitive modes of access to discover these collections. In this regard, interactive technologies can offer more intuitive and engaging modes of access, as demonstrated by several initiatives in museums settings [MNSG18, HWL18, TB22, CODEBL21]. At the Laboratory for Experimental Museology, we work at the forefront of such a shift with the goal of 'amalgamating cultural heritage archives with interactive cinema to foster novel forms of embodied narrative' [KMH21].

3. Dancing through Time - Walking through the Prix de Lausanne archive

The Prix de Lausanne is a competition for young dancers held yearly in Lausanne, Switzerland since 1973. Nearly all editions have been recorded and digitized, resulting in a rich dataset of 1493 mp4 videos of individual dance performances, across 43 years, with additional metadata on the dancers and their performances. For the missing years, photos of the finalists are available.

The primary goal in designing *Dancing through Time* was to make this collection accessible to visitors during the week of the festival in Lausanne. This required therefore an interactive installation that would attract users' attention while supporting them in browsing through the several hundreds recordings of the archive. Coupled with the primary obvious axis of presenting the videos in chronological order, the Linear Navigator (LN) was thus chosen as the interactive system for which to develop the interactive application. The LN is a 4k-touch screen mounted on a twelve-meter motorised rail, such that the screen can move along the wall the structure is mounted on. Figure 1 shows how *Dancing through Time* was installed in the Palais de Beaulieu in Lausanne, Switzerland, during the week of the Prix from January 28th to February 4th, 2024.

Alongside the primary axis of the chronological order, we decided to also present the archive along three other axes: the country of origin of the dancers (reflecting the international nature of the competition), the performances they have chosen (illustrating iconic examples such as *Sleeping Beauty* that have been chosen multiple times over the years) and based on the alphabetical order of dancers' names. To allow navigation along these axes, we designed the Navigation Menu, as shown in Figure 2, in which users can sort through the entire collection. Note that we also included an About section to provide a brief overview of the Prix history. Hence, by selecting a specific performance, they prompt the Linear Navigator to move on its axis to the corresponding position, based on the chronological order. Furthermore, if the system did not register interactions for a certain time, it would enter in Idle mode, randomly selecting a performance and moving to the corresponding position. The goal with this mode was to attract visitors' attention when they would pass by.

When not browsing through the archive on the Navigation Menu, users are presented with the Main View, in which a system of horizontally folding cards reveals fifteen performances, with a focus on the central one, as visible in Figure 3. Through this interface, users can access the Navigation Menu (central circular button with the Prix de Lausanne logo) and move left or right the LN with the two arrow buttons. Overall, *Dancing through Time* thus provides two modes of navigation: the "global" navigation, in which users search for a performance and jump to it from the Navigation Menu, and a "local" navigation in which users slowly walk through the archive chronologically, using the arrow buttons in the Main View.

Finally, the third interface users are confronted with is the Video View, as shown in Figure 4, in which they can watch the full performance. By clicking on the central card (the performance in focus) in the Main View, the card unfolds nearly to the full width of the screen and reveals additional information on the performance as well as the video itself. Above the video, users are also offered the

option to watch the performance in four alternative modes of visualisations. These are artistic renderings generated using a range of features extracted from the original footage and are meant for the visitors to focus on specific aspects of the performances, such as the dancers' movements or the space they occupy on stage. It is however beyond the scope of this paper to explain further how these renderings were created.

4. Evaluating an interactive installation

During the week of the Prix de Lausanne 2024 we installed *Dancing through Time* in one of the main passages between the different stages for the dancers' training. This allowed us to evaluate our installation in a 'real' context [EE04], as opposed to the controlled environment of a laboratory. To lead this evaluation, we addressed multiple research questions with a 'crisscrossing' methodology, inspired by the approach presented in [DP22]. On the one hand, we analyse questionnaires filled in situ by casual users during the week, after having interacted with the installation evaluated. On the other hand, we retrieve the logs of interactions with the application (i.e. which actions are performed by users). Combining these two forms of data, we strive to gain a more complete interpretation of users' experience of discovering the Prix de Lausanne archive through *Dancing through Time*.

4.1. Does receiving prior instructions on how to interact with *Dancing through Time* influence users' perception of the installation in terms of User Experience and User Engagement? (RQ1)

The questionnaire we constructed relied on well-established scales to ensure their validity [OMP17], namely the UMUX-Lite scale for User Experience [LUM13] and the User Engagement Scale in its short form [OCH18]. In addition, we asked general demographics questions and visitors' comments. The questionnaire was delivered through the *muse* tool [KK15] on iPad minis, in French or in English. Once the survey responses were collected, we proceeded with the data cleaning and data aggregation in the different sub-scales considered, controlling for their consistency with Cronbach's alpha.

Over the course of the week, we collected 59 answers to the survey, of which 3 were dropped due to data inconsistencies. We thus analyse 56 answers, fairly distributed in age of respondents (mean = 33.88 ± 2.28 , ranging from 15 to 69 years old). We observe that 32 users identified themselves as females, 23 as males and 1 as non-binary. The good scores across all scales reported in Table 1 validate *Dancing through Time* as a good experience for the task of discovering the Prix de Lausanne archive and "keeping it alive", as reported by one user. Focusing on the effect of receiving prior instructions on these scales, we use a Mann-Whitney U test (since the assumptions of normality and homogeneity of variances were not met), with a significance score of $\alpha = 0.05$. As indicated in Table 1, we only found significant effects on the AE, PU and UES scales, always with better scores if prior instructions were given and large effect sizes. The lower scores in perceived usability (PU) could be explained by the effort visitors had to make to understand how the application worked. However, it is harder to interpret the difference observed for the aesthetic appeal (AE), as we did not expect



Figure 1: *Dancing through Time* installed in the Palais de Beaulieu (Lausanne, Switzerland) during the week of the Prix de Lausanne (February 2024).

Year	Country	Performance	Style
1973	USA	Heather Tu	classical
1974	USA	Sam Spolnik	classical
1975	USA	Sara Komine	classical
1976	USA	Zhiyao Zhang	classical
1977	USA	Brenda Ferre	classical
1978	USA	Hsin-Dan Ohn	classical
1979	USA	Yuko Horikawa	classical
1980	USA	Shuzuki Kiko	classical
1981	USA	Kevin Peang	classical
1982	USA	Patricia Zhou	classical
1983	USA	Rubin Alonay Almagro	classical
1984	USA	Lina Caputo	classical
1985	USA	Derrin Harper Waters	classical
1986	USA	Gina Storm-Jensen	classical
1987	USA	Sung Woo Han	classical
1988	USA	Mayara Magri	classical
1989	USA	Jack Bartishare	classical
1990	USA	Pablo Octavio Dos Santos	classical
1991	USA	Yinhang Sun	classical
1992	USA	Henry Blabod	classical
1993	USA	Kevin Peang	contemporary
1994	USA	Patricia Zhou	contemporary
1995	USA	Henry Blabod	contemporary
1996	USA	Lina Caputo	contemporary
1997	USA	Derrin Harper Waters	contemporary
1998	USA	Pablo Octavio Dos Santos	contemporary
1999	USA	Yinhang Sun	contemporary
2000	USA	Jack Bartishare	contemporary
2001	USA	Sung Woo Han	contemporary
2002	USA	Rubin Alonay Almagro	contemporary
2003	USA	Sam Spolnik	contemporary
2004	USA	Sara Komine	contemporary
2005	USA	Zhiyao Zhang	contemporary
2006	USA	Brenda Ferre	contemporary
2007	USA	Hsin-Dan Ohn	contemporary
2008	USA	Shuzuki Kiko	contemporary
2009	USA	Gina Storm-Jensen	contemporary
2010	USA	Heather Tu	contemporary
2011	USA	Derrin Harper Waters	contemporary
2012	USA	Yinhang Sun	contemporary
2013	USA	Jack Bartishare	contemporary
2014	USA	Sung Woo Han	contemporary
2015	USA	Rubin Alonay Almagro	contemporary
2016	USA	Sam Spolnik	contemporary
2017	USA	Sara Komine	contemporary
2018	USA	Zhiyao Zhang	contemporary
2019	USA	Brenda Ferre	contemporary
2020	USA	Hsin-Dan Ohn	contemporary
2021	USA	Shuzuki Kiko	contemporary
2022	USA	Gina Storm-Jensen	contemporary
2023	USA	Heather Tu	contemporary
2024	USA	Mayara Magri	contemporary
2025	USA	Yuko Horikawa	contemporary

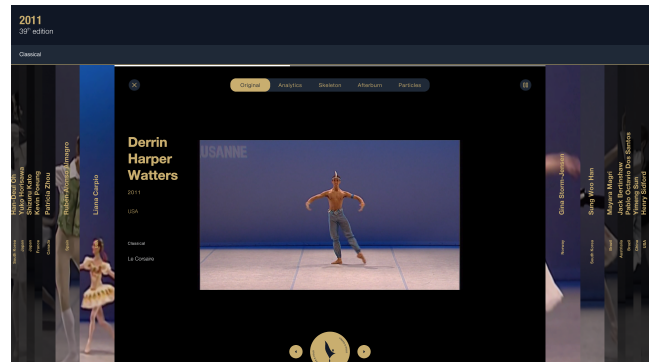


Figure 2: *Navigation Menu* showing the performances at the Prix de Lausanne finals in 2011 on the *Dancing through Time* application.

Figure 4: *Video view* showing the full recording of Derrin Harper Waters' 2011 classical performance on the *Dancing through Time* application.

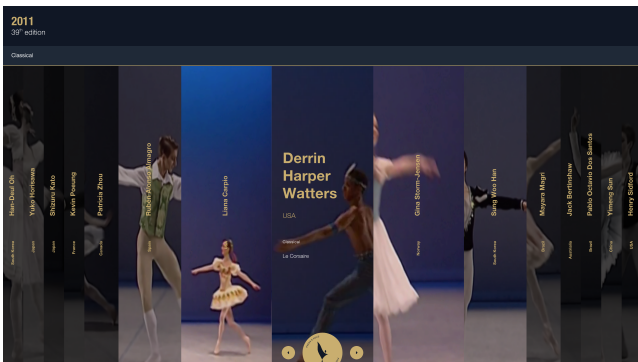


Figure 3: *Main View* showing the 2011 classical performance of Derrin Harper Waters in focus on the *Dancing through Time* application.

receiving prior instructions did not impact user experience, it did increase user engagement. A more focused user evaluation could therefore be beneficial here to understand which specific aspects of the installation lowered user engagement for the visitors that did not receive instructions. Notwithstanding, the lower UES score is still at 4, suggesting that the experience was still satisfactory even without prior instructions.

4.2. How have the different types of navigation offered by *Dancing through Time* been adopted by users? (RQ2)

In addition to evaluating how users perceived *Dancing through Time*, we also recorded their interactions with the system (all with timestamps) to better understand users' interaction behaviors. We specifically collected when a video was searched (VideoSearched), a video was played (VideoPlayed) or an alternative mode of visualisation was selected (VideoEffectChanged). We also logged the start and end of the Idle mode to group events into sessions of use. Note that this does not distinguish between multiple users interact-

Scale	Score	α_C [95% CI]	Received instructions		Statistic	p-value	Effect size
			Yes	No			
UX	4.13±0.10	0.74 [0.55, 0.85]	4.18±0.15	4.08±0.14	z = 355.0	0.560	$d_C = 0.14$
FA	4.04±0.11	0.65 [0.46, 0.79]	4.22±0.14	3.82±0.16	z = 280.5	0.069	$d_C = 0.51$
AE	4.34±0.09	0.67 [0.49, 0.80]	4.56±0.09	4.09±0.15	z = 256.5	0.029	$d_C = 0.73$
PU	4.01±0.11	0.55 [0.30, 0.72]	4.27±0.14	3.72±0.17	z = 241.5	0.013	$d_C = 0.68$
RW	4.51±0.08	0.59 [0.35, 0.74]	4.62±0.09	4.39±0.13	z = 321.0	0.233	$d_C = 0.40$
UES	4.23±0.07	0.81 [0.73, 0.88]	4.42±0.08	4.00±0.11	z = 229.0	0.008	$d_C = 0.80$

Table 1: Results of the users' questionnaire with Cronbach's α_C for the aggregated scales. Significant effects of receiving instructions are highlighted in bold (at a significance score of $\alpha=0.05$) and effect sizes are reported with Cohen's d_C .

ing simultaneously but we believe nonetheless that analysing these interaction sessions can provide meaningful insights on users' interaction behaviors.

From these logs, we found that 34.17% of the videos played had been searched for through the Navigation Menu, confirming the utility of this mode of access. Further analyses on the watch times reveals that videos that had been searched for in the Navigation Menu were watched for significantly longer times, as shown in Figure 5, confirmed with a Mann-Whitney U test ($z = 75049.0$, $p\text{-value} < 0.01$). Looking at travel distances, the much higher travel distances for global navigation observed in Figure 6 demonstrates how the search functionalities offered by the Navigation Menu encourages visitors to take a literal walk through time. Conversely, the local mode of navigation supported 'serendipitous discoveries' [T*00] and a more emergent narrative, driven by users' choices as they discover new performances in the local vicinity displayed by the Main View.

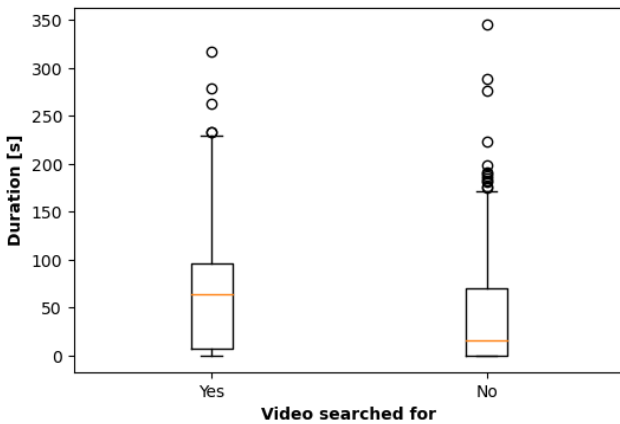


Figure 5: Watch time for the videos based on whether they have been searched for.

4.3. What are the different types of users' interaction behaviors with *Dancing through Time*? (RQ3)

Finally, we conducted a sequence clustering analysis on the sequences of events of each session, used as a proxy for users' interaction behaviors with the installation. We employed the Sequence

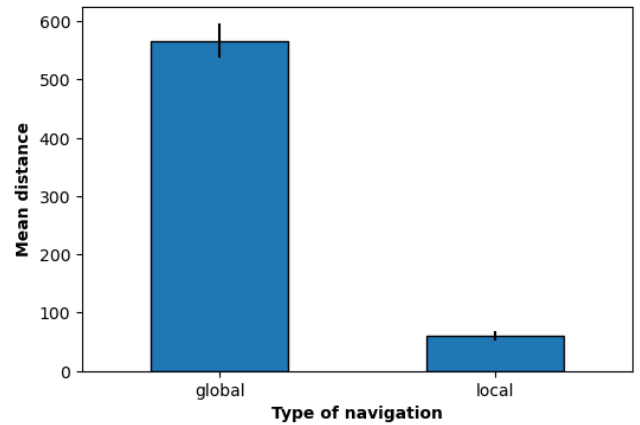


Figure 6: Mean travel distances based on the type of navigation (error bars show standard error of the mean).

Graph Transform (SGT) [REP22] and the Uniform Manifold Approximation and Projection (UMAP) algorithm [MHM18] to embed the sequences. We then clustered the resulting embeddings with Density-Based Spatial Clustering of Applications with Noise (DBSCAN) [EKSX96] to obtain the different types of users' interaction behaviors. Figure 7 presents the transitions between the three interaction events within each session, for each of the five clusters identified. Notice that the proportions sum to 1 along the rows.

We identified the following five types of interaction behaviors:

1. Type I: The user has mostly watched the video in focus in the Main View when they approached the Linear Navigator, resorting to the local mode of navigation.
2. Type II: The user has searched for multiple videos until they decided to watch one specific performance. Their average travel distance indicates a global mode of navigation.
3. Type III: The user has extensively interacted with the installation, accessing all its functionalities. They used both global and local modes of navigation.
4. Type IV: The user has extensively interacted with the installation, but without looking at the alternative modes of visualisation. They used both global and local modes of navigation.
5. Type V: The user has searched a single performance and then

watched a few videos in its vicinity. They have the narrower local mode of navigation.

Additional statistics indicate that Type III, corresponding to the full expected use of the installation, was the most common (35% of all sessions) and yielded the highest number of events, the longest engagement time and the longest average travel distance. Type IV is relatively similar, with the only difference that users did not access the alternative modes of visualisations. Overall though, these two types indicate that 60% of the sessions benefited from both modes of local and global navigation, taking full advantage of the Linear Navigator affordances.

5. Conclusion

The Prix de Lausanne archive is an important testimony for the evolution of dance performances for more than fifty years. Our interactive installation *Dancing through Time* successfully enhance its discoverability, prompting visitors to literally "walk" through time. An extensive evaluation conducted during the 2024 edition indeed confirmed the installation was well appreciated in terms of user experience and user engagement. Analysis of the interaction logs further indicated that 60% of visitors benefited from the unique affordances of the Linear Navigator, walking through the history of this important cultural event. Similarly, the ability to search through the whole collection increased watch times and travel distances, validating our design choices.

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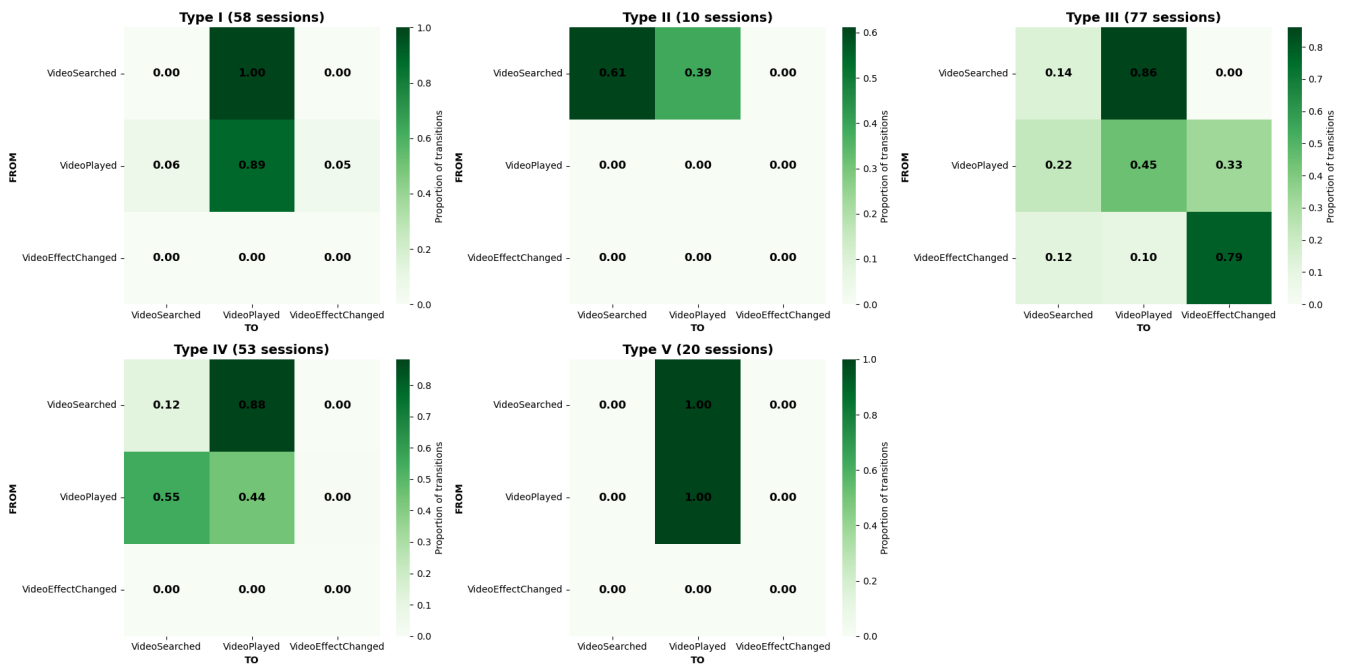


Figure 7: Proportion of the transitions from one event to the next, between the three interaction events *VideoSearched*, *VideoPlayed* and *VideoEffectChanged* for each type of users' interaction behavior identified.