


Sharing and Accessing Autobiographical Memories Tied with Media

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Abstract: Autobiographical Memory is a vital cognitive tool, as it plays a crucial role in identity formation, helping individuals establish a sense of self and continuity across time; and it contributes to social bonding by enabling the sharing of personal narratives. In turn, movies, music, and other media types are always present in our lives due to being among the most relevant and emotional forms of entertainment and education. So much so that we can easily make connections between media and memorable moments and places in our lives, supporting autobiographical memory; and these important remembrances tend to be somehow shared with other people, like family and close friends. With that in mind, we present a user survey carried out to learn about user habits, preferences, and perceived needs in this context; an interactive web application being designed and developed to allow users to register, navigate, and share their memories associated with media, with spatio-temporal and emotional perspectives, aiming to support and strengthen sense of self and social bonding even across generations; and a preliminary user evaluation with encouraging results.

1 INTRODUCTION


Media, in its many forms, has always had a predominant role in our lives and can serve different purposes. Movies, songs, and TV shows are not just a form of entertainment; as with any other art form, they allow us to relate with them by expressing emotions and experiences similar, in some ways, to the ones we have lived throughout our lives (Kubrak, 2020). Music, in particular, quite present in movies as well, can be a strong cue for autobiographical memories, accessible and relatively stable throughout adulthood; being effective for achieving motivation, by favoring positive emotional memory experiences, in particular in older adults, also quite relevant in healthy aging (Jakubowski et al., 2021).

As such, we can, in a straightforward manner, make bridges and connect moments of our lives, like important milestones and more personal remembrances (for instance, trips abroad, or the first time we have been to a place that is near and dear to us) with movies and songs. These connections allow us to build a richer and more complete autobiographical memory since they are based on moments, places, and the emotions that certain forms of media make us feel (Holland and Kensinger, 2010). Sometimes, we also like to share and talk about these key memories with

people that surround us. Usually, these are family members or some of our closest friends, who find enjoyment in knowing these often-shared memories, and sometimes they are even able to feel some of the feelings that those important moments sparked in us. This practice can have positive implications, strengthening relationships with family members, and even in our mental health (Elias and Brown, 2022).

Therefore, it is important to find a way to join media with personal and collective memories and to share them with people that are relevant to us, possibly improving or nurturing relationships, and allowing the discovery of media content that may be found significant. Even social networks and social media platforms like Facebook, YouTube, or WhatsApp, respectively, allow us to share media content that may make us remember important times in our lives in a variety of different ways; but they have a different purpose. While these ways of sharing media content have become a sort of standard in our current digital society, none of them fully explore the articulation between personal memories, the media, and the emotional impacts that these can have, along time and space.

In this paper, we present a user survey conducted to learn about how people relate to media; how often and how they write about, keep, and share important

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moments in their lives; how they represent the passage of time; and their previous experience and expectations concerning applications to store and share autobiographical memories. Based on these results and a review of the background in the area, we propose and present *As Ties Go By* an interactive web application being designed and developed to let users register, navigate, and share with family members and friends some of their most important memories, especially those related with movies and music, and be notified in contextualized settings in time and space, promoting the discovery of new media content by serendipity. Then, we present a user evaluation to assess the usability, usefulness, and overall quality of the user experience with the application, with encouraging results; and conclude with final reflections and perspectives for future work.

2 BACKGROUND

This section presents an overview of the most significant concepts and previous research and applications relevant to our work.

2.1 Context

Autobiographical Memory: At its core, it involves retaining and retrieving specific events, emotions, and contextual details tied to personal experiences (Byrne, 2017). This multidimensional construct comprises: episodic memory, capturing the "what," "where," and "when" of events; and semantic memory, providing the broader knowledge framework that contextualizes these experiences within one's life story. Moreover, autobiographical memory contributes to social bonding by enabling the sharing of personal narratives. Through storytelling, individuals strengthen social connections, foster empathy, and deepen interpersonal relationships (Bietti, 2010). The shared reminiscence of past events creates a communal reservoir of experiences, reinforcing the fabric of family and friendship bonds.

Collective Memory: This type of memory represents the shared recollections and interpretations of historical events within a community, forming a collective narrative that transcends individual perspectives. It emerges through the collective processes of encoding, storage, and retrieval of information within a community. Collective memory is shaped by cultural, social, and historical contexts, encompassing events, traditions, and cultural artifacts that become part of the group's identity (Coser, 1992). One of the inherent strengths of collective

memory lies in its ability to reinforce group identity and cohesion. By weaving a shared narrative, community members establish a sense of continuity, belonging, and shared values (Harris et al., 2008).

Personal Computing: The advent of personal computing has transformed the way individuals interact with information, media, and each other. It encompasses the use of individualized computational devices, such as personal computers, smartphones, and tablets, which have become integral components of modern daily life. These devices empower users to access, create, and share digital content, fostering a new era of connectivity and personal expression (Denby et al., 2016). In the context of memory-sharing applications, personal computing can serve as the foundational framework for facilitating the seamless exchange of movies and music among family members and close friends. The ubiquity of personal devices opened doors to the possibility of a digital landscape where individuals can curate and share multimedia content that resonates with specific events and paths of their lives (Van Dijck, 2007).

Emotional Models: Emotions significantly influence human experiences, shaping thoughts, actions, and wellbeing (Chambel et al., 2011). Movies and music evoke complex emotional responses (Hanich et al., 2014), with even sad or unsettling content often leading to positive experiences through "passive engagement." This unique dynamic fosters a deeper connection between audiences and the media, highlighting the value of understanding emotional models. Two major approaches to emotions rely on dimensional and categorical models. Russell's Model stands out in the dimensional approach; and Ekman's as a Categorical Model based on universally recognized facial expressions. Plutchik's model combines aspects of both dimensional and categorical perspectives, organizing emotions in opposing pairs, with assigned colors, around a wheel. For more details, see e.g. (Caldeira et al., 2023).

2.2 Related Work

Media platforms allow users to explore and gather information about a wide array of media content. One of the most popular is IMDb(.com), allowing users to search for movies and TV shows based on several properties, and to create media lists, save, share, rank and comment, in reviews, these movies or TV shows; whereas, Netflix and Spotify allow to access the actual movies and music content. Within a research project and with a focus both on music and movies, *As Music Goes By* (Moreira and Chambel, 2019; Serra et al., 2020) helps users discover, compare, and

watch music and movies through music versions, musicians, movie soundtracks, and movie quotes, along time and with an emotional flavor. But they are not focused on keeping and sharing memories.

In personal information systems and social media, Facebook(.com) emerged as one of the first social networks to remind its users of a post's anniversary, as a memory they can relive, repost, and share. Even the posts are published in a sequence, as a timeline, in individual accounts or groups. But they are not specifically memories or associated with media, and there are no visualizations and filtering in time, space, nor based on emotions, even though it supports reactions based on emojis and mood. In terms of memories, more recently, some mobile phones and tablets automatically highlight a selection of photos, and generate memories in videos, adding a musical background, to recall and share, as compilations of photos and videos around common perspectives, like proximity in location, or date, or activity (like dining, or at the beach), etc., even suggesting a title. But these are highlights and summaries based on photos and videos, potentially ephemeral and isolated, not in an integrated memory timeline, not in groups, and without an emotional dimension. Apps like WhatsApp or Messenger allow groups and sharing of messages with media; but the focus is on communication, not on memory building or sharing, non on viewing, filtering of searching individual and group storylines other than text search and image/msgs browsing, nor notifying about relevant events regarding these memories.

On the other hand, Family Stories (Bentley et al., 2011) emerged as a noteworthy creation of research to promote intergenerational communication through location-based asynchronous video communication. Its users, family members in this case, capture brief video stories encapsulating cherished memories and engaging narratives, with properties like when and where the memory happened. This allows to notify the family members family, when they are close to the place where the memory told in the video happened. In another context, personalized video storytelling techniques were adopted to design an interactive weather forecast, where: family interaction supported social reflection on the data, and connecting data with memories was a compelling way to foster engagement with the data presented and to support retelling the data stories. In particular, episodic memories form a compelling narrative device to encourage reflection, and, linked with the data, they can be a medium to share personal or social experiences (Van Den Bosch et al., 2022).

EmoJar (Chambel and Carvalho, 2020) is based on keeping and reliving memories associated with

media, with a strong focus on positive emotional impact. Adopting the Happiness Jar metaphor, users save in a digital jar media content represented by "colored papers" as circles (with the color of the dominant emotion) after having commented the semi-automatically detected emotional impact of the media; and then pull one out at random, when feeling down or wanting to be reminded of good memories. It has a personal perspective and allows one to view and filter the jar, even search and filter by time, but it does not represent them along time, nor space.

And "Nothing is more fundamental to a biography than time" (Larsen et al., 1996), although viewing information over time can be a challenge. In previous work, we addressed multimodal search and visualization of movies over time (Caldeira et al., 2023) with recent extensions to *As Music Goes By* (Moreira and Chambel, 2019). It explored methods that take into account how emotional information evolves as a movie unfolds, and enables users to query movies based on dominant emotions, percentage of different emotions, emojis, and emotional trajectories along time, inside the movies; now we are focusing on the time when the memories happened, along the years.

3 USER SURVEY

Before designing and developing the application, we conducted a user survey to learn about: 1) how people relate to media, in terms of their habits, attitudes, awareness, and preferences; 2) how often and how people write about, keep, and share important moments that happened in their lives; 3) the different ways that people have to represent the passage of time; and 4) their previous experience and expectations concerning applications that allow them to store and share their memories, connected or not to media.

Method: The survey was made available and advertised on social media and work and family contexts, to reach a wide range of people, in terms of background, age, and interest in digital platforms. It was carried out as: an online questionnaire, for wider participation; and some interviews, based on the same questions, in an attempt to get more complete and insightful answers. It had a total of five sections, mostly relying on closed questions, with the opportunity to choose "other" options and provide additional comments.

Results: We present a summary of the results gathered from the first 45 participants in the questionnaire and 8 in interviews, focusing mainly on the aspects that more closely inform our work.

Section 1: Demographic information: Participants aged 13-64 (M:28), 62.3% Fem, all from our country (Portugal); 26.4% completed high school, 5.7% did not, 7.6% had a professional course, 43.4% BSc, 17% MSc. Participants work or study in fields that range from informatics (20.8%) to health (11.3%), psychology (11.3%), and education (9.4%), along with others less frequent, in areas like finance, economics, law, sociology, arts, and math.

Section 2: Accessing and sharing media content: most common were communication platforms (like WhatsApp or Messenger), followed by social networks, video, and music streaming services, then "others" (like videogames, museums, and movie theatres). Their motivation to use media: more often to feel more relaxed, then to share with family and friends, to feel more motivated, and to help them go through hard times. Media content shared more often with family and friends: music, followed by movies and TV shows, photos, and videos.

Section 3: Memory register and sharing: 28% quite often, 25% occasionally, and 47% rarely or never, write about and register their memories; whereas 55% quite often, 29% occasionally, and 16% rarely or never, share important memories with family or friends. To keep and share memories, they use photos (88.2%), videos (66.7%), conversations (58.9%), digital writing (19.6%), and personal journals (11.8%). The importance of keeping and sharing memories with family and friends was considered high (5-1): very important (5) 52.8% | 26.4% | 15.1% | 5.7% | 0% (1) not important. They associate media with important memories: very often (28.3%), often (41.5%), and reasonably often (24.5%). In the interviews, they mentioned specific memories, like: "going to the fountain in Barcelona where Shakira recorded one of her video clips", "going to Disney in Paris", and "a Fast and Furious movie recorded near my father's birthplace".

Section 4: Time Perception: ways of visualizing time: based on events that happened along time (66%), in the form of a timeline (35.8%), cyclic (17%), and divided into chapters (1.9%). In the interviews, they were also asked to recall the year 2016 (when our country won the Euro football championship, and most participants mentioned it) and to think about the last and next years, to help achieve a clearer awareness about how they perceive and represent time in their minds; as in the questionnaires, with a prevalence of the role of the main events that happened or are expected to happen in the future coming to their minds. Big events' impact on Time perception: they are like milestones and help have a better perception of time (80.8%), it makes time go

faster (13.5%), go slower (3.8%), or have no impact (1.9%). Effect of digital technology, like social networks, etc., on time perception: they agreed that it makes time passage seem faster (76.9%), has no such effect (15.4%), or depends on the situation.

Section 5: Interest in platforms that connect memories to media: Very Interested, VI:(20.8%), and Interested, I:(71.6%). Interest in hypothetical features of a platform that connects memories to media: 1) saving memories with media and time visualization in a private journal VI:(47.2%); I:(35.8%); and 2) sharing memories with media with time visualization in a shared space: VI:(30.2%); I:(43.4%); 3) identifying songs playing to access and create related memories: VI:(29.4%); I:(45.1%); 4) having emotional information on the memories they saved and shared: VI:(29.4%); I:(31.4%); 5) filtering memories by author in groups: VI:(32.1%); I:(37.7%); and 6) notifications about memories based on time they happened, or place close to their current location, etc.: VI:(32.1%); I:(43.4%). On the last open question, about feature suggestions, the most relevant answers include: "having our memories show up in a map visualization"; "configure to not be reminded about some memories, e.g. sad events"; and "be notified when someone from our family adds a memory with us".

4 AS TIES GO BY

This interactive web application has been designed and developed to allow users to register, access, and share their memories, especially those associated with media like music and movies, taking into account the results of the user survey. It integrates *As Music Goes By* (Moreira and Chambel, 2019; Serra and Chambel, 2020), where users can search, visualize, and explore music and movies from complementary perspectives of music versions, artists, quotes and movie soundtracks over time; and the *EmoJar* application, also developed in the context of the AWESOME project (Chambel et al., 2023). In this paper, we emphasize this new perspective centered around personal and shared autobiographical memories, connecting or tying media with life events and the people involved, by the name of *As Ties Go By*.

Memories can be registered in a personal space, like in a journal; and also shared in groups, like family or friends, at the time they happened, not necessarily when they are registered. In each of these spaces, memories can be represented in different perspectives. Main features are described next, and illustrated in Figs. 1-2, exemplifying navigation.

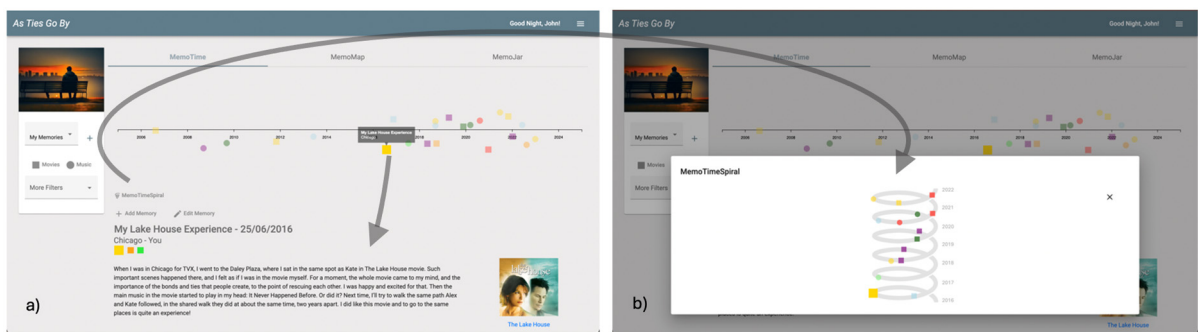


Figure 1: As Ties Go By - MemoTime View in “My Memories” Space: (a) MemoTime view (1st tab on the top) showing timeline with memories, and exemplifying the access to a memory detail below the timeline; (b) MemoTimeSpiral view.

Memory Spaces: When users first land in the application, they are met with their own memories in the “My Memories” personal space (Fig. 1a). They can switch to their group memory spaces (e.g. “The Smiths”, Fig. 2b), choosing from a scrollable list on the left, below the identification of the current space.

Memory Views: The first View displayed when users enter a memory space (Fig.1) is **MemoTime**: Memory markers are placed chronologically on the dates they occurred on an horizontal timeline, offering a familiar and comprehensive overview of time within the memory space. For an alternative perspective, based on spirals (Weber et al., 2001), aligned with the “cyclic” representation identified in the user survey, and the annual circle we go around the sun: users can switch to the **MemoTimeSpiral** View (Fig. 1b), accessible in the MemoTime tab. Time flows from the bottom to the top of the spiral, each lap representing a year. This design highlights temporal patterns within the memory space, such as recurring events like summer holidays or Christmas.

On **MemoMap** View (Fig. 2b) users have a world map, where they can see the memories in the places they happened, depending on the zoom used in this Google Maps view. Like in the other views, filters can be applied, here with a geographical perspective.

On **MemoJar** View (Fig. 2a), inspired by EmoJar (Chambel and Carvalho, 2020), users add their memories to a happiness jar, and later revisit them, to remember or relive a happy or treasured memory; with a twist of serendipity, by randomly picking one.

Memories: In all the Views, memories are represented by pins, markers, with shape dependent on media type (circles for music, inspired by cd or vinyl music records; and squares for movies, inspired by celuloïd film frames); and the color of the main emotion associated with that memory, based on

Plutchik’s model of emotions (Caldeira et al., 2003). When clicking a memory pin, it gets highlighted in the view, and its details appear below (Fig. 1a, 2a,b). The memory title is followed by its date; location; or pins reflecting the media type and dominant emotions (highlighting in front of the title the one that corresponds to the current Memory View, and presenting the other ones below; along with author, media content, and a brief description written by the user. **Music** and **movies** can be accessed via As Music Goes By (Fig. 2b-c-d), with the opportunity to access more information and songs contextualized in movie soundtracks.

To create a new memory, users click the “Add Memory” button, below the active tab view, opening a pop-up form for inputting memory details. After saving, the memory appears in the various memory view tabs. Users can also edit memories, opening a similar form pre-filled with the current details.

Memory Filters: select content to be displayed on the different Memory Views, for more focused perspectives and understanding of memory spaces, in 2 types: **Media filters** accessible via 2 labeled buttons: Music & Movies, beneath the memory space list; **Hashtag filters** in a dropdown list below the media filter buttons allow users to select one or more hashtags for filtering. These can signify various themes like holidays, birthdays, or summer vacations.

Notifications: based on time and space. Users are notified about memory anniversaries and memories that happened close to their current location. Users can click on them to access corresponding memories: the memory pin and the details below (Fig.2b).

See Figure captions for more detailed descriptions of the exemplified navigation among different views.

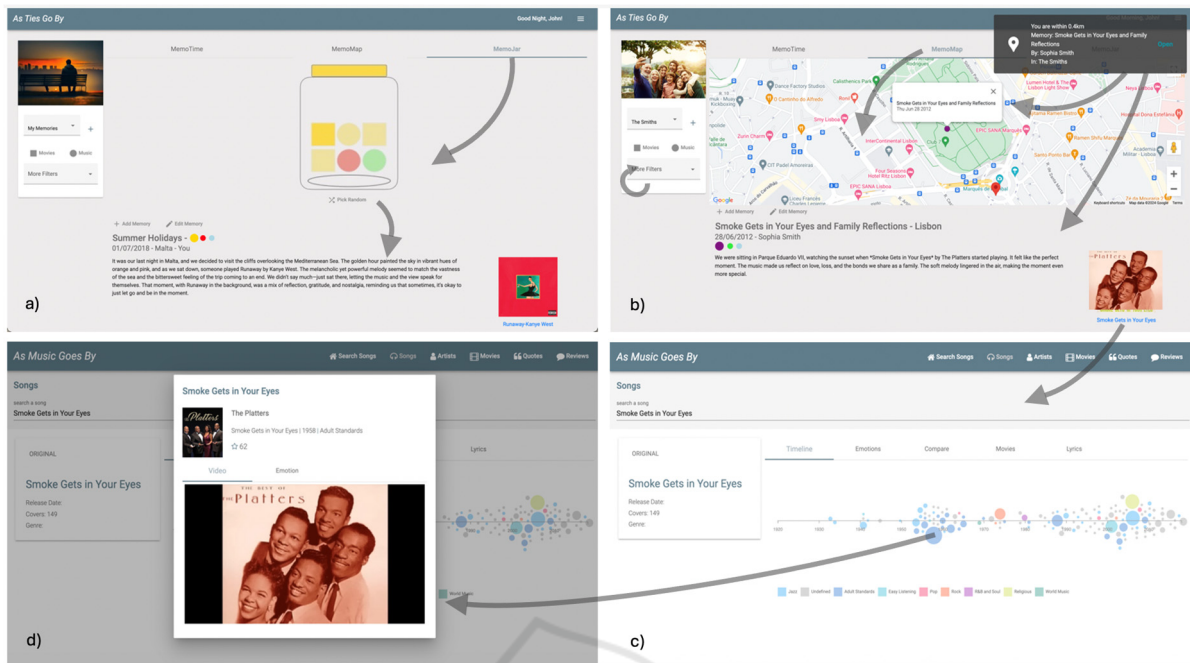


Figure 2: As Ties Go By – MemoJar and MemoMap Views, Notifications and Access to Music and Movies: (a) MemoJar View’s ‘Pick Random’ button retrieves a memory: (b) MemoMap View, transitioning from the personal to a group Memory Space (“The Smiths”), then receiving a location-based notification, and by clicking on it, the notified memory of The Smiths Family is accessed with details, below, and highlighted in a close-up of the map, where it happened, in relation to the current user location, near by; this memory is about the first ball of the user’s grand parents, where they danced to the song Smoke Gets in Your Eyes; (c) Accessing the memory song: Smoke Gets in Your Eyes to watch and navigate it, in As Music Goes By (Moreira and Chambel, 2019): first contextualized in its different versions; and (d) playing the song by the Platters.

5 USER EVALUATION

A preliminary user evaluation was conducted to assess perceived usefulness, usability, and user experience in the As Ties Go By interactive features.

Methodology: A task-focused evaluation was carried out using semi-structured interviews and direct observation as users interacted with the application and all its features. Before the tasks, participants were introduced to the evaluation’s purpose, answered demographic questions, and received a brief overview of the application. The evaluation was based on USE (Lund, 2001), assessing the perceived Usefulness, Satisfaction, and Ease of Use for each task on a 5-point scale. After the evaluation, users were asked to provide an overall assessment of the application through a global USE rating, and encouraged to identify their favorite features, suggest potential improvements, and describe the application’s perceived qualities, selecting predefined ergonomic, hedonic and appeal terms (Hassenzahl et al., 2000).

Participants: The evaluation involved 10 participants, 6 males and 4 females, ages 22-48, average 30.3. 4 held bachelor’s degrees, 3 had master’s degrees, 1 had a technical degree, and 1 completed high school. Professionally, they worked in informatics, health, psychology, business, physics, and education. All familiar with digital applications to some extent. Music consumption habits: 9 listened to music daily, 1 a few times per month, using: Spotify (7 participants), YouTube (4) and Apple Music (2). Movie consumption: 5 watched movies 2-3 times per month, 3 weekly, and 2 monthly. They also reported using streaming services like SkyShowtime, Prime Video, Disney+, and Netflix. Sharing memories: 4 occasionally document or save important moments, 3 monthly and 3 weekly. Memory-sharing: 4 occasionally, 3 weekly, and 3 daily. Almost all (9 out of 10) agreed that storing and sharing memories with family and friends was important or very important, and 8 found it easy or very easy to connect memories to media content like music and movies; overall highlighting the relevance of the platform’s purpose.

Results: The users completed all tasks efficiently and with minimal hesitation, overall having a positive experience with the application, with main features highlighted in Figs. 1 and 2; and the USE results summarized in Table 1.

Table 1: USE evaluation of As Ties Go By by feature.

Scale:1-5: lowest-highest); M=Mean; SD=Std. Deviation

F#	Feature	U		S		E	
		M	SD	M	SD	M	SD
1	MemoTime view (<i>mean</i>)	4.3	0.8	4.3	0.7	4.7	0.6
1.1	MemoTime	4.4	0.7	4.5	0.5	4.8	0.4
1.2	MemoTime Spiral	4.1	0.9	4.0	0.9	4.5	0.7
2	Filters (<i>mean</i>)	4.6	0.6	4.8	0.4	5.0	0.2
2.1	Media Filters	4.6	0.6	4.8	0.4	5.0	0.0
2.2	Hashtag Filters	4.5	0.5	4.8	0.4	4.9	0.3
3	Memory Entry Creation	4.9	0.3	4.8	0.4	4.7	0.5
4	MemoMap View	4.8	0.4	4.9	0.3	4.9	0.3
5	MemoJar View	3.7	0.9	4.0	0.8	4.9	0.3
6	Notifications (time&place)	4.5	0.5	3.5	0.7	4.8	0.4
7	Access to Music&Movies	4.2	0.5	4.3	0.4	4.0	0.8
8	Memory Spaces (<i>mean</i>)	4.7	0.4	3.6	0.8	4.8	0.5
8.1	Memory Spaces: Types	4.5	0.5	3.5	0.7	4.8	0.4
8.2	Memory Spaces: Creation	4.9	0.3	3.7	0.9	4.7	0.5
	<i>Total by Feature (mean)</i>	4.6	0.6	4.3	0.6	4.7	0.4
	Global Evaluation	4.3	0.4	4.1	0.9	4.6	0.6

Global Evaluation: Overall, participants rated the application quite positively in terms of usefulness (U:4.3), satisfaction (S:4.1) and especially ease of use (E:4.6). Interesting to note that, in spite of high scores for other features during the evaluation, at the end, when asked about preferences, they especially enjoyed features that are more specific to what As Ties Go By is all about: MemoTime and MemoMap views, time and location-based Notifications, and the contextualized Access to Music and Movies from memories. As final suggestions, they highlighted the importance of developing further mobile features and related notifications, citing benefits like easier real-time capture of moments; and improving media connections to services like IMDb and Spotify.

Table 2: Quality terms users chose for As Ties Go By.

H: Hedonic; E: Ergonomic; A: Appeal;
bold: more frequent; *italics:* negative terms

Terms	type	#	Terms	type	#
Original	H	8	Innovative	H	3
Understandable	E	7	Aesthetic	A	3
Simple	E	7	Attractive	A	3
Interesting	H	6	Predictable	E	2
Sympathetic	A	6	Trustworthy	E	2
Pleasant	A	5	<i>Unaesthetic</i>	A	1
Good	A	5			

Finally, users were asked to describe the application using quality terms (Hassenzahl et al., 2000), results in Table 2. The chosen terms are reasonably well distributed among the (H)edonic, (E)rgonomic and (A)ppeal qualities. Original was the most chosen term; then Understandable and Simple; Interesting and Sympathetic, then Pleasant and Good, all chosen by half or more subjects. Just one negative term chosen: Unaesthetic (by 1 subject), but superseded by the opposite positive term: Aesthetic (by 3). These results align and complement the feedback from the feature evaluation and the user comments.

6 CONCLUSIONS AND PERSPECTIVES

This paper addressed the concept and introduced interactive means to capture, visualize and link memories with media, such as movies and music, along time and space, with an emotional impact, and the potential to enhance memory recall and foster deeper connections, by sharing important memories and moments that happened in our lives with others, like family and friends. User feedback in the evaluation highlighted features like MemoTime, MemoMap, notifications and access to music and movies as particularly engaging; with most chosen quality terms including Original, Interesting, Sympathetic, Pleasant, Simple and Understandable; and the application received quite good ratings in usefulness, satisfaction, and ease of use. Quite relevant and encouraging as a proof of concept, with potential for future developments

Future work includes refining, based on the evaluation and user feedback, and further extending the interactive features. In particular, main challenges and perspectives for the future include:

To explore further the spiral representation, in 3D, and other time representations, and extend search, based on time and emotions (Caldeira et al., 2023) in this context. To go beyond a web application to include a dedicated mobile app with seamless crossplatform functionality and native notification support, to improve flexibility and engagement. To extend the notifications, beyond time and space, taking into account the emotions associated with the memories and felt by the users, and other contextual information, including ambient music detection to trigger related memory recall in serendipitous ways.

To go towards user-generated content at a larger scale, and consider integrating and accessing media content in larger platforms like IMDb and Spotify.

To allow memories to have richer ways for user expression in this context; linking to songs on the movies' soundtracks; and the possibility of having trajectories, instead of a static position, on the map.

In group spaces there is a potential challenge of having different versions or perspectives of the same events. Who is right or how can they coexist as shared memories? Approaches like Storytelling could be explored here, with interactive digital narratives, for its adequacy in complex, causal and multi-sequential stories (Silva et al., 2021). This type of biographical information could as well be explored in reminiscence therapy with potential benefits in social interactions and self-esteem.

Finally, it is also important to account for privacy, while providing significant ties involving memories with media.

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