Memorable and Emotional Media Moments: Reminding Yourself of the Good Things!

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Keywords: Interactive Media Content, Wellbeing, Emotions, Positive Computing, Self-assessment, Sensors, Multimodality, Happiness Jar, Personal Journal.

Abstract: Experiencing digital media content is among the most accessible and beloved recreational activities people indulge in. It can promote learning and creative thinking, as well as being an important source of entertainment, with a great impact in our emotions. In particular, it has the power to foster positive emotions and attitudes, to regulate or enhance our mood, contributing to our general sense of wellbeing and quality of life. This paper discusses and explores the potential of media and how it can be addressed to create a tool to help individuals become more aware of their emotions and promote their psychological wellbeing. It discusses main motivation and background and presents EmoJar, an interactive web application designed and developed to allow users to collect and relive media that have significant impact and remind them of the good things they experience along time in their lives. EmoJar is based on the Happiness Jar concept, enriched here with media and its emotional impact, as an extension to Media4WellBeing, aligning with the goals and approaches of Positive Psychology and Positive Computing. User evaluation results were very encouraging in terms of perceived usefulness, usability and user experience. Future work will lead us further in the aim to provide a useful and interesting digital experience that further supports users in their journey of personal awareness and development.

1 INTRODUCTION

Accessing and consuming digital media content that we treasure has never been so easy and quick to do. Watching videos (from short clips, to full movies), listening to audio (like podcasts, audio books, or music), surveying images (like memes and photographs of awe-inspiring landscapes), and reading text (factual, or literary) are among the most accessible and beloved recreational activities. Besides promoting learning, improving cognition, endorsing creative thinking, aiding in productivity, and generally being great sources of entertainment, media has a great impact in our emotions (Oliveira et al., 2013). In particular, it has the power to foster positive emotions and attitudes, to regulate or enhance our mood, contributing to our general sense of wellbeing and quality of life (Bernardino et al., 2016; Kok et al., 2013).

In this paper, we review main concepts and related work as a background to help understand this power, and how we can support users becoming more aware, and regulating their emotions with media through the EmoJar. We describe this interactive web application designed and developed as an extension to Media4WellBeing (Bernardino et al., 2016) based on the Happiness Jar concept, to collect and remind users of the good things they experience along time, enriched with emotionally impactful and memorable media, and supported by sensors and self-report. It aligns with the approaches of Positive Psychology and Positive Computing with the ultimate goal of contributing to individuals' psychological wellbeing and development. The evaluation allowed validating the concept and the design options; and the results revealed users' interest and appreciation contributing to identify and confirm preferred features, usability aspects and future directions.

2 BACKGROUND

We present main concepts, goals and approaches relevant in media support for wellbeing, as a background and context for our work and contributions.

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2.1 Wellbeing, Positive Psychology and Positive Computing

According to Dodge et al. (2012), coming up with a single definition of wellbeing can be quite challenging. But overall, one can say that wellbeing is having the physical, psychological and social resources necessary to meet a particular physical, psychological or social challenge.

Positive Psychology focuses on the psychological component of wellbeing (Seligman et al., 2005). Established by Seligman in 1998 out of frustration with Psychology's narrow focus on negative aspects and disfunctions, requiring to be solved and cured. This newer perspective posits that individuals should learn to embrace a more positive perspective, which could lead to significant shifts with impact on wellbeing and happiness. In one of his studies (Seligman et al., 2005) on gratitude, participants wrote down 3 things that went well each day, and why, every night, for one week. This greatly and lastingly contributed to individuals' psychological wellbeing, suggesting that 1) the more we shift our focus away from negativity, the happier we will be, and that 2) reflecting on the good things that happen to us contributes to our psychological wellbeing. The EmoJar intends to support this attitude with digital media.

Positive Computing is a related field, founded by Calvo and Peters in 2014 (Calvo and Peters, 2014), centered upon the design and development of technology that supports psychological wellbeing and human potential. It posits 3 approaches: 1) the preventative approach, where technology is redesigned to address or prevent detriments to wellbeing; 2) the active approach, where it is designed to consider and promote the wellbeing of individuals (the one adopted in our work); and 3) the dedicated approach, where technology is created and totally dedicated to promoting wellbeing.

2.2 The Happiness Jar

The Happiness Jar concept is about giving its users the chance to collect and remind themselves of all the good things that come out in their life (e.g. every day for a year). The traditional ones are based on a physical jar (often made of glass with a lid) where individuals place small papers scribbled with things that made them happy, proud, or grateful, to be read on special occasions (e.g., New Year or birthday), or when its owners feel like they need to be reminded of the good things in their lives. In spite of its simplicity, the idea behind this tool is quite powerful, aligning with Seligman's (2005) and related research on wellbeing and positive emotions. The Happiness Jar not only serves as a great time capsule of life's best, but may also promote individuals' psychological wellbeing. However, the traditional analog physical jar is limited in its ability to support users, in terms of flexibility, portability, media types, organization, search, access, and emotional awareness.

In digital apps like HappiJar (Cooper, 2014), Jar of Awesome (JarAwe-ref), and The Happiness Jar (TheHappiJar-ref), users can write down and collect happy moments in a digital jar, and optionally associate photos or music to them. Happiness Jar and Jar of Awesome allow categorization of happy moments. Jar of Awesome allows access in a timeline, while HappiJar supports shared jars and the possibility to shake to get a random jar entry. Not in the form of jars: HappyFeed (HappyFeed-ref) and Applied Happiness (2016) apps are daily journals to register positive moments, thoughts or memories with optional photos and locations. These projects allow users to register what makes them happy, but do not explore the power of media to do so, media being an optional add-on. On the other hand in approaches like Cove (Humane, 2015-19), media is central but from the perspective of the creator; users create small loops of music to help them express how they feel in a safe, positive environment, and it does not also support detecting user's emotions.

2.3 Media Impact on Emotions and Psychological Wellbeing

Media consumption (of video, audio, images, and text) takes a significant share of our waking hours, making media impact concerns increasingly relevant. Most research has focused on detrimental effects but, more recently, research has started to explore potential benefits. It can e.g. provide relief from stress and daily hassles, or facilitate recovery after a long day (Reinecke, 2011). It can also: have us reflect upon moral virtues and the purpose of life; impel us to be more altruistic, empathetic, compassionate, tolerant, and let go of feelings of resentment; make us experience a range of emotions; and help us be more appreciative of our life, and grateful for the good things in it.

In spite of the emotional impact of media and its potential to foster improved psychological wellbeing, most work does not allow users to access, visualize, explore, save and later relive media based on this impact (Oliveira et al., 2013; Bernardino et al., 2016). In our own work: in iFelt (Oliveira et al.,

2013), users were given the ability to access, explore, and visualize videos classified according to the emotions felt (using biosensors and 5 out of 6 basic emotions by Ekman (1992)); MovieClouds (Chambel et al., 2013) allowed to access, explore and watch movies based on their content, mainly audio and subtitles, and with a focus on emotions expressed in the subtitles, in the mood of the music, and felt by the users, like in X; in Media4WellBeing (Bernardino et al., 2016) we took a step further to include other media, a richer emotional model, and the sense of wellbeing. More recently, it also allowed users to add personal tags and self-assessment in meditative states (Martins et al., 2018); but not emotions, and no information about why media made them experience those emotions or improved their wellbeing, for increased awareness and to recall in future accesses - like we now included in EmoJar, to combine the ability to consume media based on the emotional impact with the strength of journals and jars.

3 EMOJAR

EmoJar is an interactive media application that is based on the concept of the Happiness Jar, where individuals typically collect and recall in small papers things that made them happy, proud or grateful for, now enriched with media and their emotional impact. It has been designed and developed to let its users save, access, explore, and relive media that was impactful and that they believe to have positively contributed to their psychological wellbeing. Users can rely on the emotional impact based on biosensors and self-assessment, by registering their personal perception and reflections about the impact of the media and the associated memories making it worth keeping in the jar, to be relived. What follows is a presentation of EmoJar characteristics and features, namely: its emotion model and detection methods, how to collect and relive media, how to filter the EmoJar for particular entries, how one may interact with it, and what one may learn from using it.

3.1 Emotions: Power, Models and Detection

Emotions can be classified as positive or negative. Positive emotions have been shown to foster improved health, coping ability, physical and psychological wellbeing, social relationships, work life, and even income. They also enhance cognitive capacities and creative problem solving; whereas negative emotions, which narrow the individual's repertoire of thought and action, have a valuable survival strategy, but have been shown to be detrimental to physical and psychological health and many other aspects of life (Chambel et al., 2011; Kok et al., 2013). Emotion valence (polarity: positive-negative) is one important dimension, and along with arousal (intensity) define the Dimensional Model of emotions (Russell, 1980) in a spatial 2D circumplex. The Categorical Model defines emotions as discrete states, and can be represented in the dimensional model.

In (Bernardino et al., 2016), we present more details about models of emotions and wellbeing, and describe the model we adopted in Media4WellBeing, the same now in the EmoJar. It extends basic emotions from Ekman (1992) and Plutchik's (1980) (adopting his color choices), aiming at: 1) emotional richness; 2) covering positive emotions associated with media and wellbeing (e.g. Ekman only has one positive emotion, insufficient in this context); and 3) being simple enough to enable an automatic identification of emotions, based on valence and arousal.

Figure 1: Emotion color wheels in EmoJar.

Figs. 1 and 3 present the adopted model with categorical emotions placed around Russel's circumplex as a wheel of emotions. Fig.1 presents 3 versions. The first one adopts emotion colors from Plutchik's (1980), but since these models have different dimensions, the colors do not make as harmonious smooth transitions around the wheel as in Plutchik's. The second version adopts Plutchick's color wheel mapping to the emotions on our wheel, with an harmonious color sequence; and the third version adopts Geneva wheel (Sacharin et al., 2012), also with smooth transitions but with dimensions closer to our own. Although some color-emotion mappings are more common than others, these tend to be subjective and also dependent on culture. Different options in EmoJar allow for flexible and personalized settings. Users may choose their favorite anytime (clicking on the current wheel on the right top corner, e.g. Fig1) and the interface adjusts to the new color mapping. This was appreciated by the users in the evaluation, and even,

by some, the possibility of having users personalizing or painting their own wheels - being considered for future work.

One of the challenges in these approaches refers to how wellbeing and emotions can be measured, besides from self-assessment. To a greater or lesser extent, they tend to bring about physiological changes, which can be detected and processed, using sensors. We are using BITalino (for ECG and EDA) and MUSE (for EEG) to detect emotions based on valence and arousal, complemented with meditative states (Bernardino et al., 2016; Martins et al., 2018).

3.2 Collecting and Reliving Media

Users can collect media while browsing and accessing it. If the EmoJar is accessed in its initial empty state (Fig.2a), it prompts users to consume some media in the content selection page (Fig.2). Users may save content in the jar without consuming it, pressing the icon to the right of its title (Fig.2b).

But at least they need to register what the content means to them, in the "paper"/entry they save in the jar, when there is no emotional information detected. Fig.3 shows the case when there is an automatic

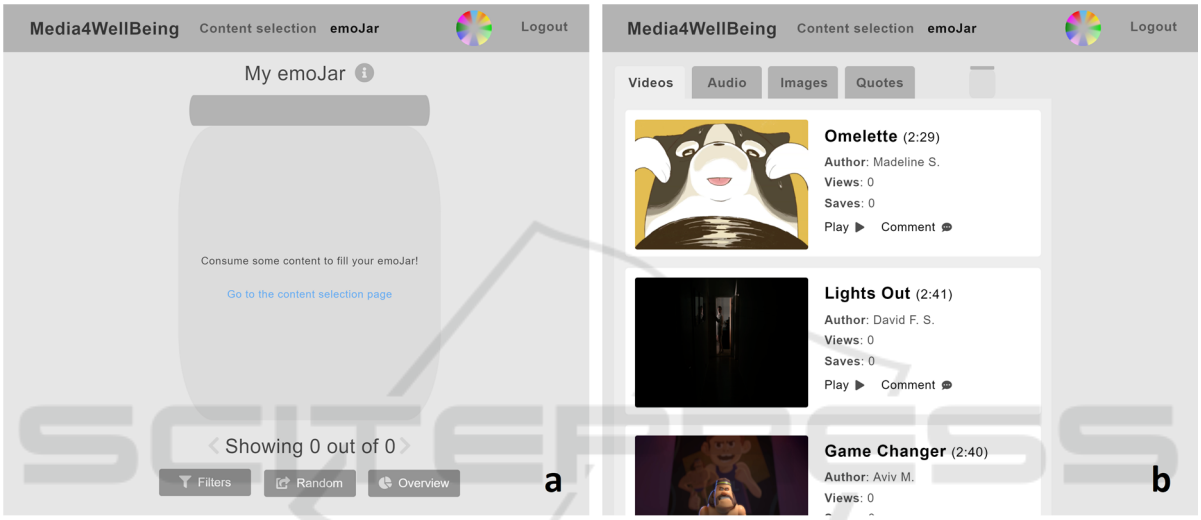

Figure. 2: Jar initial state - empty. (a) EmoJar invites users to consume content on the content selection page; (b) users can access content items (e.g. videos) and play (Play icon) or save them in the jar (Comment icon); they can check how many times this content was Viewed and Saved, the latter useful in situations when the same content was meaningful, possibly with different emotions, and it is relevant to save it. A new jar entry is created for each time it is saved.

Figure 3: Content consumption and emotional evaluation. a) Each content (left) and its emotional evaluation (center, in emoPaint view here) is represented by a circle (right) with dominant emotion color (detected or self-reported), with an icon representing media type: users may comment to add self-assessment (Fig.3-Fig.5); and a/b) Save/Remove it as a jar entry.

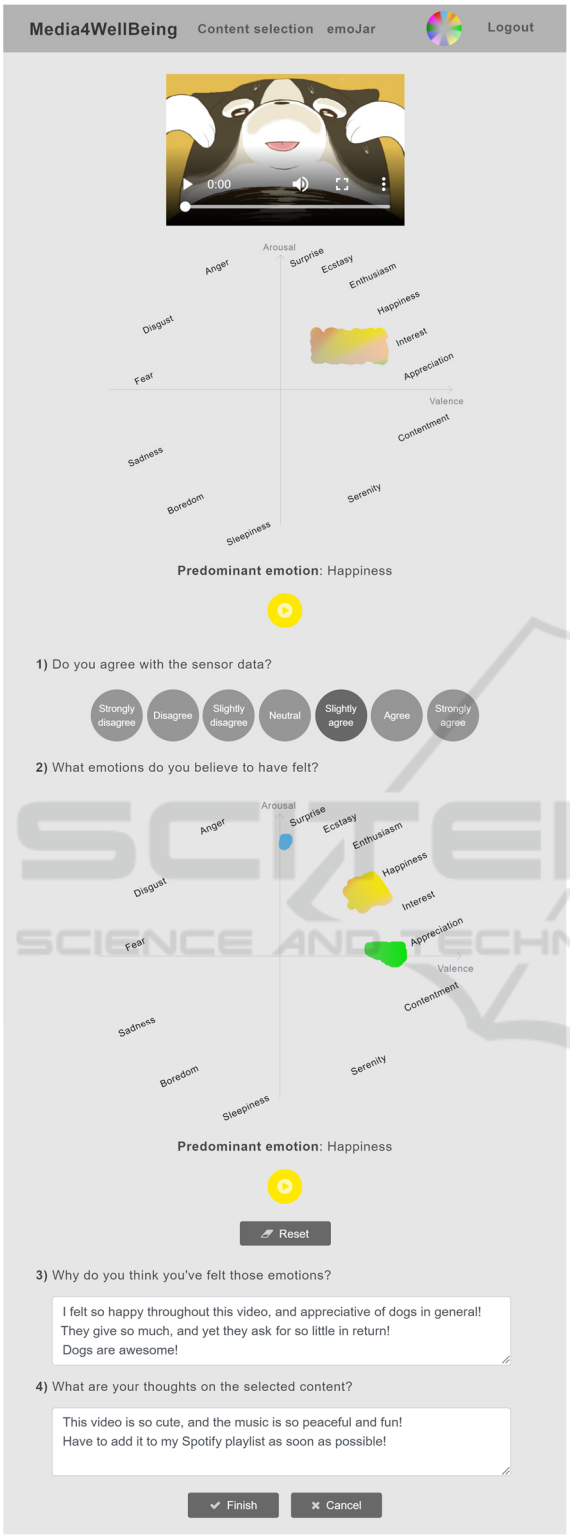

Figure 4: Entry in detail - content and detected emotions (above); below: 1) level of agreement with detected emotions; 2) self-reported emotions; 3) why user felt this emotions; and 4) what user thinks about the video, what makes it memorable.

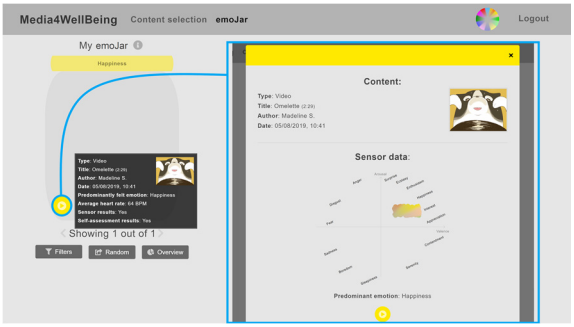

Figure 5: Entry preview in the jar (left) before opening it (right), when open is similar to Fig. 4, not editable in viewing mode.

detection while consuming a video. Users get emotional feedback (results provided by Media4WellBeing with physiological sensors) that can be presented in the form of a painting in the emotion wheel (emoPaint), a tag cloud (emoCloud), or a chart (emoChart) (Bernardino et al., 2016), synchronized with the video as it is being watched, or afterwards (avoiding interfering with the watching) by animation or final state. The users then have the option to save (or remove) the selected content and its emotional impact to their jar (Fig.3a/b), and to further complement with information by self-assessment (Fig.3b-Fig.4, and Fig.5 (right)).

In the paper/entry saved, besides the content that provides context, and the detected emotions (in emoPaint representation in Fig.4), users may comment and report their self-assessment, by: 1) rating how much they agree with the automatic emotion recognition; 2) can draw their personal perspective of how they felt; 3) comment on the felt emotions; and 4) add their thoughts and perceptions about the content, its emotional impact and the associated memories making it worth keeping in the jar. In Fig.4, the user agreed with the emotions identified by Media4WellBeing (1), but there were others (Surprise and Appreciation) that were added/painted (2), explaining why these were felt emotions (3), and commenting on how this video was important and what made it memorable (4).

Once content has been consumed and saved or commented upon, an EmoJar entry in the shape of a circle (representing a crumpled paper, Fig.2) is created, and can be retrieved and relived later on by the user. The entry's color is defined by the predominantly felt emotion recognized by Media4WellBeing or the users (in self assessment), the center icon representing content type.

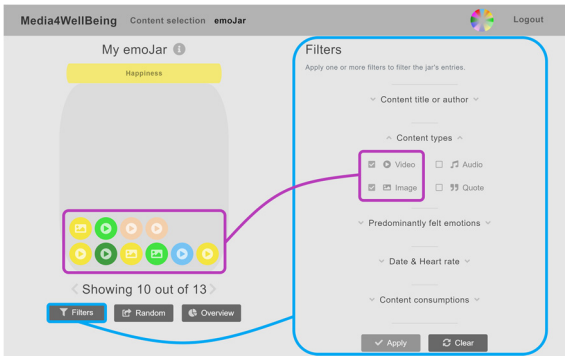

Figure 6: Jar filter in EmoJar. Filters (right); jar state after applying content type filter for videos and images (left).

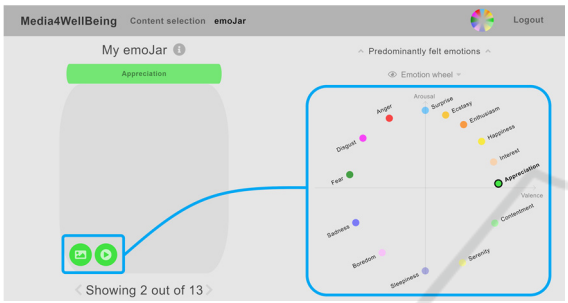

Figure 7: Jar state after dominant emotion filter for Appreciation.

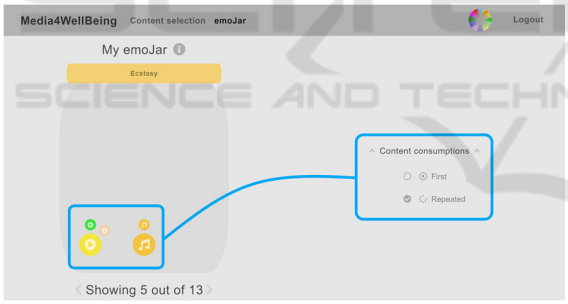

Figure 8: Filter for content with repeated saves.

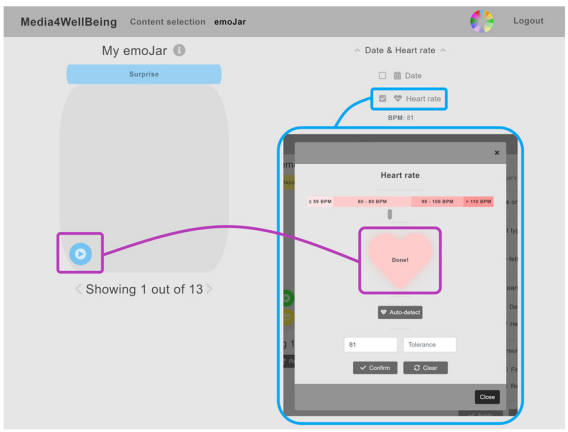

Figure 9: Applying average heart rate filter.

Figure 10: Tooltips pop-up with filter options when filters close.

This content entry, and whether it has associated results/comments can be previewed on hover, and reviewed/relived upon clicking (Fig.5). By way of its color and label, the jar's lid reflects which emotion is more predominant in the jar.

3.3 Jar Filtering in Different Perspectives

Along time, users' jar starts to fill up and users may also have in mind different properties to look for, bringing about the need for filters, to allow users to find and review contents that contributed to they wellbeing in different ways (Fig.6-10). As presented in Fig. 6, selecting the "Filters" option will show all the filters in an overview with parameters hidden.

These will be revealed for each filter, when selected: content type in the example, with video and image selected in the check boxes. Figs. 7-10 exemplify other filters, with chosen parameters and results. Currently, it is possible to filter entries by: words in the title or the author; content type (video, audio, image or quote); predominantly felt emotion (selected in the emotion wheel in Fig.7); with or without biosensor or self-assessment results associated; first entry of all the content saved ("First") or all the entries of the same content that were consumed and saved/collected more than once ("Repeated") because it made sense to save at different times, possibly with a different emotional impact and new comments (Fig. 8); date or time interval when entries were collected (using a calendar); and average heart rate (Fig. 9).

These filters can be selected separately or combined. The jar then only shows matching entries (Figs. 6-10). At any time, the lid of the jar adopts the color and name of the dominant emotion in the set of entries satisfying the filtering criteria.

3.4 Multimodal Interaction

Multimodal interaction is being adopted for flexibility, accessibility and its potential to increase engagement and immersion (Serra et al., 2014) when interacting with the jar and its contents.

Concerning heart rate filtering (Fig.9), we designed and developed different modalities for inserting a value (with a tolerance within its vicinity): 1) text entry; 2) selecting a value on a scale (a bar with different colors highlighting typical values); 3) tapping the heart icon through mouse, keyboard, or touch screen (as feedback the heart updates the numeric value, and changes color, according to the colored scale above); or 4) auto-detecting users heartrate with sensor (placing finger over the video camera on the mobile phone, it measures image brightness variability, in accordance with heart rate and subsequent blood pumping reaching the finger). For their current heart rate, in the absence of a sensor, users may e.g. press the carotid artery to sense and try to tap the heart in the interface (3) with the same frequency.

We also designed a feedback based on user's current heartbeat, e.g. in the rhythm of the emoPaint output, or the rhythm of background color change between two colors, or yet through haptic smartphone vibration, while a video is being watched, and plan to consider other modalities in the future. Janssen et. al. (2010) concluded that heartbeat perception influences social behavior, promoting the sense of closeness, as an intimate cue in immersive virtual environments. Heartbeat communication was also seen as a promising way to improve emotion recognition with potential benefits on social connectedness, health, and wellbeing. Their study was done in the context of interpersonal communication; we hypothesize that it can also be beneficial on our own, for emotional self-awareness and regulation.

Figure 11: Get random jar entry: button (left), shaking (right).

Another feature with multimodality is available when the user desires to get a random EmoJar entry (Fig.11): by pressing the "Random" button, or by shaking the mobile device in the way suggested by the "Pick random" button's icon, which resembles a mobile device being shaken. Doing so gets one random EmoJar entry out of the jar, introducing a flavor of serendipity (Chambel, 2011) creating the chance to find a relevant unexpected content. Then it is up to the user to preview and relive it (by clicking on it).

3.5 Overviews for Self-awareness and Learning

Users can get information about their media consumption habits in EmoJar. This information can add to the support of self-awareness that our approach emphasizes, in a perspective of self-development, along time. Users may, e.g., find out what content types they consume the most, as well as what emotions they have felt so far or throughout time according to Media4WellBeing's emotion recognition system and user self-assessment. Fig. 12 highlights a tagcloud view representing frequency of dominant emotions in the jar content. Happiness is more frequent in this example, being dominant in 4 of the 13 jar entries.

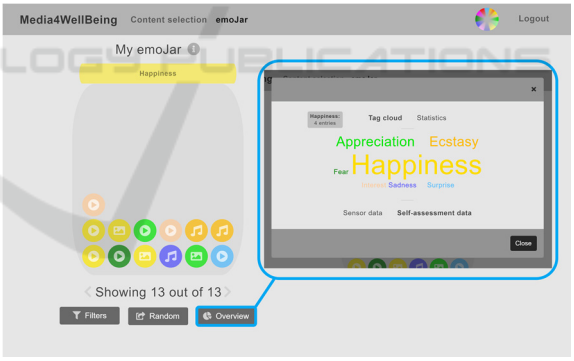

Figure 12: Overview of dominant felt emotions in jar's content. A tag cloud is presented, with "Happiness" as most frequent one.

4 USER EVALUATION

The primary objective of this user evaluation was to assess EmoJar usability and user experience through perceived usefulness, satisfaction, and ease of use of its functionalities. We also wanted to know the users' opinions, comments, and suggestions on the features, interface and representations.

4.1 Methodology

This evaluation consisted of semi-structured interviews and user observation while users carried out previously defined tasks to test the different features. First, the evaluation and system's purpose were explained, followed by a selection of demographic questions to characterize the users, who then performed the tasks, in the order listed in Table 1. For each task, we 1) observed and noted success, completion speed, errors and hesitations; 2) asked users to rate the perceived usefulness, satisfaction, and ease of use (based on USE (Lund, 2001)) of the tasks' functionalities and representations on a 5-point Likert scale; and 3) gathered qualitative feedback as users' comments and suggestions. All tasks were executed on a camera-equipped laptop, then on a smartphone, to 1) know the impact of the screen size; and to 2) assess the mobile-exclusive features (the vibration feedback on content reproduction, and the "shake to extract a random entry").

In the end, users were asked to 1) make an overall assessment of the system in terms of its design, usefulness, satisfaction, ease of use, and usability (SUS (Brooke, 1996)); 2) mention the features and characteristics that positively stood out to them; 3) make their final comments and suggestions on what they would like to see improved or added in the future; and 4) characterize the system by selecting pre-defined terms that adequately reflected its appeal and overall ergonomic and hedonic qualities (Hassenzahl et al., 2000).

4.2 Participants

This evaluation had 10 participants, 5 male, 5 female 22-57 years old (Mean (M) 31.1, Std.Dev (SD) 12.6), all with higher education (1 PhD, 3 MSc, 6 BSc) in different areas (1 systems, 1 telecom and 1 electrical engineers, 1 highschool teacher, 1 human resources manager, 1 multimedia designer, and 4 IT graduates pursuing an MSc in Informatics), moderate to high levels of digital literacy, and having their first contact with EmoJar.

1) Digital media content impact: all 10 participants strongly agreed (5, in 1-5 Likert scale) that digital content can make individuals experience emotions; has the ability to evoke memories; and that the experienced emotions can be a result of these evoked memories .

2) Access digital content: using smartphone (10 every day); computer (2 every day (ed), 4 more than 1/week, 2 1/week, and 2 (occ)asionally); and tablet (2 occ). Platforms: YouTube (5 ed, 3 >1/week, 2 occ); Netflix (4 ed, 3 >1/week, 2 occ); Spotify (2 ed, 6 >1/week); Instagram (4 ed); Pinterest (2 >1/week, 2 occ); Vimeo (4 occ), TED.com (3 occ); Crunchyroll (1>1/week); and Flickr (1 occ).

3) Motivation to access (1-5:"Strongly disagree"-"Strongly agree"): be entertained (M:4.8, SD: 0.4); feel more relaxed (M:4.2, SD:0.6); be informed (M:3.5, SD:0.5); feel good (M:3.4, SD:0.5); feel motivated (M:2.9, SD:1.1); be able to deal with difficult situations (M:2.9, SD:1.1); feel better about themselves (M:2.6, SD:1.1); feel more creative (M:2.3, SD:1.2); be able to improve as a person (M:2.3, SD:1.2); be able to work better (M:2.2, SD:1.3); better know themselves (M:1.6, SD:0.7); and positively influence others (M:1.3, SD:0.5).

4) How and why digital content is saved: 9 save in browser's favorites; 6 in the playlist of the platform used (e.g., YouTube, Spotify), and 5 download and store on computer (3) and smartphone (2). They save it to: create a collection of contents they enjoy (M:4.4, SD:0.5); consume later on (M:4.1, SD:0.3); share later on (M:3.2, SD:0.9); because they symbolize a moment of their lives (M:3, SD: 0.9); to later change their mood (M:2.4, SD:0.9); to reminisce about them later on (M:1.5, SD:0.7).

5) Happiness Jar, related apps, and physiological sensors: 6 of 10 participants are used to recording and describing their lives' most memorable moments, associated thoughts and emotions: on social media (5); journal (3); smartphones' note-taking apps (2); and on the back of Polaroid photos (1). None of the participants were familiar with the Happiness Jar concept, never created or used one, nor did they use an app or platform based on or related to it. On the other hand, 4 users had previous experience with physiological sensors, 2 in academic contexts (EEG, ECG, and BVP sensors), and 2 in personal use (at-home ECG). The other 6 had never used but were interested in doing so.

4.3 Results

In this section, we present the evaluation's results. Overall, users have completed all tasks quickly and without much hesitation, and they generally enjoyed their time and experience with the system. More detailed results are presented in the tables and commented in the text along with user suggestions.

4.3.1 Content Selection

Task 1: *"Gauge the jar's state in content selection page." (initially empty).* 6 users quickly found and made use of the small jar representation to correctly assess it was empty. The other 4 took some time to find it, but as soon as they did, they easily determined its state. They suggested to add a label, which we readily did. USE results were quite positive (U:4.1, S:4.0, E:5.0). After tasks 4 and 5, users rechecked the new state of the jar (with an entry in the jar), and some found this feature "useful", "delightful", and "amusing".

4.3.2 Content Reproduction

Task 2: *"Select, consume, and save the video 'Omelette'".* In Media4WellBeing (Bernardino et al., 2016) we had already evaluated the "emoPaint" view, here we focused on the new features, namely:

2.1) interface's background pulsing to the rhythm of one's heartbeat (U:3.3,S:3.3,E:4.1). 3 users preferred "on" (to know their heart rate was being estimated), 2 users preferred "off" (finding it distracting), and 5 users were "indifferent" (subtle enough to go unnoticed when focusing on the content);

2.2) feeling heartbeat through smartphone vibration (U:3.5, S:3.8, E:5.0). 3 users would rather see "on" (found it "uniquely different" and "a very real way of communicating one's heart rate"), 2 preferred "off" ("distracting" and "potentially irritating" in long-term), and 5 were "indifferent" (subtle enough to not disturb and go unnoticed after a while);

2.3) having "emoPaint" be painted to the rhythm of heartbeat (U:3.5, S:3.4, E:4.0). 3 users found "curious" and "interesting", and we felt that, if not for smartphone's vibration along with the painting of a dot, this feature could go a little "unnoticed";

2.4) having an "average heart rate" text shown in real-time (U:3.8, S:3.8, E:5.0), which users found "interesting" and "informative", and allowed awareness of how their bodies responded to the content they found emotionally uplifting, sad, or even scary. After task 7.2, one user suggested a heart rate line graph drawn along content's consumption;

2.5) having "Predominant felt emotion" in text (U:4.8, S:4.5, E:5.0). All users appreciated, some believed to be "absolutely essential" to understand which emotion was predominant when more than one was painted in an identical way;

2.6) being able to save the consumed content on the jar (U:4.1, S:4.1, E:4.5). Users found easy to do and communicated clearly (when saved or not).

4.3.3 Self-assessment

Task 3: *"Comment on the consumed video."* to get their input on some of this page's features, like:
3.1) the ability to rate how much they agree with the sensor-recognized emotions (U: 5.0, S: 4.4, E: 5.0).

Table 1: USE evaluation of EmoJar (Scale:1-5: lowest-highest); M=Mean; SD=Std. Deviation).

Task		U		S		E	
T#	Feature	M	SD	M	SD	M	SD
	Content Selection: *(M)*	*4.1*	*0.7*	*4.0*	*0.5*	***5.0***	*0.0*
1	small jar representation	4.1	0.7	4.0	0.5	**5.0**	0.0
	Content Reproduction *(M)*	*3.8*	*0.6*	*3.8*	*0.7*	***4.6***	*0.4*
2.1	heartbeat: background	3.3	0.5	3.3	0.5	4.1	0.9
2.2	heartbeat: phone vibration	3.5	0.5	3.8	0.6	**5.0**	0.0
2.3	heartbeat: emoPaint rhythm	3.5	0.5	3.4	0.5	4.0	0.9
2.4	heartbeat: avg in text field	3.8	0.9	3.8	0.9	**5.0**	0.0
2.5	predom. emotion: text field	**4.8**	0.4	**4.5**	0.5	**5.0**	0.0
2.6	saving content in own jar	4.1	0.9	4.1	0.9	**4.5**	0.5
	Self-Assessment: *(M)*	***5.0***	*0.0*	***4.6***	*0.3*	***5.0***	*0.0*
3.1	rate sensor-rec emotions	**5.0**	0.0	4.4	0.5	**5.0**	0.0
3.2	draw own emoPaint	**5.0**	0.0	**5.0**	0.0	**5.0**	0.0
3.3	provide self-assessment	**5.0**	0.0	4.3	0.5	**5.0**	0.0
	Jar View: *(M)*	***4.7***	*0.1*	*4.2*	*0.5*	***4.7***	*0.2*
4.1	jar entry: preview	**5.0**	0.0	4.3	0.5	4.4	0.5
4.2	jar entry: review	**5.0**	0.0	**4.5**	0.5	**5.0**	0.0
4.3	direct access to its content	4.3	0.5	4.0	0.4	**4.5**	0.5
5.1	emo representation: icon	4.1	0.5	3.9	0.5	**5.0**	0.0
5.2	emo representation: change	4.4	0.5	**4.8**	0.4	**5.0**	0.0
6.1	random entry: with button	**4.5**	0.5	**4.5**	0.5	**5.0**	0.0
6.2	random entry: shake phone	2.7	0.5	3.4	0.5	3.6	0.7
	Filters: *(M)*	***4.7***	*0.1*	*4.2*	*0.5*	***4.7***	*0.2*
7.1	a) by content type	**5.0**	0.0	3.6	0.5	**5.0**	0.0
7.1	b) by content title or author	**5.0**	0.0	3.5	0.5	**5.0**	0.0
7.1	c) by predominant emotion	**5.0**	0.0	4.1	0.3	**5.0**	0.0
7.1	d) small tooltips pop up	**5.0**	0.0	**4.6**	0.5	**5.0**	0.0
7.2	a) by sensor & selfassessmt	**5.0**	0.0	3.3	0.5	**4.6**	0.8
7.2	b) by date	**5.0**	0.0	3.5	0.5	**5.0**	0.0
7.2	c1) by heart rate (HR):write	**5.0**	0.0	**4.7**	0.5	**4.5**	0.5
7.2	c2) by HR: phone camera	**5.0**	0.0	4.4	0.5	3.5	0.7
7.2	c3) by HR: tapping	**5.0**	0.0	**4.6**	0.5	**4.6**	0.5
7.3	a) by "First" save	**5.0**	0.0	4.3	0.5	**5.0**	0.0
7.3	b) by "Repeated" saves	**5.0**	0.0	**4.7**	0.5	**5.0**	0.0
8	Jar Overview	**5.0**	0.0	**4.6**	0.5	**4.8**	0.4
	Global Evaluation	**4.1**	0.3	**4.4**	0.5	**4.3**	0.5

Users found "convenient", when disagreeing or finding detected emotions incomplete. A user mentioned machine learning to allow precise results;

3.2) the ability to draw their own "emoPaint" (U:5.0, S:5.0, E:5.0), which users found "original" and an "inventive" way of providing their personal perspective. Two users strongly appreciated the sensor-generated "emoPaint" being automatically replicated in their own "emoPaint" drawing area, excusing them of trying to match the sensor-generated one. It was not yet possible to "Undo" potential mistakes in the drawing, only "Reset" and draw anew. Curiously, no one complained about this

limitation, as they simply focused on drawing. When alerted about it, some users said it would not be hard to reset and replicate a drawing, but all recognized the usefulness of having "Undo" and "Redo". Another limitations to be addressed in the future, is that a user's self-assess-ment cannot be delayed or edited at a later time.

3.3) Overall, being able to provide self-assess-ment about consumed content was seen as (U:5.0, S:4.3, E:5.0). All users felt that the questions were completely relevant (1-5 Likert scale; M: 5.0, SD: 0.0) and in the right amount (4), some stating that more questions might become "tedious" and "labori-ous", and less questions would not allow to properly explain what made the content worth saving.

4.3.4 Jar View

For Task 4 and 5, all users had in their jar the entry that resulted from the previous tasks. From Task 6 on, they would have 13 entries to test other features.

Task 4: *"Review the jar entry that was created as a result of consuming, saving, and commenting the selected video".* This was the users' feedback:

To start with, just by looking at their first jar entry it was very easy for everyone (M: 5.0, SD: 0.0) to understand that it concerned a video, and had the predominant emotion provided on self-assessment;

4.1) the jar *entry's preview* (U:5.0, S:4.3, E:4.4), was found "convenient" by all, as it allowed to know about the entry's content and self-assessment. On the computer, all users found this preview trivial (hovering). On the smartphone, 4 users did not know what to do and asked for help (as stated in the instructions it required long pressing). The other 6, relying on previous experience with smartphones did it well. All agreed that the entry's preview had the right amount of information;

4.2) the ability to *review a jar entry* (U:5.0, S:4.5, E:5.0) was found instrumental in understan-ding what made their consumed contents memorable and ultimately worth saving. All users thought that their entry's information was well sorted (M: 4.5 and SD: 0.5), but 4 mentioned that they would like to have the sensor and user-generated "emoPaint" side by side - challenging with the limited amount of horizontal space on smartphones in vertical position;

4.3) the ability to directly access the content the jar entry was about (U:4.3, S:4.0, E:4.5), considered to be a nice shortcut to searching for that content on the content selection page, and a quick way of replaying content that they found memorable.

Task 5: *"Change the emotion representation at use."* and see how this reflected on their previously created entry and both "emoPaint". In that process, we collected the users' feedback on:

5.1) the *multicolored icon* that illustrates the currently selected emotion representation (U: 4.1, S: 3.9, E: 5.0), which users found "handy" as it quickly informed them of the emotion representation at use;

5.2) the ability to *change to another emotion representation* (U:4.4, S:4.8, E:5.0), which all users appreciated. After selecting one of our 3 available, 6 users stated their choice was driven by their personal preference of colors, 2 stated they felt the selected colors to be more representative of the emotions in the system, and the remaining 2 said it was due to a mix of both reasons. Most users suggested to better highlight the current representation in the selection dialogue, with the addition of small arrows or a text label (which we adopted);

For the future, users would appreciate the ability to: a) create their own emotion representation, with their own colors (8 said, 2 were well served with the 3 options offered); and b) customize their jar (4 to change its name, give its lid a checkered or striped pattern, and turn its entries into emojis or make them heart-shaped; 6 did not have much interest in this, as they liked it in its current, unadorned form).

From Task 6 onwards, the users' jar had 13 entries. Before these tasks, we asked users to identify the *jar's most present emotion*. All 10 users correctly identified "Happiness", coming to that conclusion, they stated, through the jar's lid, and by checking that there were more entries with the color of the jar's lid than with any other color.

Task 6: *"Extract a random entry from the jar"*. On both computer and smartphone, all 10 users made quick use of the "Random" button (U:4.5, S: 4.5, E:5.0), not occurring to anyone, even those who read the instructions, that they could shake the smartphone. After being reminded and trying it, most users commented that having the "Random" button below the jar made the "shake" command "somewhat redundant", believing it would be faster and easier to click on the button. Still, users found it interesting and distinctive (U:2.7, S:3.4, E:3.6).

4.3.5 Jar Filtering

Task 7.1: *"Find specific jar entries: a video called 'Tabook' that had made them predominantly experience 'Surprise'".* Then they replied about: **a)** the ability and process of filtering the jar's entries *by* their *content's type* (U:5.0, S:3.6, E:5.0), **b)** *by title* or *author* (U:5.0, S:3.5, E:5.0), and **c)** *by predomi-nantly felt emotion* (U:5.0,S:4.1,E:5.0); and **d)** the *small tooltips* that pop up when a filter region is

closed with filters active (U:5.0,S:4.6,E:5.0), a detail that users found to be "very thoughtful" and useful.

Five users preferred the filtering process to work the way it currently did (i.e., getting the desired results after selecting and then applying filters), they like to state "go-ahead" or find too distracting or confusing to have the jar changing every time a filter was selected or deselected (real-time); 2 would prefer real-time, as it is what they were accustomed to; and 3 did not have a preference;

To select "Surprise", 7 users used the wheel of emotions (6 because it was selected by default, and 1 because this was the favorite emotion arrangement), and the other 3 used alphabetically ordered buttons (because they prefer buttons and the alphabetical order allowed quick finding of the emotion).

Task 7.2: *"Find specific jar entries that contained sensor data, were created between two provided dates, and had the user's current heart rate (with tolerance of 40 bpm) as average heart rate"*. Then, we wanted the users' feedback on:

The ability and process of filtering the jar's entries by **a)** whether or not *they contain sensor and/or self-assessment data* (U:5.0, S:3.3, E:4.6), **b)** the *date or date interval* in which these entries were created (5-7 June, 2019) (U:5.0,S: 3.5,E: 5.0); and **c1)** writing an average heart rate (U:5.0,S:4.7,E:4.5);

c2) *estimating user's average heart rate* at the time of the content's consumption *using the device's camera and a finger* (U:5.0,S:4.4,E:3.5) was found "unique" and "very interesting", even if it turned out to be "somewhat frustrating" due to its slight sensitivity to changes in lighting and finger placement. Only 4 users managed to get an estimate of their heart rate, with 3 of them requiring more than one try;

c3) *using the tapping mechanism* to estimate one's heart rate (U:5.0,S:4.6,E:4.6) was found "fun" and "original". The 4 who obtained an estimate with the previous mechanism were pleased to see that the tapping presented a very similar estimate. One user mistakenly tapped the heart icon twice with each heartbeat (contraction and relaxation), this could be an alternative but might be more challenging to feel and replicate, so not our (and the other 9 users) choice.

Task 7.3: *"Find the first jar entries created about every saved content, and all jar entries about every repeatedly saved content"*.

The ability and process of **a)** *finding the first* jar entries (U:4.6, S:4.6, E:5.0), and **b)** finding all *repeated entries* (U:4.7, S:4.4, E:5.0) were appreciated with users considering the latter especially useful for comparing how they felt upon subsequent consumptions of the same content.

To learn about how well they understood the views in which these first and repeated entries are presented, we asked how many, out of a total of 13, corresponded to a) the first time some content was saved in the jar, b) content repeatedly saved, and c) repeated saves of the video "Omelette", with all users answering correctly to the three questions.

4.3.6 Jar Overview

Finally, in **Task 8:** *"Get an overview of one's jar use"*, accessing the "Overview" perspective and feeding us 9 bits of information regarding: 1) how many times "Happiness" had been predominantly felt, according to sensors and user's self-assessment; 2) how many entries concerned videos, audio, images, and text quotes; 3) how many entries have sensor data, and how many have self-assessment data; 4) the distribution of predominantly felt emotions recognized by sensors and by self-assessment in the jar; 5) the percentage of times that the user "Agreed" with sensor's results; 6) the average number of words written in each self-assessment; 7) the date of first entry ever created in the jar; 8) the date on which the highest number of entries were created; and 9) the overall average heart rate of the user when consuming digital content. All information was correctly provided, with overall "Overview" feature rated as (U:5.0, S:4.6, E:4.8).

4.3.7 Global Evaluation

EmoJar was considered to have a quite good design (M:4.2, SD:0.4) and found "visually appealing". In terms of perceived usefulness, satisfaction, and ease of use, the overall USE ratings were (U:4.1, S:4.4, E:4.1). As for its usability, the system's overall SUS score (Brooke, 1992) was very good: 89.5 out of 100.

The most appreciated details and features included (ordered by times mentioned): the "ability to draw one's emotions" (7), "saving content with emotional information associated to it" (6), "camera and tapping mechanisms to get an estimate of one's heart rate" (6), "ability to change the system's emotion representation, and thus its colors" (5), "Overview' perspective" (4), "ability to filter based on many different criteria" (3), "tooltips that inform users of their selected filters" (3), "colored entries" (2), "jar's lid color changing according to the jar's most present emotion" (2), "ability to feel one's heartbeat while consuming some content" (1), and "ability to contest the sensor's results" (1).

As suggestions, users mentioned it would be interesting to have EmoJar work in tandem with YouTube, Spotify, Instagram, and other such platforms. Some users commented that EmoJar had a lot of potential, and that we should continue to work on it, as they were unfamiliar with any other applications that explored the emotional and well-being dimensions of digital content consumption.

Table 2: Quality terms users chose for EmoJar. H:Hedonic; E: Ergonomic; A: Appeal.

Terms	type	#	Terms	type	#
Comprehensible	E	10	**Inviting**	A	8
Simple	E	10	Impressive	H	7
Interesting	H	10	Familiar	E	6
Aesthetic	A	10	Innovative	H	6
Attractive	A	10	Good	A	6
Pleasant	A	9	Exciting	H	4
Clear	E	8	Motivating	A	4
Original	H	8	Simpathetic	A	3

In the end, users characterized EmoJar choosing most relevant perceived hedonic, ergonomic and appeal quality aspects (out of a total of 46: 23 positive, and 23 negative opposites) (Hassenzahl et al., 2000). Comprehensible, Simple, Interesting, Aesthetic, and Attractive were chosen by all the participants, followed by Pleasant, Clear and Inviting (Table 2).

5 CONCLUSION AND PERSPECTIVES

Based on the Positive Psychology and Positive Computing approaches, this paper addressed the potential benefits of digital media content and its consumption on individuals' psychological well-being; and presented and evaluated EmoJar as an extension to Media4WellBeing, allowing users to collect and relive emotionally impactful and memorable moments.

In the user evaluation, we observed a quick and successful completion of all tasks, and realized that users were interested and invested in using and exploring EmoJar. They appreciated that it allowed them to elaborate on why certain emotions had been felt throughout content's consumption, and what made said content memorable. Users also valued the existence of EmoJar, as it allowed them to collect content that was memorable to them, and that positively contributed to their psychological well-being, and to recall and reminisce upon all the emotions, memories, thoughts, and perceptions that resulted from consuming said content. Aligning with exercises Seligman (2005) has shown to promote individuals' psychological wellbeing, revolving around coming up with things one is grateful for.

Overall, users recognized EmoJar as useful, satisfactory and easy to use, and capable of making digital content consumption more meaningful and profound. They encouraged us to develop it further, as they found the idea behind it to be very interesting, and the process and mechanisms by which this system operates unlike anything they had previously seen.

Future work includes refining based on the evaluation, and further extending the interactive features of EmoJar so as to provide a useful and interesting digital experience that further supports users in their journey of personal awareness and development. A larger scale in terms of information and time span is being addressed. More modalities, like sound and haptics, are also being designed for emotional feedback, to complement or be experienced in alternative to the visual feedback, e.g. to allow users to focus their visual attention to a video they are watching, or to experience a song with eyes closed, or yet to make the experience more accessible to users with special perceptual needs. The option of letting users record, comment, and insert their own media (e.g., video or audio recordings) in the jar is also a direction to explore.

EmoJar was tested in a short term usage. It is our intention to go on enriching the user experience with features found useful and interesting, that go in the direction of promoting and supporting users in their journey of self-awareness and personal development, also in a consistent and prolonged longer term usage.

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