Emotional and Meditative States in Interactive Media Access with a Positive Computing Perspective

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Abstract: Media influences human behavior, emotions, states-of-mind, health and sense of wellbeing, with great potential for a positive impact in our lives, and it is becoming pervasive. Advances and discoveries in the field of neurosciences and informatics have the potential to help people in emotional and wellbeing awareness and regulation, in a positive computing perspective. Our project aims to explore this potential around the design and development of an interactive application that allows the access, exploration and visualization of different media, based on their impact on emotional and meditative states. This paper presents scientific background, design choices, functionalities and a user study of this application. Results were very encouraging in terms of perceived efficacy, usefulness, usability and user experience and will inform future directions.

1 INTRODUCTION

Media like music, video and images have an important role and are becoming pervasive in our lives. They have great impact on emotions and states-of-mind (Chambel et al., 2011b; Zillmann and Vorderer, 2008), influencing behaviours, wellbeing and even health. Meditation is another practice with such an impact. It has been developed and used for millennia in several cultures, to promote personal transformation (Aubrey, 2010), and is becoming more prevalent especially in approaches like mindfulness and emotional intelligence, in personal and organizational interventions (Calvo and Peters, 2014; Kabat-Zinn, 2023). Media can help induce and support meditative states, and impact our emotions, but there is not much support in accessing media based on this impact. Our aim is to contribute in this direction. Current challenges include the effective modeling and detection of media-related emotions, and an effective and useful way to access media based on its impact.

In this paper, we present the background, main features and a user evaluation of Media4WellBeing, an interactive web application being designed and developed to access, explore and visualize media based on its impact on emotional and meditative states, using physiological sensors, in a multi-disciplinary cooperation of Computer Science and Biomedicine. It aims to support awareness and regulation of these states to contribute to users sense of wellbeing, while providing a rich and flexible way to access media like video, images and audio; aligning with the perspective of Positive Computing, an approach focused in the design and development of digital technologies that promote and support psychological wellbeing and human potential, with roots in Positive Psychology (Calvo and Peters,2014).

2 BACKGROUND

This section briefly presents key concepts, technologies and applications being researched, as a background for our own work and contributions.

Positive Psychology and Positive Computing. Positive Psychology relates to the study of what makes life most worth living (Seligman and

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Csikszentmihalyi, 2000), including the biological, personal, relational, institutional, cultural and global dimensions of life. The physiology of healthy minds and the role of empathy, mindfulness and meditation have been studied by neuroscientists, supporting a growing attention to emotional intelligence and positive psychology in order to improve wellbeing. Positive Computing is an approach focused in the design and development of technologies which support and promote psychological wellbeing and human potential, with roots in positive psychology. Digital technology has become ubiquitous, having an unprecedented major impact in how we live, with the capacity to increase stress and suffering, but also the potential to improve the wellbeing of individuals, society, and the planet. The end goal of Positive Computing is that, in the future, digital technology contributes positively to the personal growth of the user and inspires the community (Calvo and Peters, 2014).

Models of Emotions. Main types of models are: dimensional and categorical. Dimensional models are based on orthogonal dimensions, like VA: valence (polarity) and arousal (intensity), that can be represented in a circumplex (Russel, 1980). Categorical models, on the other hand, make a correspondence between emotions and discrete states. Anger, disgust, fear, joy, sadness and surprise were recognized by Ekman (1992) as basic categorical emotions based on facial expressions displayed and recognized across different cultures. Categorical emotions can also be represented in Russell's circumplex model; where, for example, anger and sadness have negative valence with high and low arousal; and in the positive valence (often associated with positive psychology and wellbeing) happiness and calmness have high and low valence, respectively. The 3D model (both dimensional and categorical) created by Plutchik takes into account polarity, similarity and intensity dimensions (Plutchik, 1980). Eight primary emotions are used here, the six from Ekman, plus anticipation/interest and trust/admiration. They are represented in different colors around the center, the intensity varying in the vertical dimension, in three levels.

The wellbeing factors include positive emotions, and sometimes also engagement and meaning (e.g. in positive psychology, those are the three dimensions considered, later extended with relationships and achievement (Seligman and Csikszentmihalyi, 2000)); and self-awareness, mindfulness, empathy and compassion may as well be considered among such factors (Calvo and Peters, 2014).

Physiological Signals and Sensors. The physiological signals to obtain objective measures of emotions are related to the central and peripheral nervous systems, being possible to assess emotions for which the user may or may not be consciously aware of (Ferreira et al., 2019). We refer to the ones we are using. Electroencephalographic (EEG) signals translate brain's electrical activity, and their frequency components (delta, theta, alpha, beta and gamma) have been used to assess arousal, valence and dominance (Reuderink et al., 2013), as well as sleepiness, attentiveness and meditative states (Ahani et al., 2014; Hirshkowitz and Sharafkhaneh, 2005; Marrufo et al., 2001). Electrocardiography (ECG) measures the electrical activity of the heart, being used to assess arousal via heart rate (HR) and its variability (HRV). The electrodermal activity (EDA), or galvanic skin response (GSR), is widely used to assess arousal. When in stress, the skin sweats more and its conductance increases. These signals can also be used combined to improve accuracy in emotion detection (Kim et al., 2004).

Applications. There are several applications, commercial or in research, that focus on emotions and explore the emotional states of the user with the intention of improving user's experience and performance. Some of these applications are based on mindfulness and other types of meditation (Ahani et al., 2014; Amores et al., 2016), like Headspace (.com), Calm (.com) and the Mindfulness App (themindfulnessapp.com). These three applications teach how to meditate with guided sessions (helping people with stress, focus and sleep problems) and how to have a healthier state-of-mind with a mindful lifestyle, but cannot measure the user's emotional and meditative states in real time with accuracy. Sites like Netflix, YouTube, Vimeo and Ted (.com) are widely used to access video, others like Pinterest (.com) allow collecting and managing images and other media. But do not support an emotional dimension.

Relevant backgroung (Chambel et al., 2011b; 2013; and Oliveira et al., 2013) includes: models and representations of emotions; the emotional classification of movie content (through content analysis, and also estimating wellbeing (Mazeika et al., 2022)), and their impact on viewers (through physiological measures, e.g. (Joaquim et al., 2020)); video access and visualization; and eliciting and visualizing emotions. Here we highlight a few approaches and applications: In iFelt (Oliveira et al., 2013), videos were classified and accessed based on the emotions felt by the user while watching them, by making use of three biosensors (respiration, heart rate, and EDA/GSR) to detect five of Ekman's basic emotions (all but surprise), and representing them with Plutchik's color model in the movie spaces and timelines in the interface. MovieClouds (Chambel et al., 2013) further adopted a tagcloud paradigm to access and watch movies based on its content, mainly audio and subtitles, with a focus on emotions expressed in subtitles, detected as the mood of the music, and felt by the users; later enriched with user annotation (Gomes et al., 2013; Nunes et al., 2022). But the initial emotional model used was quite poor (Ekman's has one positive emotion) when we aim to support wellbeing, where positive emotions are richer and more prevalent.

In other approaches like (Chec, 2015), ECG signals were used to modulate a video gaming experience: the more anxious the user, the more challenging the game becomes. Others use virtual reality and sensors to influence the experience, often in games (Reuderink et al., 2013; Chec et al., 2015; Kim et al., 2004; Halbrook, 2019). But these do not discriminate emotions or meditative states, nor focus on media access as we aim to. The group of Picard on Affective Computing has extensively used sensors and cameras to help deal with factors such as stress, sleep, attention, associated with wellbeing, e.g. (McDuff el al., 2013; Sano, 2015), and more recently presented a robotic coach integrating technologies to deliver interactive positive psychology interventions and build rapport with college students (Jeong et al., 2023). But usually not with media. Exceptions include facial expression analysis to detect users' reactions (liking) to video ads (McDuff et al., 2013). In another approach, Chu et al. (2020) proposed recommending movies that are meaningful to users (based on their highly specific everyday life experiences), for the therapeutic potential to possibly affect their sense of overall wellbeing. But do not provide the means to assess their emotional or meditative states, nor to support the media access with this increased awareness.

In (Chambel et al., 2013) work related with accessing music based on consumer's mood was presented. Rothera explored the perspective of the creator, through Flutter (Stinson, 2015), an experimental app that uses music to help those experiencing the loss of a loved one, by expressing themselves in a safe and positive environment; and Nave, et al. (2016) explore emotions through painting, photography and writing. The focus being on expression, like in a journal, not in detection, and was explored further in (Nave et al., 2023) to inform the design of affective self-reporting.

3 Media4WellBeing APPLICATION

This section sumarizes main options and features of Media4WellBeing, with a strong focus on video, for its richness. Information obtained from the sensors to assess emotional and meditative states, while users access media, is presented in visualizations and catalogs media for future access. Users are provided with different perspectives of media impact on these states, while accessing and possibly collecting them in personal journals.

3.1 Physiological Signals and Sensors

Media4WellBeing uses the Muse headset for EEG with dry electrodes (Muse-1, Muse-2). Besides raw EEG data, it provides absolute and relative values for the five frequency bands and for concentration and meditation/mellow (up when relaxing, but still alert to our senses). Valence was computed as the frontal left-right hemispherical asymmetry derived from the relative power of alpha waves. For computing arousal, ECG and EDA signals were measured using the BITalino board (Batista et al., 2019, BITalino-1 and 2), and using two wet electrodes in the wrists for ECG, and two on left-hand fingers for EDA, using prior 15 min in low-stimuli environment to get neutral baseline responses. Muse and BITalino allow real-time readings.

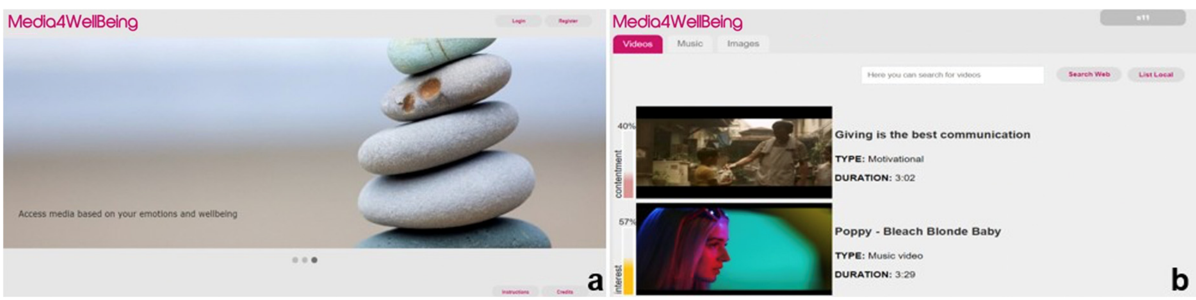

Figure 1: Media4WellBeing: a) Homepage; b) List of videos with color bars and dominant emotion %.

3.2 Homepage and List of Searched Videos

The homepage (Fig.1a) sets the mood for wellbeing in contextual images, and offers the opportunity for registration and login, and to access media organized as: videos, music, and images. In the videos tab (Fig.1b), videos can be searched. The list of results highlights the dominant emotion felt for each video in a colored bar reflecting the % of dominance, on the left. Each video may be selected, explored and watched in different views, highlighting its impact on emotional and meditative states, as described next.

3.3 Emotional States

This sub-section presents the emotional model and colors defined and adopted, followed by emotion identification, and the interactive visualizations.

Emotional Model. Our model (Fig.2a) has 14 categorical emotions, distributed along Russell's 2D circumplex, using arousal and valence as its dimensions (Russel, 1980). It includes the six basic emotions of Ekman, enriched with emotions from Plutchick's like appreciation, interest, ecstasy, contentment, serenity and boredom; enthusiasm (based on users' choices in (Chambel et al., 2011b)), and sleepiness. These emotions were chosen to have at least 2 emotions in each quadrant, to align with most used models, to be richer than Ekman's (that only has one positive emotion), to capture emotions often associated with media and films (Chambel et al., 2011b), and to simplify the process of identifying categorical emotions through arousal and valence. More details in (Bernardino et al., 2016).

Colors of Emotions. For familiarity, colors were chosen based on Plutchik's, extended and adapted for Russell's circumplex (Fig.2b). E.g. high arousal and valence have more vibrant, warm colors. This circle is the underlying reference color used in the visualizations.

Identifying and Representing Emotions. Emotions were detected with the aid of EEG, ECG and EDA sensors and by computing the values of valence and arousal (VA) (Sec. 2 and 3.1). Computed values are parsed for valence (x-axis) and arousal (y-axis) mapped into the coordinates in the emotional circumplex or graph (Fig.3a). Emotions are then presented in different ways, depending on the selected view:

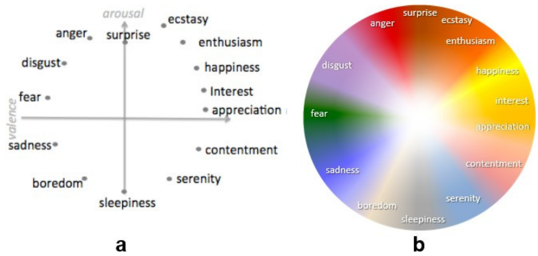

Figure 2: Media4WellBeing Emotional Model: a) categorical emotions placed in Russel's bidimensional circumplex, graph, or wheel of emotions; b) colors used for the emotions underlying the wheel in Fig.3a).

For each coordinate, there is a corresponding underlying color (Fig.2a-b, Fig.3a). The correspondence to categorical emotions (e.g. for the tagcloud), in our approach, is then computed based on the Euclidian proximity to the emotions depicted around the graph (Fig.3a).

EmoPaint. Emotions are painted as colored dots in the emotional circumplex, based on valence and arousal. The categorical emotions are labeled all around to help users identify the closest emotions. Colors are painted like scratches (Scratch Art metaphor) allowing to show the underneath colormap (Fig.3a) based on VA position. In all EmoVisualizations, emotions are represented on the side, in synchrony with the video being watched, and can be hidden, accessed later, and played back as animations (as explained below).

Users can change configurations - through the switches below the visualization (Fig.3a) – e.g. to have the drawing as continuous lines or as points; in a uniform frequency (1/ sec), or according to users' heart beat rate. This option is based on the sense of comfort and intimacy it may provide (Janssen et al., 2020) and as an additional factor for wellbeing.

EmoClouds. Emotions are displayed on a colored tag cloud, reflecting their frequency (Fig.3b). A tag grows each time its emotion is detected. This visualization reflects the power, flexibility, engagement and fun usually associated with tag clouds (Chambel et al., 2013).

EmoChart. A bar chart is used in this view (Fig.3c). Every time an emotion is detected, its bar increases in size. Hovering a bar, shows the emotion and its frequency.

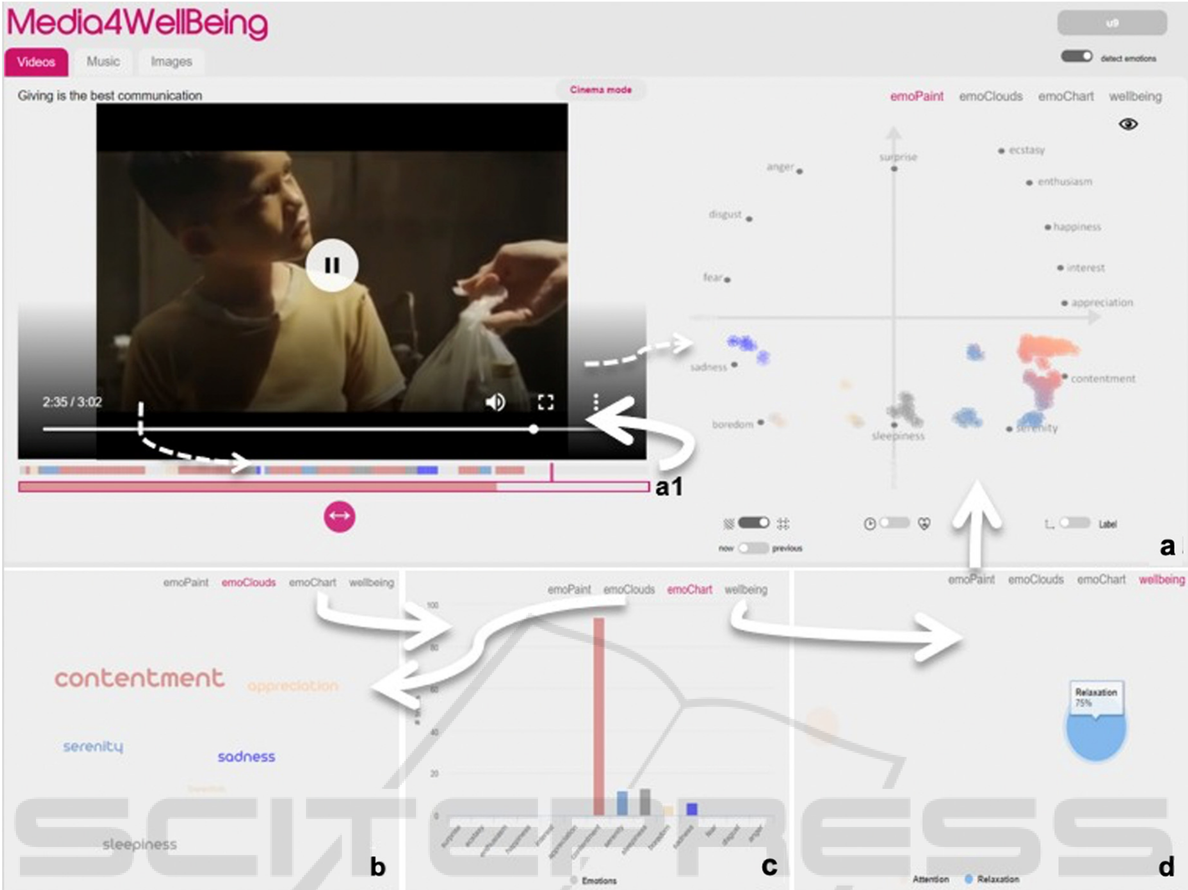

Figure 3: Emotional Views while watching video: a) emoPaint; a1) emotional timelines (top: full video; bottom: detail of current emotion); b) emoClouds; c) emoChart; d) wellbeing. Arrows: navigation; dashed arrows: synch with video.

Independent of EmoView, these functionalities can enrich the experience as a whole:

Emotional Timelines. In dynamic content (music and videos), there are two timeline bars displaying the evolution of users' emotions along time. The top bar represents the whole video length, whereas the bottom bar represents a zoom-in of the current emotion in time. The frame of this bar is of the same color of the thin frame representing current time in the top bar. These timelines are synchronized with the media being played, updating current time and emotion; and are interactive, allowing to index any chosen time in the media to watch/access it directly (Fig.3a1).

Increased Immersion and Flexibility. Full-screen and cinema modes allow users to watch videos in a more immersed way, clear of intrusive or extraneous information and avoiding split attention. Animation allows the flexibility to replay dynamic emotional representations:

- ***Full-Screen***. When entering this mode, the emotional visualization is displayed in the bottom right corner, in a smaller size, so that feedback is given in a less intrusive way;
- ***Cinema Mode.*** Where the theme of the current page changes, becoming darker, to help increased concentration on the content;
- ***Animation*** of recorded emotional data. Users can review their emotions felt for that content on different days and times through the "Previous" option below each visualization. The replay is animated; and can be synchronized with the content.

Statistics. Presents usage statistics based on user sessions: how many videos have been watched, % of detected emotions, and lists of most/recently accessed contents.

3.4 Meditative States and Personal Journal

The meditative states views and the personal journal features are summarized next.

Waves Graph. Shows Alpha, Beta, Delta, Theta and Gamma EEG frequency components (Fig.4a). Alpha waves (8-12 Hz) are dominant during quietly flowing thoughts, when the user is relaxed and awake, but with the eyes closed and in some meditative states (Aubrey, 2010; Brainworks). Beta waves dominate our normal waking state of consciousness when attention is directed towards cognitive tasks and the outside world. These waves are further divided into three bands: Low-Beta (12-15 Hz) can be thought of as a 'fast idle', or musing. Beta (15-22 Hz) is high engagement or actively figuring something out. Hi-Beta (22-30 Hz) is highly complex thought, integrating new experiences, high anxiety, or excitement. Delta are generated in deepest meditation and dreamless sleep, are the brain waves with greater amplitude and lower frequency, and are common during sleep and in awake children. Theta is our gateway to learning, memory, and intuition and is common in newborns and adults during sleep. Theta rhythms increase in awake adults while performing tasks that require attention and memory, during sleep deprivation and during loads of emotional stress (Fox, 2011). Lastly, Gamma waves have the highest frequency and relate to simultaneous processing of information from different brain areas. These five brain waves are represented with a difference between left and right sides of brain and goes from minus 2 to 2; and users can select brainwaves, by clicking the ones they are interested to follow.

Meditation and Concentration Graph. The Meditation Data (Fig.4b) is based on Theta; and the Concentration Data (Fig.4c) is based on Gamma waves (Muse-2).

Personal Journal. Journals are often used for collecting experiences and capturing unexpected moments (by serendipity) (Chambel, 2011a). In our application, users can add videos and graphs from their own perspectives of concentration and meditation lines (Fig.4d) to their personal journal, for later access. Tags can be added and suggested for organization and search purposes.

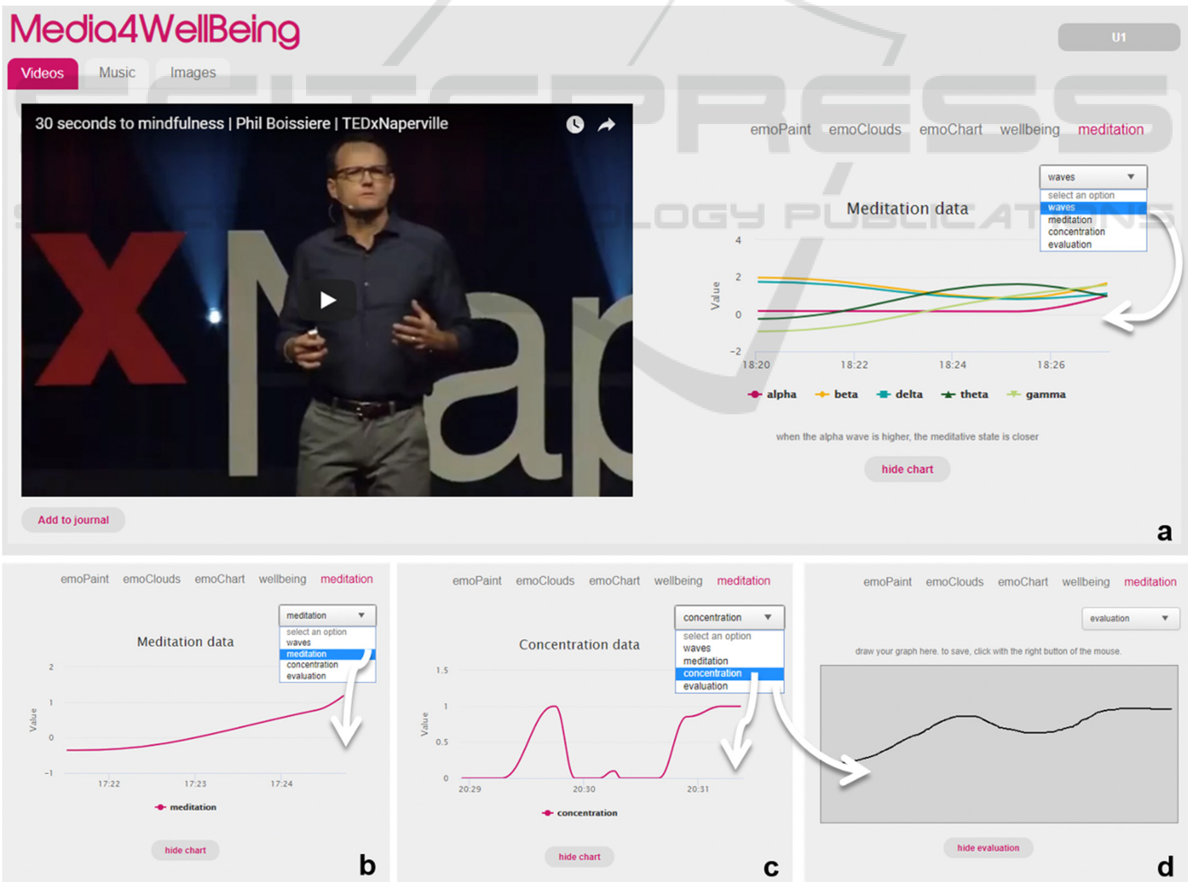

Figure 4: Meditative Views: a) Waves Graph; b) Meditation Graph; c) Concentration Graph; d) User Perspective: users draw their graph of meditation or concentration, and save it in the Personal Journal.

4 USER EVALUATION

The objectives, methodology, participants and results of the user evaluation conducted to assess Media4WellBeing's functionalities, usability and user experience, are summarized next.

4.1 Objectives

The main objectives include assessing perceived: 1) (U)sefulness; 2) (S)atisfaction; and 3) (E)ase-of-use, based on the USE dimensions (Lund, 2001); and in addition: 4) Efficacy of the Visualizations (EV); and 5) Efficacy of Identification (EI) of emotional and meditative states, based on the sensors. It is a usability evaluation to find out how Media4WellBeing might be perceived, as a proof of concept and to get users' feedback for future developments.

4.2 Methodology

This evaluation was based on semi-structured interviews and user observation while performing pre-defined tasks. After briefing the subjects about Media4WellBeing and the evaluation, demographic questions were asked to characterize the users and to get them more in tune with their own motivations and attitudes in this context, before using the app. We followed ethical and legal practices accounting for confidentiallity, as approved by the Ethics Commission of our institution. As a first task, sensors were calibrated to obtain baseline (15 sec for Muse and 15 min for BITalino). After each task, focusing on a feature, users provided ratings (on a 1-lowest to 5 scale) for the 5 dimensions above (U, S, E, EV and EI) and commented. In the end, highlighted what they liked the most, gave suggestions, and characterized the application selecting among 46 quality terms (Hassenzahl et al., 2000).

4.3 Participants, Background and Preferences with Media

Ten users (6 male and 4 female), 18-29 years old (22.5 mean) participated. Nielsen defends that 5-8 is a good number of participants in usability tests, we rounded up to 10, for diversity, testing all the features, with gender balance, and experienced with PC/internet (but new to our app). Age was not an issue at this stage, but we chose diverse backgrounds: 3 had college degrees, 2 in Computer Science and 1 in Psychotherapy, who might also provide more expert reviews about this app for wellbeing.

Awareness, Motivations and Attitudes about Emotional Impact in Media Access. Users strongly agreed (Mean in 1-5 scale) that accessing media can affect emotions (4.9 music, 4.8 videos and 4.5 images). They often feel the need to turn to media to achieve specific emotional states (4.6 music, 4.2 videos, 3.6 images). Main reasons: "to be informed" (4.6); "feel more relaxed" (4.5), or "feel good" (4.4).

Applications and Physiological Sensors. YouTube (4.6) and Spotify (3.5) were the most used apps to access media to achieve wellbeing. Six users had previous experience using physiological sensors; eight said they would use sensors to be aware of and regulate emotional states and wellbeing. Regarding applications, two mentioned using Muse app occasionally, and one using "Sleep as Android" to find optimal moments to wake up (sleep.urbandroid.org).

4.4 Results

Main results are presented for the evaluation of Media4WellBeing to support emotional and meditative states, performed in random order by all the participants.

Emotional States. The calibration phase (T1) was considered useful and easy, though not very pleasant (S:2.9) (Table.1). To test emoPaint (T2.1-5) users accessed an image and a couple of videos, in different modes regarding the visualization of the emotional states detected. Most users said the emotions they felt were reasonably correct (EI) and agreed that the detected emotions were perceivable in the visualization (EV). All prefered keeping the visualizations hidden while watching (accessing afterwards), to be more focused. Three users noted the difference when heart beat rate was used, but did not make them feel calmer (we'll test heart beat in the future). Users preferred the points vs. line view. In emoClouds (T3) and emoChart (T4), all users easily identified the most/less frequent emotions, found them easy and satisfying; though emoChart more useful, and more familiar to present frequencies. Most users understood and appreciated the timelines (T5). Most users preferred the full-screen mode (T6). The cinema mode would be used at night and when tired. Users appreciated the lateral bar with dominant emotion in video lists (T7.1) and the possibility to access emotional states previously felt. In T8, all users understood the "statistical" information about content accessed and felt emotions in the session, but a bit less useful or satisfactory than most previous features, they found more novel.

Table 1: USE and Efficacy of Visualizations and Identification for Emotional and Medidative States (Scale: 1-5; U: Usefulness; S: Satisfaction; E: Ease-of-Use; EV: Efficacy-of-Visualization; EI – Efficacy-of-Identification; M: Mean; SD: Standard deviation).

Task	**Emotional States**	U		S		E		EV		EI	
T#	Feature	M	SD	M	SD	M	SD	M	SD	M	SD
T1	Calibration of sensors	4.7	0.7	2.9	1.0	4.3	0.8	-	-	-	-
	emoPaint: *(mean)*	*4.5*	*0.6*	*4.5*	*0.5*	*4.7*	*0.5*	*3.9*	*0.9*	*3.6*	*1.0*
T2.1	emoPaint with image (lines)	4.6	0.7	4.3	0.5	**4.8**	0.4	3.5	1.5	3.7	1.3
T2.2	emoPaint compassion video	4.5	0.7	4.6	0.5	4.7	0.7	3.9	0.7	3.8	0.9
T2.3	emoPaint nature relaxing video	4.6	0.5	4.6	0.5	**4.9**	0.3	4.3	0.6	3.9	0.9
T2.4	emoPaint same video (points)	**4.8**	0.4	4.7	0.5	**4.8**	0.4	-	-	-	-
T2.5	emoPaint like T2.3 (heart rate)	4.2	0.8	4.3	0.7	4.5	0.7	-	-	3.1	0.8
T3	emoClouds	4.5	0.7	**4.8**	0.4	**4.9**	0.3	3.6	1.3	-	-
T4	emoChart	4.7	0.5	**4.8**	0.4	**4.9**	0.3	4.1	0.9	-	-
T5	Timelines in a video	4.1	1.0	4.4	0.7	**4.9**	0.3	-	-	-	-
T6	Full-screen and cinema modes	**4.8**	0.4	4.7	0.7	**4.8**	0.3	-	-	-	-
	Emotional states history: *(mean)*	*4.6*	*0.6*	*4.5*	*0.6*	***4.8***	*0.4*	-	-	*3.9*	*1.2*
T7.1	Dominant emotion bars	4.6	0.7	4.5	0.7	**4.9**	0.3	-	-	3.9	1.2
T7.2	View previous emotional states	4.6	0.5	4.5	0.5	4.7	0.5	-	-	-	-
T8	Statistics	4.5	1.0	4.5	0.7	**4.8**	0.4	-	-	-	-
	Total *(mean)* - ***Emotional States***	4.6	0.6	4.4	0.6	**4.8**	0.4	4.0	0.9	3.9	0.9

Task	**Meditative States**	U		S		E		EV		EI	
T#	Feature	M	SD	M	SD	M	SD	M	SD	M	SD
T1	Meditation Graph	4.4	1.0	4.7	0.5	**4.8**	0.4	4.2	0.4	3.7	1.2
T2	Draw of Meditation Graph	4.6	0.7	4.5	0.5	4.7	0.5	-	-	3.1	1.3
T3	Concentration Graph	**5.0**	0.0	**4.8**	0.4	**5.0**	0.0	4.6	0.7	4.4	1.0
T4	Draw of Concentration Graph	**5.0**	0.0	4.7	0.5	**4.9**	0.3	-	-	3.4	1.8
T5	Waves Graph	4.7	0.7	4.7	0.5	**4.8**	0.4	4.2	0.4	3.4	1.2
T6	Journal	**5.0**	0.0	4.7	0.7	**5.0**	0.0	-	-	-	-
	Total *(mean)* - ***Meditative States***	**4.8**	0.4	4.7	0.5	**4.9**	0.3	4.3	0.5	3.6	0.9

Meditative States. These features were also appreciated, found very useful, easy to use and quite satisfactory. Some users did not understand the Meditation Graph at first (T1 with music video), not being familiar with meditation, but recognized its usefulness and found it quite interesting in the end. The Concentration Graph (T3 with a TED Talk video) was more readily understood and appreciated. The information presented was believed to be correct and found useful in the cases they thought were more concentrated than it was detected. Only one user had difficulty drawing and saving graphs from his perspective (T2, T4), although a couple mentioned not being easy to draw with a mouse; and most reported some differences or having been influenced by detected graphs seen before, but appreciated registering their own perspectives. Most users preferred watching videos in full-screen, and seeing the graph of the app after their own. Waves Graph (T5 with video on compassion) was found interesting and informative by nine users, and a couple suggested to add labels explaining meaning of each brainwaves. In T6, users added a video to the journal with tag 'inspiring' and explored the tabs. None felt difficulty, finding the journal very useful in the long-term. There were suggestions to have the color of graphs in blue or green (that they associate with wellbeing), to make brainwaves colors more distinct, and to have search and organization of videos by tag, and graphs by days, weeks or sessions, not only by type.

Global Evaluation. At the end, the order of preference in emotional states was: emoPaint, emoChart, and emoClouds. Cinema mode, the timelines and statistics page were also mentioned as favorite functionalities. The most appreciated aspects in meditative states were: "the idea", "to watch lectures and see my concentration state", "to learn how to meditate and see the results", and "to collect memories on a virtual journal, like I do in real life". After 30 minutes with Muse, users were feeling discomfort.

Most chosen quality terms for both States (Table 2) refer to the appeal and hedonic category, and almost all are positive (the table had 23 positive and 23 negative/opposite terms). The exception being six users selecting Unpredictable for Emotional states,

Table 2: Number of users choosing each Quality term (Hassenzahl et al., 2000) to describe Emotional States (E) and Medidative States (M) in the Media4WellBeing app, from (E: Ergonomic; H: Hedonic; and A: Appeal) terms.

E	M		Terms	E	M		Terms	E	M		Terms
10	10	E	Supporting	10	10	A	Desirable	9	10	A	Inviting
10	10	H	Interesting	10	9	E	Comprehensible	9	9	E	Trustworthy
10	10	H	Impressive	10	9	E	Clear	9	7	H	Costly
10	10	A	Pleasant	10	9	H	Exciting	7	8	E	Simple
10	10	A	Good	10	9	H	Exclusive	*6*	7	E	*Un*|Predictable
10	10	A	Aesthetic	10	9	H	Original	6	7	E	Familiar
10	10	A	Attractive	10	9	H	Innovative	5	7	E	Controllable
10	10	A	Sympathetic	10	9	A	Motivating				

yet balancing with 7 Predictable; aligning with having some uncommon representations, and this being the first contact with the application; and being found Original and Innovative by all the participants (with an underlying unpredictability).

5 CONCLUSIONS AND PERSPECTIVES

We discussed the computational and physiological sensor technology symbiosis to support the access of media based on emotional impact and meditative states. Media4WellBeing is being designed and developed as an interactive web application to provide this support, and its components were described and tested in a preliminary usability evaluation. Most users learned fast and stayed engaged with the application, having found it very useful, satisfactory and easy to use. These high scores reflect their enthusiasm about the application. They liked the concept and found it very appealing and novel. Good but not so high the scores about efficacy of visualization at first (while unfamiliar with them) and the efficacy of identification. Not surprising though, since users are not used to being aware of their emotions and the detection is a research topic, still appearing fairly effective in our approach.

In sum, we got relevant and encouraging feedback for future improvements, and a preliminary recognition of our core contributions: 1) a rich model that extends standard ones with emotions relevant in media and wellbeing (Chambel et al., 2011b; Bernardino et al., 2016), that users can recognize; 2) an approach to capture richer emotions, using physiological sensors to measure: arousal & valence, interpreted with our model to identify and output rich emotions; and brainwaves to identify meditation and concentration levels; and 3) rich and flexible interactive mechanisms to increase awareness about users' emotions and meditative states, when accessing and navigating media based on these dimensions.

Future work includes: tuning further the precision of emotion detection; adopting more unintrusive and ubiquitous sensors; revising and exploring further new ways of providing emotional awareness and regulation with media; helping to reach higher meditative states, exploring non-visual feedback (besides current support for increased immersion) to enrich users support while focusing on the content; and enriching the personal journal with information that supports self development in the longer run.

These directions in the support of welbeing in media access align with coping strategies (Wolfers and Schneider, 2021) found relevant in different perspectives, including emotion regulation; and align with longer term interventions envisaged to support positive functioning and wellbeing, that has been linked with better physical health and greater longevity (Kubzansky et al., 2023), reinforcing a path to follow.

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