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The Story of Our Lives

From Sensors to Stories in Self-Monitoring Systems

Dana Pavel[1], Victor Callaghan[1], Anind Dey[2], Michael Gardner[1], Francisco Sepulveda[1]
[1]University of Essex, [2]Carnegie Mellon University

***Abstract*—Lifestyle management is a growing area aimed at giving individuals support for an increased self-awareness; self-monitoring technologies are essential in providing an objective account of our daily events. However, most self-monitoring technological solutions largely focus on physical health and ignore other aspects, such as mental or social. Our goal is to utilise context aware technologies in order to support people in understanding how various aspects of their lives influence their wellbeing, including, for example, mental and social health. For that, we need to gain a deeper insight into the challenges of designing such solutions, from sensing to interaction paradigms to user acceptance. This paper describes our proof-of-concept system design and implementation, including several novel information presentation choices, as well as results from our exploratory user-based evaluations.**

Keywords-context awareness, self-monitoring, self-understanding, wellbeing, story-based visualizations

I. INTRODUCTION

Advances in wearable technologies as well as the realization that self-monitoring systems help people become more aware and even change their behaviours (as discussed in [1][2]) have helped create many solutions that deal with various health aspects, within preventive as well as assistive scenarios. While health is defined by the WHO (World Health Organization) Constitution as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”, the reality is that most currently available lifestyle management systems rarely take this integrated view, mainly focusing on measuring certain physiological parameters (e.g., heart rate, blood glucose levels, or blood oxygen levels) and less on addressing mental or social aspects of health, even though they are extremely important aspects of our lives [3][4]. We believe that by using self-monitoring technologies that are able to create a more detailed and complex picture of our lives, we will be able to address the wellbeing at a holistic level, including all aspects of health, rather than looking at various issues in isolation. For this, we argue that it is time to take advantage of the varied data available through our smart environments and move from focusing only on *what* happened towards *why* it happened, while engaging the end user throughout the process. For that, we start from identifying the various aspects of our lifestyles and carefully considering how they can be captured through correlating and interpreting automatically collected data that we produce through our daily interactions with various computing devices or by wearing certain physiological sensors. Our aim is to create systems that support users in self-understanding and self-reflection, allowing them to identify stress factors within their daily activities and, ultimately, providing them the support for making lifestyle changes. Self-reflection is an important part of self-understanding and, ultimately, of self-change and it is an essential step within a lifestyle management support framework, especially when dealing with issues such as stress management [5][6].

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In this article, we present a proof-of-concept system we built to incorporate such views, including our novel approach towards creating more engaging interfaces for such systems based on stories. We also show results obtained through some of our exploratory user-based experiments before concluding by discussing the relevance of such system to various areas and future plans for evolving both the system and the evaluation scope.

II. BACKGROUND AND MOTIVATION

Various self-monitoring lifestyle management solutions have been developed over the past years, both in research and commercial spaces, driven by multiple factors, ranging from technological advances to societal needs. While many of these solutions (e.g., [2]) focus on the physiological issues, other aspects, such as mental health, remain poorly addressed by self-monitoring technological systems. Within this space, memory loss is probably best represented, both in terms of available products as well as research. Various systems, such as PivoTell or SIMPill, help patients with memory problems keep track of their medication. Others use camera-based systems, such as Microsoft’s SenseCam, for supporting patients with advanced memory problems [7]. Stress plays an important part in our personal and professional lives [4] and various technological solutions exist to address it, most of them combining sensing (e.g., GSR, heart rate and its variability, EEG), biofeedback, relaxation techniques and, in certain cases, using visualization methods such as games, lights and sounds, to support end user self-awareness and self-control [8][9][10][11][12].

Few such systems support users in understanding why something happened, as they mostly focus on recording physiological aspects without too much other contextual data. Usually, correlations between the data recorded and events that might have influenced certain changes are mostly based on end-user recollections [13], which are prone to memory errors and lack of attention.

Attitudes towards self-monitoring are changing and we believe that the acceptance levels will continue to rise, driven by the higher degree of acceptance towards digitally recording life experiences that can be observed in younger generations [17], by societal needs for encouraging and supporting self-care [1][2] and by the continuous technological advances allowing for unobtrusive monitoring within real-life scenarios.

Within research, there is a trend towards combining various sensors within platforms for wellbeing applications [14][15][16] but they do not address the challenges of visualizing multiple and varied types of sensors. Storytelling approaches are used in projects such as [18][23][24][25], to name just a few, but they have different approaches from ours, either regarding the approach to generating stories or the level of involvement of end users into the whole process of information creation and presentation.

III. System Design and Implementation

A. *The MyRoR system*

Just to make it easier to understand we start by explaining how the MyRoR system is used: the system collects information about a user's daily activities from various sources, such as sensors, her work and private computers and her mobile phone and stores it into a local, trusted space that can only be controlled by her. Correlated information helps her understand what has happened during the day both at a detailed level and at a high-level, through a story-based representation. The story created by MyRoR helps her revisit the daily events in a fun and summarized way. When she wants, she also has access to more detailed information, allowing her to see what she did, where she went, who was around, and how she felt. She can add notes and her own media to the system. She can also customize her story by creating definitions for places she most visits and adding photos to be used as background for her stories.

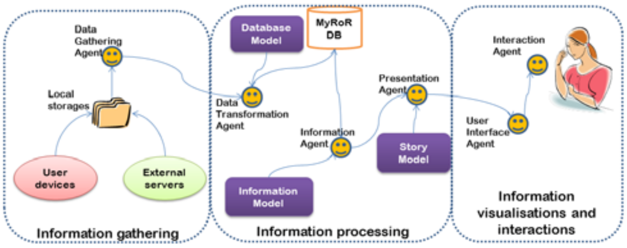

Figure 1. Information flow in MyRoR

Figure 1 shows the information flow throughout the system, from gathering to information to visualizations and interactions. The current recording scenario implies an asynchronous storage and usage of data (real time scenarios could be realized with the system but are not considered at this point). A more detailed description of how the system works is given in the following sections.

B. *Information gathering and processing*

The decisions regarding the information collected and sources used are governed by various requirements. While technological capabilities play a role in selecting how data should be collected, the main reason for selecting the devices and data we now can use is purely to create, as much as realistically possible and with minimal discomfort, a comprehensive picture of one's daily activities. [4][5][6][18] provide inspiration for the kind of data to be collected for supporting self-reflection, so that the system helps users understand why something might have happened. Privacy, security and social issues are very important and our system design is entirely centred on the need for end-user control and awareness, with end users being able to control what is recorded and when, where it is stored, how it is accessed and if/how it is shared. Figure 2 shows the input sources and data we are currently able to collect or have access to through the current gathering platform (captured automatically, through user input or on-demand). Please note that we do not envision to collect all the data all the time, the recording depending on user's willingness to record certain data, availability of computing devices, and, most importantly, the envisioned scenario and needs. The sources we selected to integrate into our system can provide data in realistic scenarios, indoors or outdoors, stationary or mobile.

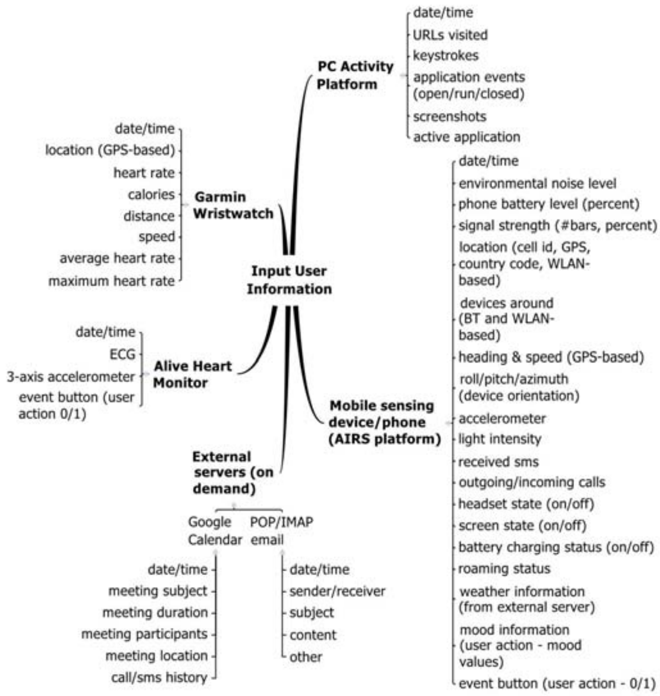

Figure 2. Sources and input data in MyRoR

All data, except the on-demand one, is stored in a local MySQL database, under full control of the end-user. For more on this see **Error! Reference source not found.**. Stored information is further processed either before or at the time of visualization and all information is used to create a complex picture of user's context (where context is defined as in [20]) along various dimensions: *physical/spatial*, *social*, *emotional*, *mental* (i.e., interest), *activity*, *availability* and *environmental*.

Physical/spatial context includes location information (absolute, relative and at various granularity levels) obtained from various sensors (e.g., GPS, cell information, country code, WLAN, meeting location, Bluetooth - BT vicinity), as well as derived information such as distance, speed or heading. *Social context* includes information about user's social activities, obtained from sensors (e.g., people in vicinity from BT devices) or social communication tools such as emails, calendar, chat programs (through PC activity platform), and call/messaging history (through phone). *Emotional context* contains information obtained from physiological sensors, such as ECG and heart rate, as well as through virtual sensors, such as keyword-based filtering of keystrokes, email content, and through the mood button (user pressed via phone widget). *Mental context* includes information about a user's mental state (i.e., interest both as topic and as intensity level, derived through web activity, applications used, keyword-based filtering of keystrokes, messages sent, and screenshots. The *activity context* contains information about what the user was doing and the activity level, derived from physical sensors, such as accelerometer data and GPS, as well as from applications used, web activity, screenshots and calendar information. The *availability context* includes information regarding availability of people (e.g., through identifying people around, checking calendar information) or devices (e.g., through BT vicinity, battery level, signal coverage). The *environmental context* contains information about environmental parameters that can affect users, such as noise, temperature or light intensity.

We use various rule-based algorithms for interpreting, abstracting and correlating data at various stages, from storing into the database to the story creation phase (called through the interface). Within our data processing we avoid creating very high-level information so that we leave room for end user's own interpretation and avoid wrong assumptions that can easily arise due to hidden parameters, current or historical (such as previous encounters with a certain person). With all technological advances, automatic recognition in real world scenarios is still not working as in laboratory setting [21]. Because of that, we consider that it is better to show the user that something important happened at a certain time (e.g., increased heart rate, etc.) but let her deduct what happened and why, by allowing access to other context information (e.g., people present, concurrent events, etc.).

C. Information presentation and usage

Visualization is a major challenge when dealing with such diverse information. Commonly used means, such as graphs, maps or charts are not user friendly enough in this case. Our exploration of more natural ways of conveying information brought us to stories. A basic story contains characters, a storyline and a setting (e.g., time, place, weather). The storyline is formed by a sequence of meaningful events structured around a timeline, a topic or character [22]. A story can also have a theme (i.e., focusing on a certain aspect) and a point of view (i.e., storytelling depending on audience). Our aim is to create an interactive, customizable system that can offer both a summarized view of collected information (for quick browsing) and a detailed one (to increase understanding). For that, we combine a story-based representation with detailed graph-based visualizations integrated within a blog (Wordpress-based) environment, which offers a calendar-based access to recorded data, a customizable, familiar interface of a personal blog, the possibility of further adding own media, and access from any device, including mobile ones (Figure 3).

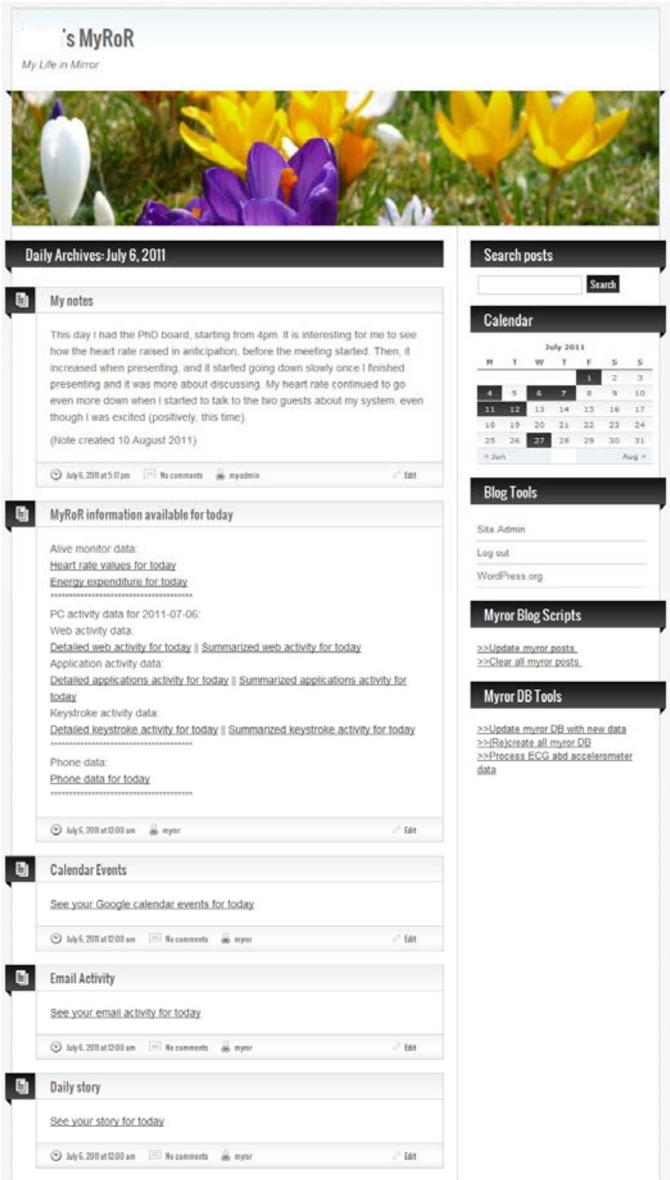

Figure 3. The MyRoR blog-based interface

Organizing collected information within a story-based representation forms one of the main aspects of our current research. Figure 4 summarizes the story creation process, with context dimensions and values being described before.

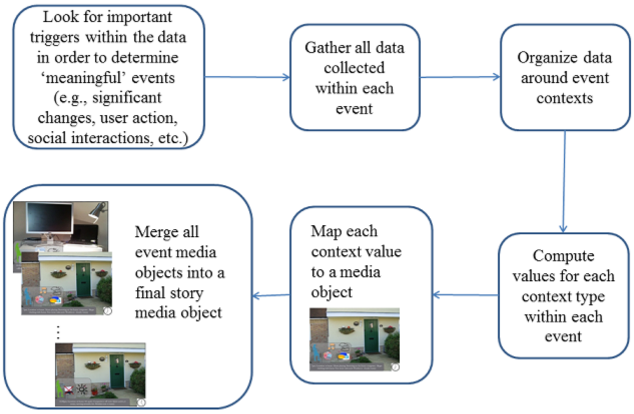

Figure 4. The story creation process

The creation of story events is based on certain triggers within the data, such as user actions (e.g., event or mood button), certain social interactions (e.g., making/receiving a call or sms) or significant changes within physiological parameters (e.g., high heart rate). New triggers can also be easily added either by the system designer or the end user. An example of an event media object created by our system is shown in Figure 5.

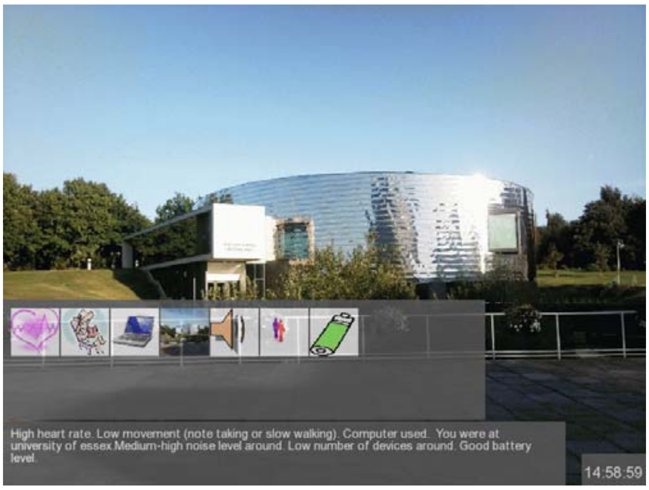

Figure 5. An event within a story

IV. USER-BASED EXPERIMENTS

In our research so far, we have taken an exploratory approach focused on learning more about designing such systems, both from existing literature and through user-based experiments. Such process, where participants' input is primarily used for deriving new design ideas in information visualization systems is favoured by Ellis and Dix in [26]. Our user-based experiments include an online survey (for more generic questions) and hands-on experiments (for more detailed questions). Our main goals are to better understand self-reflective behaviours, determine what daily aspects are more important to people and should be included within a summarized story and how should such stories be created.

The online survey [29] contains 3 parts focused on: (1) daily self-reflective behaviours and means; (2) attitude towards such systems and visualizations; and (3) mapping between colours and emotional states within a cultural background. The participants were invited through various means (CS staff and student mailing lists, Facebook and LinkedIn contacts, X (blind review) project, etc.). As background, we consider participant's experience with self-monitoring systems and their attitude towards self-reflection more important than technological abilities (which is quite subjective) or age. The results included here are based on 34 participants, 6 with previous experience with self-monitoring, 26 without and 2 did not specify (Q5 in Figure 6(c)). Participants' self-reflective behaviours were tested by asking how often they reflect over what happened during the day (Q1), if they try to understand why something happened (Q2), and if they propose any changes to their behaviour afterwards (Q3) (Figure 6(a)). 58.8% of all participants think back and think why and propose changes. 70% of them do this often (45% of all participants). Figure 6(b) shows what means for self-reflection participants use. When asked to give examples of situations that trigger such self-reflection processes, the main categories were: stress management, social interactions management and time management, sometimes even combined (e.g., stress related to certain social interactions).

The participants were introduced to the MyRoR system from the beginning, through a scenario and a high-level system description (see Figure 2). In part 2, they were asked if they would find such system useful for self-reflection. Encouragingly, 65% of all participants answered positively (see Q6 in Figure 6(c)). We were especially interested how people we considered more self-reflective (people that think back often and think why something happened) feel about MyRoR system (Figure 6(d)). Out of the people that answered positively, 70% had no previous experience with self-monitoring systems.

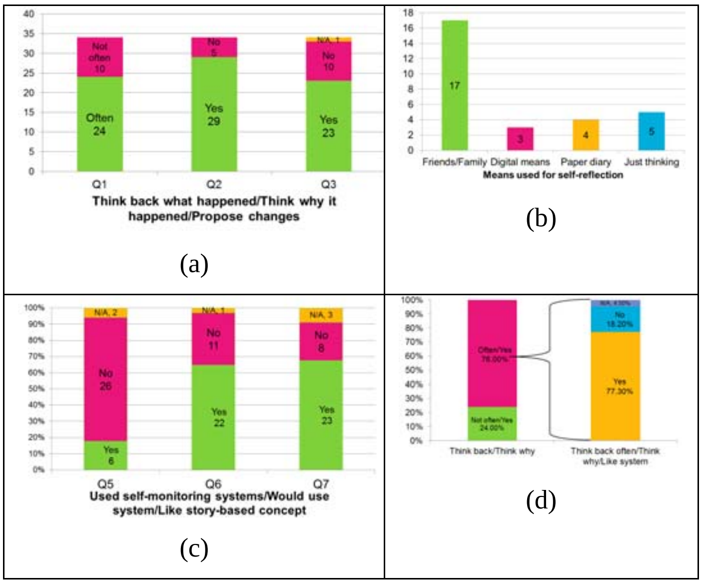

Figure 6. Results from online survey

Next, we asked if they would like a story-based representation created by the system based on their recorded data (using a concept movie containing images similar to Figure 5). 82% of the people that said they would find the system useful said they would like such interface. We also asked if they would like to customize their story. 94% of the ones that like both the system and the story answered positively, with most people wanting to customize characters, places, emotional states, and activities.

Part 3 looked at how participants map certain emotional states to colours while also recording their cultural background and gender. Our intention was to compare our results to works such as [18][27][28] as well as determine if colours can be used by system designers to convey emotional states in an unambiguous way. The 6 emotional states included are based on a stress-related scenario and include stressful situations, both positive (e.g., energetic) and negative (e.g., anger, annoyance), calmer states as well as transitional states such as cooling down from positive or negative stress. Figure 7 includes results from this part (based on available answers). As observed, there is not a high correlation of colours between the participants, except for highly negative stress, represented through red shades, regardless of cultural background or gender. These results show that most colours do not have the same meaning for everybody and that interfaces that use such mapping in order to faster capture complex states should allow for end user customization.

State 1: Energetic/positive stress
State 2: Medium (negative) stressed (e.g., annoyed)
State 3: Highly (negative) stressed (e.g., angry, frustrated)
State 4: Cooling down after a positive stressful situation
State 5: Cooling down after a negative stressful situation
State 6: Relaxed

User	State 1	State 2	State 3	State 4	State 5	State 6	Gender	Cultural background
1	F2CC50	07388C	FF0505	45821D	8B0EC9	EBFC92	male	western
2	F21BC0	FF9B29	B30000	70FFFA	C4FF03	FFFFFF	male	All of the above
3	FF872B	614599	590C51	E6FF6B	FFCB7D	67CF7F	female	western
4	43FF2E	FFAD1F	FF4124	8B59FF	FF54BB	96FFEE	female	western
5	4ED126	D40000	D46606	0FB7FF	BB33FF	FFFFFF	male	western
6	0AFF1B	F7FF12	FF1414	0A12FF	1D0DFF	1100FF	male	western
7	FF54DD	FF2146	FF3814	36FF4A	263CFF	45FFF9	female	western
8	6EFF4A	FF8533	FF1605	FF8FB4	7AFFED	FCFFFF	male	eastern
9	2937FF	F0FF38	FF2129	8AFF9D	75FAFF	21FF21	male	muslim
10	00FF20	FFF71C	FF3819	8CFF69	B494FF	3D1FFF	female	chinese
11	19FF19	FFA07D	FF3414	E294FF	8682FF	0820FF	male	western
12	FFDF0F	FFA114	FF1A12	0AFFDE	FF12C8	77FF0F	female	western
13	1CFF33	FFA114	FF4B1F	D8FF57	5CDEFF	E854FF	male	western
14	FF7F0F	FF0B03	FF120A	51FF3D	75F1FF	059E14	female	eastern
15	A0D62E	E3D61E	EDA005	14FFE8	028EEB	2BC0ED	male	western
16	26FF17	E35812	FF0000	CDFF69	5E94FF	E4FFB5	female	western
17	FF61EA	FF6E30	FF1434	B3BDFF	FFCFD8	8297FF	male	western
18	FFFF14	FF6C47	FF0F0F	A6FCFF	FFB8F3	A5FF9C	male	latin
19	FFFF38	A81E31	050101	2E6DFF	462D8C	57FFCD	female	western
20	F7FF12	FF6459	FF180A	ACFF40	FF8769	3D44FF	male	western
21	FFF700	FF7E5E	FF0D05	97FF78	FFDBAB	FFFCCF	male	eastern
22	FFC83D	E6DCD8	FF4040	BFE1FF	FFEDFD	5CC3FF	female	western
23	008C59	FF9D47	FF0303	CCE7FF	FFE2BD	19F7FF	male	eastern
24	FF845E	000008	FF0F3F	9185FF	FFAD42	1A12FF	female	
25	FFF706	FF6E30	FF0800	66A8FF	FFB17D	CCD6FF	female	western/latin
26	F0FF24	FF0A0A	241CFF	D1C575	8DEDFF	FFFFFF	female	White British

Figure 7. Mapping emotional states to colours

The hands-on experiments were mainly focused on determining what people consider important enough during the day. For that, we had 6 volunteers that used the system for recording data during various days (from 1 day to more than a week), depending on their preference. The users had the option to chose their scenarios for recording, so that we did not create an artificial environment for using such system. The users' ages ranged from 20s to 80s. Technical abilities were not a selection factor. One of the most important tasks they had to perform was to annotate what events they considered interesting during the days by using an event button (provided by the ECG monitor device), so that we can better understand what is "meaningful" to people, i.e., what should be captured through stories. After the recording, the data was transferred to their own MyRoR system (no user data was collected by the authors for these experiments) and one or more follow-up semi-structured interviews were performed along these topics: (1) Usefulness of information gathered: look at which information better supports self-reflection or what the user considered most interesting; (2) Usefulness of correlations performed by MyRoR and identify new ones based on user feedback; (3) Meaningfulness of events based on user annotations enhanced by user explanations of why they thought some events were more interesting or what other events they wished they would have annotated once they saw how such annotations are used; (4) Creating a personalized story of their daily recordings included discussions around how such stories should look, what they should include, how they should be customized and how they could be shared; (4) Experience with using the MyRoR system.

While we are currently still processing the results collected through such experiments, here are some initial findings, especially related to the selection of meaningful events, as this is an important aspect for the story creation. The users pressed the button when they considered that something out of the ordinary was happening or was about to happen (as in the case of scheduled meetings). The type of event was not the same for all users and was not even the same for the same user, sometimes people pressing for reasons related to increase in heart rate, being in a certain place or being in a certain situation (such as meeting somebody), pressing only once or pressing to delimit a certain event (such as getting on/getting off the bus). It also seems that certain information takes precedence (such as stress levels) and in the absence of any significant changes within that dimension other information is observed instead. However, users said that when the current activity is very intense, they forget to press the event button therefore the system should offer a way to add annotation later during the day (while information is still fresh). Out of such experiments we added new features to the system, such as the phone widgets used for annotating an event with own descriptions and a mood widget that allows an user to set their current mood. We consider such features essential for a system like MyRoR, as the inference such system could create automatically would probably not be able to (always) capture the meaning of why an event is interesting (e.g., is it because the user is in a certain place, in a certain stress level or in a certain situation, such as meeting). Essential to understand how such systems should be created is that every user said that their behaviour in terms of annotating events as well as their expectation for what they would like to see in their story would change with usage. Therefore, the ability to change stories based on various aspects (such as the context dimensions defined above) as well as allowing for customizations based on media used within stories are essential.

V. Conclusions and Future Work

In this paper we presented a summary of MyRoR, a proof-of-concept self-monitoring system aimed towards providing more support for lifestyle management scenarios and experimenting with novel ways of visualizing user information. We also described results obtained through our exploratory user-based experiments (an online survey and hands-on experiments) we have performed with the goal of better understanding how such systems should be designed, who will be interested in using them, what and how information should be presented to the end users. Through the online survey, we were especially interested in finding out if people that consider themselves more self-reflective would find such system useful as well as like our story-based visualizations and the answers we got were encouraging for our work. Through our hands-on experiments we looked at what constitutes "meaningful" information, an essential aspect involved in creating user stories. The results we gathered helped us better design the system and even adding essential features into it.

While the main scenario here is a generic lifestyle management, further scenarios related to preventive health and monitoring of less critical conditions are addressed within the X (blind review) project. Testing such systems within more specific application areas (such as bipolar diseases, heart diseases, etc.) is also envisioned within our future efforts. Given the design choices we have made in terms of data collected as well as the types of interactions created, we believe that MyRoR is very well suited for supporting various health scenarios (i.e., physical, mental and social), either as a self-reflection tool or as a more complex and unbiased personal diary.

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References

[1] Friends Provident and Future Foundation. Visions of Britain 2020: Health and Wellbeing. Report, July 2010.

[2] UK's Department of Health. Supporting self-care-A practical option. Report, April 2006.

[3] The Future Vision Coalition. A future vision for mental health. Report, July 2009.

[4] J. Burton, "WHO Healthy Workplace Framework and Model: Background and Supporting Literature and Practices, " report, 2010.

[5] B.J. Fogg, Persuasive Technologies: Using computers to change what we think and do. San Francisco, CA: Morgan Kaufmann, 2003.

[6] R. W. Picard, "Affective medicine: technology with emotional intelligence, " in Future of Health Technology, Bushko R G (ed), IOS Press, 2002, pp. 69-85.

[7] M.L. Lee ML, A.K. Dey, "Lifelogging memory appliance for people with episodic memory impairment," in: Proceedings of the 10th International Conference on Ubiquitous Computing, Seoul, Korea, September 21-24, 2008, vol. 344, pp.44-53.

[8] Journey to Wild Divine. http://www.wilddivine.com (accessed 3 January 2012).

[9] SmartBrain Technologies. http://www.smartbraintech.com (accessed 3 January 2012).

[10] GSR2 Biofeedback System. http://www.biof.com/onlinestore/gsr.asp (accessed 3 January 2012).

[11] StressEraser. http://stresseraser.com (accessed 3 January 2012).

[12] Resperate. http://www.resperate.com (accessed 3 January 2012).

[13] HealthBuddy(Bosch). http://www.bosch-telehealth.com (accessed 3 January 2012).

[14] M. Sung, A. Pentland, "LiveNet : Health and Lifestyle Networking Through Distributed Mobile Devices, " in: Proceedings of Workshop on Applications of Mobile Embedded Systems, MobiSys 2004, Boston, MA. 2004. pp. 2-4.

[15] L. Zeng, P-yun Hsueh, H. Chang, "Greenolive : an Open Platform for Wellness Management Ecosystem," in Proceedings of the IEEE International Conference on Service Operations and Logistics, and Informatics, Qingdao, Shandong, China, 2010.

[16] D. Trossen, D. Pavel, "Sensor Networks, Wearable Computing, and Healthcare Applications, " in IEEE Pervasive Computing 2007;6(2):58-61.

[17] D. Tapscott, Grown Up Digital: How the Net generation is changing your world. New York, USA: McGraw-Hill, 2008.

[18] A. Ståhl, K. Höök, M. Svensson, A.S. Taylor, M. Combetto, "Experiencing the Affective Diary," in Journal of Personal and Ubiquitous Computing 2009;13(5):365-378.

[19] {removed for the purpose of the blind review process}

[20] A.K. Dey, G.D. Abowd, "Towards a Better Understanding of Context and Context-Awareness, " in Proceedings of the 1st international symposium on Handheld and Ubiquitous Computing (HUC'99), Karlsruhe, Germany, September 27-29, 1999.

[21] R.W. Picard, E. Vyzas, J. Healey, "Toward Machines with Emotional Intelligence: Analysis of affective physiological state, " in IEEE Transactions on Pattern Analysis and Machine Intelligence 2001;23(10):1175-1191.

[22] K. M. Brooks, "Do story agents use rocking chairs? The theory and implementation of one model for computational narrative, " in Proceedings of the 4th ACM International Conference on Multimedia (MULTIMEDIA'96), Boston, MA, U.S.A., 1996:317-328.

[23] V. Nisi, A. Wood, G. Davenport, and I. Oakley, "Hopstory : An Interactive , Location-Based Narrative Distributed in Space and Time," in Proceedings of the 2nd International Conference on Technologies for Interactive Digital Storytelling and Entertainment (TIDSE 2004), Darmstadt, Germany, June 24-26, 2004, pp. 132-141.

[24] B. M. Landry, "Storytelling with Digital Photographs : Supporting the Practice , Understanding the Benefit," in CHI 2008 Proceedings, 2008, pp. 2657-2660.

[25] L. Romero, J. Santiago, and N. Correia, "Contextual Information Access and Storytelling in Mixed Reality Using Hypermedia," Computers in Entertainment, vol. 2, no. 3, pp. 1-23, 2004.

[26] G. Ellis, A. Dix, "An Explorative Analysis of User Evaluation Studies in Information Visualization, " in Proceedings of the 2006 AVI workshop on BEyond time and errors: novel evaluation methods for information visualization (BELIV 2006), Venice, Italy, 23 May, 2006.

[27] N. A. Nijdam, Mapping emotion to color. http://hmi.ewi.utwente.nl/verslagen/capita-selecta/CS-Nijdam-Niels.pdf (2005, accessed 3 January 2012).

[28] D. McCandless, Information is Beautiful, http://www.informationisbeautiful.net/visualizations/colours-in-cultures/ (2009, accessed 3 January 2012).

[29] MyRoR online survey: http://ieg.essex.ac.uk/myror/survey/intro.php.