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## MOMMA: Museum MOTion & Mood MApping

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# eNTERFACE

2015

Mons, Belgium  
Aug 10th - Sept 4th

## Proceedings of eNTERFACE'15

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### The 11th Summer Workshop on Multimodal Interfaces

August 10th - September 4th, 2015  
Numediart Institute, University of Mons

Mons, Belgium

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# eNTERFACE

2015

Mons, Belgium  
Aug 10th - Sept 4th

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*Paolo Albornò, Ksenia Kolykhalova, Emma Frid, Damiano Malafronte, and Lisanne Huis in't Veld*

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#### EASA : Environment Aware Social Agent

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### Project #4:

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#### MOMMA: Museum MOtion & Mood MAPping

*Charles-Alexandre Delestage, Sylvie Leleu-Merviel, Muriel Meyer-Chemenska, Daniel Schmitt, Willy Yvart*

# eINTERFACE 2015

Mons, Belgium  
Aug 10th - Sept 4th

## Preface

The 11th Summer Workshop on Multimodal Interfaces eINTERFACE'15 was hosted by the Numediart Institute of Creative Technologies of the University of Mons from August 10th to September 2015. During the four weeks, students and researchers from all over the world came together in the Numediart Institute of the University of Mons to work on eight selected projects structured around “multimodal interfaces”.

The eINTERFACE workshops aim at establishing a tradition of collaborative, localized research and development work by gathering, in a single place, a team of leading professionals in multimodal human-machine interfaces together with students (both graduate and undergraduate), to work on a prespecified list of challenges, for four complete weeks. In this respect, it is an innovative and intensive collaboration scheme, designed to allow researchers to integrate their software tools, deploy demonstrators, collect novel databases, and work side by side with a great number of experts. It brings together dozens of researchers for a whole month, subsequently it is the largest workshop on multimodal interfaces.

The eINTERFACE was initiated by the FP6 Network of Excellence SIMILAR. It was organized by Faculté Polytechnique de Mons (Belgium) in 2005, University of Zagreb (Croatia) in 2006, Bogaziçi University (Turkey) in 2007, CNRS-LIMSI (France) in 2008, University of Genova (Italy) in 2009, University of Amsterdam (The Netherlands) in 2010, University of West Bohemia (Czech Republic) in 2011, Metz Supélec (France) in 2012, New University of Lisbon (Portugal) in 2013, and University of Basque Country (Spain) in 2014.

eINTERFACE'15 returned to Mons in 2015, exactly ten years after the first workshop held in the same place. This year was also a special year for the city of Mons which was European Cultural Capital.

We would really like to thank the entire local organizing committee which made this event a great success both from a professional and personal point of view.

And finally, we would like to thank to all the participants to this workshop for coming in Mons!

Matei Mancias and Christian Frisson

*Publication chairs*

# eNTERFACE

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## Project #4:

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### MOMMA: Museum MOtion & Mood MApping

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# MOMMA: Museum MOTion & Mood MApping

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## Abstract

Technologies available today allow the experience of the visit to be documented precisely within a somewhat ecological framework of research museum curators and, more broadly, any individuals involved in the domain. However, they still need simple technical devices and easy-to-implement investigation methods in order to obtain precise, reliable, and easily interpretable results. The M4Museum project aims at testing a particular setup of mixed technologies as to assess their usefulness in analysing a visitor's experience. It is based on the intimate experience of visitors during their route in a natural and autonomous setting, as it synchronously records a video tracing their visual perception (visual field and position of the gaze), their emotional state, and the circuit travelled. It is also a case of application for SYM in a more challenging environment.

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**Keywords:** subjective re-situ interview, course of experience, mood, valence-arousal, android application

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## 1. Introduction

Nowadays, the better understanding of the public, its motivations and expectations represents keys of the understanding of strengths, weaknesses and possible improvement of a given facility. To a great extent, this project was a kind of a feasibility study attached to a larger project. During this workshop we aimed at determining strengths and weaknesses of an exhibition by trying to characterize the visitor experience throughout his/her sense-making processes.

Indeed, sense-making processes are expected to be influenced by the visitors affects (emotions, mood, feelings, etc.) especially when it comes to being confronted a piece of art that is specially intended to produce feelings. In this case, affects can be seen as part of the first parameters regarding their potential impact on the personal experience. Thus, in this workshop, we decided to test the feasibility and the workability of a prototypical tool aimed at helping the researchers access that very private kind of data.

Making this access easier could lead, in our opinion, to new tools for assessment, analysis and decision making in a wide variety of areas. Although available

existing technologies, we were unable to find any simple or integrative set-up capable of giving a precise, reliable and easy-to-implement measure with easily interpretable results.

The main goal within the MoMMa Project is to sketch a protocol to get the visitor's intimate experience during his/her visit in an ecological<sup>1</sup> and autonomous setting<sup>2</sup>. Trying to follow the adage saying that there is no better data than more data, we decided, in this study, to try to make a synchronous record of their visual perception with focalization spots and their localization in the museum, as well as their emotional state. This approach could create a viable common ground between qualitative and quantitative research.

## 2. User experience: a survey

<sup>1</sup>trying to be the least invasive

<sup>2</sup>trying to give to the visitor a certain freedom in his/her movement

## 2.1. Museal experience and sense-making processes

In museums, the ‘course of experience’ research programme [33] aims to identify, describe, and understand how visitors construct meaning and knowledge during a museum visit under natural and autonomous conditions (without a guide or teacher). The question concerning the museum experience is : what makes sense from the visitors's point of view during their visit?

Sense-making can be schematized this way: when confronted with reality, the person has to join up the perceived dots and his/her available reference points (past experience, knowledge, patterns, etc.) in order to create a coherent drawing, his/her reality, avoiding, if possible, confusion, non-sense, etc. This construction is trapped into the very limited spatio-temporal configuration, in other words, the exact ‘drawing’ is only available to the person at that moment and in the place where and when it happens.

That is to say ‘Every visitor lives in an environment that is meaningful on a personal level’ [35]. However, we know that if this environment as it is perceived by the visitor can be reproduced (i.e. by presenting to the person a recording of his/her point of view), he or she may relive this experience, with, this time, adequate conditions to be able to describe to the researcher. This ability to describe what has been seen and felt as well as the thoughts that come to mind is based on revivification, namely the ability to re-experience (in quality) what has already been experienced [28]. Hence, in our experimental set-up we decided to rely on subjective re-situ interviews we present hereafter.

## 2.2. Mood as a central parameter in qualitative research

If it is a common ground to say that pieces of art are created in order to produce feelings or emotional experience, the study of the bystander's mood is sometimes neglected in many areas of science. However, since the early work of Herbert Simon [30] on the link between decision making processes and emotional experience, mood and affects in general have been, with highs and lows, at the very centre of the scientist's focus, at least in human sciences. Findings have shown the importance of this parameter[20]; nevertheless, in the literature, it is very hard to find any sufficiently stable or rigorous definitions or distinctions between different possible affects - according to Gross and Barrett : ‘*It is widely agreed that emotion refers to a collection of psychological states that include subjective experience, expressive behaviour (e.g., facial, bodily, verbal), and peripheral physiological responses (e.g., heart rate, respiration). It is also widely agreed*

*that emotions are a central feature in any psychological model of the human mind. Beyond these two points of agreement, however, almost everything else seems to be subject to debate*’ [13]. Quoting Dennett we could regret this epistemological lack as ‘*Rigorous arguments only work on well-defined materials*’ [8]. Using the disambiguation exposed by Yvart *et alli* [38] we decided to work with the affective concept of mood which refers to something we can attach to Heidegger's ‘*stimmung*’and ‘*befindlichkeit*’[14]. From a strictly emotional point of view it lasts longer and has milder but more pervasive effects on the person compared with emotions. But from a more general point of view it can be seen as a central parameter of attentional, dispositional and sense-making processes [38].

Following evidence between learning and felt happiness [10] and between enjoyable museal experience and reported knowledge acquisitions [28], we thus proposed to rely, as a work hypothesis, a strong link between sense-making processes and mood. In this way, by characterizing the contextualized emotional experience of a visitor during an exhibition, we think possible to characterize the efficiency of the exhibition according to its main objectives: bring something to the visitor and help him to create sense out of his/her experience. The information about mood is no substitute for re-situ interviews but can be seen as a valuable additional source of knowledge.

Be that as it may, we first need a tool to characterize moodal experience, then we need to contextualize this experience (where and when that moodal configuration occurred). Studies of emotions and affects managed to raise such an enthusiasm and an interest that it is now possible to talk about an industry of emotion [7].

## 3. Experimental setup

MOMMA directly follows Daniel Schmitt's work on trying to characterize the strengths and weaknesses of a museal exhibition [27] by taking a look at the sense-making processes in context. His main experiment consisted in the use of a POV<sup>3</sup> camera worn by the subject during his/her visit (with or without gaze capture). After that, the subject was invited to comment the exhibition and his/her experience relying on the upsurge effect of the POV video; this technique is called ‘*Subjective Re-situ Interview*’. In order to access verbalized affects, the researcher used a discrete VAS (Visual Analog Scale) represent for the hedonistic valence (from -3 to +3).

MOMMA was the opportunity to go one step further by introducing SYM, a new tool developed in order to help the user in expressing his/her mood at any

<sup>3</sup>Point of View.

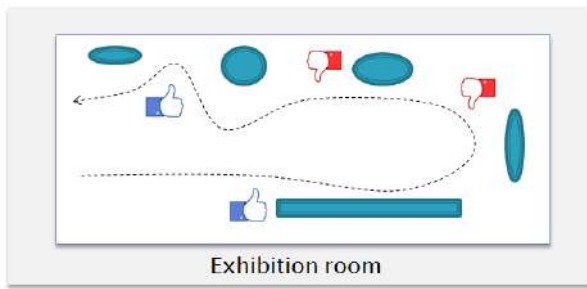


Figure 1. Aimed representation of the MoMMa project

moment of an experimental setup, adding the arousal information to the hedonistic valence one and replacing the discrete VAS by a continuous graphical space. Furthermore we could add latest generation eye-tracking glasses and localization techniques in order to contextualize the experience of the visitor in order to diagnose the exhibition in itself.

The main purpose of the workshop was to obtain a prototypical tool that could lead, after many improvements, to the constitution of qualitative and quantitative global evaluations of an exhibition setup [see Figure 1].

### 3.1. Eye Tracking

Eye tracking is about keeping a trace of the eye movements of an user in his/her visual field [17]. This technique is generally used for a purpose of interactivity (i.e. touchless control of some devices) or for a purpose of diagnosis (i.e. to determine salient parts in a picture) [9] as has been studied for a long time [23].

Nowadays, there are two main ways to perform this kind of measurement: an ‘invasive’ but wearable way (the person wears equipment on the head) and a ‘non-invasive’ but static one (the equipment is set up at a defined place, the person does not wear any special gear but cannot move). Technically, as for calibration, the two methods give similar results, penalizing, in general, people wearing glasses - the measurement takes account of the movements of the eye with infrared light that is easily reflected by glasses.

Although still technically improving and being modified, these techniques still suffer from technical limits, but, according to Duchowski [9], eye tracking techniques are able to provide a ‘*quantitative measure of real-time overt attention*’. Our objective in this project is to try to marry these quantitative measures to more qualitative ones relying on affective states.

For ecological reasons (according to Bateson’s meaning [5]), in other words, in order to minimize the influence on the subject, non-invasive methods seem to be the best option as we can expect fewer experimental biases. However, as our experiments were

performed in a museum, we were not able to use non-invasive methods such as the FaceLab, as they require a fixed environment for the user (the eye-tracking measurement is an indirect one consisting in filming the retina). Fortunately, we were able to test one of the latest Tobii Glasses. They consisted in headgear resembling glasses, with a full-HD front scene camera with 50 / 100Hz gaze sampling cameras. This way, we were finally able to obtain, a POV recording with focal measurement as an additional video layer.

### 3.2. Subjective Re-situ Interviews

The measurement of gaze and focal points seems critical for museum curators, as it gives them information about what people look and read - if an information plaque is read or not or if people look at the collections. To their mind this measurement is seen as a qualitative justification for expenses (should we pay for bigger plaques? etc.). However, from our standpoint, it only allows us to know what the visitors have been seeing, but not what they have been looking at attentively or retaining.

So, during this experiment, we only considered the eye-tracker as a tool to preserve a trace of the world as perceived by each visitor and as an anchorage point allowing further re-situ interviews. The visitors were equipped with glasses and after about 30 minutes of free visit, the eye tracker was removed and the visitors placed in front of a video screen, close to the site of the visit. The video recording of the visit with the gaze points was then projected on this screen, and the visitor was invited to comment on his/her experience of the visit.

During the subjective re-situ interview, the visitor spontaneously divided his/her actions into units which were significant and fully coherent from his/her own point of view. The subjective re-situ interview was then transcribed for further analysis. The aim was to identify what was taken into account by the visitor at each and every moment: what he/she looked at (with attention or intention) and did in addition to the expectations, preoccupations, and knowledge called upon, with the aim of documenting each fragment of the meaningful sequence and then reconstruct the visitor’s experience.

For any piece of art shown to the public, visitor tried to isolate a fragment, a shape, a color, that raised expectations. These expectations are often identified as questions and tensions (why a shape, a color, a relationship...) that call for answers. So each visitor mobilizes his/her knowledge, but also his/her experiences as memories, images, dreams... anything that may help to link him/her to this fragment of reality, always in relation to the question he or she asks.

Empathy for example, is a possible form of resolution of the tension from their point of view. To feel the



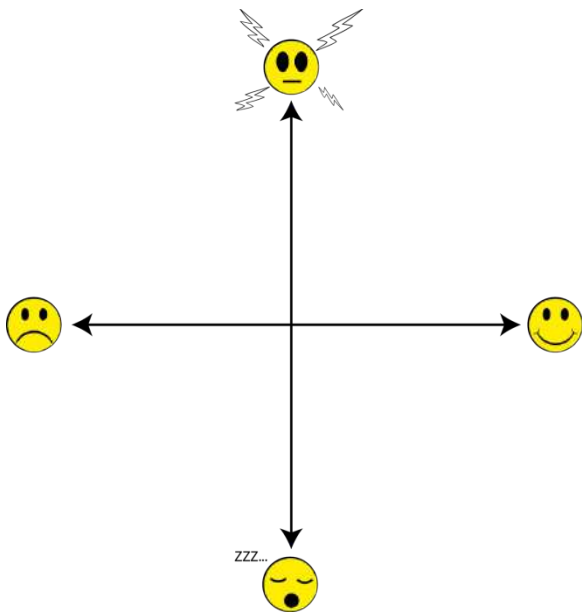


Figure 2. Valence / Arousal space of SYM

environment of a painting, its atmosphere may be sufficient to "understand" something. Empathy is a way to connect the visitor to the painting, to his/her reality of the painting. Then the visitor "knows" something and this knowledge allows him to make sense. In this case, empathy is an operative relationship, but we also found relationships built from memories, dreams or reminiscence.

For each one, a camera placed behind the visitor and the researcher recorded the interview for conservation purposes or future meta-analysis [26] or in order to aggregate data into a set using, for example, annotation tools such as Advence[3] or ReCall[4].

### 3.3. SYM: Spot Your Mood

SYM [38] aims at proposing a protocol of explicitation support of individual mood in *in situ* experimental conditions. For MoMMa, the software solution consisted in an Android application, running on a tablet, collecting contextualized data to be gathered in a database (for analysis). Tablets were distributed to the co-participants so that they carried them during their visit. At any moment and at any place during this visit, the co-participants could, without any supervision, indicate their mood, their psycho-physiological state.

The indication of this state was done by the user on a diagram of Valence / Arousal as defined by Russell[24]; that is to say, an orthonormal referential where the X axis stands for the hedonistic valence (pleasure / displeasure) and the Y axis stands for the psycho-physiological activation, the arousal (drowsy / excited). *Extrema* of the vectors show smileys representing,

in the most explicit non-verbal manner, pleasure (right), drowsiness/sleepiness (bottom), displeasure (left), excitement/high arousal (top) (see Figure 2).

Originally, the first implementation of SYM was using a *node.js* server. The client received a single page with a *SVG* area handling all the interactions through web-sockets. Data was processed and stored in a *MariaDB* database. Even if it could be transformed into an Android application, the initial implementation was a "test of feasibility" design of SYM. To be more reliable, a specific Android application was specially developed during eNTERFACE. It also allowed an easier implementation of a rough indoor localization solution based on WiFi RSSI.

During the development phase of SYM we were able to notice that the totally a-verbal approach could be confusing and a little "user-unfriendly". Originally, when spotting a point on the VA diagram we could not be sure of the correct apprehension and understanding of the tool. Moreover, in some cases, it could be impossible to characterize a unique mood based upon coordinates. For example, "angry" and "afraid" are very different in nature but very close on a VA-space.

It was then decided to design an additional "emotional concepts" database. Considering a lack in terms of available adjective checklists in French we decided to rely on tried and tested ones based on English as a starting point [25][29][15][16][11][6][36][1][2][18][21][32][19][34][31]. Hence we were able to collect 373 different adjectives standing for different emotional concepts. Translating these words with every possible translation and considering every synonym and short sentence gathered on wordreference.com finally resulted in a collection of 2278 different concepts (including polysemic ones).

These concepts linked together nouns, verbs, adverbs and/or short expressions standing for the largest possible "experientable" mood. Each concept comes with its definition so as to disambiguate in the case of a polysemic one. For example "*bouleversé*" in French (literally "turned upside down") stands for different possible moods from "shattered" to "overwhelmed", we can be "*bouleversé*" by a romantic movie or by the loss of somebody resulting in very different experiences but also resulting in different *loci* on the space.

In order to link similar concepts to each other, a semantic proxemy analysis created a net based on the words leading to emotions. This net was based on the use of Dicosyn [22] in order to create "*intersynonymic*" relationship between the terms weighted as a Jaccard's distance [37]. Then, about 150 words were placed by the team on the diagram in order to produce a temporary tagged space. These words were selected as being the 150 most frequent translations within the corpus of checklists collected.

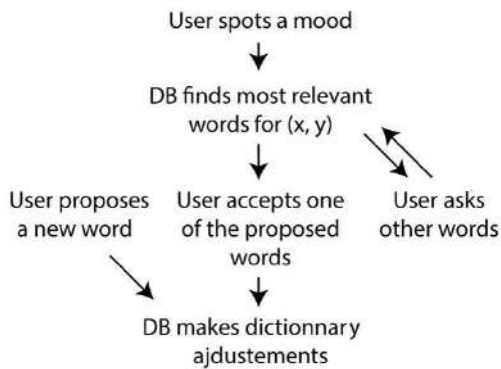


Figure 3. SYM simplified workflow

During the experiment, when the user spotted a mood on the diagram, the coordinates of the point were processed to find the 3 closest emotional concepts in terms of coordinates. The 3 suggestions were then proposed to the user to be accepted or discarded; in this case, 3 other suggestions were proposed each time the 3 previous suggestions were rejected by the user. Each tuple of  $(x, y, \text{word})$  was saved for experimentation analysis, and was taken into account to update the positions of the emotional concept on the Valence / Arousal space.

At the very moment the person spotted his/her mood, his/her location was also saved and added to the dataset.

#### 4. Analysis

As the experiment took place in a student-city during summer holidays we were afraid not being able to collect enough data. Moreover, the experiment could only be conducted over one week and in a somewhat secluded part of the museum in order not to disturb the public. Due to a lot of technical issues we are going to sum up, the initial experiment had to be lightened.

During the experimentation (one week out of the eNTERFACE month), 12 visitors were equipped with an eye tracker for approximately 20 to 30 minutes to record their subjective visual perspective that is numerically compliant in the heart of a qualitative study [12]. The eye trackers allowed us to go further as compared with previous research[27], to be more precise by increasing the quality of information but also the quantity (we could add to the dataset about the focalization points within the field of view). At that moment, we were able to confirm that the eye trackers are not experienced as foreign nor invasive elements, they do not significantly modify the behaviour of visitors, thus they can be neglected as a significant bias.

Until now, visitors had only been equipped with spy-cameras, then they were asked to show on the screen and comment the items they were looking at during

the subjective re-situ interview. During this phase, an additional witness camera, at that moment, was intended to record the interview but also some visual information like the person pointing out a part of the screen. During MOMMA we decided to discard witness camera to avoid some experimental cumbersomeness. In fact, we were able to ascertain that most of the people indicated the same area of the screen, consequently the same area of the video, as the gaze area highlighted by the eye trackers.

As an alternative to the use of the witness camera, we can now advocate the use of screen capture software alongside with an audio recording to reach the same results. This is an important practical contribution provided by the MOMMA experiment in terms of reducing the experimental setup cumbersomeness.

Due to technical issues we were not able to collect correlated mood spotting measurements during the user's route throughout the exhibition. Nevertheless we were able to run tests with available students and observe that not a single person had difficulties in spotting a mood on the Valence-Arousal space. The proposition of words also worked very well, and gave us some feedback on the initial placement of concepts on the diagram. However, the main issue was linked to the usage of the tablet. We had a certain variety of participants, and some of them did not know how to use a tablet, and were unable to get out of sleep mode - and quickly stopped using it for this reason.

Moreover, they felt indisposed by the size, the weight and the brittleness of the device they had to carry all along their visit. This means we will have to find, for future experimentation a more comfortable device to wear for the participant where SYM could be implemented while keeping its presentation and functionalities. As SYM is based upon a client based software, we have been able, so far, to run it on a smartphone without any sizeable adaptation problems. A good perspective to investigate would be to create a graphically smaller version that can be used on small screen devices such as smart watches or smart-phones.

Be that as it may the biggest technical issue we had to cope with concerned the indoor localization we tried to set up. The number of concurrent WiFi networks changed significantly between the installation of the WiFi spots and the actual experimentation. It may be explained by the fact the installation took place on a closing day, when no one was in the building. Also, any smartphone can emit its own WiFi signal to allow net browsing on a laptop, which could happen in the atrium - an area freely open to the public really close to us.

Nevertheless, we managed to draw the route of the visitors not without a lot of noise resulting in a fuzzy drawing. Taking into account the WiFi technique and the smoothing we had to apply, our system was only

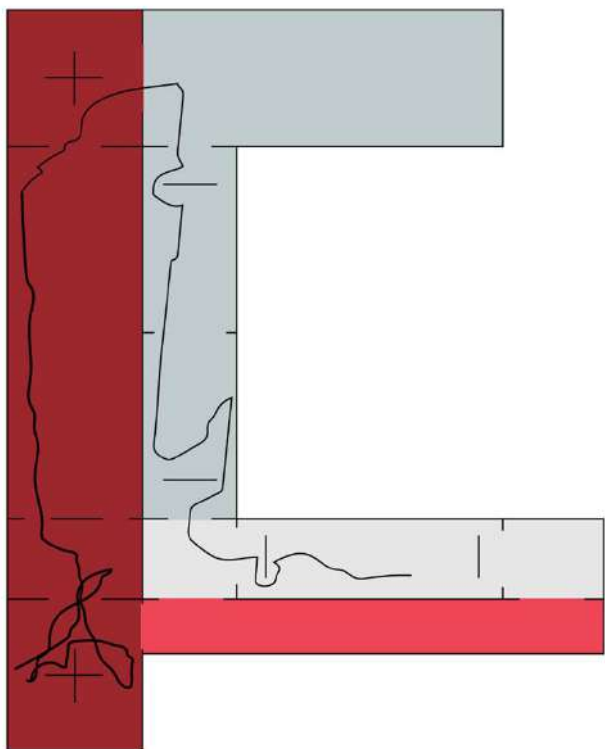


Figure 4. Map of the visit of one interviewee

able to produce a route with a margin of error of around 3 meters. This margin is still too big for further analysis.

This lack proved the necessity of getting a reliable localization method, as the mood spotting done through SYM would only be synchronized by the video of the eye tracker - which is a long and painful process. Actually, all along the data gathering process we had to take into consideration the future analysis which needed the data to be synchronized. We were not able, during eNTERFACE workshop to find a suitable technique to do so. Paths we are exploring for future works consist in either the use of the tablet clock or the use of an inaudible high frequency signal to be broadcast by the tablet and recorded by the eye-tracker's built-in microphone.

## 5. Conclusion and future works

Subjective re-situ interviews have been raised to become an invaluable tool for qualitative research about visitor's experience. It reveals that knowledge is not simply transmitted in the sense of accumulating information, but rather constructed by each visitor as an adequate response to his/her expectations through the resources available in the environment and linked to his/her past and knowledge. Hence we cannot neglect such a collection of cues we can sometimes notice

in the literature. Furthermore, the addition of eye-tracking tool appears to be insightful, especially when it allows to dispense with a relatively cumbersome or hefty witness camera during the interview procedure. Making the procedure lighter is a great gain when it comes to minimizing experimental biases as it becomes less invasive and persuasive for the interviewee. In this sense, subjective re-situ interviews can be seen as being part of the decision support systems family.

As it is now clear that we need to rely on very private information during the exhibition visit, and as we consider the mood as being one of the most important parameters to explore, SYM appears to be a suitable tool especially when it can be set up alongside localization techniques and on wearable devices.

Despite a certain lack of experimental data, we can however consider that in a pragmatical view, MoMMA can be regarded as a test of feasibility for further improvements. We can also notice that the semantic layer we started to implement could be seen as opening promising avenues transforming SYM into a real verbalization assistance tool. Lighter and quite practical to deploy as compared with subjective re-situ interviews, SYM can be set up as a light diagnostic tool in order to first characterize the "greatest" weaknesses within a given exhibition. It allows researchers to collect qualitative information without the loss of a sizeable quantity of experimenters. Then, it could be possible to deploy a subjective re-situ interview setup in order to inquire deeper into the very heart of the problem. This strategy is the one we choose to develop in our new M4X project.

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