DIGITAL MUSIC INTERACTION CONCEPTS: A USER STUDY

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ABSTRACT

The popularity of digital music has recently rapidly increased. The widespread use on computers and portable players and its availability through the Internet have modified the interaction issues from availability towards choice. The user is confronted daily with an enormous amount of music. This situation shapes the need for the development of new user interfaces to access and retrieve music that takes full advantage of the music being digital.

This paper reports the results of various user tests aimed at investigating how music listeners organize and access their digital music collection. The aim of the study is to investigate novel interaction concepts to access and retrieve music from large personal collections. The outcome of these studies was an interaction concept based on the notion of similarity of music items (artists and songs). This concept was further refined and developed into a demonstrator eventually tested with users.

1. INTRODUCTION

The paper focuses on retrieval, navigation and organization of music from large personal user collections. While the focus in literature is on the very important aspect of playlist generation such as [1] or music recommendation, not many have described interactive user interfaces to navigate through music collections. An interesting attempt is found in [2] where features directly extracted from the audio are used to build a map of the music collection. This work, however, addresses collections of only few hundreds of songs (359) and is mainly concerned with PC based interfaces. Another music browser is described in [3], although it seems designed for professional use and not for non-professional music lovers.

The author does not know a deep study on this topic. Vaessens [4] studied how people express and describe their preferences for music they want to hear but it does not address navigation nor organization issues. Another study, reported in [5] focuses on music listening behavior for CD collections. The authors interviewed 6 music lovers who owned a large music collection (350 - 1400 albums). The main questions were: (i) How do users retrieve content out of their collection? (ii) What attributes do they use as cues?

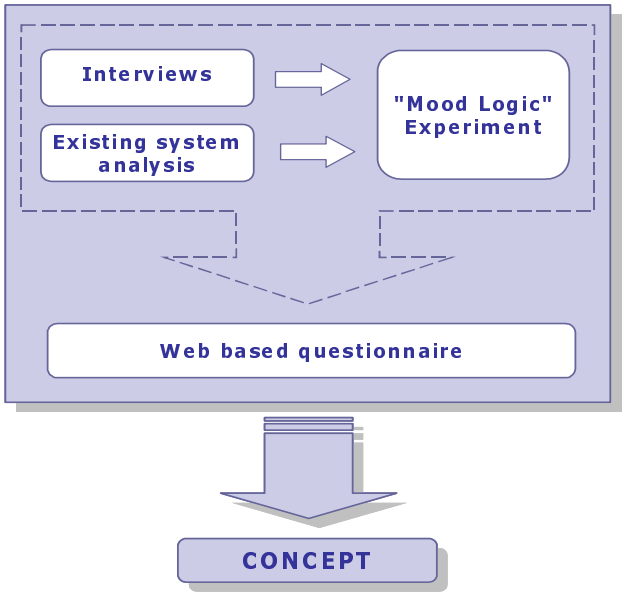

Figure 1: Scheme and flow of the user study: interviews and analysis of existing system plus a small field test lead to the hypothesis definition which were verified with a larger scale web questionnaire

Common ways of organizing a music collection were identified, among them: alphabetical, non-alphabetical and hot rotation (of recent/favourite CDs). All of them have in common the physical format of CDs: "… *As a result of the physicality of current collections, attributes are mainly visual and spatial attributes and the history enriched information that is added to the collection through the interaction of the user during use.*" [5].

Unfortunately these results can only partially be applied to digital music collections because these collections have a different physical format. Moreover just relying on the disk metaphor would not make the users aware (and the interaction richer) of the enormous potential offered by digital music.

In our study we are focusing on those characteristics or attributes of the songs that can be obtained (e.g. through content analysis or web-mining) when the music is stored in a digital format on DVDs or hard disks on PCs or CE devices. Some of these attributes (catalogue metadata), such as *artist-name*, *album-name*, *song-name* are well known and widely used. Others, less common, are related to intrinsic characteristics of songs such as *tempo, rhythm,* and *timbre*. Others, such as *listening frequencies* and *preferences,* are dependent on users' behavior. The purpose of this study is to identify what are the most important attributes as well as the best way to combine them into a meaningful interaction concept to ease organization, navigation and browse through music collections.

The paper is organized as follows: a first section describes the objectives and the logical schema of the study, the following sections describe in details the experiments and the results obtained. A section follows that wraps up the requirements for the design of the demonstrator. The last section presents some recommendations and the conclusions.

2. OBJECTIVES OF THE STUDY

The main concern of this study is to investigate what the users know, how they listen to and takes care of their music and how they organize and use their collections. This study is made up of smaller user studies logically connected as shown in Figure 1. In particular it consists of interviews with potential users, small field tests of existing software and a web-based questionnaire.

In order to get a clear and unambiguous understanding of the research goal and research questions some frequently used concepts will be defined in the following:

- *Digital music collection*: a set of digital music files stored in different digital formats on hard disks or memory or optical disks, audio CDs are not considered to be digital music collection in this context.
- *Popular music*: a group of different music styles found to be popular by people in one period of time (read today).

The research questions addressed in this study are the following:

- How do users organize their collections?
- What are the most important attributes and what role they play for organization and usage of a digital music collection?
- Are there different attributes for playlists creation, browsing and navigation?
- What kinds of additional information do user desires?

The study does not address the problem of distributed and/or not always on-line collections of music.

The objective of the interviews was to collect qualitative information about users' behavior and needs. On the basis of these information and the results of the analysis of existing systems, a small field-test was designed to test how the availability of new features music influences the retrieval preferences of the users. These two steps lead to the formulation of some hypothesis about users' behavior and preferences. A web-based questionnaire was used to obtain quantitative data to verify these hypotheses.

3. STUDY 1: INTERVIEWS

The semi structured interview technique was chosen as the main tool to obtain a first set of answers. It allows not only answers to direct questions but also to go deeply inside the motivation. The interview consisted of forty questions divided into seven sections. The first section contains questions about the organization of the users' personal collection. The second section contains questions about the perceived importance of some attributes for search, navigation and browsing. The other sections were dedicated to obtain information about the use of statistics, the process of retrieving songs, play list generation and browsing. Before the interviews, a pilot study with one participant was done. His comments were taken into account and the questionnaire was changed accordingly.

Given the scope of the study, collections of jazz and classical music are excluded. It is generally known that to organize these collections people use specific attributes that matter only for this specific music, but not for the rest. For example the composer of a piece of music is commonly used in jazz and classic music but not for popular music.

Seven subjects were interviewed. Six were males, one female. All subjects had high vocational education, six technical and one psychological. The age varied from 23 to 29 years. All of them were experienced users of PC and Internet and owned a large collection of digital music (> 1000 songs). Their collections contain mainly popular music, but there were also other genres. Before each interview the goal of the study was explained to the participant who agreed to have the interview recorded. Each session took approximately 40 minutes.

3.1. Results of the interviews

All participants use hierarchical structure with folders and folders of folders (digital music is mostly played on PCs). Some participants create consistent structures with logical levels of hierarchy, but some have unstructured organization. Four participants out of seven use a hierarchical structure based on *artist-name/album-name/song-name* with small variations, two based their classification on *genre-subgenre* and only one uses *popularity* for his collection (he created his collection on the basis of the top 2000 songs of one radio station). Almost all subjects use additional folders to store music that does not fit the structure of the collection. One participant uses *language* as the highest level of the classification.

All participants own a CD collection as well. The way they organized their CD collection influences the organization of their digital music collections, basically they keep the same structure. For this reason the concept of *album* is very strong. CD covers were described in [5] as the most powerful search cues for CD collections and despite the fact that in digital collections they are mostly not available, the participants expressed high interest.

It was harder to find women that own large digital music collection than men. Whether there is any correlation between gender and willingness to collect music is unclear. Schuessler's study [6] showed that women were more interested in music than men, as well as having different tastes. Therefore according to this study gender is not the main issue. Perhaps other factors influence the situation indirectly, such as knowledge and experience of technology. It seems that women in general less likely have technical background and experience

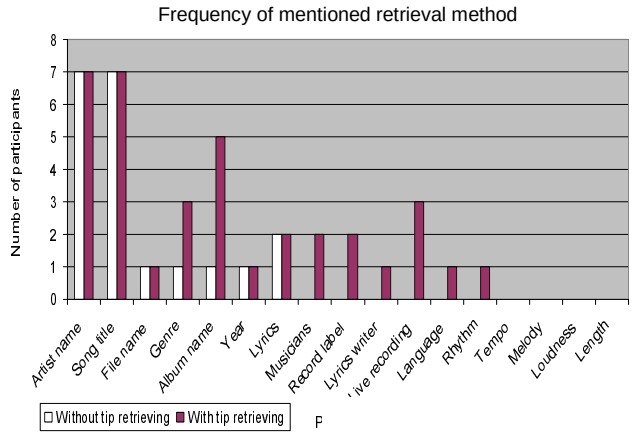

Figure 2: Frequency of the attributes to retrieve songs mentioned during the interviews. Left bar is without tip, right bar after the tip.

with new technologies than men. For this reason technology could be the barrier because, the main source of digital music consists today of web download and sharing tools. The sizes the collections vary between 1200 and 3500 music files (average about 2300).

The main findings are the following: All participants organize their collection and they do not use any specific tool for this purpose. Figure 2 shows the distribution among the participants of the attributes mentioned to retrieve music from their collection. During the interviews it became clear that the participants could not think of attributes other than the usual ones (catalogue metadata) so other attributes where mentioned and subjects were asked to agree or disagree (labeled tip retrieving in Figure 2).

3.2. Additional remarks

Genre as organization and retrieval method was mentioned quite frequently. In general music listeners feel comfortable to use *genre* classification when searching on web sites and in music stores. In music information retrieval (MIR) literature much emphasis is also given to genre classification methods based on feature extraction (see these paper for a deeper review [7;8]). However *genre* appears not to be a consistent, nor an objective classification scheme, see also [9]. AllMusicGuide [10] has 531 genres and styles, Amazon [11] 719 genres, CDDB [12] has 255 genres and subgenres. From our analysis of the interviews it seems that *Genre* is more appropriate for classification of music not known to the users. In this case it gives information about the kind of music they could expect. For personal collections the subjects apparently do not need the *genre* because the name of the artists convey more information.

For browsing and selection the interviewd subjects prefer to use attributes such as *mood*, *situation* or *activity*. Almost all of them mentioned situation as an important attribute: *music for reading, programming, driving, working, morning music, evening music* etc.

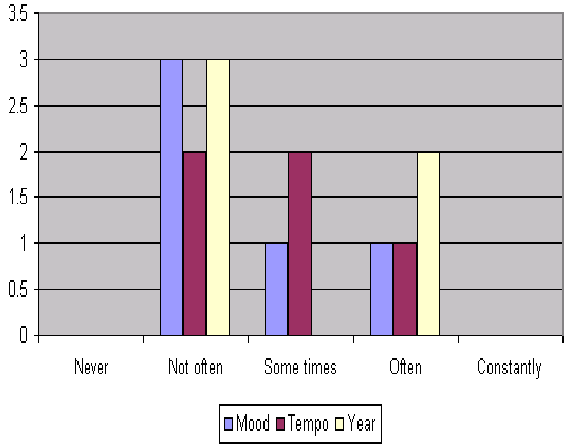

Figure 3: Frequency of declared usage of the features for the "MoodLogic" group (selection of music by mood or tempo or year).

4. STUDY 2: ANALYSIS OF EXISTING PRODUCTS

An analysis of currently available software players (a.o. *Winamp, RealOne, Windows Media Player, MusicMatch, Apple iTunes, MoodLogic*) was carried on. There are two main browsing concepts adopted by the tested systems (i) *view-based*, (ii) *association-based.* The *view-based* concept is the most popular because it provides a wide range of possibilities. It is based on the idea of selecting a particular set of songs according to one or more parameters. A user can define one parameter, for example *artist-name* and the system shows all songs of this artist. It is also possible to set more than one parameter to retrieve the desired music. Usually parameters such as *artist-name, album-name*, and *release-year* are used.

The *association-based* concept relies on the "*Give me some music similar to this particular song(s)*" idea. For the user this option is very convenient because it requires a low effort level. It is also a nice solution for playlist generation because users have difficulties to express their preferences in a formal way (e.g. by specifying attributes for the playlist) [4]. The drawback of this solution is that there is not much control on the output.

Most of the analyzed software products present the music collection in a hierarchical way based on the following structure: *genre, artist, album, and song*. Some products omit one level, such as *MoodLogic,* which omits the *album* level.

5. STUDY 3: THE "MOODLOGIC" EXPERIMENT

During the analysis of the existing systems it came out the only software that enable new ways to access to music (thus not based on simple hierarchy) is *Moodlogic*. This software allows users to choose the music according to the *mood*, to the *tempo* and to the *year-of-release* of the songs. Mood classification is based on information obtained from a community of users *Moodlogic* offers also the possibility to create one-

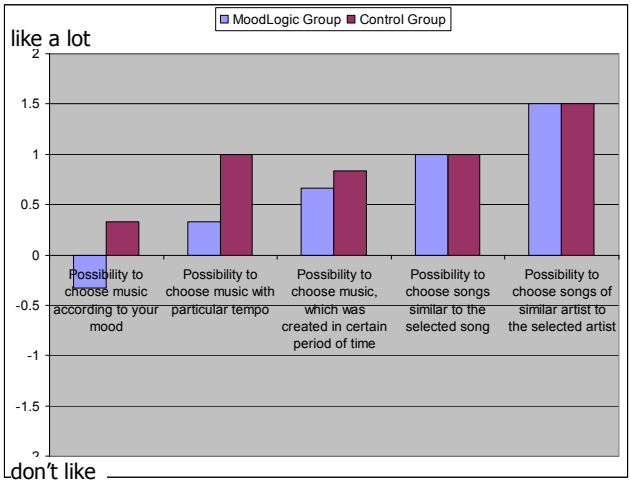

Figure 4: Averaged results for the alternative selection methods question for the *moodlogic* and the *control* groups (scale from –2: don't like to +2: like a lot)

click playlists of songs similar to a 'seed' song selected by the user. A specific field test was needed to investigate what users think about these new functionalities.

Twelve participants participated to this test: six of them in the *MoodLogic group,* the others in the control group. The *Moodlogic group* used the software for five days. They had access to a collection of 6000 songs (not their personal music collection) of different genres. The participants were asked to try all features and then to use the product the way they like. The *one-click playlist* feature did not work properly so a demonstration was showed to the participants. At the end of the experiments the participants were interviewed and a filled out a questionnaire. The answers to this questionnaire are given on a scale from -2 to 2 where -2 is "*I don't need it*", and 2 "*I want to have it*".

5.1. Results of the *MoodLogic* Experiment

Figure 3 shows the frequency of answers to the question about how often the new "MoodLogic" features were used. It can be seen that the participants did not use these feature often. Figure 4 shows the average results to the question on what features the users like most, respectively for the *MoodLogic group* and for the *Control group*. There is some visible difference in the perception of some features (e.g. mood based selection) for the participants who did experience the software, with respect to the control group. A statistical analysis is not performed due to the limited number of participants. What is apparent from the results is that the both "similarity" features: music similar to the songs selected and music from similar artists score quite high with respect to the other features.

6. STUDY 4: THE WEB QUESTIONNAIRE

The main goal of web-based questionnaire was to obtain quantitative data for the questions asked during the previous two user studies. The questionnaire consists of 14 questions that covered the following topics: personal information, collection and organization, most frequent

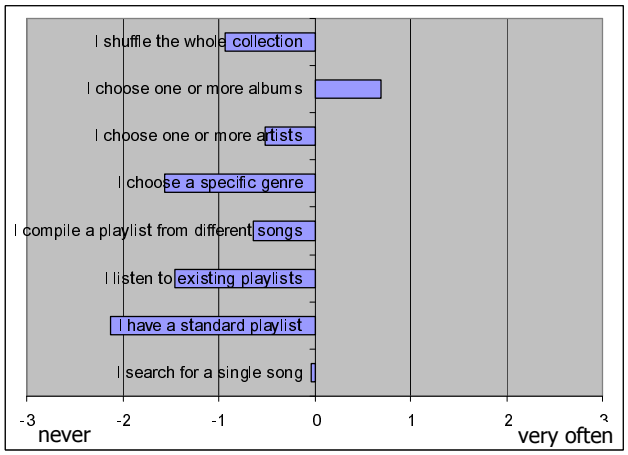

Figure 5: Averaged user's behavior (scale from *–3: never* to *+3 very often*)

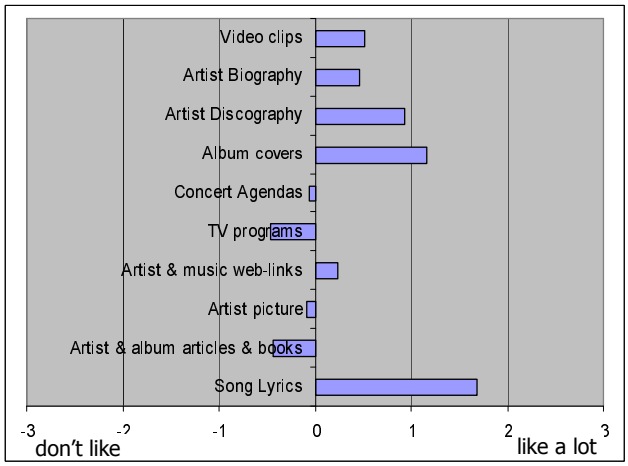

Figure 6: Averaged ratings of desired additional information/services for a music player (scale from *–3: don't like* to *+3 like a lot*)

tasks, new features and services and finally play lists creation. Eleven questions out of fourteen are multiple choice and the options come from the interviews.

The questionnaire was separated into 6 pages to keep the attention of the participants focused. On the first page a short explanation of the study was presented. The questionnaire was distributed to a number of subjects interested in music, obtained from previous studies [13].

6.1. Results of the Web Questionnaire

130 participants responded to the questionnaire. The responses were considered valid if the number of songs in the collection was bigger than 500 and if pop and rock genres contribute to the majority of the collection. According to these criteria only 86 responses were further analyzed. Among the participants 67% were between 20 to 30 years, 22% between 30 to 40 years and the remaining 11% older than 40 years. The population was almost exclusively male: 93% against a 7% female. The participants have their own collections organized along some sort of structure in 87% of the cases.

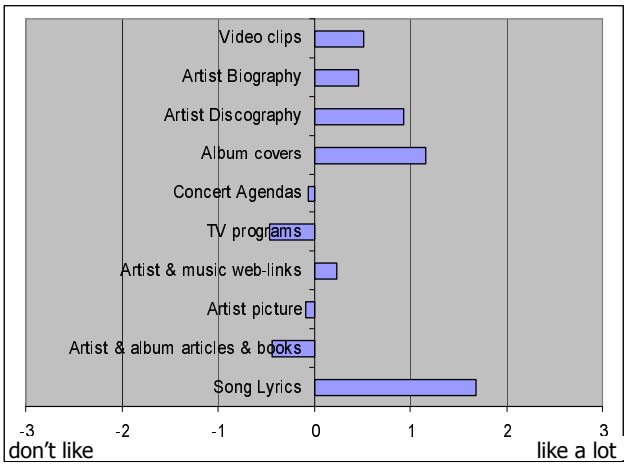

Figure 7: Averaged ratings of desired additional information/services for a music player (scale from *–3: don't like* to *+3 like a lot*)

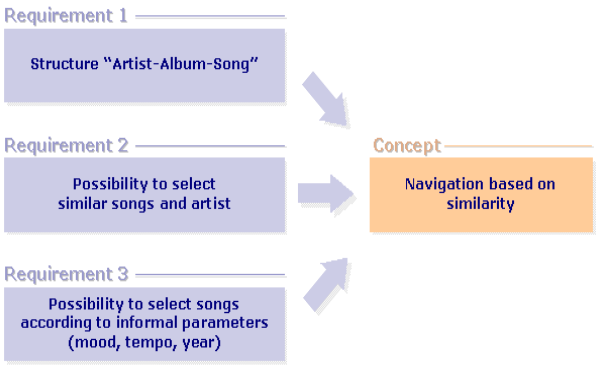

Figure 8: Requirements for the interaction. The notion of "similarity" (of artist and songs) was chosen as the basic interaction around which the interface was designed.

The most common structure used by the participants is hierarchical with *artist-name* as the first level in about 60% of the cases and *genre* or *album* in about 15%. Figure 8 shows the averaged ratings for some alternative selection methods (not based on hierarchy).

It can be seen that "similar artists" and "similar songs" scores quite high to confirm the results obtained during the interviews. In Figure 6 the results of the questionnaire on additional information or services are summarized. It is visible that song lyrics and album covers are very appreciated together with discography, biography and video clips.

7. USER REQUIREMENTS

The results of the user studies gave us some ideas for alternative ways to navigate music collections, which were developed further into a user interface concept. Moreover the following requirements have been identified: (i) the music collection should be presented with the structure *Artist-Album-Song*. (ii) *Genre* can be presented as an option. (iii) The system should allow the selection music according to *period of time* and *mood*. (iv) The system should offer the opportunity to select songs similar to those already selected and songs of artists similar to the already selected artist(s). (v) Statistical data about the usage of the collection should be recorded to enable functionalities such as: play *last acquired songs*, play *frequently played songs* and play *last songs played*. (vi) the following additional music related information should be presented or access to this information should be provided: *song lyrics, album covers and artist's discography*. (vii) Easy and effective way of creating play lists should be provided. Figure 8 shows a schematic view of the more important identified requirements.

8. DEMONSTRATOR AND EVALUATION

A preliminary demonstrator was developed and evaluated with users (a screenshot is shown in Figure 9). The users can browse the collection in the 'traditional' hierarchical way to select artists or songs and use the 'similar' window to obtain similar items to those selected. When satisfied with the selection of a song they can displace some "adapters" on the target (top left of the screenshot) to adapt the similarity to their desires (e.g. song similar by tempo and by sound etc). If an adapter is close to the center it is weighted high otherwise it is weighted low. The adapters used for this experiment are: timbre, tempo, year, mood and genre. Mood, genre and tempo are manually labeled for a database of around 2000 songs.

The demonstrator was compared against MoodLogic. The participants to the "MoodLogic" experiment were offered to evaluate the two concepts according to following criteria: *overall impression, efficiency, originality, understandability, enjoyability, usefulness,* on a scale from –2: very poor to +2: very high. The results are available in Figure 10. The demonstrator scored better with respect to *Moodlogic* in every aspect. This user test was conducted with only six subjects so it is not much representative, however it shows a positive attitude of the participants towards alternative navigation methods.

9. CONCLUSIONS

The paper presents a study about navigation and organization related issues around digital music. First a series of interviews with potential users gave insight about users behavior, habits and preferences. The most interesting finding confirmed the results in [4] about the use of vague preferences and personal expressions to describe the music they desires.

To evaluate the appeal of being able to choose music according to alternative attribute such as *tempo, mood* and *year*, a small field test, which involved the use of the *MoodLogic* software, was conducted. Finally (to obtain quantitative data) a web-based questionnaire based on the results of the interviews and the field test was designed and distributed. The major finding was, not surprisingly, that the most popular form of organization

Figure 9: A very preliminary demonstrator of the similarity-based concept

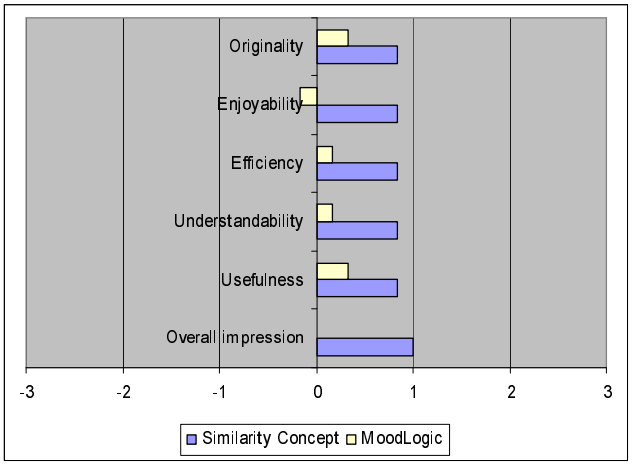

Figure 10: Results of the user evaluation for MoodLogic and the Similarity-based concept

is hierarchical and based on the *artist/album/song* structure. Also not surprisingly we found that the participants want to choose music on the basis of similarity. The features "*select songs similar to the chosen song*" and "*select songs of artists similar to the already selected artist(s)*" were highly rated by the participants. It is relevant to point out that nobody among the participants mentioned melody as an important retrieval method (however this might be due to the way the issue was addressed).

Following these user tests a novel concept to browse a music collection was proposed. The main requirements were set with respect to the user study: the concept should provide the possibility to browse through the collection in the classical way based on *artist/album/song* and at the same time the concept should offer new ways of browsing based on the similarity. These two navigation strategies result to be complementary. To illustrate and test the concept a demonstrator was realized. Preliminary user tests were conducted according to usefulness and usability issues.
A more advanced demonstrator robust enough to be tested in real life experiments is in development.

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