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A KANSEI BASED IMAGE RETRIEVAL SYSTEM BASED ON THE CONJOINT TRENDS ANALYSIS METHOD

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ABSTRACT:

The information process is a crucial part of the design process. The novelty of the design candidates depends mainly of this part and of the manner to integrate this information during the generative phase. This crucial phase of searching for inspirational material is also one of the less effective. It is currently often done punctually as and when the need arises, through a limited manner. In this way, more and more researchers work on new image retrieval systems which use specific keywords. This paper presents a Kansei Based Image Retrieval (KBIR) interface based on the Conjoint Trends Analysis (CTA) method. This interface proposed is aimed to provide a better exhaustiveness of the input data and a greater speed of information gathering. Continuous and systematic watch tools from the Web could help the designers to gather the right words and images in order to improve the overall inspirational approach.

Design Process, Information retrieval, Trend boards

1. INTRODUCTION

Designers use a large variety of types of sources coming from different areas as comparable designs, other types of design, images of art, animals, objects and phenomena from nature and everyday life. Sources of inspiration are an essential base in design thinking, as definition of context, triggers for idea generation (Eckert, 2000), and anchors for structuring designers' mental representations of designs. In favourable contexts, designers built trend boards in order to structure their inspiration sources. Trend boards offer a visual and sensorial channel of inspiration and communication for design research and development, which could be considered to be more logical and empathic within a design context than only verb-centric approaches (Mc Donagh D, 2005). They are usually a collection of images compiled with the intention of communicating or provoking a trend or ambience during the product design process.

As a routine part of the creative process product designers search for and collect materials that they find inspirational. They get their inspiration in their personal life and through a more focused way in their professional life, in various sources like specialised magazines, bibliography, material from exhibitions and the web. They deal with this visual information individually and/or collectively through complex cognitive processes. Sometimes they use commercialized image search engines but the results provided are still not adequate because of the semantic gap inherent to this kind of tools. This problem is particularly of great importance by this corporation. Indeed a core activity of a designer when selecting inspirational materials is the use of high-level information like semantic adjectives in order to link words with images and vice-versa. When they are searching for inspiration sources, pictures they select explicitly or mentally often have a high emotional impact. In this way, the keywords used by the designers are mainly semantic adjectives, also named Kansei words or impression words. Searching for inspiration is based on a more or less focused information search by professional designers. Traditional manual approaches showed some shortcomings. For instance, they are very time consuming and do not provide exhaustive results.

In this paper we propose a new interface which enables to partly support the informational process, especially where the computer can provide an added value and in some way the web. This interface is aimed to improve designers' access to web-based resources, helping them to find appropriate material, to structure this material in ways that support their design activities and identify design trends. The Trends Research ENabler for Design Specifications

(TRENDS) system will integrate flexible content-based image retrieval facilities that utilise ontological referencing, and software able to realise main procedures relating to Conjoint Trends Analysis, i. e. the ambience identification and formalisation and the pallets generation. Besides it will include other facilities like the possible annotation for describing the images and sharing this description with other designers. The developed interface is being built after the formalization of the cognitive processes of the designers.

2. STATUS

2. 1. CONTENT BASED IMAGE RETRIEVAL (CBIR) APPROACH

With so much information available on the web, the difficulty lies in providing appropriate methods of interaction so that users can locate relevant material (Pirolli, 2003). This is particularly true when dealing with images where the main difficulty arises from their multi-dimensional and subjective nature. In the context of industrial design, these issues may be exaggerated due to the influence of inter-individual context- or domain-related subjectivity. When databases are very large (TRENDS image database contains about 500 000 images) the problems are compounded. CBIR s are software solutions that can be applied in the context of such large databases. The technologies used come from a range of scientific knowledge bases, including statistics, pattern recognition, signal processing, and computer vision. CBIR systems have been developed to support the instigation of image search via a number of different types of user queries. These include Query by example, Query by region of interest, Query by concept, Query by relevance feedback and Query by sketch. Designers use many sources of influence and are therefore likely to benefit from assistance in accessing, managing and categorizing visual information. Although CBIR is a very prolific research area involving various available technologies, there are few CBIR s dedicated to industrial designers. Indeed, designers mainly deal with visual information that they link with particular feelings. And yet the core of recent image retrieving tools is mainly based on visual content processing more related to low level features.

2. 2. SEMANTIC BASED IMAGES RETRIEVAL, KANSEI BASED IMAGE RETRIEVAL (KBIR)

Future CBIR systems should move towards Semantic and Kansei Based Image Retrieval. Some experimental software were found in the literature, which are not particularly dedicated to the field of design (Kato, 2001), (Bianchi-Berthouze, 2002), (Black, 2003), (Black, 2004), (Naphade02), (Tanaka, 1997), and (Colombo, 1999). A design oriented system should be able to correlate high-level dimensions like concepts, semantics and affective reactions with low-

level dimensions, following so the more or less unconscious rules brought into design cognition. This linking task is very subjective and variable from person to person. Consequently, the previous systems are often based on a strong interaction between the end-users and the itself, using images and semantic adjectives. The connection of low-level and high-level dimensions is frequently done with the intervention of the end-users thanks to learning systems using neural networks (Bianchi-Berthouze, 2002), (Bianchi-Berthouze, 2003), or genetic algorithms (Kato, 2001). TRENDS will be able to integrate semantic adjectives for retrieving images. This will be done through a specific fusion algorithm between text and images, where text will integrate three complementary semantic descriptions: concepts, contexts, and semantic adjectives coming directly from designer's expertise.

2. 3. TOWARDS AN INNOVATIVE KBIR FOR DESIGNERS

- An integral part of the project presented in this paper is the analysis and description of the cognitive and affective processes of designers. Early outputs from this work constituted a first step of the project that provided research advances: the analysis and description of designers' expertise in a manner that can be used by computers. The initial research focused on the ways in which designers access inspirational materials and how different types of material support the creation/development of designs. This contributes to a user-centred/participatory design process that has been adopted for the project.
- The second step that offered research progress was the provision of creative solutions for user interfaces to a that will enable direct, automatic extraction and structuring of content from the web. This information was subsequently combined with the very detailed process of Conjoint Trends Analysis. This process will be enriched through the web and through a semi-automatic iterative process by relevance feed-back for retrieval of semantic image categories. Three essential and very innovative functionalities were extracted from the CTA method (described later see fig.1): categorisation with semantic adjectives or low-level features for ambience identification, extraction of ambiences elements for pallets generation, and statistics.
- A third step providing significant research results is the formalisation of a procedure for the extraction of design trends through the web. This procedure is based on the extraction of designers' expertise in order to find out sectors of influence from which websites can be selected by design experts. Then this list of websites is used for grabbing pages on the web and creating a design and images database.

- A fourth step in which research progress will be made involves the specification of domain ontology in the design field and the use of concept indexing. This ontology is currently linked to specific sectors (automotive design and shoes design) and potential ways of generalisation are explored. It was established from a lexical content analysis of previous applications of the CTA method using itself semantic structures based on the cognitive chain.
- Finally a major research advance in the future system is the integration of the three previously mentioned technologies into a single tool that will offer a high level of performance, flexibility, robustness (a common base used with the own words of the end-user from design, marketing, innovation departments). The interface will enable the use of semantic adjectives for retrieving images by merging textual and pictorial approaches through a specific fusion algorithm.

3. THE CONJOINT TRENDS ANALYSIS METHOD

Few issues until now in the discipline of design science were specifically centred on the design information phase. However, this area is in progressively informed and we can mention the following researchers showing an interest in it: (Eckert, 1999) (Eckert, 2000) (Mac Donagh, 2005) (Büsher, 2004) (Keller, 2005) (Restrepo, 2004) and (Stappers, 2005). The information phase of cognitive design activity was studied and formalized in order to define the Conjoint Trends Analysis (CTA) method (Bouchard, 1999) (Bouchard, 2002). The Conjoint Trends Analysis method was created after a study of the designer's cognitive activity. CTA makes it possible to enrich and to inspire the designers when designing a new product. It takes place in the early phases of the design process following the steps shown in Figure 1.

Figure 1: The Conjoint Trends Analysis method: "Quirky Pop"

CTA enables the identification of attributes linked to particular datasets (e.g., common properties of images in a database) so that they can be used to inspire the early design of new products. CTA results are trend boards that represent sociological, chromatic, textural, and shape related trends. The trend boards communicate identified homogeneity in terms of style and consumers' sociological values. They are mainly based on visual information, and result from the frequent occurrence of certain properties within a dataset. From this analysis, images and relevant words are selected and formalized under the form of ambiences. Ambiences are typical representations where the emotional impact is intended to be high. Global and discrete design elements are then extracted from these ambiences under the form of pallets. These design elements are used for the generation of new design solutions. Trend boards offer a relatively exhaustive representation of the references usually used by the designers for their composition and play an important role in stimulating idea generation while anchoring contextual matter (Eckert, 2000). They reinforce the link and semiotic coherence between the consumers end values, functionalities in any domains of influence, and product attributes as form, colour, texture, and usability principles. Another purpose of the trends analysis is to define user-convenient principles and solutions that can be integrated in future products. Indeed designers often have to provide new designs using insufficient information about consumers. Trend boards show ambiences including people in context. Contexts are decisive in the attribution of a signification to the object. The fact that the concept is in harmony with its context adds not only to its merely semantic contribution but also to its aesthetic contribution. The trend boards constitute a visual synthesis of many sources of inspiration, enriching the generation of design solutions. This synthesis plays a major role in design, especially for the innovative side of the to-be-designed products. The information that is integrated in the trend boards encompasses images and keywords.

In the Conjoint Joint Trends Analysis, current activity of information research integrates routine tasks which are manually and intuitively done. Some of them are laborious, time consuming, and provide incomplete results. The design watch activity, as it is done for the technological watch, is never exhaustive. However the aid of computerized tools from the Web resource could allow a significant optimization of certain phases in the Conjoint Trends Analysis. The usefulness of the main functionalities related to the CTA method was firstly validated by 30 European car manufacturers. As shown in figure 1, these functionalities are the following: search, categorisation, labelling, pallets generation.

4. ANALYSING DESIGNER'S NATURAL COGNITIVE PROCESSES

To develop the functional requirements for the GUI and the technology behind, field observations and analysis were performed at first to study how designers search or and integrate visual and textual information. In particular the designers' information process was investigated and some essential data for the project was extracted. The sample of 40 professional was mainly composed of designers at 70%, and also marketing and R&D managers. The study was led through interview sessions supported by an interview grid and a booklet to be completed by the attendees in an ethnographical context. Then a content analysis enabled to extract a list of needs and functional requirements. Results focused on:

- sectors of influence, i.e. fields which provide designers with inspirational materials,
- physical and digital references, i.e. magazines and websites commonly referred to by designers,
- design requirements, i.e. end-users expression of their needs and expectations.

The design process consists in reducing abstraction through the use of various successive levels of representation which integrate more and more constraints. It can be seen as an information processing activity that includes informative, generative, evaluative and deductive stages. The informative phase is a crucial. First it enables to complete design problems which are by nature ill-defined and ill-structured (Simon, 1981, Restrepo, 2004), and so refer to semantically impoverished tasks. Designers integrate many categories of information that will be gradually visually synthesized into design solutions. This information includes project related information and designer's information including their sources of inspiration, references and influences. Sources of inspiration help designers structuring mental representations of designs and also arguing the generation of design solutions. They come from sectors of influence. A sector of influence can be "any sector related to the initial sector (arts, nature, industrial design, etc) which integrates high-middle or low-level attributes (semantic adjectives, consumer values, shape, color or texture), being potentially transferred

as new references in the initial sector while being coherent with the brief and the targeted consumers values.

The generative phase of design is highly based on analogical reasoning (Bonnardel, 2005, Blanchette; 2000, Kryssanov, 2001, Visser, 1996). The originality comes from the creative distance between the sector of influence from which analogies were extracted and the reference sector. So designer search iteratively words and images from different sources in specific sectors of influence. Each new selected image is classified, categorized into various groups according by particular harmonies (colour harmony, but also texture and shape). In figure 1 we can recognize a common colour harmony in the different images, mainly characterized by the presence of very saturated purples, pinks, oranges. Shapes similarities can also be recognized (rounded forms, like distorted plastics…). Specific keywords come into our mind when watching these images: pop, inspired by seventies, plastics … There are sometimes subcategories, in this case there is more chic and luxurious version of pop characterized with more shiny textures. A specific name and keywords are then given to each category by annotating sticky notes. Sometimes they come directly from a magazine. The passage from words to images and vice-versa is iterative and very dynamic. The proposed names combine usually semantic adjective, one or several object attributes, and sociological values.

Only the strongest categories and elements (images and keywords) are kept. Strong means: a strong emotional impact, a high coherence level of the elements together, a minimal number of represented sectors in the category and finally an obvious character. The composition takes place after touching out most of the images. The composition is not really in the scope of the TRENDS system because it is a highly creative and complicated part of the work where designers can bring their added value. In a second time, specific harmonies can be extracted under the form of shape, texture, colour pallets.

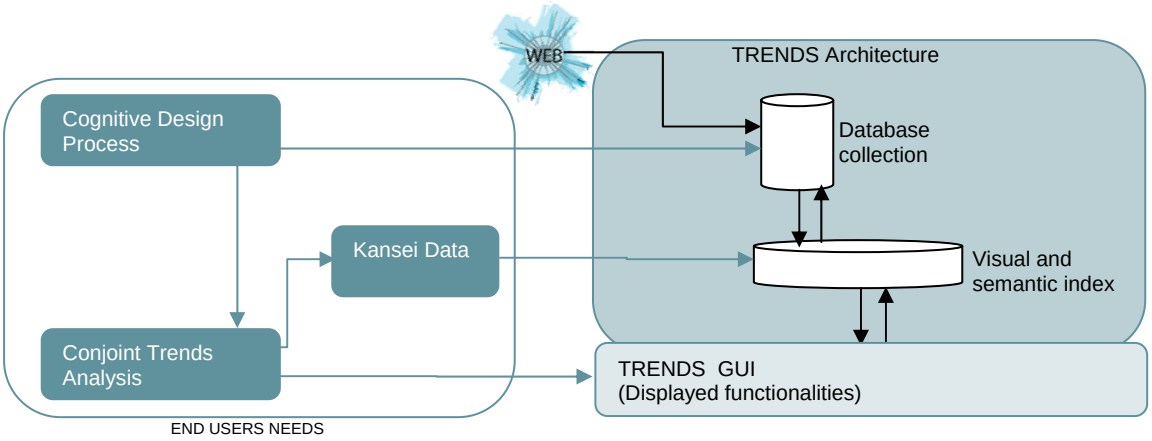

Figure 2 : From the designer's cognitive processes to a semantic text-image search engine

The results of this preliminary study about designer's natural cognitive processes were exploited in several ways for developing the following parts of the TRENDS system:

- A list of functionalities coming from the Conjoint Trends Analysis method which enables the identification and description of design trends through the investigation of sectors of influence.
- A list of the designer's sectors of influence, these sectors leading to the extraction of specific websites in order to build the TRENDS database (§4.1).
- Kansei data: list of Kansei words used by the designers in order to search for information: this data is used to assist in the development of the ontology and image content description technology (§4.2).
- A list of functionalities described by the designers themselves which will support them in inspirational material retrieval.
- The complete set of functionalities was predominantly the input data for the elaboration of the first version of the non interactive Graphical User Interface (§4.3).

The three following parts wil explain how a specific database was built for the TRENDS system, which semantic structure is be used for accessing the information of this database, and the repercussion of the needs analysys on the GUI design.

4. 1. DEFINITION OF A WEB-BASED DESIGN EXPERT DATABASE FROM DESIGNER'S SECTORS OF INFLUENCE

There is little understanding of the requirements for information retrieval in the context of a creative process such as industrial design. For creative tasks it is possible that, instead of highly focused searches being optimal, some diversity in retrieved material is useful

(Bonnardel, 2005). This idea is supported by the results of Ansburg Pi & al. (Ansburg, 2003) who found that creative thinkers tend to use more peripheral cues (data not directly linked to the problem) (Hocevar, 1980). Of relevance is the theory of Conceptual Blending (Fauconnier, 1998). This holds that the process of thought involves 'moving' between mental spaces that organise our knowledge of the world. Creativity can be conceived as the combination (or conceptual blending) of two, or more, conceptual spaces. This process requires both divergent and convergent thinking (Perreira, 2002). The benefits of information diversity, as a facilitator of creativity (in contrast to traditional focused information retrieval), are something that is explored further in TRENDS project.

The generative part of design, also recognized as a creative process, is highly based on analogical reasoning. Analogical reasoning intervenes massively in the divergent process of the designers. It is recognized as essential for idea generation. It is based on the use of metaphors and mental images from which specific sets of features are then extracted and integrated in the generation of new solutions. These features cover all the gradations from high-level to low-level.

Relevant to this is the work, the notion of creative distance leads to the sectors of influence from which analogies are extracted. Creativity was defined in previous studies as a combination of originality and practicality (Goldschmidt, 2006). Here we take creativity as the creative distance according to which the degree of difference between the features of an archetype in the sector of reference and those of another archetype in the domain of analogy being explored.

The creative distance from the metaphorical sector to the reference sector can be measured and it will impact the creative potential of the generated solutions.

The preliminary analysis of the designer's natural cognitive processes enabled to define a list of designer's sectors of influence (automotive, architecture, aeronautics, fashion, sailing, sports goods, etc). From these sectors, specific websites were identified by the designers. Then the database was elaborated. It includes websites, images and words related to the sectors of influence. This part falls within the competence of the data mining specialists. It consists of gathering the content of the database from the internet using a crawler. This software explores the list of websites that have been previously pre-selected by the designers. Then it makes a local copy of the sites: html pages and images are copied on the computer's hard drive. After harvesting the list of sites, the database includes contents related to the various sectors that can be automatically exploited.

In the coming developments of the system, the major issues will be related to the huge quantity of data available in TRENDS, and the automatic exploitation of the database.

The current version of this

database gathers approximately 500.000 good quality images that illustrate products in many sectors:

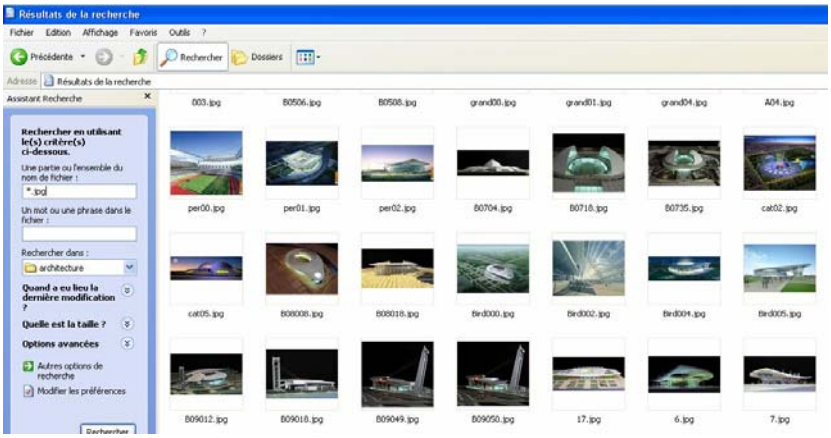

Figure 3 : TRENDS database V2, sector of Urban Architecture (NOV. 2006, 14 Websites, 2,2 Go, 65 000 files, 500000 images)

4. 2. DESIGN KNOWLEDGE EXTRACTION: ANNOTATION WITH KANSEI WORDS AND DEFINITION OF KANSEI-BASED ONTOLOGY

In order to link the images contained in the database with the adequate keywords by taking into account the expertise of the designers, it was first necessary to define the links between high-level and low-level vocabulary in a manner which reflects the cognitive structure used by the designers themselves. This part consisted in the extraction of the design knowledge from previous design processes based on the CTA method and so where the process is highly formalised through the expression of keywords.

Figure 4 : Manual Kansei words extraction (Mougenot, 2007)

The results of three previous CTA studies in car and shoes design were used in order to further develop the design-oriented ontology. The CTA method suggests the conjoint search of images and words from the initial brief specifications which include three complementary fields: sociological, functional and product related. The CTA method uses a specific structure to capture the correspondence between low-level and high-level descriptors related to the initial brief. This is based on the following values-function-solution chain:

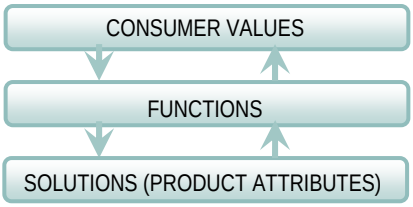

Figure 5 : The values-function-solutions chain

The value-function-solutions chain is inspired by the cognitive chain initially established by Valette-Florence in the field of advertising (Valette-Florence, 1994). The method of cognitive chaining enables highlighting the way in which the influence of values will bear on consumer behaviour. It scrutinizes the value-attribute relationship of the product through a train of hierarchical cognitive sequences graded into ascending abstraction levels. "Product attributes, both tangible (specific evaluative and descriptive features of a product such as material, colour, price, etc.) and intangible (semantic terms such as fresh, light, flowery, etc.), bring about functional and psycho-sociological consequences for the consumer helping the latter to attain their instrumental and end values". Values can be instrumental (specific behaviour modes, such as courage, honesty or romantic attitudes) or end values (aims of life to be attained through instrumental values, such as self-fulfilment or hedonism). Rokeach (Rokeach, 1973) has defined a basis of stable values, limited in number. Young and Feigin (Young and Feigin, 1975) point out that this method is of considerable interest and has a predictive aspect concerning product consumption and brand names.

The reinterpretation of the cognitive chain method in engineering design turns out to be particularly interesting in order to establish a correspondence between consumer's values and stylistic or use products attributes. Indeed it allows linking coherently the conceptual space to the products. In engineering design, the cognitive chain is not established by a content analysis based on questionnaires: it is built by the work team during the design process. From the earliest stages designers use keywords including low-level features like colours and textures description, and high-level concepts with semantic adjectives and values words in the sense of these sociological values. In this way, specific supports like

advertising pages are extremely rich because they are able to show all these levels on the same support at the same time.

Figure 6 below shows a representation where the value-function-solution chain appears at the top of the table, and the values are listed in the first column. The terminal values come from the Rokeach's list which provides a finite number of values like comfort, pleasure, etc. Each of these values is defined into words following the values-functions-solutions chain. It uses semantic adjectives which are used by the designers when working with images and sketching new concepts of design. The highest level is that of values, the lowest level is that of products attributes.

Terminal Values of Rokeach	Behavioural Values of Rokeach	Other values	Trends	Semantic adjectives	Related semantic adjectives	Metaphors	Functional attributes	Visio-tactil attributes
A Comfortable Life				*pleasant*				
				delicate				
				softness				
				roomy				
				ergonomic			*adaptation to the morphology of the driver*	
							maintainability	
							assistance: the vehicle goes automatically to the garage	
							habitability	
							accessibility:	
							comfort of	
							facility of driving, vocal control	

Figure 6 : The values-function-solutions chain applied to the TRENDS

After depicting the main concepts and relations through the CTA method, the knowledge has to be formalised using methods such as ontology. Ontology specifies a conceptualization of a domain in terms of concepts, attributes and relations. Concepts are typically organized into a tree structure; in addition, they are linked through relations forming a semantic net structure. Nowadays, ontology is the only widely accepted paradigm for the management of open, sharable, and reusable knowledge in a way, which allows automatic interpretation (Van Elst & al, 2002). They provide background knowledge, views and navigation structures for browsing. They support integration of knowledge sources as they build upon a collective understanding within a community. Today, many ontologies are collaboratively created across the Web and used to search and annotate documents. TRENDS design ontology was built with an open-source platform (OSP) that provides a suite of tools to construct domain models and knowledge-based applications with ontologies. This OSP implements a rich set of knowledge-modeling structures and actions that support the creation, visualization, and manipulation of ontologies in various representation formats. It can be customized to provide domain-friendly support for creating knowledge models and entering data. Furthermore, the used OSP uses an editor based on the stand recommended by W3C's Web Ontology

Language (OWL). This later was adopted because it is more suitable for building ontologies which will be later used on the Web and with Web Services (Setchi & al, 2007). The CTA ontology is developed by creating instances and linking them in terms of the abstraction, aggregation, and dependency-based semantically-rich relations using the open-source . The use of design domain ontology in the TRENDS will be enriched by a of images annotation involving the semantic description of the images by the designers. It is a relevant way for overcoming major difficulties arising from the multi-dimensional and subjective nature of the visual information used in the design process.

4. 3. TRANSLATION OF NEEDS RANKING INTO GUI SPECIFICATIONS

To develop the functional requirements for the GUI and the technology behind, field observations and analysis were performed at to study end-users needs. Another major output from the needs analysis was the list of ranked expected functions expressed by the professional designers (see figure 6) coming both from the current situation and their expectations for an ideal computational tool, for trends analysis, idea generations and design activities.

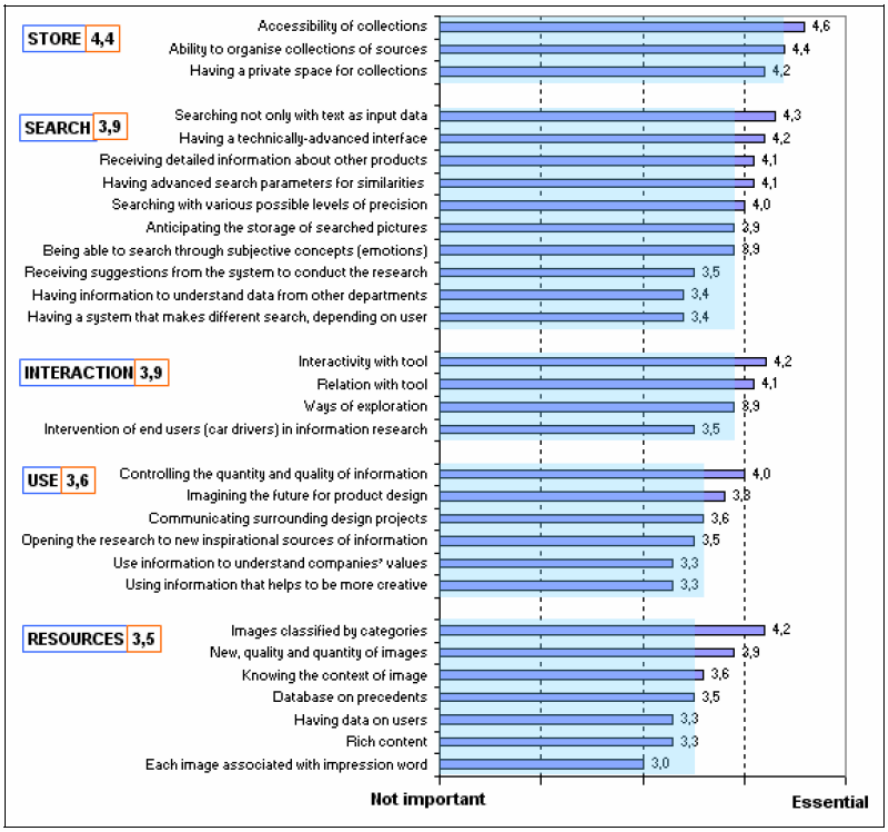

Figure 7 : List of functionalities wheighted by the designers (10 individuals)

Designers put emphasis on visualization, quality and freshness of information, mainly under the form of images in various sectors. The most important function they expect is storing. In fact they are limited by their own memory in their usual activity. The storing function could help them to find and retrieve adequate information. In addition, designers would like to store information everywhere and at every time. This function could be fulfilled by mobile devices. But then they want to visualize high quality images with high resolution, which is more appropriate on big screens.

5. TRENDS INTERFACE

Creativity session enabled TRENDS end-users and project members to integrate their needs and opinions into the definition of the TRENDS-tool interface. Through these work sessions, the graphical interface and the functional sequences behind the latter were progressively defined. This result comes from a specific methodological approach including both a highly user centred approach and creative collaborative thinking.

Thus a list of around hundred functions coming from the needs analysis and from the Conjoint Trends Analysis was transferred into design solutions. This was done during a one-day creative session which involved all the work team. The proposed ideas were refined before the development of the initial version of the non-interactive GUI.

Figure 8 : TRENDS interface: pallets generationfrom a database

The first of TRENDS GUI was used as support for the expression of the design and ergonomics specifications. After the first testing session by the end-users, the main improvements were the addition of personalisation capabilities, and the visual integration of

the technologies of text and image retrieval on the GUI. Also the lightening of menus visualisation, the differentiation of spheres types by colour, and the integration and the illustration of multiple functionalities in the search module. Finally, taking these improvements into account, the TRENDS will be composed of the following main functions: SEARCH, STATISTICS, PALLETS … The workspace is an additional function enabling the transfer of images into writing mode.

6. ARCHITECTURE

The architecture has been designed in order to support the numerous functionalities that have been collected and defined in the user need and functional analysis (see figure 9).

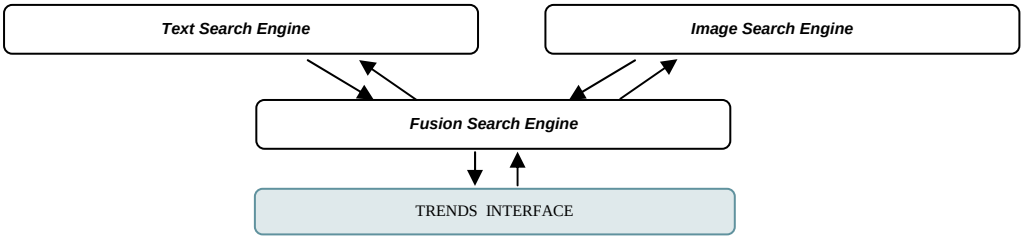

Figure 9 : TRENDS overall architecture of the TRENDS system

For the system to be able to store and search information, with a good level of interaction and still remain feasible, it was important to design an architecture based on a scalable and open platform. As components develop, the will require a high level of resources (memory, data storage, processing); we oriented the architecture towards the collaboration between multiple specific servers supporting the various specific functions of the system: image and text retrieval, data storage, mappings, communications and exchange, etc. For the integration to remain simple and cost efficient, we based our architecture design on standard system communication protocols and request formatting languages.

6. CONCLUSION

TRENDS is a user interface enabling image retrieval through Kansei words. This paper outlines an approach for building the TRENDS GUI and the related outputs. The methodological approach is original in the way it favours an early creative approach while integrating the end-user's point of view from the very beginning in a pro-active way. The end-users participate directly in the design process thanks to the design and use of early prototypes. Such a process, where creativity and end-users evaluation arise in a continuous concurrent way, should lead to a cutting edge efficient tool.

Main outputs so far were identified sectors of influence used by the designers for searching trends, and semantically structured tables of words reflecting the expertise and knowledge of the designers. The later constitute the main input data for the elaboration of design domain ontology. Through the integration of the main functions of the CTA method, and of an open needs analysis led by the designers about the current situation for trends analysis, idea generations and design activities and their expectations for an ideal computational tool, functional specifications were defined and translated into GUI design specifications. The next steps will be the whole integration of technology behind this GUI. In this way, specific tools like hierarchical clustering, ontological referencing and multidimensional scaling will be used.

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