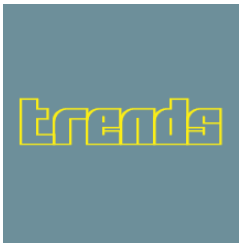
	Trends Research ENabler for Design Specifications
	FP6-IST-2005-27916
Deliverable	**D 9.10.1 Project annual public report N°1**
Security Classification :	**PU**
Leading partner	**SERAM**
Issue Date	**30/11/06**
Version	**1**
Authors	**C. BOUCHARD, J.F. OMHOVER, X. MIGNON, M. FERECATU**
Approved by	**E. CAZOR**
Date	**15/12/2006**

D9.10.1 Annual public report N°1

This document is aimed at a broad public outside the consortium. It describes the main results obtained and the objectives of TRENDS.

Acronym	TRENDS
List of participants	LCPI SERAM PERTIMM INRIA ROBOTIKER CRF (FIAT) STILE BERTONE UNIVERSITY OF LEEDS UNIVERSITY OF CARDIFF
Coordinator organization	SERAM : Laboratoire Conception de Produits et Innovation, SOCIETE D'ETUDES ET DE RECHERCHES DE L 'ECOLE NATIONALE SUPERIEURE D'ARTS ET METIERS
E-mail contact person	carole.bouchard@paris.ensam.fr
Project Website	www.trendsproject.org
Project Type	STREP (Specific Targeted Research Project)
Contract number	FP6-IST-27916
Start Date	1 January 2006
Duration	36 months

TRENDS Annual Public Report 2006



trends research enabler for design specifications

http://www.trendsproject.org

TRENDS' goal is the achievement of an interactive software for the elaboration of design trend boards dedicated to product designers in business to consumer markets such as for the automotive and original equipment manufacturers. The main research challenges will be met through the integration of three innovative technologies: (1) web search agent, (2) visual content indexing and retrieval, (3) semantic multimedia search engine. All of these will be integrated into a cutting edge interface. The innovation of TRENDS lies in developing a system which will be moulded to the information gathering process that takes place during industrial design, taking into account the task-based requirements and the cognitive and affective processing of designers.

Summary of activities

TRENDS, is a 36-month targeted research project which initially began with investigating the inspirational needs of the designers before setting out the initial components of the future TRENDS system. The initial components of the system were to be as follows; (1) a database integrating inspirational material for designers; (2) the system architecture; (3) the first version of the graphical interface (which is not as yet interactive but developed to a standard whereby the functionalities can be tested). The user centred approach was supported by methodological tools such as, interviews, ethnographic methods, observations and web questionnaires. A literature review summarising existing computational tools that support the search of visual and lexical information, and integrate the users' subjectivity (Kansei) was completed along with a benchmark about the existing tools that are used at end-users' companies to search for information about trends for design. Currently the development of the component prototypes is in process. These components consist of; (1) user interface of text and image search; (2) user interface for ambience and pallets; (3) user interface for the intelligent agent search; (4) results and the Intelligent web agent software.

Important work areas

The main work areas involved in the TRENDS user centred methodology are on one hand the formalisation of the cognitive design process, including the definition of the Kansei design knowledge and the integration of the Conjoint Trends Analysis method, and on the other hand the initial developments for Semantic Text and Image Search technology, Image content description technology and Intelligent web agent. The cognitive design process was used for the definition of the main functions of TRENDS, the elaboration of the TRENDS database, the

design of the system architecture, and the design of the first version of the graphic interface and non interactive functions.

Cognitive Design Process

The cognitive activity of the designers from the CENTRO RICERCHE FIAT (CRF) and STILE BERTONE (SB) was studied in the earliest phases of the TRENDS project.

Fig. 1: Stile Bertone and Centro Ricerche FIAT Interviews snapshots (MARCH 2006 – TORINO)

In particular the designers' information process was investigated and some essential data for the project was extracted. Following is a breakdown of the extracted information:

- A list of the designers' sectors of inspiration, these sectors leading to the extraction of specific websites in order to build the TRENDS database (see figure below).
- 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.
- A list of functionalities described by the designers themselves which will support them in inspirational material retrieval.
- A list of functionalities coming from the Conjoint Trends Analysis method (method developed by SERAM (LCPI Laboratory) which enables the identification and description of design trends through the investigation of sectors of influence).
- The complete set of functionalities was predominantly the input data for the elaboration of the first version of the non interactive Graphical User Interface.

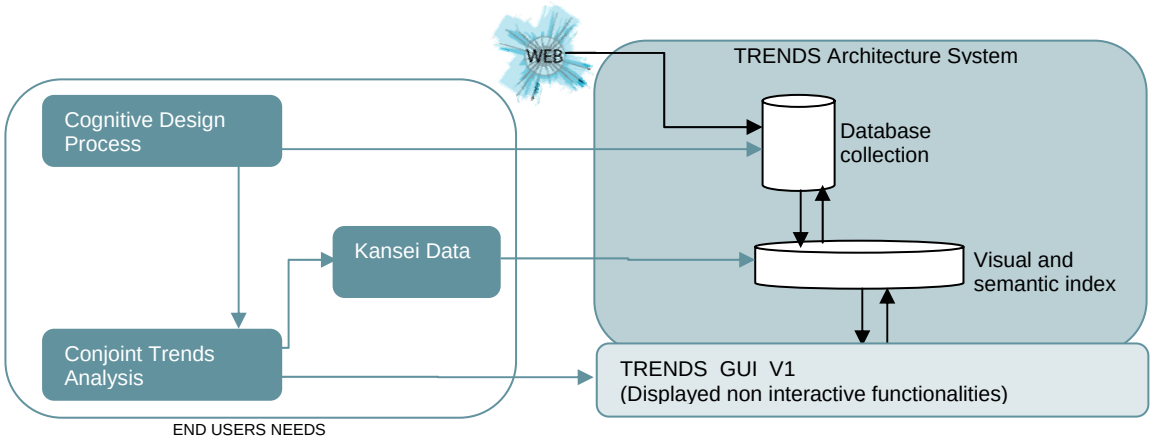


Fig. 2: TRENDS User Centred Approach and related results

Design Knowledge: manual annotation with Kansei Words

When selecting inspirational materials, the core activity of a designer is to link semantic adjectives with design parameters and *vice-versa*. Designer's expertise consists of giving emotional effects through new design solutions characterized by their semantic expression. *Kansei* oriented methods cover all the various approaches for translating semantic words (*Kansei words*) into design parameters, by measuring semantics and showing the correlation with some design properties. Kansei words mainly include semantic adjectives, objects names

and low-level descriptors. The TRENDS system will be based on design rules according to the extraction of Kansei words by the end-users in order to build Design-oriented ontology. Designers already proposed specific links between semantic words and product images during pre-defined observations, here they were asked to associate words and pictures.The results of this data are illustrated in Microsoft Excel spreadsheets showing words which illustrate the relationship between pictorial information and high level attributes like semantic adjectives, and, middle and low level attributes. Merging textual and pictorial approaches to develop semantic queries will allow the user to browse the database using concepts, ideas, emotional or semantic terms.

Fig. 3: Kansei words extraction: manual annotation of images from magazines by the --users (JULY 2006 – TORINO)

Semantic text and image search technology

A human has the ability to understand an image instantly. However, this understanding can become a very difficult and a long process for a computer. A computer on the other hand, can read and search textual matter instantly, whereas it would take a human much longer. For this reason, combining text and image is integral to the TRENDS system. Adding descriptive texts to images is a time consuming and costly procedure. Therefore the main idea of the TRENDS system is to look into texts related to images for some concepts linked with the atmospheres, moods or emotions the designers are looking for. This will result in a set of images associated with a list of terms. The designer is then able to; (1) search for images from a selection of either positive or negative images; (2) search images from a selection of terms; (3) combine the previous two search functions and search using a special fusion algorithm.

Image description technology

INRIA has built a preliminary set of test image databases, these will constitute towards the core workbench for the development and the assessment of the visual descriptors. Multiple tests have been conducted to determine the visual structure of the databases and the set of visual descriptors that are appropriate to this category of images. Several experiments have been performed to determine how the quality and the different parameters of the images (e.g. size, compression factor, etc.) may influence the relevance of the visual descriptors. Various image signatures for global description of the image ambience have been tested using several colour spaces (RGB, HSV and LAB) and different quantizations. These results will be used for choosing the colour descriptors that are best adapted to the content of the TRENDS project databases. Different combinations of image signatures have been tested to seek the combination that is better adapted to the project data. Work on local descriptors has also

started. INRIA and PERTIMM started to design the system interface between the PERTIMM repository and the INRIA search engine.

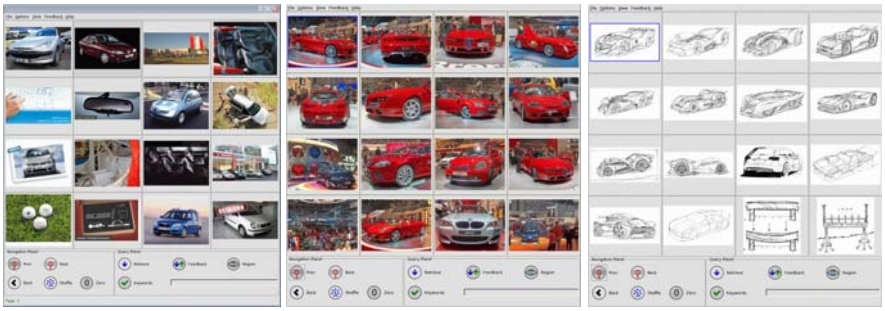


Fig. 4: Query by Example in 17000-image test database: (left) random sample of images, (centre) query by colour, (right) query by shape. The query image is top left with a blue frame.

Intelligent agent web technology

The first step was to locate the list of websites from the internet which were of particular interest to the designer's. These were then put into a database in the form of texts and images. We then developed a system which would find images of more than 10 Kb, and would maintain the links between texts and images. By June 2006, we had more than 95.000 images and 2 million texts. The results are as follows:

Extension	Total size	Files	Mean size
.htm	79 406 284 290	2 288 013	34 705
.pdf	18 231 036 435	34 505	528 359
.jpg	**9 570 877 357**	**89 266**	107 218
.gif	**212 044 585**	**5 405**	39 231
.doc	162 927 012	1 647	98 924
.bmp	**101 119 508**	**174**	581 147
.rtf	70 326 770	1 737	40 487
.jsp	69 835 083	2 258	30 928
.xml	55 252 717	2 177	25 380
.ppt	37 180 416	23	1 616 540
.png	**32 549 097**	**253**	**128 653**
.xls	17 324 042	192	90 229
.tiff	**5 324 452**	**2**	**2 662 226**
.mpg	3 470 111	1	3 470 111
.zip	3 458 352	1	3 458 352
.m4a	3 035 754	1	3 035 754
.txt	308 080	121	2 546
.rss	100 074	13	7 698
TOTAL SIZE	107 982 454 135	2 425 789	44 514
TOTAL Images	**9 916 590 547**	**95 100**	**104 275**

Fig. 5: List of files by extension, resulting on the content of the first complete database

Then, an intelligent agent has been developed to find only new texts and images on the same list of sites, using semantic signatures of texts to perform a differential grabbing. This process is still bringing new texts and images to the Content Data Base.

User centred innovative interface design (GUI)

The first version of the graphic interface and its description were completed. 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 members of the TRENDS consortium. The proposed ideas were refined by SERAM (LCPI Laboratory) who developed the initial version of the non-interactive GUI. It is a PowerPoint animated mock-up in which the mouse pointer automatically moves on the screen through the several pages of coherent sequence.

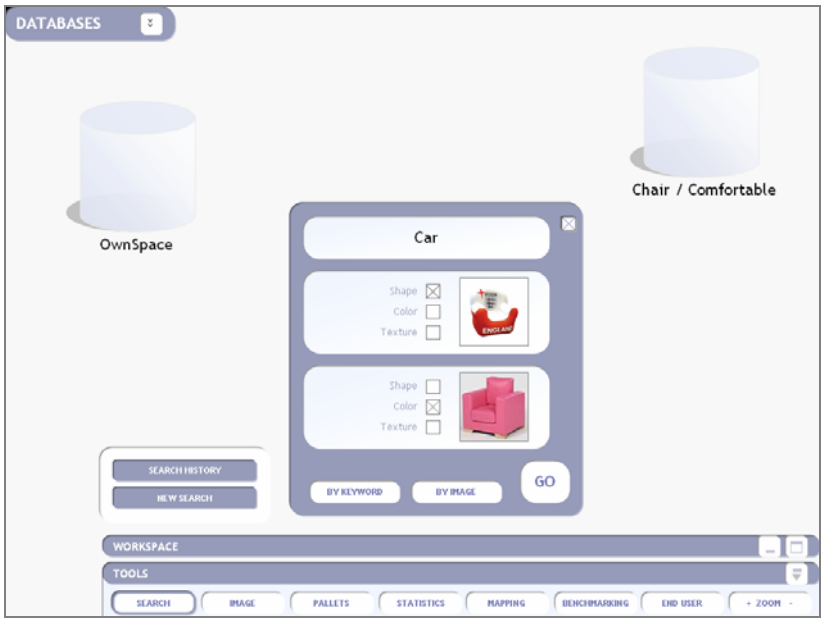


Fig. 6: First version of the TRENDS GUI

This GUI is composed of databases including images and a toolbar with tools related to the main functions of the TRENDS system, these are SEARCH, STATISTICS, PALLETS … The workspace enables the transfer of images into writing mode.

Overall architecture of TRENDS system

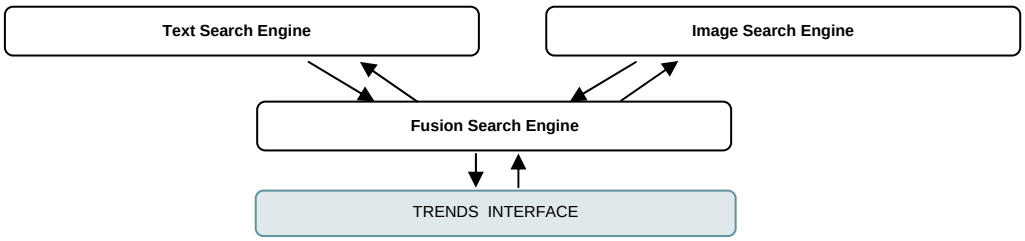


Fig. 7: TRENDS overall architecture

The TRENDS system architecture has been designed in order to support the numerous functionalities that have been collected and defined in the user need and functional analysis. 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 TRENDS system will require a high level of resources (memory, data storage, processing); we oriented the system architecture towards the collaboration between multiple specific servers supporting the various specific functions of TRENDS: image and text retrieval, data storage, mappings, communications and exchange, etc. For the system integration to remain simple and cost efficient, we based our system architecture design on standard communication protocols and request formatting languages. 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 our database. The second version of this database, another technical result of TRENDS, gathers approximately 500.000 good quality of images that illustrate products in many sectors: automotive, architecture, aeronautics, fashion, sailing, sport, etc.

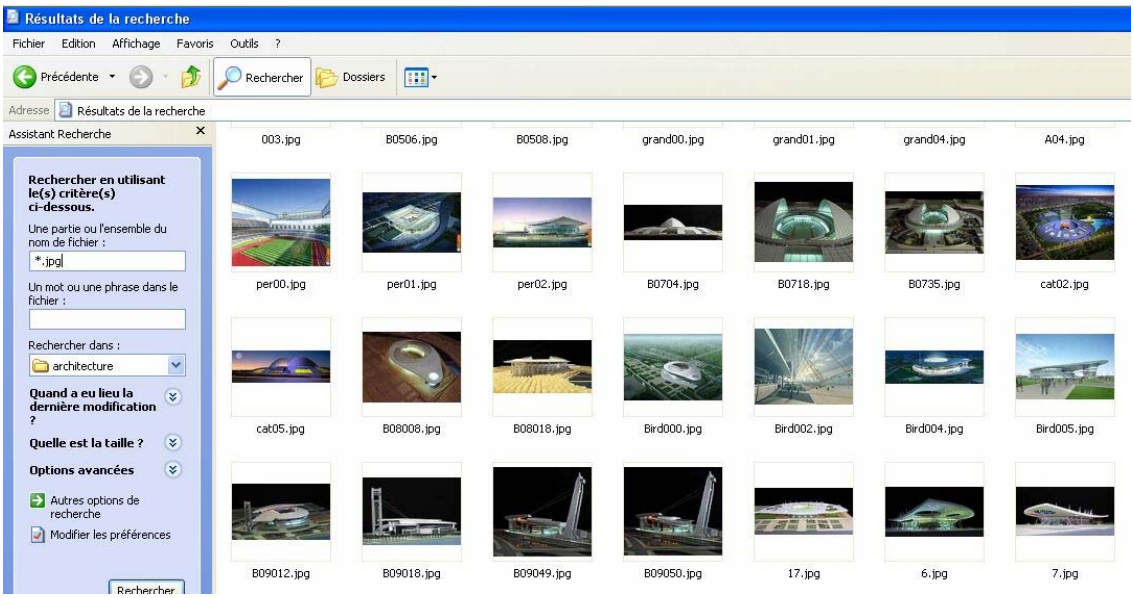


Fig. 8: TRENDS database V2, sector of Architecture (NOVEMBER 2006, 14 Websites, 2,2 Go, 65 000 files)

User Involvement, Promotion and Awareness

Several sessions had already been carried out with the end-users CENTRO RICERCHE FIAT and STILE BERTONE, these included: the initial needs analysis, the weighting and validation of the whole list of functions coming from the functional analysis, the early evaluation of the interface graphical concept, and finally the evaluation of the first TRENDS prototype which is the first version of the graphic interface and non interactive functions.
The currently main targeted sector by TRENDS is industrial design. The project website gives an overview of the project outside the consortium. The TRENDS partners can find more detailed information at by logging into the secured area of the site. A project flyer is available on the website in the *project* website section; this also gives an overview of the project.

Fig. 9: TRENDS website

The following papers were (or will be) published and presented in the framework of international conferences:

- Kaur, S., Westerman, S.J., Mougenot, C., Sourbe, L., & Bouchard, C., *Computer-based support for creativity in industrial design (*Poster), First International Symposium on Culture, Creativity, and Interaction Design., London, Sept. 2006
- Mougenot C., Bouchard C., Aoussat A., *Fostering nnovation in early design stage: a study of inspirational process in car design companies*, Wonderground 2006, Design Research Society International Conference, Lisbon, Nov. 1-5, 2006
- Mougenot C., Kaur S., Bouchard C., Westerman S., Aoussat A., *An experimental study of designers' cognitive activity in design information phase*, ICED 2007, 16th International Conference on Engineering Design, Paris, Aug. 28-31, 2007

Future Work or Exploitation Prospects, as appropriate

The first prototype graphical interface and non-interactive function was designed and evaluated by the end-users; the system architecture is now defined.
The next six months will focus on the development of the components prototype, which will include the user interface of text and image search, the user interface for ambience and pallets, the user interface for the intelligent agent search and the intelligent web agent software. The first user interface prototype will be validated by the end-users in June 2007.
In 2007, the consortium will work on the integration of these components into a full prototype. Further tests will be performed, throughout the development process, to provide detailed assessment of the performance of the system and its acceptance by end-users.
The final integrated system will be achieved and validated by the end-users in 2008. The end-users here will be manufacturers we are currently working with (CRF and SB), and others such as French car suppliers like VALEO CLIMATISATION CONTROL and FAURECIA.
Designers from other industrial design sectors (computers, PDA's, mobile phones, fashion), and more widely stakeholders working on markets linked to the need for cross-lingual and mixed semantic text and image queries will be approached.

Further Information

- Additional information related to TRENDS activities can be found on the TRENDS website: http://www.trendsproject.org
- The EC website for Knowledge and Content Technologies is available at: http://cordis.europa.eu/ist/kct/projects.htm
- The TRENDS consortium members are: SERAM (coordinator), PERTIMM, INRIA, the UNIVERISTY OF LEEDS, the UNIVERSITY OF CARDIFF, ROBOTIKER, CENTRO RICERCHE FIAT and STILE BERTONE.
- PERTIMM provides multimedia and cross lingual search, retrieval and classification capabilities. PERTIMM is also member of SCHEMA Network of excellence: Content-Based semantic scene Analysis and Information retrieval.
- INRIA is member of two European networks of excellence DELOS 2 at http://www.delos.info, MUSCLE at http://www.muscle-noe.org, and of the integrated project ACEMEDIA at http://www.acemedia.org/aceMedia.
- The University of Leeds is a project partner in HUMAINE (Human-Machine Interaction Network on Emotion) HUMAINE is a Network of Excellence in the EU's sixth framework programme in the Information Society Technologies (IST). HUMAINE aims to lay the foundations for European development of systems that can register, model and/or influence human emotional and emotion-related states and processes - 'emotion-oriented systems'. For further information see, http://emotion-research.net/