# Pop-Science on the Internet: How ULISSE Makes the Ends Meet

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## Abstract

There is an increasing demand for what we can call *pop-science* that is pertinent scientific information dedicated to the non-specialists. This demand comes both from professional categories and the general public. Simultaneously in the scientific community there is an increasing consciousness that diffusion of the scientific information is an asset the scientific community cannot afford to overlook.

The Internet is a perfect tool to meet this demand. It reaches a large and ever-increasing number of people and permits an interactive and detailed exchange of information. As an experiment of how to combine high quality services and the information technology, we have set up *Ulisse - In the net of science* (http://ulisse.sissa.it), an innovative Italian project for the **popularisation of science via the Internet**. Its main purpose is to establish a connection between scientists and the general public. *Ulisse* is based on three major characteristics: a) **high technology** to create an efficient and friendly system, b) **customisation** of the services, c) a network of **scientists**, which guaranteed the quality of the materials.

**Keywords***:* communication of science, science education, e-learning, web and database interface

## Analysis of the Demand and Our Objectives

The circulation of scientific information both within the scientific community and toward the public is a fundamental task in any well organised modern society (Greco, 1999). The Internet and the new electronic tools offer a unique opportunity in accomplishing this task: Internet can reach a very large and ever-increasing fraction of society.

Actions aiming at raising the quality of information of the public about science and its day-to-day achievements, and increasing the familiarity of the public with research and its results will contribute to raising the general scientific and cultural level. The outcome of all this will be a general drift toward higher levels of culture and technology as well as a better appreciation of scientists' activities. There have recently been in Europe a number of episodes of apparent clash between science and social needs (actually the clash has always been between social needs and a certain use of technology) in the fields of health, food and environment. Also, moral issues have been recently raised in connection with the freedom of research. An increased familiarity of the public with the research world and direct interaction with scientists go in the direction of overcoming the misunderstandings between the public and the scientific community.

Starting from this demand and the possibilities offered by the new information technologies, we have started an innovative enterprise *Ulisse - Nella rete della scienza* ("Ulysses - In the net of science"). Started in in year 2000, *Ulisse* intends to create and make available via the Internet a number of services, which are flexible and interactive. The type

of scientific information that can be spread in this way can be adapted according to the needs of the different categories involved. Moreover, interactivity stimulates among the users a participating attitude, in contrast with the passivity induced by most mass media.

Beside a well organised telematic service, *Ulisse*'s aim is the direct and active involvement of the academic and research world. The active role of scientists in the project will also help the latter to appreciate the concerns and needs of the public.

The objectives of *Ulisse* can be summarised as follows:

1) Establish the possibility for **different groups of the public** to have access via the internet to **qualified scientific information** and to interact directly with the scientific world
2) Set up an an **intelligent ambient** built on the basis of recent technologies dedicated to the communication of science
3) Establish a **wide network of scientists** among different scientific disciplines within the Italian research area, which serve as qualified source of scientific information via the internet.

This will be obtained through the following **actions**:

creating an Italian **network of scientists** actively cooperating with *Ulisse*

creating and running **various services** oriented to different sectors of users

creating **software tools** able to assist in setting up and running the services, organising and publishing materials, interacting with the users

creating **databases and retrieval systems**, in particular establishing a classification system of sciences, which makes it possible to index all the information and users.

*Ulisse* is dedicated to anyone dealing with science, either for personal interest, or for educational or professional needs, and in particular:

the **general public**, that will be allowed to know what is going on in the most advanced fields of science

**scientists**, who wish to be reliably acquainted about other disciplines

**communicators**, who need reliable and updated information and direct contact with the members of the scientific communities

**teachers** interested in updating their skills and finding new ways of teaching sciences

**students** who need support in their studies or wish to test their aptitude for science.

It is important to note that most of the Italian schools, many individual teachers and students, are now equipped to connect to the web (De Mauro and Zullino, 2000), and are therefore able to enjoy the *Ulisse*'s services.

*Ulisse* is an undertaking of the SISSA Medialab, the Laboratory of science communication, which has developed Babbage – the Italian server of the Los Alamos preprint archive (http://babbage.sissa.it), JHEP – the first scientific journal entirely run via electronic means (http://jhep.sissa.it/)– and TIPS, an advanced project aimed at developing innovative tools for academic publishing (http://tips.sissa.it). *Ulisse* is run in cooperation with CIRD-University of Trieste, AIF (Italian Association for Physics Teaching), SCI (Italian Chemistry Society) - Education Division, Master in Science Communication (Trieste), Edumond Editori

Associati SpA (Milano). Other collaborations are in the process of being established. *Ulisse* is sponsored by the Italian Ministry for University and Scientific and Technological Research.

# The Setting Up

Starting from September 2000, we have progressively set up a complex system made of different services and materials, which are all available through the *Ulisse* web site at http://ulisse.sissa.it.

*Ulisse* is now a "place", completely dedicated to the dissemination of the scientific information in Italy, in different forms, at different levels and for different users. In the long run this will lead to establish a direct connection between scientists and the general public, and thereby contribute to bridging the gap between scientific research and the society at large.

The use of new technologies of communication and electronic publishing developed for *Ulisse* allows to add a wide range of tools which enhance the efficacy of the services (Butler, 1999; Patino, 2001):

direct interaction between the readers and the authors

use of the media such as hypertexts, simulations, etc.

continous updating of the information

large distribution

asynchronous fruition

customisation of the information according to the level and interest of the users.

## *How Ulisse works*

*Ulisse* sets up a variety of services and products dedicated to the scientific information. Most of the procedures of selection of the material, interaction with the system and users, publication, etc. are (or will be) highly automatic and run by a software robot.

The materials published in *Ulisse* are part of a database and are archived according to a system of keywords; they are made available through efficient and friendly search engines to all interested users.

Thanks to the software robot and the classification system (see below) all users are able to have access to *Ulisse* through personal web pages, which will be set up according to the user needs, preferences and role within *Ulisse*. Experts, members of the Scientific Board, members of the Executive Office, administrators, etc. – who have an active role in the project – are also put in the condition to carry out their job in the editorial procedure through personal web pages. It goes without saying that access to these pages are restricted.

The scheme of the structure of *Ulisse* system is described in figure 1.

## *Quality and Selection*

Materials published on *Ulisse* are selected using the system of peer reviewing, which in our opinion is a reliable procedure for increasing the quality of the published information (Harnad, 1996; Lustig, 1996). Referees will be selected by the Scientific Board, who will also monitor their work in cooperation with the Editorial office. Naturally refereeing is not considered a censorship with respect of scientific subjects which are not approved by the scientific establishment. Indeed there are always at least two referees (one reviewing the scientific content and one the communication efficacy), and debates on controversial

themes are envisaged and strongly encouraged. The scheme of the refereeing procedure is represented in figure 2.

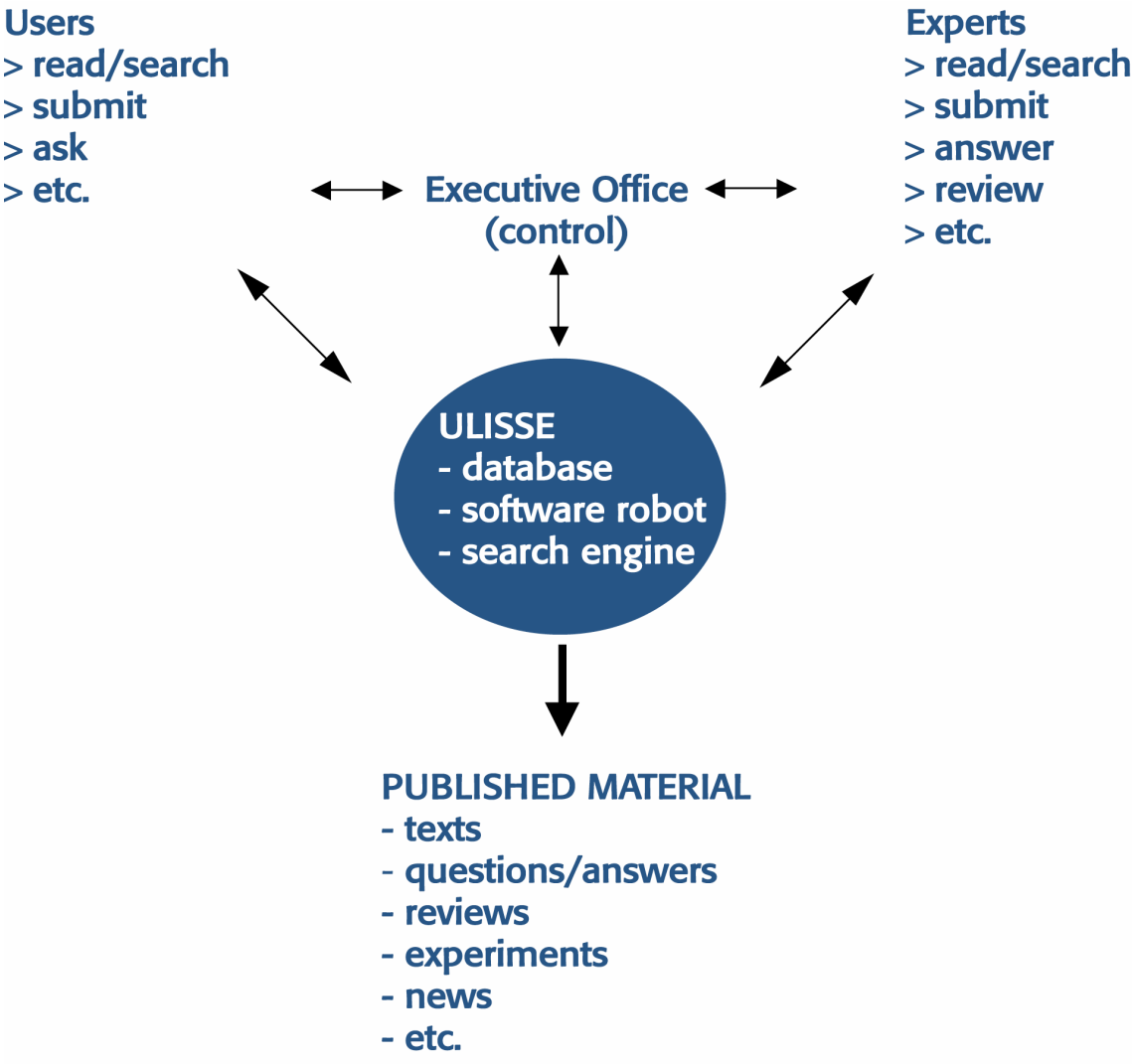


*Figure 1.* Schematic representation of the structure of the *Ulisse* system

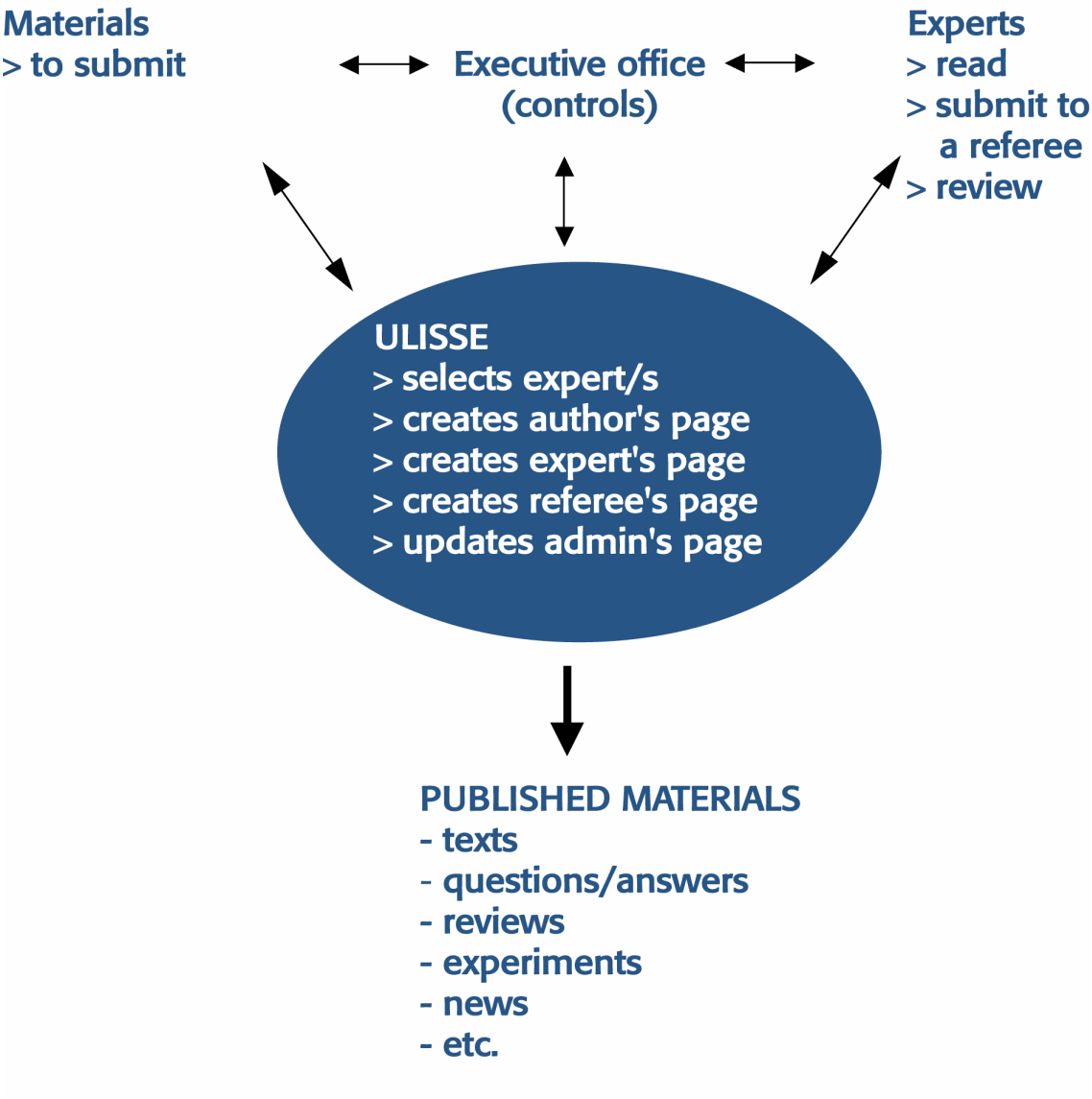


*Figure 2.* Scheme of the *Ulisse* refereeing procedure

## *Classification*

All the information (questions/answers, papers, hypertexts, users, experts, etc.), will be classified according to a comprehensive system of keywords that are grouped per sciences and disciplinary sectors. The system of classification is based on the one proposed by UNESCO.

Thanks to this system of classification *Ulisse* is able to

archive and retrieve all the information on the materials and users of *Ulisse*

assign a particular material to the appropriate expert

select referees

create personal pages on demand

etc.

The system of classification is dynamical, and is being continuously updated by the Executive Office and the experts of the Scientific Board to take into account new research developments and new needs of the users.

The sciences *Ulisse* is now dealing with are the following:

Biology

Chemisty

Mathematics

Natural sciences

Physical sciences.

These are divided into about hundred sectors, some of them belonging to more than one science.

## The Services

Within the system described above, various services and products have been set up for the different groups of users. Of course the services planned within this project can be considered as a first demonstrative version. Most of the services – in particular the interactive laboratories, Asking scientists and Tourist routes through the web – can also be used as tools for e-learning, which is now a new frontier for a modern education in science (Andronico et al., 2001; Balmelli et al., 1998; Rosenberg, 2000).

### *Asking the Scientists (Chiedi a Ulisse)*

Through *Chiedi a Ulisse* anyone can submit their queries to an expert. Each question is sorted out using the classification system and assigned to the appropriate expert, selected out of hundreds of scientists specialised in several fields. He or she provides an answer through a personal web page. Questions and answers are made public on the *Ulisse* web-site. Answers are hypertexts, consisting of text, formulas, figures, multimedia tools, links to other materials published in *Ulisse* or to external web sites.

### *Tourist Routes through the Web (Andar per Siti)*

*Andar per siti* is a collection of selected scientific web sites, which *Ulisse* suggests to its users. Each site has a review with general, technical, scientific information to assist users to browse the web more efficiently.

Moreover *Ulisse* offers a series of virtual thematic tours, which present particular subjects and suggest possible tours among the most interesting web sites. This is meant for students or teachers for preparing lessons, or for the general public looking for specific information on particular subjects.

### *Archive of Italian Science Centres and Museums (Scienza e Gita)*

*Scienza e Gita* provides an interactive database of the science museums, science centres, education laboratories, botanic and natural parks, etc. spread all over Italy and open to the general public. Particulars events, such as exhibitions, confererences, science competitions, etc., are also available in this sections.

### *Newsletters (Scienza7)*

*Ulisse* provides a newsletter, in order to inform its users about science and technology, or with respect of some particular sector (i.e. physics, mathematics, school&education, etc.). The newsletter is published in

co-operation with Zadig, an Italian specialised agency for scientific journalism. Upon request, *Scienza7* can also be received via e-mail.

## *Interactive Laboratories*

According to the new trend of the third generation science museums, *Ulisse* sets up interactive laboratories on different fields of science. The laboratories are interactive environment, where the users can put their hands on science, making experiments and simulations. Theoretical explanations of the experiments are also available. The first laboratory is *Luce virtuale* ("Virtual light"), dedicated to the physics of light. A laboratory on brain and perception in now in preparation.

## *The Online Library (La biblioteca dei 500)*

The online library for the public understanding of science publishes articles, essays, hypertexts and the like according to a peer review system. Only quality contributions are selected for publication. Contributions can be invited by the Executice Office and the Scientific Board, or directly submitted to *Ulisse* by the authors. After submission the contributions are then examined by at least two referees, both from the linguistic and communication, and the scientific point of views. Only material which are positively refereed are published in *Ulisse*. This procedure guarantees a significant improvement of the level of the information published in *Ulisse* with respect to other more traditional publication of popularisation of science in Italy.

The online publication enables to add interesting features, which are not possible with paper publication, such as:

multimedia tools

continuous updating of the information

direct communication between authors and readers.

Traditional indexes are replaced by efficient and friendly search engines.

## *For Scientists (InterScienza)*

*InterScienza* [*at the time of preparation of the present article this service is under construction*] will be a service for the interdisciplinary exchange of information among scientists of different disciplines. The main goal is to provide a professional environment – which guarantees the privacy of the participants and the quality of the information – where scientists can reach experts of disciplines other than their sector of specialisation, and ask for information or discuss scientific issues which are not yet settled and lay at the border of different fields.

*Interscienza*, thanks to interactive tools and interface between users and databases, will allow to overcome the barriers which often stand among sciences, and can prevent the spread of new ideas. In this way it will be possible to get to the "right person" to get the "right information" even without being an expert of that particular field. *Interscienza* will be available to all accredited scientists who are also available for answering to the requests of their colleagues.

This will lead to set up a network across disciplines which will contribute to a more innovative development of some scientific sectors.

## Technology Required by the Project

*Ulisse* is developed in order to provide a communications and information exchange system to be used both within the scientific community and between the latter and society at large (schools, the media, etc.). This system must therefore allow users to submit, store and consult different types of electronic documents which need to be processed in a number of ways (i.e. submitted, read, downloaded, reviewed, corrected, published, etc.), according to a procedure that involves the co-ordinated interaction of several users.

These documents may be provided and made available in a number of formats: text, MSWord, LaTeX, TeX, PDF, Postscript, HTML, XML, and video/audio (MPEG, JPG, WAV).

The system interface is presented to its users through a web site and users interact with the application using a web browser. Users of the system, other than readers, include editors and experts responsible for maintaining content and performing other managerial tasks. Each class of users has access to specific categories of functionality, and each interacts with it through a specific user interface mechanism.

The system is located on a central server and provide dynamic and interactive content to browser-based clients.

The system is developed using object-oriented methods and technologies. The architecture of the system reflects the multi-tier application model and the expected tiers are:

a client tier to provide the user interface

one or more middle-tier modules that provide client services and logic for the application

back-end information system tier providing persistent data management.

These choices are made in order to satisfy the following requirements:

the need to make rapid and frequent changes to the "look" of the application

the need to deliver dynamically generated content, which can be personalized to a single individual

the need to easily refine and scale the application

the need to enhance code reusability

the need to facilitate the development of the application.

Most of the procedure are run by a software, developed within the project, so that to perform a high variety of functions and services with a minor human intervention, which will be restricted to the quality evaluation and interactions with users.

The system consists of a set of dynamical pages developed with the technology JAVA servlet and JSP (Kassem, 2000), which allows to

customise the services offered by *Ulisse*

continuosly update the information through the connection with a *database management system* SQL, i.e. a persistent data storage of the information with which the dynamical page interacts as a relevant event occurs.

JAVA has been chosen for the development, because it allows to efficiently run the database and interact with it, and is easly portable. The *Ulisse* system is developed on a SUN/Solaris platform (version 2.7), and uses the Apache 3.1 and Tomcat 3.2 web servers.

# Future Developments

The first year of experimentation and testing has proved *Ulisse* a valuable and reliable system, and a good example of how technology can help to create an efficient and friendly service for the public.

Even though *Ulisse* has been working at an experimental level, we had reached thousands of users and got about 1000 connections per day [*at the time of the preparation of the present article*]. Many users (teachers, scientists, students) have taken part actively to the development of the services and helped to improve them.

Therefore we are now plannig to extend *Ulisse* to new services and functionalities, and export it in different languages other than Italian.

## *New Functionalities and Services*

In the year 2002 the following technical features are envisaged:

development of the system of running of the editorial procedure for the refereed materials

automatisation of the submitting procedure

automatisation of the reviewing procedure

automatisation of the service *Chiedi a Ulisse*

extensions of the system of classification.

As regards the services to the public we are now planning the following:

further development of the online library

set up of a new interactive laboratory dedicated to neurosciences

set up of a new "column" dedicated to science and literature

production of a series of monographic glossaries

make *Interscienza* active.

Naturally we will do our best to enlarge the number of users and improve the quality of the services provided.

## *Internationalisation*

As the need of scientific information is a general need of all Europe, we hope to get the necessary support to internationalise *Ulisse*, i.e. to create a similar system able to support many languages and a networks of scientists all over Europe (or at least in some countries).

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# Biography

**Simona Cerrato** graduated in Physics and Cosmic Physics at the University of Turin, and obtained the Master in Communication of Science at SISSA (Trieste). She did research work for some years in the field of Astrophysics, in Italy and Germany. For more than ten years she has been working in the popularisation and communication of science, both in private companies and public bodies, thus gaining experience in traditional (books and magazines) and electronic publishing. At present she is executive editor of the project Ulisse, an innovative Italian project of popularisation of science via Internet, and of the scientific journal JHEP, the first fully electronic scientific journal and one of the most relevant in the field of high energy physics.