

## MULTILEVEL CYBER-WRITING FOR THE DISSEMINATION OF SCIENTIFIC AND TECHNICAL INFORMATION ON THE WEB

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### ABSTRACT

A multilevel cyber-writing model is proposed for the on-line scientific reviews in order to:

- improve the presentation of their content by using in an interactive way text, sound, colour images, computer drawings and video sequences; - to ensure a large dissemination and easy storage of the scientific and technical information; - to favour the production of teaching documents (training courses, books,...) for students and that of reports in newspapers and scientific magazines which are needed for the education of the public at large.

Such multilevel scientific reviews written by scientists and available on the web sites of their universities, research institutes or professional societies should provide access, via active words/images and links, to three different specialization levels, from the most general (students or scientific journalists), to that of teachers or non-specialists and up to the highest level of specialists. This on-line multilevel model is hereby described and will be soon available on the web together with several scientific reviews devoted to the treatment of wastewaters, to the solar technologies, etc.

### INTRODUCTION

Economic growth, quality of life, competitiveness and job creation depend heavily on technological innovation and improvement. Scientists and engineers often feel that this statement is obvious to everyone but many individuals accept it as fact even if they do not fully understand the reasons why. In reality, general recognition of science and technology to our standard of life is usually lacking in society because scientists seldom promote their efforts with those individuals who most benefit of technological advances, viz. the public. Correction of this problem must begin at the elementary school level and continue throughout the student's education and into their adult life. Unfortunately, scientists and engineers generally prefer to discuss research and development activities with their peer group(s) rather than with elementary/high school teachers and students, guidance counsellors, policy makers or scientific journalists. As a result, the largest part of the technical & scientific papers contained in the 100,000 professional scientific journals existing today is entirely devoted to specialists, while for teachers, students or scientific writers and reporters the access to such specialized information is quite difficult. However, all citizens, scientists included, have a stake in everyone's education, because a better-educated citizenry benefits all of society. In addition, the research task of scientists is not only to reach some knowledge from their own research work and to inform the specialists about it, but also to actively disseminate this knowledge and to make it available, to students, teachers and scientific journalists, i.e. finally to the big public.

We have now entered the electronic communication era and each scientist could take advantage of the advent of multimedia tools and of World Wide Web improvements for creating interactive scientific documents and making them available everywhere to everyone. Almost all universities, scientific institutions, governmental organisations or professional scientific societies have now a web site providing to the big public a very useful information on the scientists who are members, on their scientific goals and main achievements. For most of scientists, using web and electronic messages became very common because this is very helpful for sending abstracts or publications, to obtain information about the various meetings and to register, etc. Many professional scientific journals are now under both paper print and digital forms, but in the last case, the existing multimedia tools are not really used because these contain only text and black & white presented in a non-interactive way. Therefore, one among the most challenging tasks of scientists & publishers is to maintain the scientific quality of the technical publications and at the same time to improve their presentation by introducing colour images, animated computer drawings, video sequences, computer simulations and interactive references providing direct access to the related content. A new type of writing, increasingly different from that used so far on paper, has to be invented if we want to take advantage of the possibilities offered by the multimedia tools now available for producing more attractive and comprehensive documents. The creation of a new cyber-writing model for the scientific publications to be written by scientists

requires a scientific author having some experience in writing story boards for audiovisual or interactive documents who is familiar with the multimedia tools to be used.

Or, since 1992 we have produced over twenty scientific films on various topics such as electrochemistry (“*Electrochromic devices*”, “*Triboelectrochemistry*”, “*NEMCA, the electrochemical promotion*”), nanotechnology (“*Atomic designs*”, “*Nanowriting*”), materials science (“*Electron pathways*”, “*Growing crystals*”), solar technologies (“*PSA, the Plataforma Solar de Almeria*”, “*Solar detoxification of water*”), water decontamination (“*Diamonds kill carbon*”, “*Chemists & Bacteria vs. Pollutants*”), catalysis (“*Magic catalysts*”) etc., presented at many seminars, conferences, Workshops and Meetings [1], [2] or broadcast on TV within “*Les Amphis de La Cinquième*”. In these audiovisual documents, most of technical explanations are alternatively devoted either to specialists or to the large public and therefore only fragments of them can be presented to a specific audience. This is why, more recently, we have experienced the production of two interactive documents devoted to the use of natural resources by human societies or to explain to the college students the existing solar technologies with the objective to give them a better idea on the solar production of electricity [3], [4]. These documents have been tested in an interactive way by the students at the lyceum level in La Rochelle, France before making them available on-line on the following web site: <http://www.crdp/poitiers.CNDP.fr/BIPSSite>

These multimedia experiences have been encouraging and we want now to focus our efforts on the development of a new type of scientific documents [5], [6], differently conceived with respect to those issued in the professional scientific journals on-line. It is important to produce on-line publications, because the ability to transmit scientific and technical information around the world is enhanced, the publishing cost is reduced and storing information under digital form is easier. However, as insofar the content of on-line and print versions is almost identical, we intend to use all the possibilities offered by the multimedia tools to introduce sound, coloured images, video records computer drawings or simulations for producing more attractive scientific reviews on various topics. In addition, by using active words & images and interactive links between the scientific & technical information given at different specialization levels, such documents, available on the web, may be accessible not only to the specialists but to become comprehensive for other scientists, teachers, students and scientific journalists.

## **DESCRIPTION OF THE MODEL**

**Principles** A multilevel scientific review should:

- contain a concise text, short sound messages (20’’ each), coloured images, animated computer drawings or simulations and also the video sequences showing real life situations, processes or techniques difficult to be described only by comments;
- contain interactive words/images and links providing an interactive access from the first level (devoted to the students or scientific journalists) to the levels interesting teachers or specialists in a specific topic;
- permit an easy introduction of new results, concepts or interpretations and thus to be kept up to date;
- be peer reviewed in order to ensure the quality of the scientific & technical content;
- be distributed via the web sites of universities, research institutes, professional societies or scientific publishers;
- be useful for preparing educational documents, computer assisted presentations (PhD presentations, communications at meetings & workshops, etc.).

**Presentation** Exception made of the possibility to explore in an interactive way several understanding levels via active words, images and hyperlinks, the web pages constituting the multilevel scientific review have to be very simple (no net surfing!) and similar to the “classical” scientific publications:

**The first page:** has to offer the possibility to read the content either in an international scientific language (English) or in a national language such as French, Italian, German,... The reader can eventually hear a short (20’’) message explaining how to explore the document in the best way.

The presentation of the 1<sup>st</sup> page has to be very simple and especially to offer the possibility of a quick choice among the topics presented, as shown below for both the general scheme and a specific example:

## **GENERAL TITLE OF THE SCIENTIFIC REVIEW**

Chapter N° 1,      Chapter N° 2,      Chapter N° 3,      Chapter N° 4,      Chapter N° 5

Title of the Chapter N° 1

Section N° 1,      Section N° 2,      Section N° 3

Title of the section N° 3

Authors Names (links to their web pages)  
Institutions, Universities,.. (links to their web sites)

Key words: active words having links to the most important information on the topics (main Meetings, Journals, reviews,...)

### **Exemple**

French (Italian, German,...)

1<sup>st</sup> page

English

*TREATMENT METHODS OF WASTEWATERS*

*Catalytic,      Photo-catalytic,      Biological,      Electrochemical*

*Photo-catalytic decontamination:*

- *TiO<sub>2</sub> suspensions;*
- *Ti/TiO<sub>2</sub> photoanodes;*
- *Photo-Fenton.*

*Ti/TiO<sub>2</sub> photoanodes for the solar decontamination of wastewaters*

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Key words: environment, solar, photoanodes, wastewaters

Thanks to the active words given on the first page, the reader has the possibility to choose quickly a specific topic of interest, to see the web pages of the authors, to contact them via email, and also to visit the web sites of their universities, research institutes or professional societies.

Several active key words can lead to a valuable information about the main scientific books, reviews, Meetings and professional journals covering each topic.

### **The 2<sup>nd</sup> page should contain:**

-an abstract of 1000 characters written for the lowest specialization level (students, scientific journalists) and describing the economical or fundamental reasons of the research, the objectives to be attain, the experimental methods and the main results;

- an introduction written for the lowest specialization level, in which the interest (fundamental, economic,..) of the research has to be described in detail by using general terms and also some active words providing access to data, drawings or images giving more detailed explanations. The principles of the experimental methods used have to be explained by text or by using, if necessary, computer drawings or simulations. The active numbers of references can give the possibility to have an idea on the research previously done on the specific topic and also to find more explanations about the principles of the experimental methods used. The expected results and achievements can be also briefly enounced.

**The 3<sup>rd</sup> page** should be devoted to the experimental section in which the preparative methods, the experimental set-up & instruments used and the protocol of the experiences performed have to be described for giving via active worlds/images & hyperlinks all the details and technical information needed by scientists and specialists. Video sequences can be used to show dynamic processes, specific preparations, etc. for all the understanding levels.

**The 4<sup>th</sup> page** should contain the main results and their discussion presented for the lowest specialization level. All the experimental results and their interpretation have to be found only via active words/images and links for providing all

the information necessary at the highest specialization level.

**The 5<sup>th</sup> page** should contain the conclusions and perspectives, summarized in 2000 characters and presented in general terms for the lowest specialization level. The interest, fundamental or economic (and in the last case the eventual impact for the local communities or mankind) must be well understood by most of readers. Several active words/links should be also be available for the information needed by specialists. The references listed on the same page and given as active numbers in the previous web pages, should provide a direct access to the full title of each publication and also, if existing, to the on-line journals in which the scientific publication was issued.

## **MODEL APPLICABILITY**

**Production of on-line scientific reviews.** More sophisticate multimedia tools than those used today for the computer-assisted presentations (PhD, Meetings, seminars) are needed in producing such on-line, multilevel scientific reviews. The number of scientists able to use such multimedia tools is today small but continuously increasing. Guidelines made under the form of web pages could be prepared in the future, as soon as the model will be improved, and thus only a short time will be necessary to fill them out by scientists.

**Scientific content.** Maintaining scientific quality of the content is a crucial requirement and this can be guaranteed only for the peer-reviewed publications. This is also the condition for having such on-line scientific reviews considered in the evaluation of the research work done by researchers. Today, this evaluation is based on the quotation of different professional reviews like Nature, Science, The Lancet, etc. Each publication issued in one of the 100 000 existing professional journals is quoted by a number of points depending on the ranking of the Journal. So, for instance, a paper issued in the “Review of Modern Physics” will have 13.44 points, while a paper issued in “Advanced Materials” only 4.96 points, and so one. In addition, a Science Citation Index (SCI) is used to quantify the interest of each publication and thus to evaluate the research work of scientists. This system is far from being perfect and objective.. Most of the researchers are therefore working under “publish or perish” conditions [7] a very bad situation for the quality of their scientific publications but also for the introduction and the use of new publication models such as the one proposed in this paper...

**On-line dissemination.** Having a direct access everywhere to scientific reviews describing the most important research topics would be clearly profitable for the dissemination of scientific and technical information. The interest of universities, research institutes and professional organizations is to have on their web sites such high quality, peer-reviewed scientific reviews. On the other hand, by introducing personal web pages (containing the email and web sites), scientific authors could obtain direct feedback, comments or opinions on their research work in a much better way than reached from an anonymous citation index. Nevertheless, the contribution of scientists to creating such interactive documents will heavily depend on the extent in which this kind of work will be taken in account for the evaluation of their activity and carriers. It is however expected that the creation of SciDev.Net, a free-access internet-based information network (<http://www.scidev.net>) under the sponsorship of Nature, will encourage scientists to contribute to such a regularly updated website containing scientific news, reports and peer-reviewed articles [8]. Other similar initiatives are existing: ULISSE (<http://ulisse.sissa.it>)[9], Biomedica (<http://www.upf.es>)[10] etc., and thus scientists will have very soon several opportunities to contribute with documents to the on-line dissemination.

## **CONCLUSIONS AND PERSPECTIVES**

The dissemination of scientific reviews on the web sites of universities, research institutes or scientific societies has the following advantages:

- to ensure low cost production, fast dissemination everywhere and easy storage;
- to improve the quality of presentations at Meetings, Workshops, Conferences, PhD defences, etc.;
- to favour the creation of useful documents for education, especially for the on-line teaching;
- to enhance the visibility and prestige of the scientists and their organizations.

It is very important to favour the creation of the multilevel scientific reviews by the scientists themselves. Thus, the model of multilevel cyber-writing presented here is simple, do not favour “net surfing” and uses the same construction (Title, Abstract, Introduction, Experimental, Results, Conclusions, References) as in the case of the “classical” scientific publications. Moreover, the multimedia tools (active words/images & hyperlinks) are quite similar to those already used by many scientists during their presentations (PhD defences, Meetings,...). Our efforts are now focused on the production of a such documents on “Treatment of wastewaters” and “Solar technologies” in order to offer several examples of such multilevel cyber-writing. However, previously to distribute them on the web, we intend to test their cognitive qualities by students, teachers or scientific journalists, in order to check the qualities

or defaults of this cyber-writing model and thus to improve it.

Our ultimate goal is to find the best model for the on-line multilevel scientific reviews in order to offer more elements for producing educational documents, books and reports for newspapers or scientific magazines, i.e. finally leading to a better knowledge of science advances and to an increased visibility and prestige of scientists and their professional societies in the eyes of the large public.

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