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CAAD-CAAI Integration by means of High-Impact Small-Scale R&D Projects

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Pointing towards the ultimate goal of instrumental integration between our instructional and professional environments, the paper deals with the articulation of small scale R&D projects that, due to their consistency with main-stream tendencies, can have considerable impact on allowing people, institutions and enterprises to perform a relevant role in our dynamics of "Continuing Professional Development" and "Practice-Based Learning". The paper presents the results of a European Union R&D Project that aims to empower small and medium size enterprises of the building sector with the knowledge needed for the development of multimedia programmes with pedagogical value. The paper is explicit on addressing not only the achievements but also the difficulties that the consortium of European partners had to face, and makes reference to a future spin-off project that follows the same tactical approach.

Scenario

For quite a few researchers, conceiving Research & Development projects of large, medium or small scale can be a frenzy habit. We can not help ourselves from identifying research paradigms everywhere. The raw formulation of research paradigms can be fun, but to elaborate consistent research projects is a different story. Our real problem starts when we need to fragment large scale projects into short term targets, or we need to articulate a number of small scale projects towards "relevant" objectives. In addition to this, as if not sufficiently entangled, we must face the task of relating fundamental research with development research and application research, within a R&D community where not everyone has the same view of "who should be doing what".

As far as our experience can tell, by the end of the 1980s some research sponsoring institutions were still willing to finance a number of fundamental research adventures, but as we now sample present tendencies, we can not dare to make further fundamental proposals. From our point of view, we see that the responsibility of performing fundamental research is being largely forced into the hands of our universities, and that due to financing limitations, research contractors will need to concentrate on development and application research.

We believe that PhD research will need to come back from narrow research subjects to address the scientific fundaments from which long term objectives may be drawn, and that research contractors will need to address the opposite research spectrum where short term targets are identified. University scholars and contract researchers will need to establish partnerships in which large scale projects may find development feasibility and small scale projects may accomplish articulation and contextual relevancy.

This paper makes reference to a partnership where fundamental objectives, established within a doctoral dissertation at TU Delft, and short term targets, that compromise a European consortium in which TU Delft has a sub-contracting role, has been articulated on mutual interest and benefit.

Fundamental Objective

On 1992 fundamental research on the subject of Design Support Systems was undertaken at the Faculty of Architecture in Delft. The idea was to abandon the "leg of the fly" research approach and address the fundamental issue of global R&D conjunction.

From such a global and fundamental perspective, it became quite clear that Design Support Systems and Pedagogic Support Systems hold mutual dependency in terms of implementation feasibility. The idea of a system that offers support for knowledge application (design), in our professional environment, and support for knowledge acquisition (learning), in our instructional environment, became consistent with all our foreseen requirements for implementation feasibility.

Knowledge capture mechanisms (Michalski 1986), within Design Support Systems, required a wide range of "start-up learning opportunities" that could not be offered in a professional scenario. On the other hand, Pedagogic Support Systems required a "virtual design platform" of professional characteristics (Schön 1984). The conceptual blending of offering design and learning support, as a single fundamental commitment, gave way to a new concept of CAAD-CAAI Integrated Support System. A fundamental objective.

From Objective to Targets

In order to avoid redundancy with other publications (Vásquez de Velasco & Angulo 1994) this paper is not going to describe the characteristics of the CAAD-CAAI Integrated Support System of reference. In any case, we will only mention a few characteristics that explain the relation of such a large scale objective with the small scale project we will later describe.

In particular we must mention that the intended system presents a front-end panel that articulates a number of knowledge sources on top of a common design platform, and that the question: Where are these knowledge sources going to come from? was an obvious and perturbing one.

This was a perturbing question because we were unable to consider seriously the image of software houses buying knowledge from domain experts and selling such knowledge as an out of the shelf product.

Making an analogy, we are not likely to find a publisher that buys data from experts and later writes a book that students or professionals will use as a source of knowledge. In reality, the publisher will only publish the book. It is a person with the domain knowledge, and some writing skills, the one that actually writes the book as an articulation of data, structure, and deliverable format. The author of a book is, in essence, producing a simulation of the intended book, and the publisher is using such a simulation as a source for the production of the actual book.

From our point of view, we find no reason why our main-stream distribution of tasks should change. Holders of domain knowledge must be able to simulate the computer-based knowledge sources we will be needing in the future. If we choose to adopt the tactical decision of protecting main-stream distribution of tasks and promoting their definition up to future requirements, we will need to train the authors of our pedagogic material on the skills of simulating computer based material.

The academic personnel in our schools will need to move from the paper-based simulation of text books to the computer-based simulation of educational programmes. The technical personnel in our industry will need to move from the paper-based simulation of hand-books to the computer-based simulation of training programmes.

It became clear to us that an obvious target within the objective of developing the intended CAAD-CAAI Integrated Support System was to produce the training material needed by our authors of pedagogic material. At the end, they are the best qualified for supplying a comprehensive framework of knowledge sources for our CAAD-CAAI System to use.

Our First Target

The theoretical choice, between the academic personnel of our schools or the technical personnel of our industries, as our first target group, was never made. It came as a coincidence that a number of research contractors of Europe felt a similar need at the same time. The fact is that very short after identifying the previously mentioned training needs, the initiative of a Portuguese research contractor was offering us the opportunity of initiating actions that addressed some of the training needs we had identified.

On 1992, following an original initiative of TECMINHO (Portugal) and the sponsorship of the European Union's FORCE Programme, a team of six research sub-contractors took the challenge of developing a computer based programme that would supply training on multimedia and hypermedia authoring skills to our enterprises.

The team of subcontractors was composed by: Axis Consultants (Luxembourg), DBB-Akademie (Germany), Dialogos Nea Media (Greece), University of Delft - Faculty of Architecture (The Netherlands), University of Derby - Institute for Health and Community Studies (United Kingdom), and University of Minho - Department of Computer Sciences (Portugal). Not two members of the consortium have the same professional background, and each one was encourage to approach the subject from its own professional and national perspective.

Our first year target was to produce a paper-based version of the content material. Our global target, to be accomplished on two years, was to produce a "computer-based modular instructional programme" addressing all aspects of multimedia and hypermedia authoring. For such purpose, and considering the areas of expertise that each partner could offer, the content of the intended package was divided into five topical modules and one introductory module, namely: 1) Overview, 2) Methodology, 3) Interaction, 4) Pedagogic, 5) Technology, and 6) Management.

Considering our main field of interest, and the expertise that we had to offer, we committed ourselves to the production of the module addressing the topic of Methodology.

The Module

Considering our particular interest on addressing the Dutch building industry as main target group, we decided to change the title of our module from "Methodology" to "Procedural Know-how", which means basically the same but is far less intimidating, specially out of an academic environment.

The module was divided into two large sections, one section on theory that was on its own turn divided into 5 subsections, and a practical example. The practical example could be viewed as an integral section or a collection of practical subsections that were directly related to each of the previously mentioned theoretical subsections. Illustration 1 shows the main structure of hyperlinks that the module offers.

We had no problems producing a paper-based version of the content of the module, but as initially suspected, it became impossible to simulate the hyperdirectional structure that we intended. In order to complete the simulation of the module we had to abandon the paper support and use digital support. Some other members of the consortium had felt the same limitation and it was agreed that, if necessary, certain level of digital simulation was to be produced.

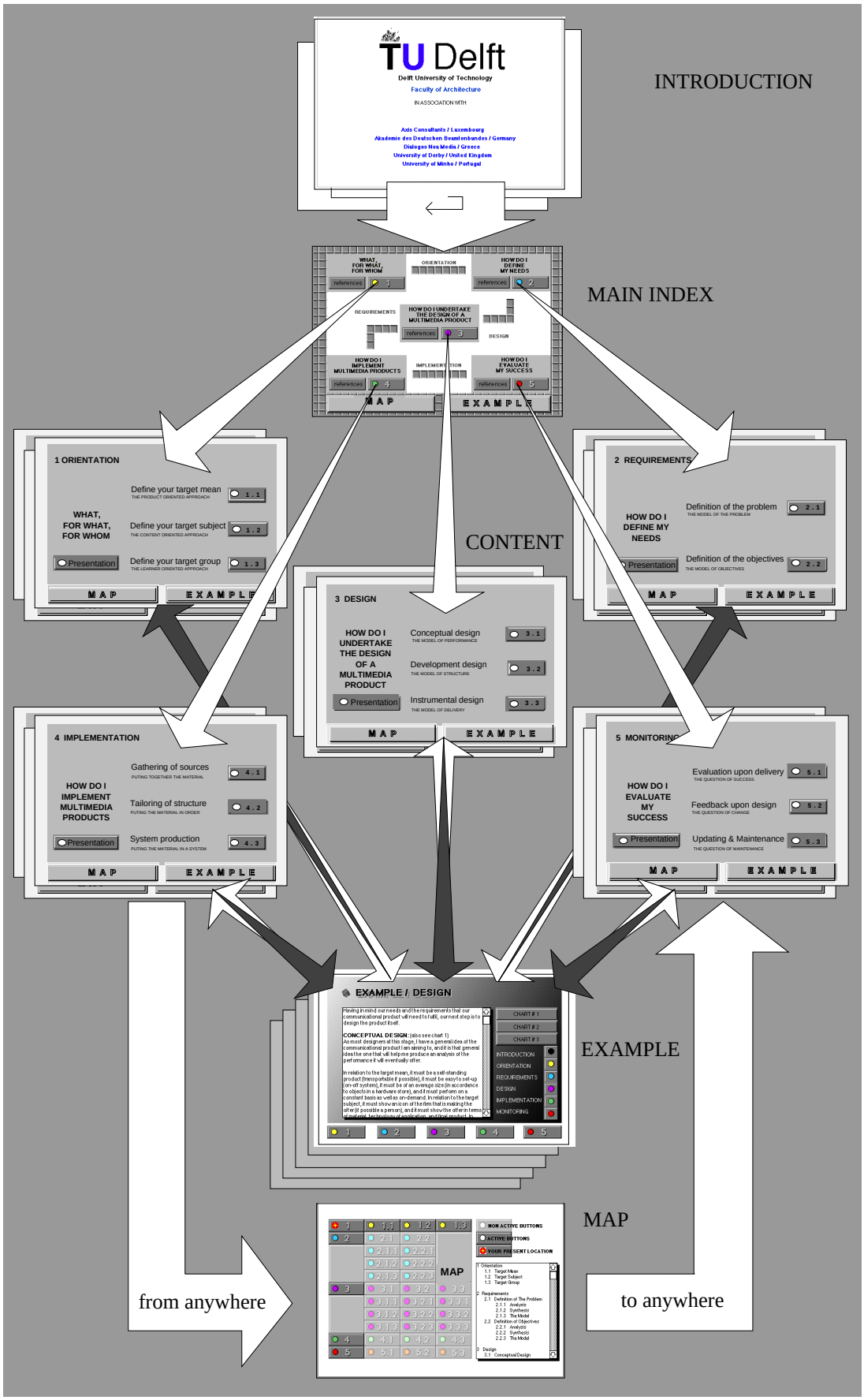

Illustration 1. Range of Hyperdirectional Links in the Global Structure of the Module

In our case, we found that the kind of structure we intended could be easily simulated by means of HyperCard on a Macintosh. The simulation itself was quite unattractive, but it was possible to simulate the content and structure that the paper-based version was unable to handle. Only some of the programme's modules needed digital support at this time.

Due to domestic reasons, and meanwhile the intermediate report was produced, delivered, and reviewed, members of the consortium followed to make changes or the upgrading of their modules. In our case, we decided that for actual testing purposes it was desirable to produce a more attractive version of our module. For such reason, but without leaving the Macintosh platform, we converted original sources from a 4 bit b/w palette to a 8 bit colour palette and transferred the card-based structure supplied by HyperCard to the frame-based structure that MacroMind Director offers. We hereby follow to describe the basic content of our module.

What, for what, for whom

This is considered as the introductory chapter of the module. Its fundamental objective is to discuss the scenario in which the initial idea of producing a computer-based communicational product is conceived. In particular, three scenarios are discussed.

In the first scenario we may have a clear idea of the subject of communication and our target audience but ignore with what kind of communicational product we must complete the communicational equation. This kind of design scenario tends to result on what we call the product oriented design approach.

Somehow less common but still relevant enough to be mentioned, the second scenario we present in this chapter is the one related to a content oriented design approach. We may have the means, i.e. the capability of producing interactive multimedia programmes, and an audience with access to computers, but we still need to define for what purpose we intend to build a communicational link.

The third scenario makes reference to the situation in which the target audience remains to be unknown. We may be well aware of the kind of product we can supply and the subject we want to address, the question is to whom. We hereby discuss the learner oriented design approach, that is frequently derived from such circumstances.

How do I define my needs

Communicational needs are frequently derived from communicational problems. It is by producing a model of our communicational problem and a matching model of our communicational objectives that we can define our design requirements and constraints.

This second chapter of the module makes reference to common communicational problems and how they may be subjects of analysis, synthesis, and modelling techniques. In similar way, related communicational objectives are handled within analysis, synthesis, and modelling paradigms. On balance, this chapter commonly referred as the chapter about design requirements, aims to underline our awareness of the intuitive drives that guide the identification of communicational needs.

How do I undertake the design of a multimedia product

This is the central chapter of the module, and probably the most extensive one in terms of user-system interaction. It has been divided into the three most common design stages we can account, namely: conceptual design, development design, and instrumental design. See illustration 2 as an example of the hyperdirectional structure offered within the chapters of the module.

In the context of conceptual design, we discuss the process of defining a performance model relevant to design requirements and constraints. The performance model is defined across all the participating parameters of the communicational equation, namely: the product, the subject, and the target.

Within a similar framework, development design makes reference to the model of communicational structure that can give feasibility to the intended performance. Global characteristics of the communicational equation find their origin

at this stage. Considerable importance is given to the need of offering particular attention to the articulation of analysis and synthesis at this stage.

Finally, instrumental design makes reference to the ultimate level of global synthesis to be established before initiating implementation procedures. The understanding of the fact, that it is only at this stage of the design procedures that the communicational equation becomes completed, is underlined.

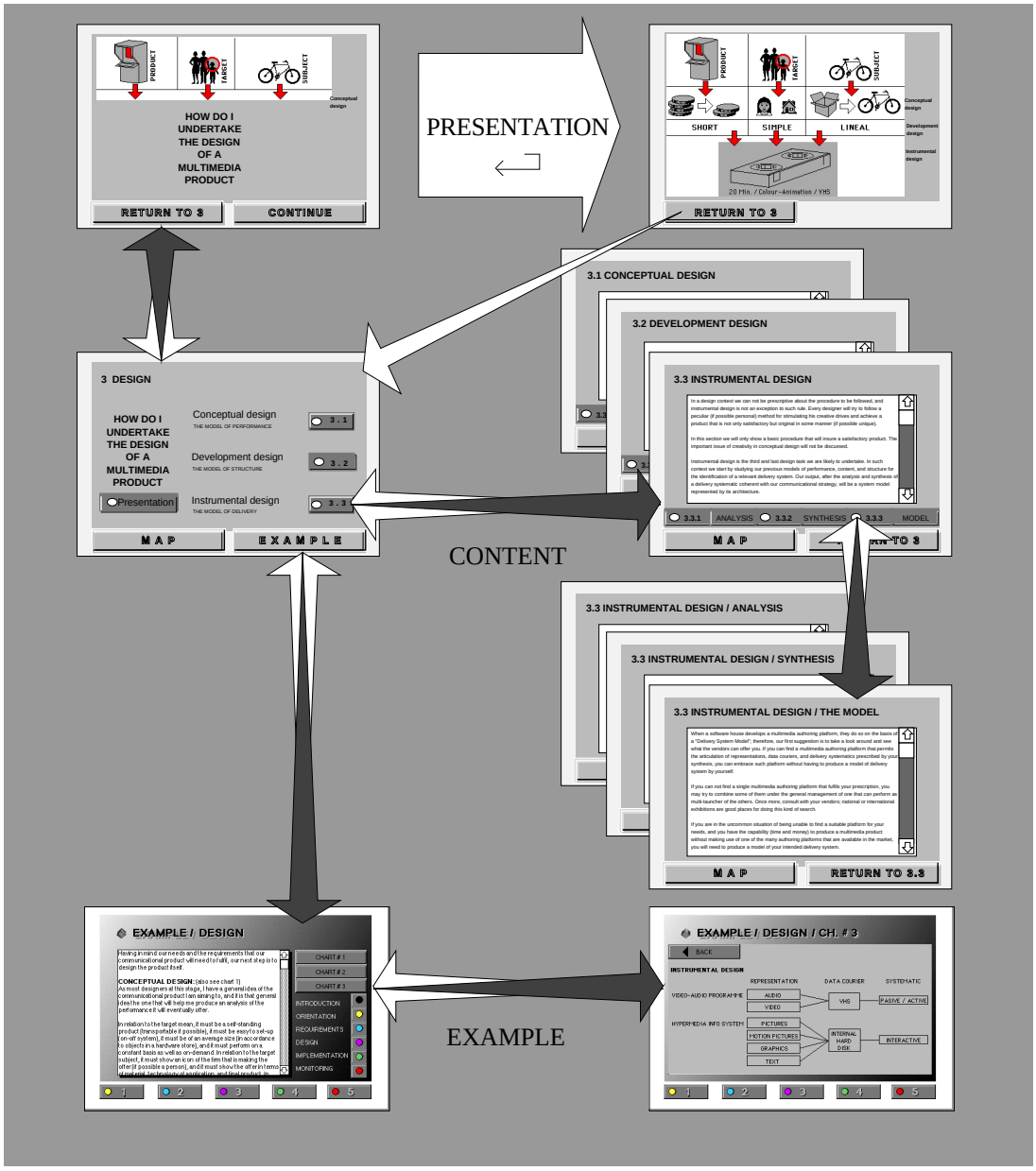

Illustration 2. Range of Hyperdirectional Links in the Internal Structure of the Module

How do I implement multimedia products

The single chapter is frequently viewed as the whole of what training on multimedia authoring skills should be about. The importance of how we implement multimedia products can not be overlooked, but on the other hand, it should neither be over stressed.

In the case of our module, this chapter deals with the question of gathering sources, tailoring the information structure, and editing the material. The typical discussion about hardware and software has been reduced to a minimum in order to avoid the dating of the material. In addition, it is understood that our modular programme includes a complete

module that is referred to the subject of multimedia and hypermedia technology. This chapter makes reference to the same range of technical questions but remains addressing a strategic concern instead of a tactical one.

How do I evaluate my success

This is an issue that is frequently overlooked due to the difficulties involved on evaluating the achievement of instructional targets. In our module, we recognise the validity of empirical methods of evaluation on given situations, and at the same time we question how reliable less empirical approaches may be. On balance, we present the feasibility of evaluating our communicational products on the basis of their content, structure, and/or delivery system.

In relation to feedback needs, the subject is also addressed on a break-down of content, structure, and/or delivery system. Considerable stress is put into underlining that a single feedback upon a single parameter is not necessarily going to report upgraded results. The need of integral feedback procedures is strongly recommended.

Finally, the question of updating and upgrading is subject of discussion. A break-down into content, structure, and delivery system is once more used as back bone of the analysis and synthesis of the subject. Particular attention is given to the line-up of updating, upgrading, and changing needs that may be raised along a time line.

Further development of our first target

As we resumed the first year of activities and made plans for the second year, it was time to be self critical of our work. The result we had achieved was highly diversified in terms of content depth, content structure, and the delivery system that was foreseen. The freedom we had given ourselves had resulted on complementary material that could be found on a single book shelf but not a single book. Our modules were very far from being modules of a single modular package.

In order to reduce diversity, at the same time that we continue to respect individual interests, we have followed to agree on a single standard for the delivery system. The MS DOS + Windows system was chosen as standard platform for all the modules, but yet, we have remained open to different window formats. In particular, we had the intention of covering both systems, Macintosh and MS DOS, with minimum format differences. Therefore we have remained to use a 12.5 cm. X 18.0 cm. Screen format imposed by the small Macintoshes and a physical resolution of 640 x 480 typical of the VGA physical resolution versus colour resolution trade-off.

In addition, each member of the consortium has continued to emulate, in their own modules, some distinctive characteristics of the other modules. Moved by this dynamic our module has been complemented by a third section that offers presentation back-up and remains bounded, by hyperlinks, with the main theoretical body of the module.

At present we are in the process of presenting our individual modules to enterprises in each participating member state and using the actual instructional package, under the title "Advanced Training on Multimedia" in seminar scenarios.

Our second target and a view into the future

As we proceed with the use, the evaluation, and the improvement of our programme "Advanced Training on Multimedia", we must realise that our present effort is addressing only half of our potential target group. Technicians in our industrial sector will receive assistance on the development of multimedia and hypermedia authoring skills, but our academic personnel remain largely unattended on such regard.

Following the same tactical approach of undertaking small scale projects, that may report high impact on the achievement of long term objectives, we intend to promote a new project with the target of establishing a similar support framework for our academic personnel.

We are well aware of the fundamental differences that stand between our industrial and academic target groups. Nevertheless, we believe that a consortium of CAAI ateliers, will be able to elaborate a global proposal for the content, structure, and delivery system to be used on the subsequent production of a programme on "Multimedia and Hypermedia Pedagogic Authoring Guidelines".

Summary and Conclusions

The fundamental objective of developing Design Support Systems, of advanced performance, underlines the need of developing a comprehensive framework of computer-based knowledge sources. Answering to the question of who is going to supply such knowledge sources is of vital importance.

If we adopt the tactical decision of supporting present main-stream authorship sources as our future sources of computer-based authorship, we may be able to achieve high impact contributions without having to incur on large scale implementation projects.

Academic personnel that hold the domain knowledge of our present text books and future educational computer programmes, need to complement their present authoring skills with the skills that will allow them to simulate the computer programmes that our future publishers-programmers will produce. In similar way, technical personnel within our industrial sector, authors of a formidable body of knowledge in the form of handbooks, will need to acquire similar new skills.

We need to supply our industrial sector and our academic environment with the training aids that may help them on acquiring reliable multimedia and hypermedia authoring skills.

As a first target, with focus on European small and medium size enterprises, a European consortium, sponsored by the European FORCE Programme, has accomplished the production of a version 0 of a computer-based training programme entitled "Advanced Training on Multimedia".

Following similar criteria, we look forward to the implementation of a new small scale project for the production of a training programme entitled "Multimedia and Hypermedia Pedagogic Authoring Guidelines" addressing the academic environment of participating schools of architecture.

It is yet early to draw a reliable conclusion on the measurement of the impact that we may be accomplishing. In general terms, "Advanced Training on Multimedia" is yet a product in development, but nevertheless, it has been already considered as an alternative to the sub-contract of multimedia consultants. We believe that such a reaction does indicate that we are, at least, reaching part of our target group.

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