

POLLEN

Report on the validation and evaluation in Saint-Quentin

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ABSTRACT: The report describes how the prototype on Genome has been received by home-learners involved in the validation process. The analysis is focused on technology, ergonomics (of concept maps), pedagogy, communication and marketing perspectives of on-line publishing.

KEYWORD LIST:

Educational multimedia material, Evaluation, Home-learners, On-line delivery, Telematics

**POLLEN
ET 1016**

**Deliverable 7.4
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**Report on the
validation and evaluation
in Saint-Quentin**

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Summary: The report analyses the evaluation results outcoming from the use of the Genome prototype by 28 home-learners in Saint-Quentin delivered by Internet cable access. The analysis addresses the technological, pedagogical, communicational, ergonomical and economical aspects of the prototype utilisation, based on interview of users and log-files records.

Keywords: Educational multimedia material, Evaluation, Home-learners, Online delivery, Telematics.

Executive Summary

Between October and December 1997, 28 families have accessed to the GENOME prototype developed according with the POLLEN design method based on concept mapping principles. Six evaluators have visited each family two times, before and after the validation period, and have conducted interviews with 26 home-learners. Users had the possibility to participate in a discussion forum and to ask questions to the product editor. Log-files of every users sessions have been recorded and analyzed. In technological terms, the validation has been successful. The analysis of evaluation data (interviews, logfiles, messages) are presented according with five main issues which contents are summarized below.

- **Technology**

Evaluation of technological performance from the users point of view and from the project management point of view.

- **Navigation Interface and Ergonomy**

Perception and utilization of the concept map (in particular, of the links between concepts), utilization for navigation, general consideration about ergonomy in the different modules (forum, Guided Tour, tools base line, mail to editor, videos, etc.).

- **Communication**

Perception of functions in the communication modules, forum (active and passive participation), web, mail to editor. The confidentiality issue, synchronous and asynchronous functions, up-dating of contents. Typology of correspondents: tutor, expert, editor, author.

- **Pedagogy**

General considerations about the educational marketing of the application, level of scientific contents, mediatisation styles, perception of tutoring (or lack of tutoring), perception of user activity (or lack of activity), perception of pedagogical function in the Guided Tour.

- **Perspectives for On-Line Publishing**

Product, price, distribution, communication. Relevance and conditions for on-line publishing. Editorial marketing: thematic encyclopedia, reference, didactic. Product target audience (multiplication of levels to access). The service component: tutor, expert, up-dating, news. Diffusion and commercialization mode: free, price included in the subscription, pay-per-view, individual and collective payments. On-line / off-line hybrid versions.

Table of contents

1. Objectives, methods and overall results	7
1.1. Evaluation objectives	7
1.2. Method	7
1.3. Sociological characteristics of the population	7
1.4. Nature of results	9
1.5. Overall users impression on the prototype	9
1.6. Interest for POLLEN and limits of validity	10
1.7. Structure of the evaluation report	11
2 Technology	12
2.1. Main characteristics of the technical architecture	12
2.2. Problems met during the installation process	13
2.3. Problems met during the utilization process	14
2.4. Overall impression of users on technology	15
2.5. Strengths and weaknesses	15
3. Navigational Interface and Product Ergonomics	16
3.1 Objectives in Relation to the Navigational Interfaces	16
3.2 Interface Element Ergonomics	17
3.2.1 Product Accessibility	17
3.2.2 Graphic Aspects	18
3.3 The CM's Role in the Product's General Architecture	19
3.4 The CM as a Representation of Content Structure	21
3.5 The CM as a representation of content structure	22
3.6 Conclusion	22
4. Utilization of Prototype Communication Tools	23
4.1 Their Utilization Viewed Globally	23
4.2 Use of the Forums	25
4.3 Relations with the Editor	28
4.4 Utilization of Web Links	29
5. Pedagogical issues	29

5.1. Users profiles	29
5.1.1 The «good pupil» user	30
5.1.2 The «curious» user	30
5.1.3 The expert user	30
5.1.4. The computer skilled user	31
5.2. Contents and Level	31
5.3. Mediatisation and popularization	32
5.4. Perception of the educational function of the Guided Tour	33
5.5. Perception of Tutoring	33
5.6. Conclusion	35
6. Perspective for on-line publishing	35
6.1. Conditions of the evaluation	36
6.1.1 Credible experimentation	36
6.1.2 The limits of the experimentation	36
6.2. Sociological population characteristics	37
6.2.1 A top-of-the-range sample	37
6.2.2 Well informed users	37
6.3 A large target audience	38
6.3.1 Domestic use	38
6.3.2 The general public level	39
6.3.3 Multi-level resources	40
6.4. An on line service-product	40
6.5 A market ? at which price?	41
6.6. Conclusion	43

ANNEX 1

Peer review report

ANNEX 2

Interview reports

ANNEX 3

Log-files records

1. Objectives, methods and overall results

1.1. Evaluation objectives

The POLLEN project evaluation in Saint Quentin took place in the context of a wider experimentation of France Telecom aiming at testing the technical and commercial feasibility of an Internet cable access with 250 families in the city of Saint-Quentin. The specific objective of the POLLEN experimentation is focused on the use of an educational application prototype designed for being exploited on-line. The evaluation addresses technical, educational and economical issues. From the technical point of view, the evaluation focuses on the conditions of access and utilization of the prototype ; the educational evaluation focuses on the perception of the product by the users, from the points of view of didactic, ergonomics and communication ; the economical evaluation focuses on the editorial aspects in on-line production.

The Genome prototype belongs to the category of "scientific popularization". Its contents are the "Human Genome Project". It is addressed to an audience of adolescents and adults at the secondary education level.

1.2. Method

The evaluation method applied is described in the deliverable 7.1 (*Design of the validation and evaluation*). It is mainly based on two instruments ; on the one hand, two interviews conducted by the six POLLEN evaluators with the users, the first one at mid-October before the utilization period, the second at mid-December, after the utilization period ; on the other hand, the systematic recording on the server of log-files which allow to trace each of the 96 users sessions which occurred during the evaluation period by the 26 users who have connected at least once to the Genome prototype.

Guides and reports from the two interviews (in French) as well as the detailed report of log-files and their statistical analysis are grouped in an attached annex separated from the present evaluation report.

1.3. Sociological characteristics of the population

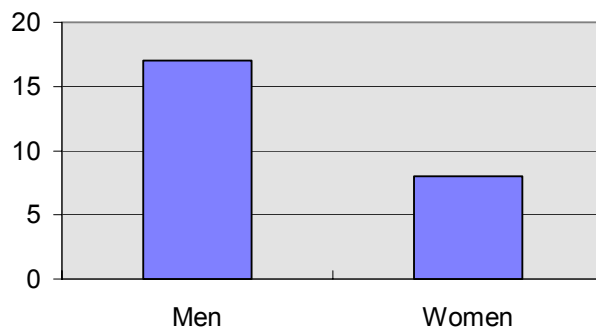
Families having participated in the POLLEN experimentation were volunteered. At a first stage, 35 families answered positively to an invitation mail. Among them, some were not able to participate, whether for personal reasons or for technical reasons when the user equipment was not compatible (low level *PC*, *Apple* hardware). Finally, 26 different user log-files have been recorded on the application server. The evaluation of uses is based on these 26 users ; their list

(coded for confidentiality) is included in the annex as well as the detailed records of the log-files and of the two interviews (one hour each).

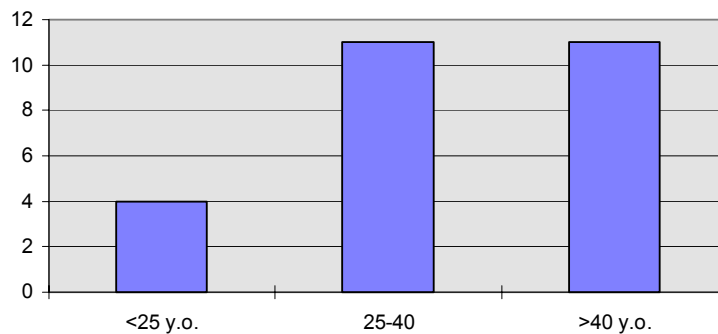
The thirty families selected for participating in the experimentation have the following characteristics:

- they reside in Saint-Quentin;
- they have a recent and powerful multimedia PC at home;
- they were volunteer for participating in the France Telecom experimentation (i.e. they accepted to pay 289F per month for the Internet cable access);
- they were volunteer for participating in the POLLEN experimentation (i.e. they accepted to use the Genome prototype).

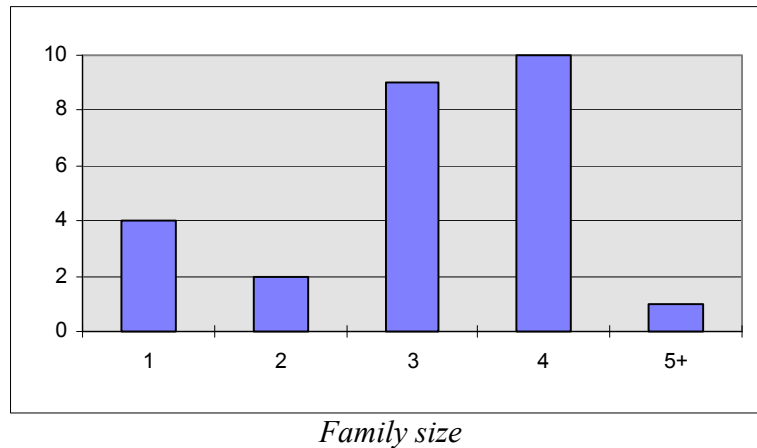
This set of characteristics explains why the households who have participated in the POLLEN experimentation all belong to the upper social class. In their majority (18 out of 25), the profession of one of the two parents is at the managerial level and for half of them in the computing industry sector. Contrary to what was expected from the educational characteristic of the POLLEN prototype, most of the users are adults. Within several families where children were potential users of the product, parents were the only users. Following charts bring complementary data about users population (gender, age and family size).



Gender



Age



In conclusion, the group of users is mostly made of men, parent with an engineer profession. From a cultural point of view, interview confirm the image of high level users, motivated, having a good professional and personal knowledge and know-how about computers and software.

1.4. Nature of results

The evaluation analysis is based on quantitative data, namely those coming from the log-files, but mostly on qualitative data coming from interviews. The results presented below have been elaborated from a systematic analysis of the second interviews where the users describe the prototype usage (more precisely their personal perception and representation of this usage) and express their personal judgment about the different components of the product. The analysis inferred from the second interviews have been confronted, each time it was necessary and possible, to the information coming whether from the first interviews or from the related user and sessions log-files.

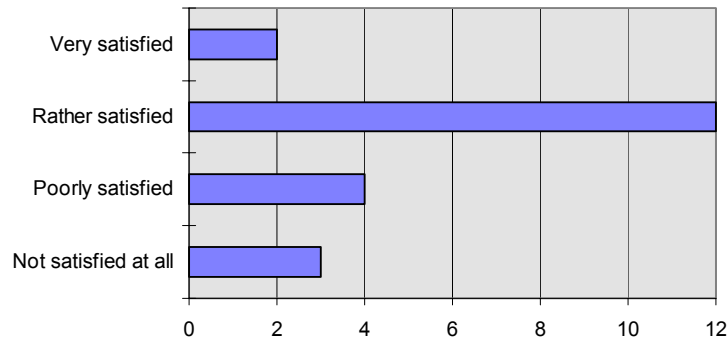
Thus, the evaluation results lead mainly from qualitative and homogeneous data eventually supported or illustrated with quantitative data.

Evaluation outcomes aim at providing an accurate image of the Genome prototype uses and their representation by the 26 people who have actively participated in the evaluation process. These outcomes are primarily destined to the publishers of the POLLEN project consortium whose interest is to explore and assess the potential of on-line publishing. This is why the proposed analysis of use and representation is mostly concerned with the editorial marketing of educational on-line products and services and with the users requirements towards such products and services.

1.5. Overall users impression on the prototype

Interviews contents allow to link the global perception of each user about the product to one of the four following categories: *very satisfied*, *rather satisfied*, *poorly satisfied*, *not satisfied at all*.

The 21 users having expressed their opinion in the second interview can be grouped as indicated in the following chart.



Global satisfaction of 21 users

The impression expressed by the users is *globally positive*. Almost all of them declare they like the product and they felt interest, and sometimes pleasure, in using it ; two of them are even enthusiastic. From a general point of view, the users consider that on-line publishing of products like the *Genome* prototype would be of a high interest, first for themselves but also, beyond themselves, for the future market they imagine for such products and services.

After the users general impression has been stated, the following chapters will detail its multiple dimension and ways it is expressed. But essentially, the evaluation report will analyze in details all the critics mentioned by the users. The report of product exploitation by a user is often complemented by the story of difficulties met in the utilization; these difficulties are spontaneously explained by the users in terms of defaults, lacks in the prototype conception and implementation. Conversely, qualities and causes of satisfaction are less clearly analyzed. This is why, numerous interviews start with a short declaration of satisfaction followed by a detailed description of the different problems that have been met in the utilization process; implicitly, the "experimentation contract" between the POLLEN team and the user states that the main objective is to find out bugs and mistakes because they are helpful for improving the product.

1.6. Interest for POLLEN and limits of validity

For the POLLEN partners in general, and especially for those who are commercial publishers, the main interest of the evaluation outcomes lies mainly in the experimentation context and in the quality of the evaluation analysis ; first, the experimentation context is very close from a regular commercial exploitation ; second the evaluation process did not consist in asking users to fulfill a pre-formatted questionnaire but, through partly formal interviews, in trying to reach the level of individual representation of the product and its use.

In the framework of a Research and Development project as POLLEN, it is important to underline that the experimentation context is not, as usual in such product, the laboratory condition. The product has been used at home by people having a professional activity. Even if

the access to the Genome prototype was free, its use took place in the context of a commercial service. The analysis of the log-files reveal that the application is mainly called in the evening and during the week-end, with the exception of the holidays period (first week of November).

In such conditions, the product as well as its diffusion system have been appreciated by the users. This is an important result for the publishers. Most of the surface defaults already identified within the POLLEN project team have been confirmed by the users and some others have been revealed (refer to the following detailed analysis, notably in the chapters 3, 4 and 5 about ergonomics, pedagogy and communication). However, the reasons that explain why the product has been appreciated remain unclear and for some of them surprising. But above all, the evaluation of use constitutes a rich source of information and inspiration for the designers and publishers of on-line educational and cultural products and services (this question is developed in chapter 6). Finally, the global approach applied in the analysis should not hide the huge variety of positive and negative judgments which have been expressed all along the experimentation and evaluation processes.

The main limits of applicability of the conducted evaluation is due to the size of the sample. Moreover, the users social and cultural profiles, clearly located in upper categories, introduce an additional bias. Also the technological equipment of families involved in the experimentation is significantly over the average level observed in French households.

In fact, in the specific context of the POLLEN projects, these characteristics of the population do not create an important constraint for the analysis. The sample of users does not pretend to be representative from a market which, in any case, does not exist yet. It was not in the purpose of the evaluation to be a market study but to open, for the publishers, the designers of applications and the telecommunication operators, ways for thought which would not be grounded only on personal intuition or highly hypothetical market data, but on behavior of real users in normal usage conditions.

From this point of view, the following analysis demonstrate that the main evaluation objective has been fully reached.

1.7. Structure of the evaluation report

The detailed evaluation outcomes are grouped in five main chapters.

- **Technology**
Evaluation of technological performance from the users point of view but also from the project management point of view.
- **Navigation Interface and Ergonomics**
Perception and utilization of the concept map (in particular, of the links between concepts), utilization for navigation, general consideration about ergonomics in the different modules (forum, Guided Tour, tools baseline, mail to editor, videos, etc.).
- **Communication**

Perception of functions in the communication modules, forum (active and passive participation), web, mail to editor. The confidentiality issue, synchronous and asynchronous functions, up-dating of contents. Typology of correspondents: tutor, expert, editor, author.

- **Pedagogy**

General considerations about the educational marketing of the application, level of scientific contents, mediatisation styles, perception of tutoring (or lack of tutoring), perception of user activity (or lack of activity), perception of pedagogical function in the Guided Tour.

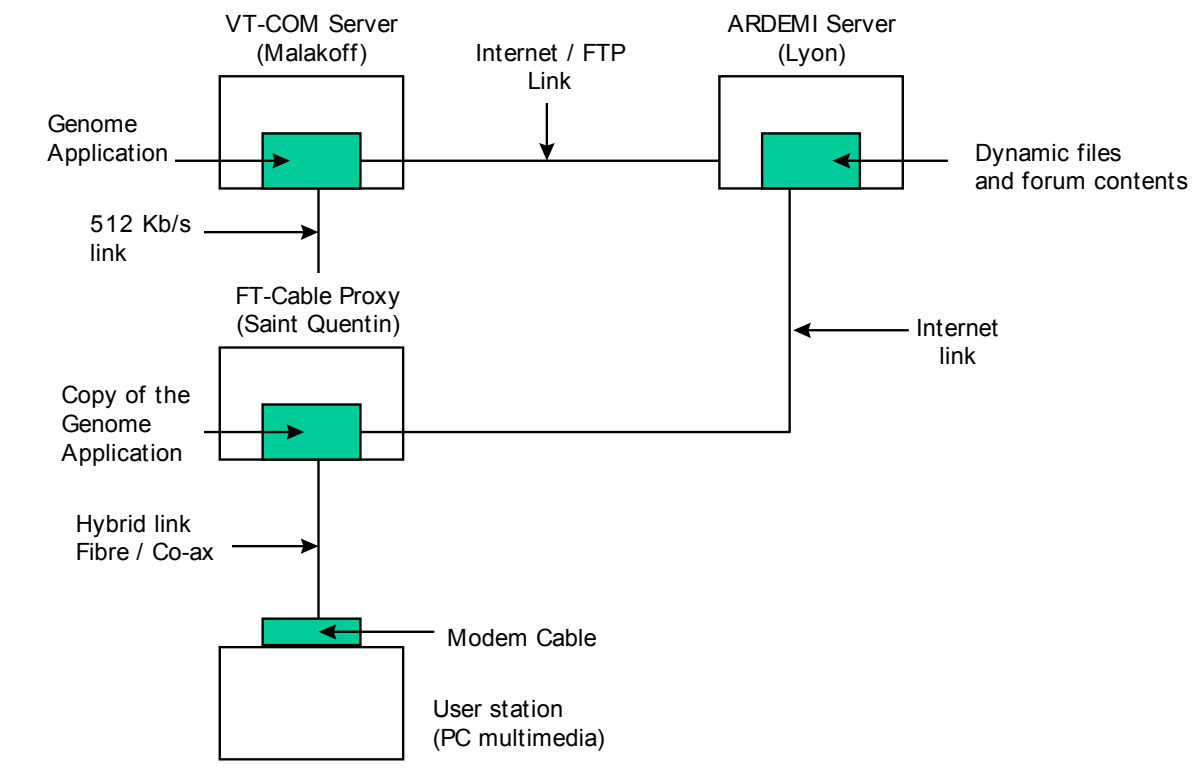
- **Perspectives for On-Line Publishing**

Product, price, distribution, communication. Relevance and conditions for on-line publishing. Editorial marketing: thematic encyclopedia, reference, didactic. Product target audience (multiplication of levels to access). The service component: tutor, expert, up-dating, news. Diffusion and commercialization mode: free, price included in the subscription, pay-per-view, individual and collective payments. On-line / off-line hybrid versions.

2. Technology

2.1. Main characteristics of the technical architecture

The technological system used for the experimentation is detailed in the deliverable 7.1 (*Design of the validation and evaluation*). In this part, only the main features are summarized in the form of the following simplified schema.



Contents of the Genome application have been downloaded on the server that France-Telecom put at the disposal of the POLLEN project for the experimentation. The total volume of the application is 258 megabytes. ARDEMI technical responsible for the POLLEN experimentation in Saint-Quentin was connected with the VT-COM server through an FTP link all along the experimentation (October to December 1997). From their own server in Lyon, ARDEMI was able to modify the application contents, data and program. Moreover, ARDEMI was able to command from Lyon the copy of the application files from the VT-COM server in Malakoff to the PROXY server of France-Telecom Cable located in Saint Quentin. The Proxy server was used by the 250 families involved in the Internet-Cable experimentation to access to the Genome application.

Thanks to this technical organization and architecture, the application manager has been able to manage the application at a distance. It allows also to make the application immediately available from any site sites where France Telecom offers an Internet-cable access (Metz, Nice, Paris, etc.) from the same single central server.

Compared with the architecture initially planned, the only change made at the implementation stage concerns the way dynamic files which contains access parameters as well as forum contents have been managed. In order to simplify the procedure, it has been decided that these files would not be stored at the VT-COM server with the other application files but directly at the ARDEMI server in Lyon. When a user connects to the Proxy server, a regular Internet with Lyon server link is established in order to load parameters required for the up-dating of the application (list of web sites, titles of the forums) especially the forum contents. When a user introduced a message in the forum, the generated file is immediately sent to the Lyon server which up-dates automatically the related file and sends it back to the user : the whole process needs 2 or 3 seconds maximum in general. The global application management system has perfectly functioned all along the experimentation.

2.2. Problems met during the installation process

Among the 35 families who accepted to participate in the POLLEN experimentation, only 28 were equipped with compatible computers able to run the application and confirmed their intention. It must be underlined that 5 families have been rejected because they were equipped with *Apple Macintosh*. Some of them forcefully protested and got the impression they have been ostracized.

Between October 16th and 18th, six POLLEN evaluators have visited the 28 families. The evaluators being not experts in IT, ARDEMI had prepared for them an installation kit made of a CD-ROM and detailed instructions for use in paper form. A hot-line was open during the whole installation process.

The installation procedure followed 4 stages:

- installation of the plug-in *Neuron*
- installation of drivers *Animator*
- verification of the screen configuration
- connection on the *Genome* site for test (<http://pollensqy.ed.vtcom.fr>)

The installation process ran well in 19 cases out of 28. Causes of difficulties met were:

- *Worm* disk containing files unreadable (4 cases);
- no *Internet* connection at the time of the installation (3 cases);
- other technical problems (graphic card not compatible, software conflict, 2 cases).

To support the 9 families for whom the installation process failed, a distance installation procedure has been set up, immediately after the visit, on October 18th. The *Neuron* plug-in, the *Animator* drivers and the instructions for installation have been installed on the server and the user had the possibility to download and install the software by himself or herself. A permanent support by mail with the evaluators was also organized which allowed to connect in that way 7 families out of 9.

In conclusion, despite having faced several difficulties, the installation process took place in quite good conditions. Looking back, the installation procedure applied revealed itself as efficient. Face-to-face contacts between evaluators and users has allowed to overcome some of the unpredictable obstacles; for instance in the case of a user, yet very familiar with Internet, who had never make the experience of entering directly an URL address on his Browser and who was only jumping from site to site through hypertext links and his collection of favorites. Without a visit at home, it would have been very difficult to understand why this user was not able to connect. We must also underline that technical difficulties are not only met with beginners. Experienced users, and especially those who are professional, could have unusual hardware and software configuration which could be sources of conflicts and incompatibility when drivers are installed: for instance, one user had 3 PCs at home connected in local area network which made the connection process particularly hazardous. Thanks to the applied procedure, lost of users due to technical reasons has finally been very limited (2 out of 28).

2.3. Problems met during the utilisation process

The analysis of second interviews and the follow-up of users through the messages sent to the editor show that, from a technical point of view, the utilization of the prototype did not face important problems all along the experimentation. The only problems mentioned by the users and that could be related with the prototype itself, have always been punctual, and could never be reproduced. For the well-equipped users and since the prototype have been properly installed, it has ran correctly, without any bug.

The main difficulties met are related with the quality of the rapid access to Internet provided by *France Telecom*. The quality of this services was obviously not regular, whether the network was totally inaccessible, whether the speed proposed was very under what was promised (2 Mbits/s). It seems that magnetic resonance due to interference with hertzian waves of portable phones

badly affected the lines. The speed highly depends on the number of connected people but it is also strongly dependent from the location of the machine in the different districts of Saint-Quentin. We have experienced this by testing the access from different places at the same time ; also that the speed could decrease and increase very suddenly. However, when the speed is good it can stay at the level of 2 Mbits/s ; we had the opportunity to check that on a station with a software tool able to control the speed parameter. *France Telecom* was finally able to work out the cause of the problem and to solve it.

2.4. Overall impression of users on technology

Users impression on technical conditions generally do not make the difference between technical problems related with the rapid Internet access service and the specific service offered by the Genome prototype. When a page is long to be downloaded, it is often impossible to identify the reason, low speed of the network or bug in the software. In such conditions and despite the difficulties met which were during some periods very important, it is important to underline that the users declare themselves, if not fully satisfied with the provided service, at least very positive about its future, confident that problems won't last and will be overcome by France Telecom. No user has said he or she is disappointed with the technology ; all confirm they are willing to carry on the experimentation.

The global user support to the POLLEN project does not prevent users to express negative remarks and to protest on specific aspects. In particular, some users blame France Telecom not to allow direct communication among the service clients. An informal users association has been set up exploiting a mailing list from France Telecom. The animators of this group have created a web page where advises are proposed, notably for supporting the users to overcome technical problems. Opposed to this approach, the direct relation with POLLEN evaluators, strongly personalized , has been much more appreciated by the users.

2.5. Strengths and weaknesses

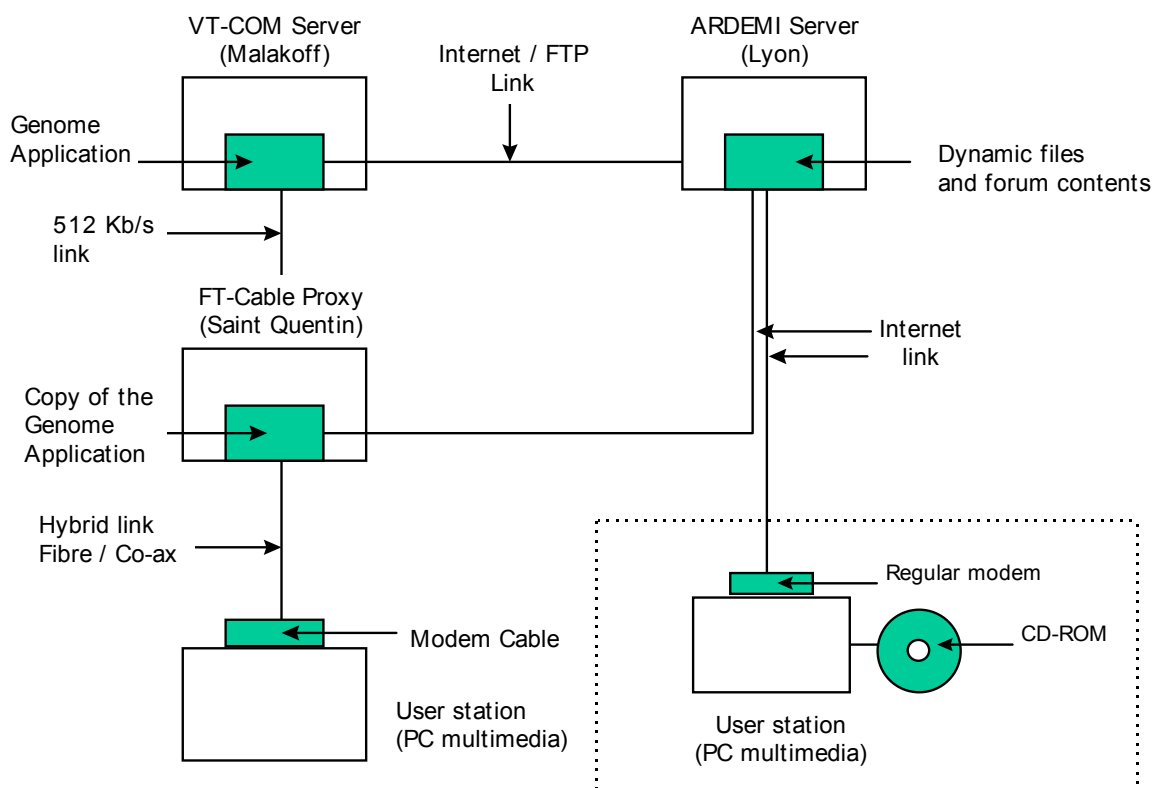
Interviews with the users and above analysis show that the two main components of the technical architecture used for the Genome prototype diffusion has been appreciated:

- from the telecommunication architecture point of view, the application was accessible in good conditions (especially for the video sequences) since the network was able to keep a speed of 2 Mbits/s,
- from the application production point of view, the choice of *Toolbook* its plug-in *Neuron* has given full satisfaction to the production team, allowing the development and implementation of the application in short delays with a very small number of functional bugs (which is rare in the context of multimedia production).

Moreover the dynamic files management as described above (2.1) which requires a continuing updating and which was based on the exploitation of strong and standard tools, demonstrated it is a very secure and efficient system. The main advantage of the applied management, maintenance

and updating mode lies in the fact that it allows the application manager (the editor) to maintain the application and to communicate with its users totally independently from the network access provider.

This system would also be very well suitable in the case of the application audience would be extended towards users not connected on the cable. In that case, the user should exploit a CD-ROM with the main application contents and a regular Internet connection with the ARDEMI server in Lyon for the dynamic files. This is the way POLLEN evaluators, scattered in different places of Europe (Lyon, Paris, Genève), had daily control on the forum contents evolution all along the experimentation. However, in this type of access, the user would lost the advantage of free access.



In the perspective of the generalization of on-line publishing of multimedia products, the face-to-face and personalized installation procedure, as it has been applied in Saint-Quentin should not be used as such. A specific procedure, taking into account the high number of potential users should be defined, namely an on-line procedure. An additional software interface should be developed for making the installation procedure friendly and for solving any technical problem which would appear.

3. Navigational Interface and Product Ergonomics

3.1 Objectives in Relation to the Navigational Interfaces

The prototype includes three interface elements for navigating in the program architecture which can all be reached from a single "home" screen (see Figure 1) :

- the Concept Map (CM)
- the task bar
- the Guided Tour (GT)

With these three interface elements users can navigate in the different sections of the Concept Map (CM) and access the on-line functions (Task bar). The Guided Tour (GT) enables the user to carry out an exploratory tour of the contents.

The evaluation objectives for the navigational interfaces, and above all for the CM, as defined in Deliverable 7.2, implied an overall view of the types and strategies of use of the prototype on the Human Genome, with, as a starting point, the analysis of the navigational interface use, which takes into account:

- the interface element ergonomics (use of different resources, ease of access to different documents or sections, efficiency and navigation speed)
- the CM's role in understanding the overall product architecture (practical representation)
- the CM as a representation of the content structure.

Using the general structure of the test, analysis of navigational interface elements was carried out on the basis of two types of information. The first type of information comes from the descriptive approach to prototype use via log file acquisition and analysis. The assessors recorded data on time, number of accesses and the type of document or product section which was accessed, so as to be able to describe the different types of application for which the prototype was used. The second type of information comes from a quality based approach to the evaluation via information supplied by the two interview sessions, E-mails sent to the assessors and certain contributions to the forums.

Analysis of the first type of information enabled the assessors to formulate hypotheses on the utilisation and navigation strategies used inside the product. The second session of discussions enabled them to confirm, infirm or look deeper into a certain number of hypotheses. The objective behind this notion was to develop an overall approach to all the factors contributing to satisfactory use of a programme designed for scientific popularisation.

3.2 Interface Element Ergonomics

3.2.1 Product Accessibility

Analysis of the content of the second interview revealed that the product was generally perceived as being simple and practical. Certain users qualified it as being austere, but also said that this austerity corresponds to a positive perception of the product's ergonomic organisation and architecture. The task bar was also qualified as being austere and even *primitive* (user 050), whilst it was pointed out that it had the merit of making the user functions even clearer and directly accessible.

A large number of the people interviewed confirmed the functional hypothesis of the prototype design team which considered that a very simple structure was necessary to avoid creating an obstacle to understanding scientific data, which can sometimes be arduous (*"The level is very high. It's not designed for beginners"* (User 300); *"The concept is very interesting, especially the interactive aspect with the network and the Forum. The contents are very good"* (User 290).

The importance for the users of identifying the type of product with which they are confronted is clearly shown by specialist literature (cf. deliverable 3.2. and documents used for evaluation preparation): this identification enables them to define their requirements and their utilisation strategy. In this sense, it is interesting to underline the fact that, when the prototype was identified by the users (See Figure 2), its *austere* design was considered to be positive (discipline and simplicity). A large group of users who replied to the question *"What name would you give this prototype"* (77%) defined the prototype as being designed to provide information. A part of this group (33%) considered that the teaching aspect of this type of product is to facilitate access to information. In terms of teaching only a small part of the group (22%) expected some form of didactic or training product. Furthermore we must underline the fact that identification of the prototype with a certain type of product largely determined the expectations and strategies of operation.

Educational product <i>(the accent is put on the socio-educative, fun aspect, popularisation in a general sense)</i>	6
Didactic product <i>(the accent is put on the training and educational aspects in a given field)</i>	4
Informative product <i>(the accent is put on total information in a certain field; dictionary, encyclopaedia)</i>	8

Users' expectations (n=18) in relation to their identification of the product

One point much appreciated by all users was the "full screen" option» used to present the programme. This option lets the users isolate a particular environment, and gives them better ways to integrate a given context of activity by avoiding external distractions and disturbance (this is the case when you stay in a navigation window or when you have to access to task bars or icons which are not directly usable). The fact that the large majority of users have rarely or never activated the Web links proposed in the prototype confirmed a general tendency to consider the prototype as a "closed " product rather than an "open" concept. The "passive" use of the Forums, i.e. reading only, also reinforces this idea.

Generally the two level architecture from the "home" screen onwards was generally appreciated for its didactic qualities (the user does not get lost), but the absence of cross links between different documents (without going via the CM) was considered as a limiting factor to the capacities of reaction of more advanced users. Here we are confronted once again with the opposition between free navigating and controlled or guided navigating in educational programmes. Despite the didactic qualities underlined by users, the option taken by the developers of the POLLEN prototype seems to be opposed to representing hypertext environments on the web; the user must be able to activate all the links he wants.

3.2.2 Graphic Aspects

Users found the prototype relatively restrained as far as graphic and page layout were concerned. The quality of design, the colours and pleasant visual texture and the fact that the prototype worked on full screen have been underlined. Other than the technical problems of downloading sequences, the Guided Tour fulfilled its introductory job pleasantly and amusingly. The option taken to reduce the window size of level 2 documents ("learn more") leaving the starting document in the background was considered to be an agreeable way of simplifying the product's architecture (the user keeps a reference to his starting point).

Users were unanimous in underlining the quality and relevance of the video sequences, both in terms of graphics and content. Certain users would have preferred the video windows to be bigger, even if they were aware of the technical problems that such an option could make for the developers (essentially in terms of the RAM needed to project video sequences).

Amongst their suggestions for alterations and improvements, users brought up several graphic and ergonomic problems:

- the amount of text in the documents was often considered as being a negative element in graphic terms. It was not the amount of information which created most problems, but the fact that the pages were overloaded and that the video window was often too small in relation to the amount of information it contained. Many users would have liked more documents and illustrations, with a clearer hierarchy concerning the level of difficulty.
- a fault underlined by almost all users concerns the communications window, especially in relation to use of the forums: they all found that the screen was too small which did not encourage them to consult the forums and even less to participate in them. Furthermore, the chronological order used for reading the forums (the most recent contributions were at the top of the page) was the reverse of normal "paper reading" habits (the oldest messages are first, the most recent messages are last). In addition to the restriction related to the "paper reading" context, the users noticed an ergonomic inconsistency between the direction the forum took (from bottom to top) and the way long documents were read (lift from top to bottom). Use of a larger window would undoubtedly have solved this last problem.

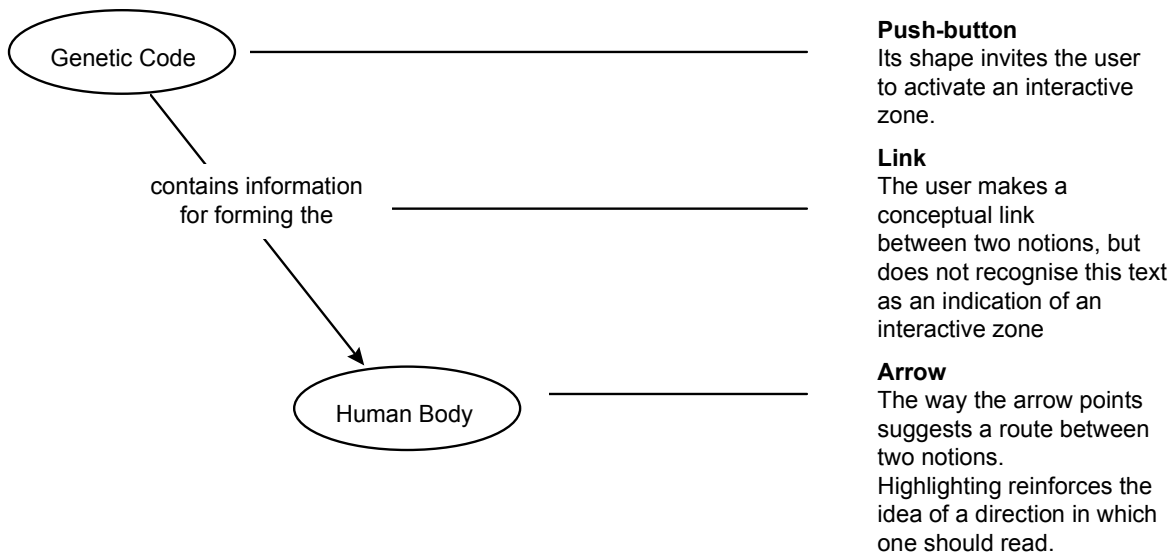
3.3 The CM's Role in the Product's General Architecture

The image that a user has of a product based on its graphic aspects considerably influences the type of navigation he uses. In this sense the analysis made of the CM as a navigational and access interface to all the different contents revealed certain factors which allow us to understand the navigational strategies observed.

The first factor was to note the preponderance of graphic concepts over relational concepts (See the figure below). Often defined as *balloons* or *push-buttons* the interaction between different concepts corresponded to the representation of the prototype as an "information" product: documents related to a specific term are "behind" each *balloon*.

On the same level of thought, links represented by arrows, and the highlights associated with them, were considered as simple indications of the relationship between two terms (*chapters* or *parts*). The fact that the cursor is transformed into a hand when it touches a link was neither perceived nor interpreted by users as an indication of the presence of an interactive zone on the CM.

The habit of "interpreting" arrows as elements whose objective is to signal a direction or to propose the way the document is to be read (reinforced by the highlighted link) prevailed over the transformation of the cursor into a "hand".

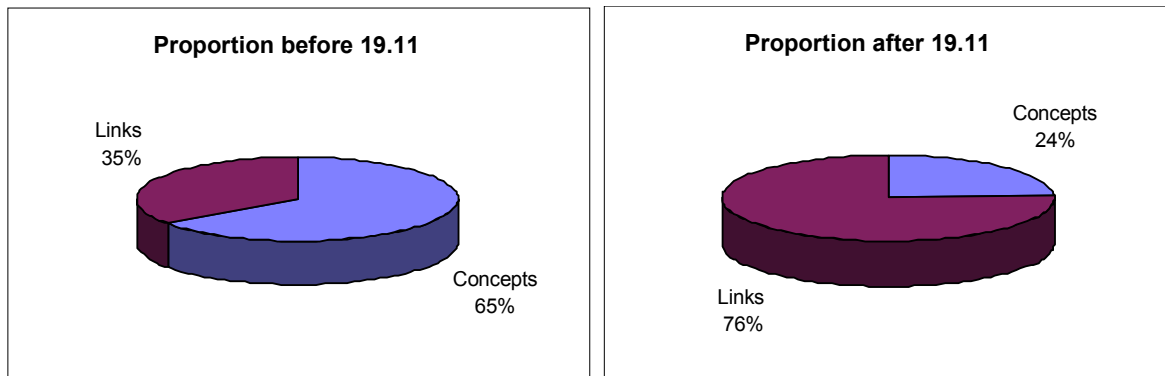


The CM graphic elements.

Many users throughout the first half of the test period (from 16.10 to 19.11) activated documents almost systematically and exclusively via concepts and very rarely via links (See Figure 4). The reasons proposed all underline the prevalence of normal significance of *balloon/push-button* and *arrow* elements: "I tried to follow the arrows" (User 190) "I clicked on the balloons (why not on the arrows?) No idea, that's the way it happened" (User 271), "Alexis started directly by clicking on the first balloon, he absolutely wanted to follow the recommended course" (Discussion 180), "I didn't notice the links; you just accept the concepts" (User 310). Most users discovered link

interaction fairly late, for the most part, after receiving an e-mail message from the assessors (See mail sent 19/11/97).

An additional remark concerning this ergonomic problem resides in the fact that there is no differentiation, as far as graphics and page layout are concerned, between documents relative to concepts and documents relative to links.



Proportion of accesses to Level 1 documents starting from concepts and links carried out by the five biggest users of the POLLEN prototype before and after the message of 19.11.97.

Users discovered the possibility of document access via arrow links relatively late, which confirms the idea that the graphic preponderance in concepts in this type of interface corresponds to habits of computer interface utilisation firmly fixed in the public's mind (especially the equivalence of "push-button" → interaction) .

Note: An analysis of a possible solution to overcome the problem presented above, based on evaluation of the GENOME and SUN concept map design is developed in the Deliverable 7.5, Comparative evaluation.

3.4 The CM as a Representation of Content Structure

Users gave two different roles to the CM:

- a help tool for navigating in the contents
- an access interface

Keeping the idea that the prototype is represented as a tool for diffusing information (rather than an educational tool), for many users, the CM played the role of a navigational help inside the application's architecture and the content structure. Users principally underlined the second aspect of this function. A large majority interpreted the CM as a guide to an interactive course. Numerous elements, noted in Figure 5 confirm the importance of graphics in interpreting the part played by the CM in discovering the contents.

CM Element	Users' interpretation of its function
------------	---------------------------------------

CM writing / reading from left to right, and from top to bottom (reinforced by the fact that all the arrows point downwards)	<ul style="list-style-type: none"> ■ Prepared order of reading CM, which follows a ■ planned content, chapter or section title or "name" structure
Push-buttons	<ul style="list-style-type: none"> ■ Organisation of contents into specific notions (by following product interpretation like a sort of dictionary) ■ logical, organised access to all the notions
Arrows	<ul style="list-style-type: none"> ■ suggest or reinforce an order of reading ■ indicate logical links between different notions
Push-button highlighting	<ul style="list-style-type: none"> ■ indication of an interactive zone
Link highlighting	<ul style="list-style-type: none"> ■ invitation to follow a given order of reading
Background whirlpool	<ul style="list-style-type: none"> ■ indicates that the "gene" notion is a central notion

CM graphic elements used as an access interface to different contents

This view of the CM as a navigational interface in the prototype's functional structure is defined by the functions attributed to the concept board: *summary*, *index*, *synthesis of contents*, *menu*. The interface was perceived as an operator which enabled the user both to move inside the program and to understand the structure and the variety of contents.

3.5 The CM as a representation of content structure

Oddly, users who were familiar with the subject matter dealt with by the prototype had a rather particular perception of the CM. For the most part, they considered it to be an access interface *separate* from the content structure; in this perspective the content structure is represented as an abstract web which can be accessed by different means (of which the CM is one). These users did not form the relationship between an author and the content structure and often spoke of

reference knowledge. For these users the CM justifies itself more as a didactic tool for understanding the hypertext environment and less as a tool for helping to understand the contents.

Amongst possible prototype improvements these same users propose installing a "home" screen presenting this device separately from the contents, a more traditional index or summary, as well as the possibility of having more direct links between documents (see, for example, users 50, 260, 90).

3.6 Conclusion

The Saint Quentin tests clearly revealed the complexity of the interrelations between ergonomic aspects (page layout, functions), the representation of the product type (functions and user expectations) and user experience (context of computer product use, knowledge of subject matter, personal implication). We can however note certain elements likely to contribute to considerations concerning on-line socio-educational computer program development.

One first aspect confirms the decisions taken by the prototype developers concerning the use of concept maps (CM) as a navigational interface in the application's architecture and as an aid to understanding content structure. This interface proved to be greatly appreciated by a large number of users for its simplicity and its capacity to propose a good synthesis of the different contents. We note however that installation of this type of tool must be compatible with the possibility of "freer" navigation, i.e. it must not become an obligatory point of passage for exploring the contents.

This last aspect is separate from the fact that the CM can become a key element in the contents' hypertext organisation. In the case of the POLLEN prototype, the amount of extra freedom requested by users consisted in the possibility of passing from one concept to another without returning to the CM. This possibility would mean the relatively simple installation of a feed-back function which would indicate on the CM the concepts and/or links which the user has visited. On the other hand, the installation of other navigational interfaces in a more classical summary or index configuration would require the contents to be structured separately from the CM. Even so, this last option also responds to a fairly common belief that there is a "reference knowledge source" and a "content structure logic" which are separate from the authors' contributions.

Furthermore, even though noted by a certain number of users, the absence of activities such as QCM, exercises, simulations, and/or experiments did not appear to be seriously missed in the prototype. This aspect can be perceived as being positive if we consider the POLLEN prototype more as a program for diffusing information rather than a training or educational program. It was, in fact, the users who considered the prototype from a didactic, training point of view who most felt the need to "test" their level of knowledge and understanding of the contents. Users did not think that the *Forums* could have filled, even partially, the role of confrontation and discussion. Despite the errors noted, the users perceived the existence of communication functions as being highly innovative and original for a socio-educational product designed for the popularisation of science. Potentially communication functions are considered to be very useful: regular updating of information, contact with experts, tutors etc..

4. Utilization of Prototype Communication Tools

4.1 Their Utilisation Viewed Globally

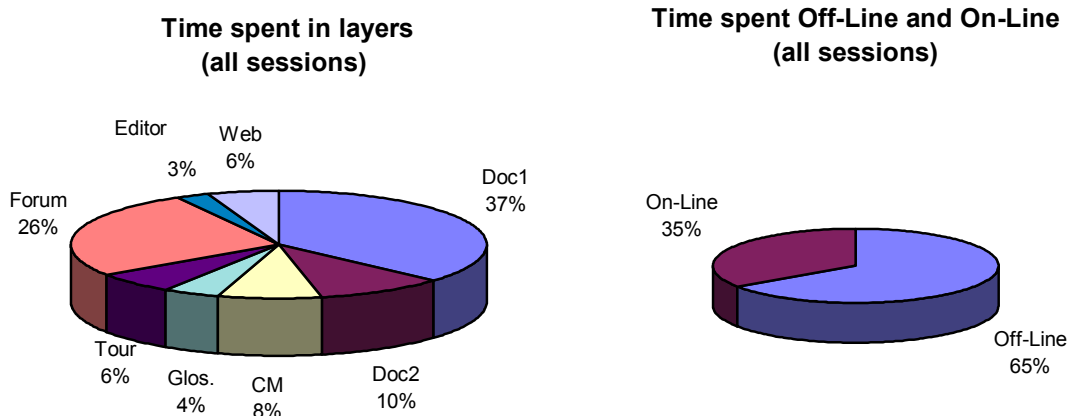
During the test carried out using the Pollen prototype on the Human Genome, from 16.10.97 to 30.11.97, the users of Saint-Quentin logged-on for 96 interactive sessions for a total time of 29 hours, 25 minutes. For this analysis, eight essential parts of the prototype, called layers, were distinguished. They can be distributed as follows:

1. off-line layers: Document 1, Document 2, Concept Map, Glossary and Guided Tour
2. on-line layers: Forum, Editor and Web (also called communication layers)

Here, we focus on the communication layers.

The two pie charts below show the proportion of time spent by the different users in all the layers of the prototype as well as this proportion when the layers corresponding to the two parts, on-line and off-line, are summed up.

1. Forum layer: 26% of time, i.e. 7:38:53 (in h:mn:s)
2. Editor: 3% of time, i.e. 0:52:57 (in h:mn:s)
3. Web layer: 6% of time, i.e. 1:45:54 (in h:mn:s)
4. TOTAL on-line: 35% of time, i.e. 2:17:44 (in h:mn:s)



Using the communication tools therefore represents a third of total use, with preponderant use given to the Forum (74% of communication tool use). This high proportion shows that the

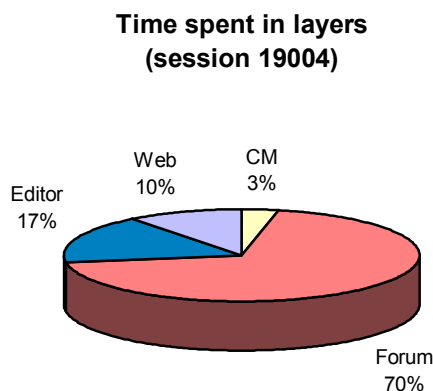
communication tools offered are used correctly and correspond to a real demand from users for this type of interactive educational application. We shall return to a more detailed analysis below on the use made of each these tools.

To complete this first overall view of the prototype's communicational dimensions, it is useful to remember that the application offers users two types of main and complementary activities:

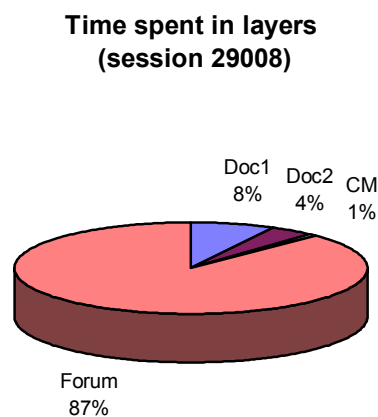
1. navigation in content documents (off-line layer);
2. access to and exchange of information via four Forums, Web links and communication with the editor (on-line layer).

In this general analysis, attention will be confined to the Forum given the preponderance of its use in comparison to the Web and Editor Functions.

Before the experiment, the design team assumed that the users would develop a strategy whereby they combined these two different types of activity during the same session and passed much more often from one activity to the other. Use shows that, on the contrary, the users saw them as being independent components, each encouraging specific navigation. Indeed, it was observed (see charts below) that they devoted a number of interactive sessions to the almost exclusive use of communication tools. Also, obviously, there were sessions completely devoted to the content offered by the prototype.



*4th session of user 190
(total time: 1,043 s)*



*8th session of user 290
(total time 1,096 s)*

Regarding understanding of the use of communication tools, it is necessary to refer to the parts of this report on the prototype's technological and ergonomic dimensions. During the final interviews, the users mentioned different faults apparent in these tools. They would have made greater use of them, for example, if their connection to the network had been more stable and if the page layout and implementation of the Forums had been more functional (bigger window, easy access at each operation, etc.).

4.2 Use of the Forums

The total number of connections to the Forum was 149 for the seven weeks of the experiment, i.e. an average of 21 connections per week. The total number of operations in the Forum was 33. This difference between the number of connections and operations shows the two types of Forum use:

1. non-interactive use;
2. interactive use.

Contrary to what might be surmised from the relatively low number of contributions to the Forum (interactive use), efficient use was made of them. When users accessed the Forum, they stayed for a certain time (172 seconds on average for each of the 149 accesses) which they spent reading the contents. On the other hand, this use would not have been efficient if they had left the Forum immediately after accessing it. The preponderance of non-interactive use can be explained by the three following factors:

1. the total number of users accessing the prototype (26) was quite low;
2. the subjects offered by the Forum were not subjects of everyday conversation;
3. operations in the Forum were not anonymous.

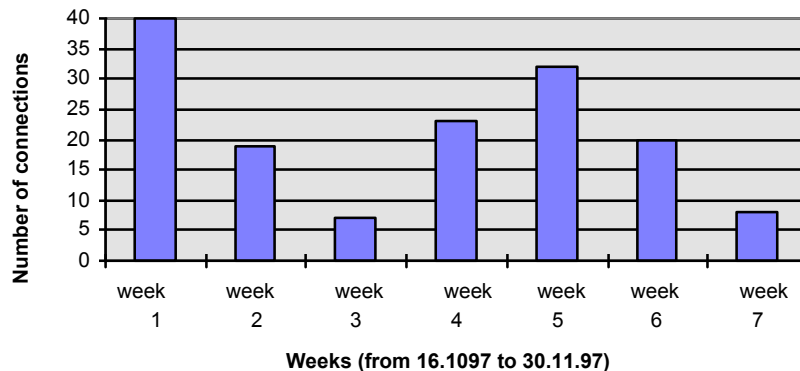
The second factor was mentioned by a female user during the final interview. It is certainly not significant. The third obviously cannot be neglected since the questions broached in the Forum concern the users' deep, personal, and even private convictions. This is particularly so for the «Ethics» Forum which deals with the possibility of human cloning, and for the Forum on genetically transmissible diseases. Nonetheless, this factor is not set out in greater detail here given that it is very difficult to quantify and only one user mentioned this possible problem during the final interview.

The first factor, which undoubtedly had the highest incidence on the Forum's progression, corresponded to a problem of critical mass. If we qualify the dynamism of the Forums by the number of messages that a single user writes in the Forum per session, in other words, by drawing a correspondence between this dynamism and the speed with which new information is made to all the people who can access it, it can be seen that it will depend in particular on the total number of users.

In the case of the prototype on the Human Genome, it appears that the total number of 26 users was still too low to maintain the renewal of information that can be consulted in the Forum from becoming sufficiently fast, in turn stimulating the user to intervene and therefore generate a snowball effect. In other words, between two consecutive sessions by the same user, the discussion on the Forum had not progressed enough for this user to offer a new opinion. This observation is further highlighted by the following information:

1. the proportion of sessions during which the users accessed the Forum (52) in comparison to the total number of sessions (96);
2. the proportion between the number of accesses to the Forum (149) and the number of operations in the Forum (33).

Connections of Users to Forums



(the weeks are counted from Wednesday to Tuesday inclusive)

It should be noted that, in this chart, label «week 7» only represents four days (from 27.11.97 to 30.11.97) instead of seven days represented by each of the other weeks. The decrease recorded during week 7 is therefore not as substantial as the chart implies.

Thus, it can be seen that, after a fairly substantial participation in the Forum during week 1, the decrease in the number of weekly connections (see chart above) occurring before the evaluation team decided to stimulate use of the Forum, in particular by sending articles that had been published in daily newspapers on the subject of the Human Genome. This resulted in an increase in access to, and participation in, the Forum. Furthermore, during the second interview, the users confirmed that such a forum for discussion should be stimulated by the inclusion of press articles which permit taking into account new aspects of the issue in the debate.

On considering the contents of the 33 operations made in the four Forums, three aspects appear worthy of mention:

1. the Forums were not subject to parasite conversations;
2. the Forums are a place in which opinions can be discussed;
3. the Forums encourage discussion on major scientific concepts.

Although the evaluation team had decided that there would be no control over the content of the Forums, there was no discussion that could be termed as parasitic, about subjects other than those dealt with by the Forums, even in the open debate Forum. On the contrary, the participants focused on the subjects offered, while in the open debate Forum the users first gave their overall appreciation of the prototype, and/or requested additional information, then they discussed the exhumation of the Yves Montand's body and the analysis of his DNA (an affair which received

much media attention in November 1997). Thus there was good overall understanding of the role of the Forums.

It was Forum 3 (on the ethical question, *"Under what circumstances and conditions do you think that the cloning of human beings would be acceptable?"*) which received the most interest from users (amounting to 14 of the 33 operations). One of the operations was exemplary of this interest (user 260):

"I feel it is vital that people should raise these questions and ask themselves what kind of world they want to leave to their children, otherwise others will answer in their place."

By writing the above, this user clearly shows the need for places where and for moments when citizens can discuss major issues affecting society, and the Human Genome prototype Forum became, in its modest way, one of these necessary tribunes, without this user stating the fact. Furthermore, the users clearly indicated to the assessors that the prototype; and the Forums had made them think and progress. Thus, during the final interview, when speaking of the Forum's ethical aspect, user 190 said, *"The software made me think"*.

We shall not pass judgment here on the quality or the scientific validity of the arguments discussed in the Forums since the opinions expressed are personal. In this analysis of using an educational application, we feel it is preferable to insist on an aspect of how the Forums function, that which we termed above «debate of opinion». Acting within the framework of an «educational product» which in particular makes available a number of documents on the Human Genome, it is rational to assume that, during the discussions, the participants would have referred to passages, for example, from certain documents. However, this was not the case.

It is not our intention to say here that this prototype constitutes an exclusive reference on this scientific issue, though it is surprising that of the strategies implemented by the users, there is no clear evidence that they used the documents available to them to back up the opinions expressed in the Forums. Certain of the comments in the Forums mention this aspect, for example, that of user 290:

"This Forum is interesting, but I wish that the participants would attempt to build their points of view better, but this is certainly difficult when handling new concepts associated with atavistic fears as old as the world».

Nonetheless, it was not only the members of the evaluation team, whose task among other things was to stimulate the Forum, who referred to the prototype's content documents. We find here another trace of the idea, set out above, of the separation of the two main activities in the strategies of using the prototype.

4.3 Relations with the Editor

The Editor function, seen by the design team as the means by which the users could express themselves directly with the Editor in case of problems, was used very little: 3% of overall

utilization time and only 29 accesses during the whole experiment period! In a certain way, this shows that the prototype functioned well. Thus, during the second interview, user 90 said, *"I only used it once because I had a problem"*. In other words, if I didn't use it more, it was because there was no problem.

However, it is advisable to view this result relatively. It seems that its function was not fully understood. Thus users 190, 110 and 290 said, *"I didn't really see what its purpose was"*, *"I didn't really understand what it was for"*, and *"I didn't understand what could be done with it"*. It appears that this lack of understanding stemmed in part from an error in the name given to this function.

In addition, the personal contact between the assessors and the users was largely responsible for the non-utilization of this function. Indeed, the evaluators went to each of the users during the first interview before the experiment and they exchanged their e-mail addresses. This direct communication with the assessor, met in person beforehand, took precedence over the Editor function and a large number of e-mail messages were exchanged, for example, to check the correct installation of the application and/or to finish it. Users 310 and 50, moreover, expressed this idea by commenting on this communication function during the final interview, *"I used another function, the traditional E-mail, to send comments"*, and *"The messages about technical problems were sent by mail without going via the application"*.

On the contrary, several users expressed their desire to be able to contact an expert (whose task would be to provide the latest information on the scientific issue dealt with) and a tutor (whose task would be to assist the user in discovering the contents and interactive options offered by the application). Thus, when speaking of the Editor function, user 90 said, *"I prefer to understand, be able to raise questions, and ask advice from an expert"*. When speaking of the possible improvements to be made to the prototype, user 110 mentioned, *"It should be possible to have access to a tutor"*.

Therefore, it appears that with a more explicit name, and a slightly different function, this function would have found itself better integrated within the overall use of the Pollen application.

4.4 Utilisation of Web Links

The Web links, integrated in the communication part of the prototype, were hardly used either. They correspond to 6% of the total use time and 24 accesses. This is the least used of the prototype's interactive functions (in terms of accesses), if the number of accesses to the Guided Tour is not taken into account. None of the users discovered this function until very late.

Certain users, for example, user 100, did not see the Web site access function pre-selected for the Human Genome. However, the most important obstacles are represented by three other factors:

1. the users felt they were operating inside a product when using the prototype, whereas using the Web obliged them to quit it;
2. most Web sites are only available in one language: English (users 30 and 190);

3. the very short test period led users to spend more time exploring the contents of the prototype.

On the contrary, the users made several positive remarks, as much regarding the choice of proposed sites as regarding the short summaries written by the design team (the summaries included a short description of the sites, mentioning the existence of certain specific pages containing non-specialist language and the existence of information used by researchers, etc.). Although the users only used this part of the Pollen prototype sparingly, they found that it functioned well. Thus, user 120 said, *"I clicked once on a link and found an interesting site»*.

5. Pedagogical issues

The following evaluation of pedagogical issues related with the use of the prototype is focusing mainly on the perception of the prototype by the users in its didactical, ergonomical and communicational components.

5.1. Users profiles

From the producers point of view, the prototype is placed between information and training. The GENOME prototype is addressing both a need for education in the sense of learning, and a need for information in the sense of informal education. We tried to detect the way in which our users, taking this ambivalence into account, have perceived the product and its use, between information and training.

Analysis of the interviews show that four types of users profiles emerge. These profiles are described below but it must be underlined that the same person could be clearly associated with one profile, while also showing certain characteristics of others.

5.1.1 The «good pupil» user

The prototype being introduced as a training product, some users adopted spontaneously a "schooling behavior". The users having adopted this attitude consider the product as a training prototype related with the concepts usually attached to such a product like: pre-requisite, level, courses, evaluation (MCQ, Multiple Choice Questionnaire), tutoring: *«if I consider it as a training product, there is a lack of MCQ, to check if I understood»* (user 110).

One can wonder whether this attitude was not even reinforced by the role of the POLLEN evaluation team who has supported the experimentation process. During the first interview, people were asked a series of three questions, which were also used as discussion topics in the forum. The same questions asked again during the second interview could be perceived as a

knowledge acquisition control. Some users have "revised" before our arrival. Others told us: *«I forced myself to read everything because I knew you will come»* (user 301).

Very numerous users, more familiar with multi-levels popularization document, or having a good know-how with interactive media felt that this type of product could be a good training tool: *«It is a good training product, helpful for learning»* (user 190).

5.1.2 The «curious» user

This second profile corresponds with information users adopting a consumer attitude, in the positive and active meaning of the term: attraction for new products, new information... They compare the prototype with other similar products: *«dictionary»* (user 271), *«encyclopedia on genetics»* (user 190). They perceive the GENOME prototype it as a reference product: a kind of electronic *«Que sais-je?»* (a very popular French thematic encyclopedia). Users having a profile of "curious user" also appreciate the advantages of the Internet access: *«Internet access is interesting because it provides a lot of information»* (user 180), as well as the updating of information: *«(...) regular updating, in order to be able to evolve»* (user 300). Up-dating of information and direct connection on recent scientific results is an explicit request of numerous users.

5.1.3 The expert user

The third users profile corresponds with a category of users who stand back to assess the subject. Such users are for instance professional in the healthcare sector or people who have a personal knowledge of the contents acquired through initial training (scientific studies) or in a personal way. These users have validated the contents and the form of the prototype. Some of them have been very active in the forums where they really played their role «of expert in the field», by clarifying certain concepts. Others even come to a second stage and foresee in this prototype the possibility of individual training for each citizen: *«(...) I believe such hybrid product in the domain scientific popularization, supported by local authorities or institutions, could be a fundamental step towards active citizenship»* (user 260). The prototype communication features give to this type of on-line application, a new socialization space, and an active role in the city.

5.1.4. The computer skilled user

This fourth profile is composed of computer expert users who focused on the technical and ergonomic aspects (human machine interface) of the prototype. Their motivation is based on their expertise in the field of computing: *«At the level of the platform used, Asymetrix is not adapted the Time out sequences are badly implemented»*, *«it has been developed in 16 bits, it would be better in 32»* (user 070), and they generally did not pay attention to the educational and/or informational aspects of the application. The use of a prototype exploiting new technologies naturally generate such reaction in such a technician population. These users remain however marginal in our population of users and their opinion cannot be generalized.

Whatever the users profile could be, the prototype has generated many different expectations from the users. Some users expect in learning (formal education), others in being informed (informal education). But these two expectations are not exclusive. Professionals also perceive the product both as an education and public information tool.

The analysis of observed behavior lead to the identification of indicators of the needs expressed by the users about the prototype, related to contents and didactic levels.

5.2. Contents and Level

From a general point of view, users with an expert profile have expressed an important satisfaction regarding the quality of the contents: *«very good written texts»* (user 190), *«made by a team of scientists»* (user 070), *«interesting, basic documents and good facts»* (user 290), *«basic, but however well written contents and pleasant to read»* (user 050).

Some users, less at ease in the field of human Genome, think on the other hand that: *«the text is too condensed, one has some difficulty to distinguish the essential things»* (user 301), *«some terms are too much sophisticated, too much scientist»* (user 180). These "novices" often consider that *«the written part is too dry (...) and audio would be perhaps better»* (user 190).

The prototype contains no indication about the required pre-requisite. Expressed opinions insist on the need for clear levels. Spontaneously our users are concerned to position the prototype: *«it is designed for an informed audience»* (user 301), *«It is scientific popularization»* (user 090), or on the contrary *«it is made for people who know a lot about Biology. But for those who do not know, it is not attractive enough. And for the experts, that might be not enough»* (user 120), but also *«perhaps suitable for the children»* (user 180).

These judgments refer to traditional perception of education: before training, people want to know if they are at the required level. This desire to be clearly "located" somewhere on a scientific level (between novice and expert) in the multimedia product shows the need to share a common scale: *«you should have several levels : for the beginners, the advanced, the experts»* (user 090). This request is less formalized among people having a "curious users profile": they are less demanding towards personal assessment and perceive the prototype as an encyclopedia, a resource. They browse through the pages and get the information according to their need or their imagination.

Users with a "curious users profile" express critics but they also propose solutions when they claim for a more precise users targeting. Their remarks and their demand must be taken into account, in particular the necessary pre requisite, but solutions are difficult to find within the framework of a necessarily limited prototype. To overcome this problem, they suggest two kinds of solution:

- To design resource products having several identified levels and facilitating the activity and the progression of the user.

- To design different products, each attached to a specific level.

The target audience of the prototype was intentionally broad (from secondary education, young adults, adults). This type of reaction was inevitable. But this difficult question about the application level and its adaptation, could be perhaps improved by a better presentation of information and the adequate use of media resources.

5.3. Mediatization and popularisation

One could notice in the interviews, that criticisms concerning the presentation of the contents or the volume of textual information, generally come from the non-specialists in the field who were more demanding regarding the presentation, the choice of the terms and general ergonomics

The most enthusiastic judgments are generally addressed to graphical animations: *«nice images, video very good»* (user 301), *«superb animations and images»* (user 300). Users express a genuine interest for the parts of the prototype which use audiovisual media. They express this preference to strengthen the use of the animation section. For them the main improvements of this prototype are: *«to have sound, speech in the product, but not only in the Guided Tour»* (user 300), *«the texts must be mixed with animations, images»* (user 190), *«I find it is a pity that the glossary is not illustrated»* (user 070).

They also express some regrets: *«Technology is promising, but this product does not exploit deeply the potential of the media»* (user 310).

It was often noticed that the media fill well with one of its vocation which is the individualization of training by giving to the users, according to their cognitive profiles and personal preferences (rather audio, visual ...), sensitivity, motivation, tastes, the form which is the more appropriate for them. For instance this user who finds: *«the rather short animation's, pleasant because it changes from reading, but they do not bring additional information»* (user 021), another for whom: *«I lost my motivation because there was too much text»* and another: *«the multimedia is more interesting than the book, it is motivating to go inside»* (user 030).

From the user point of view, the added value of this type of product, compared in particular with the book, lies primarily in the media contribution: *«I find nevertheless that it looks like a book. There should be more images, more animation's»* (user 070), *«that does not bring much more than one good popularization review, except for the videos, perhaps»* (user 090).

Whether the product is perceived as information or training, these users are aware to its aesthetic, user-friendly and ergonomic aspects. They intend to get information and to learn if possible in a pleasant way *«product not enough ludic»* (user 190), and qualify the prototype of: *«ludic computer program : jaunt across genetics»* (user 120).

The reaction of the users of the prototype shows the importance of the media such as sound, video, images. They give a new pedagogical dimension which allows a better understanding of the subject. The Guided Tour was targeting this aim.

5.4. Perception of the educational function of the Guided Tour

The Guided Tour is designed as an introduction module accessible from the main menu of the prototype. It has been appreciated by the users: «*It is a master-piece*» (user 190). Its main objective is to give an overview of the prototype: «*it is the part which I saw in first, then I was quite autonomous*» (user 030).

The Guided Tour teaching function has been understood by the users as a mediation between the user and the knowledge. The character has been appreciated and its metaphor seen as an host who opens the door. He invites to enter into a new field and to be the guide: «*When you go into a country that you do not know, you first hire a guide*» (user 070). A user even saw him as a teacher: «*...while starting with the teacher support and the human body*» (user 025).

The second Guided Tour pedagogical objective concern the ergonomic and user-friendly aspect. With his jolly face, the scientist gives a pleasant and funny aspect to the prototype: «*at the start, the Guided Tour appeared rather naive to me, but finally I liked it*» (user 180).

The Guided Tour has also a function of identification. The image of a friendly *Doctor Folamour* who takes you by the hand to guide you and the image of the boy who is a naive but skeptical person allows a dual identification, sometimes with the scientist and sometimes the boy.

But the Guided Tour has also its opponents: «*I do not like that*» (user 271), «*it is rather for the children*» (user 110), «*not very interesting*» (user 090).

At home, alone, without teacher, without present colleagues, the relational dimension has to be assumed. The generic metaphor of the Guided Tour, reintroducing «the absent», seems partly to have played its role. This function, confirmed by the users, has to be taken into account in the design and realization of this type of product. The need of human mediation and relation is clearly expressed by the users who wish to communicate with tutors and experts.

5.5. Perception of Tutoring

The asynchronous communication tools (Mail to the editor, Forums, Web) establishing a relation among users and with the prototype production team were expected to play an important role in the experimentation.

In the Genome prototype, the tutor's mission understood in a very broad sense of a guide, an expert and a coordinator is implemented in the function «Mail to the editor». But it appears that the concepts *Mail* and *Editor* were not sufficiently clear for a majority of users: «*I did not understand its purpose*» (user 110), «*never used*» (user 180), «*between fairly and little used. I only used it to suggest technical corrections. But I did not see very much for whom it was made*» (user 190).

Many users have suggested ideas for improving the prototype by integrating the concepts of tutor, teacher and expert: «*There is no tutor and it is missing. There should be a synchronous tutor and the possibility to make appointments even in asynchronous modes. If not, people give up*» (user 110), «*the theory should be supplemented by the practice. For example through a system of mailbox to the teacher*» (user 120).

The users who expressed a request for tutoring functions also claim for «*mechanisms of self evaluation (games, tests, MCQ)*» (user 260), «*drill and practice*» (user 110), «*to include quiz or memo-tests*» (user 120). They do not want to remain in a passive position of reading, listening, seeing but also of DOING: «*suitable product for the students (...) if there is a dossier to produce (...) it could be useful in training, to make presentations*» (user 300). These users perceived the prototype as a resource connected with school, with preparation of examinations, with continuing training. The product becomes an activity support, or even of production, connected to external needs.

When the users have perceived the prototype rather as an information product, their request has been oriented towards a demand for a reference product: then they do not claim for a tutor but for an expert: «*I do not find the forum very interesting, it would be better to ask questions to an expert*» (user 090), «*I prefer to ask questions to an editor, requesting an advice from an expert (...) with updates, of the topicality papers*» (user 190). It has to be related with a demand for an evolving prototype and for press reviews. They do not want a fix product: «*I thought it was going to become richer*» (user 110). These users refer to an active approach. They do not want to go passively through pages, videos and texts. They wish mainly «*to discuss, to exchange*» (user 150).

The forums set up for peers communication did not totally satisfy this demand since: «*... the number of participants is too weak to generate discussion and exchange dynamic*» (user 050), additionally, «*rather than a forum, it would be better to have possibilities of synchronous communication. One could discuss, it would be an advantage, not only for delivering my opinion*» (user 150).

Thus, users are clearly expecting for interaction with tutors and experts. So that interaction with learners could play its role, a larger number of users and animators is necessary. These expectations constitute clear recommendations for the design and the setting of future on-line educational products.

The human contact, even virtual or in the form of *tele-presence*, seems essential to the users, to support their motivation. They express this demand more directly : «*in training one cannot ignore human contact*» (user 110).

Interviews were presented as appointments of evaluators with users. They have played a positive role of motivation and of human contact. Very conscientiously some users have explored quite exhaustively the possibilities of the prototype, recording in an almost professional way, all the errors they found and suggesting many improvements. Would this implication have been the same if they had only to fulfill a pre and a post questionnaire sent by mail or e-mail ? The care some users had about a complete reading of the prototype, these almost "word of apology" saying

us «*that they had not been able to work as much as they would have liked*» (user 110), «*I had a great deal of work*» (user 100), show once again the importance of the human contact, the necessity to take it into account in the design of any type of training product.

5.6. Conclusion

The GENOME prototype generated different types of reactions and expectations. Some users have adopted as «learning» approach and others an «information» approach, both being however not exclusive. This observed behavior are indicators on the expectations and the needs of the users who express their interest for a range or product collection:

- encouraging access at several levels,
- offering self evaluation and training activities,
- can be the support for activities related with external needs,
- giving a more important role to the audio-visual media,
- and allowing to establish relations with tutors, animators, experts, other users.

6. Perspective for on-line publishing

From a socio-economic point of view, in this chapter, we will analyze the *Genome prototype* experimentation in order to identify the editorial positioning of this type of on-line service-product. Indeed, several publishers are Pollen partners and electronic publishing constitutes one of the main objectives of the project.

We will talk about “service-product” to designate the prototype and the future products of same type, in order to underline that the concerned «object» concerned comprises a framework structuring the activity of each of its users, the communication between the users as well as publishers. This terminology is inspired from approaches developed by economic theories concerning the immaterial services. Sometimes named “servuction”, they analyze the contents and the loyalty from the customers-supplier relations while being attached in particular to the activity of the users and to their contributions to the elaboration and to the development of service-product in question. As we will see, this conceptual framework makes possible to clarify the Pollen experiment and to identify some of the requirements by the development of such socio-economic activities which probably pass through new forms of participation of the users.

The analysis of uses and representations is particularly focusing on elements allowing the identification of expectations. The evaluation of uses is a source of precious information for application designers and editors in the perspective of on-line publishing in the educational and cultural field.

We will first analyze the credibility of the experimentation and the characteristics of its population, the specific characteristics of home learners and of the required level for products

targeting a large audience. We will synthesize then the ways indicated by the users towards multimedia, communicating and up-dated products. Lastly, the expectations of the users will enable us to formulate some hypothesis about the possibility and the characteristics of a market for collections of product-services, based on the results of the Genome prototype.

6.1. Conditions of the evaluation

Under a *Research and Development project* like Pollen, it is important to insist on the conditions of the experimentation of the human *Genome prototype*, led in natural situation which can be actually only potential and therefore non observable.

6.1.1 Credible experimentation

Two characteristics of Pollen experimentation make it possible to consider it as a significant test of the on-line publishing aiming at a broad target audience:

- **reaching the user at home** is possible thanks to the cabled mechanism of Saint Quentin, which offers numerous services including access to cultural information and training products under good technical conditions (cf. Chapter 2);
- **being able to attract a broad public** of adolescents and of adults is a potentiality of the *Genome prototype*. Its contents are of general interest, its scientific topic is recent and still not much taught in initial training, the subject is largely covered and discussed by the media. The Research and the Technical progress of biology are presented as affecting the life of each one and as a component part of a civilization issue.

These two assets of the Genome prototype could be tested to a significant degree under natural “conditions” only thanks to the quality of its setting: the design was entrusted to experienced authors specifically trained; the realization led by professionals of the interactive media. Finally, close attention was paid on the user interfaces, essential condition of a “general public” ambition (cf. Chapter 3).

In summary, one can consider that, despite weaknesses, identified by the actors of the project and confirmed by the users (cf. previous chapters), each important component of the mechanism presents sufficient quality so that *the whole product and experimentation conditions reaches the credibility threshold* allowing significant results.

6.1.2 The limits of the experimentation

It is clear that we did not analyze use of mass but set up an experimental mechanism in natural situation which represents the principal dimensions of a real observable use. The main limits of validity of the led evaluation are due to the narrowness of the sample. Moreover, the multimedia and telematic features of the prototype meant that the technical equipment of the users involved in the experimentation was located in the top-of-the-range. Lastly, the social and cultural profile

of the users, definitely located in the upper part of the socio-professional categories, introduces an additional bias but presents too, as we will see further, the interest to benefit from the reactions of innovative users well anticipating on future users.

The automatic recording of data about the sessions provided quantitative traces (logfile) which were supplemented by interviews aiming to explore the users' individual representations on the prototype and of its use.

The study carried out under these conditions drew aside therefore from a real situation by its size (only one prototype and not a range, restricted number of users) but also by its “ experimental ” accompaniment (two interviews, distant observation of the follow-up). The awareness purpose of being voluntary, observed and consulted innovators, have therefore to be taken into consideration in the interpretation of the users' representations.

In a field like information technology, where one would often need to analyze uses which do not exist yet, the experiment of Saint Quentin is precious insofar as it meets conditions fulfilled simultaneously: voluntary users who can reach since their home a complex technical mechanism (network and prototype).

6.2. Sociological population characteristics

The sociological composition of Pollen experiment is a decisive piece of data of its analysis from the socio-economic point of view of the on-line edition. We first of all summarize therefore here its major presented characteristics in a more detailed way in the Chapter 1.

6.2.1 A top-of-the-range sample

The sample is located clearly above the basket “of the fifty-year-old housewives” but it has an interest, based on the experience, for scientific and technical popularization products corresponding to the positioning of the Genome *prototype*.

6.2.2 Well informed users

The users have positively perceived the popularization objective and due to their usual practices they could be considered as relevant partners: number of them have and use printed materials, they also subscribe to popularization reviews like «Science & Vie»; they use to visit museums. It is with full knowledge of the facts and in comparison with existing traditional “ supports ” that they judge the interest and the limits of the Genome prototype.

Their sociological characteristics and their cultural practices also make them experienced users of products which are closer like the CD-ROM (16 out of 26). They have and they use CD of: Atlas, Encyclopedias, Museums, and subject type «Parents». Many (10) also use CD games and some have already been trained with a teaching software or make use of information technology for

their “hobby” (genealogy for instance). Lastly, and in particular since the adoption of the network of Saint Quentin, they have been using Internet from home for personal objectives like consulting Web sites, taking part in forums, sending electronic mails to their family or relations.

This sample of users is restricted and specific but it has a practice of traditional and computerized products which constitutes the reference frame on which their reactions and opinions about the prototype are based: “ *it does not bring much more than a good popularization review, except for the videos perhaps ... I find that it is a good rather elementary product but when a subject is well known. I find nevertheless that that it looks too much like a book*”. (user 090).

In general these users considered that on-line publishing which the Genome prototype would be the préfiguration is interesting. They have ideas about the market of these future goods and services : they formulate their expectations and indicate their demand for a collection, more media, access to experts: “ *Of course, it should deal with other topics. All what is scientist interests me. We should have more images, more animations, access to experts ...* ” (user 090).

6.3 A large target audience

The Genome prototype is positioned like a technical and scientific popularization product intended for a public of adolescents and adults. This target “general public” also corresponds to home users which constitutes one of the innovative aspect of the project, even if other conditions of use, integrated into initial or continuing training, are not excluded.

6.3.1 Domestic use

Home time. All users having a professional activity have used the product at home freely. The analysis of the traces (file-log) shows that the application is almost exclusively called at the end of the day and during the weekend (cf. Chapter 4). The duration of sessions is very variable : numerous small sessions (10 to 15mn), longer (45mn) or combining both. “ *I used it approximately 6 times, without the times it did not run. The utilization period depended on the time I had in front of me. Once, I used it 1h30, but in general, it was rather between 30 and 45 minutes. I made two or three times the complete visit* (user 190) ”.

The sample size does not allow to detect temporal use profiles. But the variety of the users attitudes corresponds well to the general public situation and shows the potential flexibility of this service-product for a broad distribution. Without still being able to talk in terms of consumers and market, the experimentation confirms that service-products like the *Genome* can be used at home and with a flexibility comparable with television. One finds probably here a key criterion, common to other general public products: individualised use bringing potential freedom and autonomy.

Family space. The usage space is the home, the family's territory. The first interviews showed that a collective use “ in family ” was possible, in group or successively by several members of the family. The second interviews really do not allow to confirm this hypothesis. Even if the

majority of uses were individual some cases of joint “or” very concerted use arose: “*It was tested immediately. We (wife and husband) found the Guided Tour by chance. We carried out a complete test a morning ... (users 110)*”. Getting information and learning also are a personal activity and that can explain such rather individualised uses. There, still different practices seem possible, and this indication shows the adaptive potential of this type of product to the variety of the real situations. From this point of view, the insertion at home inside a private time frame, the prototype could find a gap in the daily life of persons and families. The experimentation shows that *this type of service-product has good chances to be “domesticable”*.

6.3.2 The general public level

How can this type of product aim at a large public audience? As indicated previously one knows that the topic of the prototype and its setting allow to raise interest from a large audience. But, there is a big difficulty to cope with, in terms of users understanding ability: their educational and cultural background is necessarily different. This question is complex as following users answers show: «*it is made for people who know a lot about Biology. But for those who do not know, it is not attractive enough. And for the experts, that might be not enough*» (user 120).

In fact, opinions position in general at both extremes. Some users find the level too high: “*As far as contents are concerned, it is too complex, the prototype is designed for a public well informed. For a beginner, sentences must be read several times (user 301)*”. meanwhile others found it too simple and quite useless: “*I am disappointed by the contents... too elementary contents for my own knowledge, I was frustrated (user 050)*”. On the other hand, all users associate this problem of level to other dimensions of the prototype such as the difficulty to separate contents and presentation. But especially one stops here on two limits of the experimentation: the presentation of a single prototype and its own characteristics.

The lack of a range. Numerous users well understood the situation, they integrated it into their reactions by mentioning the need for a range: “*If there were several scientific subjects proposed, it would be super. (user 300)*”.or by proposing topics: “*It is an educational product, in the broad sense. If I were voluntary, it is to discover, by curiosity. One should widen to biology in general. Other topics? Sociology, Europe, mechanics (user 150)*” and even by formulating the collection idea: “*I doubt whether without modification a product or a saleable service could become, but I am interested in the possibility of several titles following the example of “Que sais-je”. (user 260)*”

It is clear that the interest of the user and the economic viability of a collection cannot be supported by a single title. In reference with newspaper, we can say that the *Genome prototype* can be compared with a “zero issue”. The users of Saint-Quentin assessed it in this way and stated their interest in certain conditions.

The limits of the prototype. Some limits are linked to the *Genome* characteristics in terms of quality of the popularization. “*Some terms are too much sophisticated, too much scientist (user 180)*” or of the prototype interface. For instance, despite a glossary, some did not find it while it could have brought answers to their difficulties of vocabulary.

6.3.3 Multi-level resources

The solution to face the level problem is well known. It relies on products designed as a **multi-level resource**. It requires a pedagogical approach centered on the learning process which sets up the conditions to make their activities possible (cf. chapter 5). This approach gives users the opportunity to choose what is convenient, to assess oneself, to find the help they need. Information and communication technologies facilitate this individualization of teaching means. Thanks to the interactivity of the product, the user can decide on his path and on his rhythm according to his interests and to his level. These possibilities are already implemented in off-line software application. But they are largely extended with on-line mechanisms which add distant access to other resources, whether about on-demand data or human contacts: other learners, tutors, experts.

This approach is suggested by the users themselves: “*Several levels are needed, for the beginners, the advanced, the experts. (users 090)*”. It poses however an important problem because providing several levels oblige to include as many versions of each element as user's profile. It also requires varied features: exercises for those who want to learn something new but also to check if they understood, access to a professor for beginners while experts will rather need a deeper study even a contact with international experts.

These guidelines have not been developed in depth in the prototype because they exceeded the capacities of the project in terms of resources and time. Concerning future products, the adaptability to the user profile and individualization constitute assets of new information technology but they involve a high design and realization cost which can only be cost-effective in case of a large number of customers.

6.4. An on line service-product

The questions related with media and communication of the prototype already having been analyzed in previous chapters (4 and 5), we will interpret these results in the perspective on the on-line publishing.

Communication is expected by users but individually with a tutor, a teacher. The proposal is pedagogically relevant: one does not learn alone otherwise one gives up. A presence is necessary and for this reason a remote exchange is not enough. What is claimed through synchronous connections is of course a rapid and direct answer but also an individualized relation with a person who answers your question, who is almost there. In terms of training, a service at home appears as a kind of individual course which would no longer be reserved to children (ignorance is acceptable if it is protected by the intimacy of the home).

It is simple : the user wants EVERYTHING and at home! Demand is there... publishers have just to set up such service-products...

As the technical evaluation shows (Chapter 1) telematics allows of course the distribution of such products at home and also facilitates their updating under the same conditions. But, beyond these traditional “ functionalities ”, the experimentation indicates a demand for new services.

On-line distribution offers the possibility for publishers to update their products permanently and to link them to topicality, to connect their products to an information world and knowledge network covering identical or close fields. It enables them to establish direct links with their customers. This distribution channel also allows to envisage collaboration with professions who have to teach or inform their clients (patient-doctors). Distant tutoring must especially be organized, and for some users access to experts of the fields covered by the products could be proposed.

These jobs do not exist yet, but there are sources of employment for the students who could thus propose less expensive courses, for teachers able to support individualized training, for skilled early retired, for animators of virtual Agora...

The interest of Pollen experimentation, is to show that it is not a futurist high-tech question, but expectations clearly expressed by the users of the Genome prototype. Sure it was a "high-level" population, familiar with network culture and its new practices. However, this tribe is not in the process of extinction and probably prefigures behavior likely to become general. But in this prospective it is equally clear than one distinguishes badly what would fall within the competence of «sales departments” and what would concern rather “public services”.

6.5 A market ? at which price?

Before letting the « Genome » customers express themselves again about their economic futurologies concerning editorial positioning, it is useful to point out that, with regard to the traditional media, the French educational market - including culture and even the general public communication - has some strong characteristics: the consumer is seldom the one who pays, or, if he does, it is not in a straight ways like a customer usually does. Indeed, we use the term *users* to refer to the specificity of totally or partially public services. Concerning the general public media, a free-like category has ever been set up, referring to a group of people nearly all citizens, or at least all electors.

In this particular case, and apart from the public channels users, it is interesting to note that the consumer does not pay everything for viewing commercial TV - including subscription -because it is indirectly financed by advertising. In the field of education, whether it concerns initial teaching or in service-training, the financing source is usually public. Most of the time the economic mechanism is based on originally financing or via grants paid to organisms as to in-service training. When the consumer can access to these services and when there is a choice, then the consumer chooses.

We must bear this context in mind while hearing the remarks of the users from Saint Quentin, without forgetting the influence of the national environment. What has also to be integrated into this situation is the world wide extent of liberal economies, or at least, the European

harmonization, which tend to (re) establish the market laws. At least, we must not neglect the recent aspect of the communication technologies and their quick evolution: in this domain, new economic and social practices can be set up more easily than in the historical areas of the city.

The « Genome » users opinion about the significance, the consumers, the price and the methods of distribution of service-product which would be inspired by them are well represented by the following.

“ ... Genome is at the level of certain good products. But it is not a “ Killer application ”. On the other hand I will not buy it because for the same price I find better in the books. The genuine value added is the forum and Internet links because one must be to the point of information. But a wider “ Forum ” on a European scale... (user 310) ”.

“ Suitable product to the students, if they have for example a dossier or a presentation to prepare. The principle is good, but on Internet, there are so many things to see that the site has to be brilliant so that one remains there. I would be ready to pay if the site proposes regular updates (user 300) ”.

“ Very well for the students. But that must not be expensive (user 290) ”.

As we can see, in terms of products, the function of networks is perceived as an advantage over other materials and could possibly invite to buy...provided the price is affordable.

For other people, the Internet impact encourages the fact that no change should be made:

“It is an interesting informative product, but it should be a free service: in principle, Internet is free and there is no reason this free access to information to be challenged by paying services... I am not opposed to paying sites, but I would not pay for (user 050) ”.

“ I would use it in an occasional way, if the program were in the style of the Guided Tour. If it were a CD-ROM, I will not buy it. Perhaps suitable for the children. I am in favor of educational products at home, but I think that Internet users would not pay for this kind of product (because it enters into competition with the disseminated information on all the other sides). (user 180) ”.

Yet some of them express a more qualified opinion and go so far as to devise the methods of diffusion and invoicing:

“ There is no market for Internet on the telephone, but with the cable, conditions are met. The price 289F per month is a good price. It gives a good control of the costs, one no longer pays for the time. The offer of contents does not have to be part of the overall offer. The price must be flexible according to the contents offered, as for the television by cable. If you want more channels, you pay a small supplement. The payment system on-demand is not relevant: it is always too expensive when you have to pay. It could be a system like France Loisirs (French Library Club); you receive x titles per month for your subscription. (user 190) ”.

Some users suggest a mixed economy combining public and private financing, therefore allowing prices to be lower.

"I believe such hybrid product in the domain scientific popularisation, supported by local authorities or institutions, could be a fundamental step towards active citizenship. Today, newspapers play this role of information, but due to their price, they circulate only in a restricted circle that Internet could widen (poses itself the problem of the equipment of the hearths, communities can there also play a role by giving free or cheap accesses : libraries, schools,...(user 260) "

For these product-services, all the interviewed users underline the following dialectic : customer/user, market/public service.

6.6. Conclusion

Users demands are clear and convergent but very hard to satisfy. They cover a range of series of multi-levels products, multimedia, including self-evaluation and training possibilities. Those products must incorporate communication features, collective and potentially personalized services, which may offer in particular updating of the contents, access to tutors and experts, discussion forums. Those services could be spread in several directions: city life, the society debates, international.

Under these exhaustive conditions, there is a demand. The users ask for - and suggest - products, services and relations. For answering this demand, a significant supply has to be build up. There are fields to explore for those who are not afraid to undertake, attracted by a profitable market on the private side or by the progress of citizen life in the city on the public side. Who will be taking of the challenge? cf. fear of a user: *" I fear that the market is taken by Big Brother (user 310) "*.

Do the existing publishers of cultural and educational products have all the required skills? Are they competent enough for the setting up of such a supply? In a strategy which has, at least, to be European?

The question obviously gives the answer: **NO**

Anyway, a demand has been expressed by the users from Saint Quentin and this demand corresponds with the potential of network technologies. It opens the way to networks strategies associating skills with partners' strength. The expression *associating partners* has to be understood in a wide new sense: to associate private firms with administrations of course, but also to consider the users as partners. Users meaning here users persons of course, but also associations, communities, professions.

In a short time, the first result of the POLLEN experimentation seemed to indicate that it was worth being carried on and made deeper.

POLLEN

Validation and evaluation in Saint-Quentin

Peer review

by

Jean-Hugues Dobois (Executive Management, Paris)

1. Introduction

The following report concerns the document mentioned in reference. The reported work is situated at the very last stage of a two-years European R&D project which has explored a possible approach of on-line publishing exploiting rapid network access.

In order to have a good knowledge on the already achieved project results, the reviewer has been invited to consult the following documents and products:

- the prototype "Genome" on CD-ROM,
- the report "Guide for the design of educational multimedia applications based on concept mapping"
- the report "Feasibility of the design methodology"
- the interviews reports

Due to the lack of time, and after agreement with the project responsible, taking into account the fact that the project has reached its very last stage (it has been officially closed from January 1998) and moreover taking into account the personal center of interest and domain of competence of the reviewer, only two components of this important work have been considered here:

- the design style of the product,
- the perspective of on-line publishing.

The objective of this review report being as much as possible to be useful for the project partners for further initiatives.

2. The design style of the product

Evaluating the product is not the purpose of this review report, but evaluating the evaluation. However, the quality of the product itself, its adaptation to the targetted audience, are key-elements if one want to understand some of the users reactions. I am obliged to say that my personal opinion on the Genome product is not very positive. I tend to be less indulgent with the product I have tested than the project partners (it is not a surprise) but also with the users of Saint-Quentin (it is more surprising).

From my personal view, the product has the following positive and negative characteristics.

POSITIVE:

- It runs well (there is no bug)
- the text is generally well written and understandable for someone having a secondary education level as indicated in the report;
- the quality of material is good (no mistakes in the text, images and videos of good technical quality);
- the user interface (concept map) is clear and friendly (with the reserve of links problems mentioned on pages 19 and 20 of the report).

NEGATIVE:

- it is a poor hypermedia (too much text, few navigation possibilities);
- the level of interactivity is low (no manipulation, no exercises);

- the communication functions are limited.

In my opinion, if one put aside the concept map system which seems actually innovative and promising, the product itself is not yet at the level of a commercial product. However, the POLLEN team says in the evaluation report that the user have been globally satisfied with the product. I do not express any doubt about the honesty of the evaluation. All the defaults of the product are indicated by one or several users. Anyway from a methodological point of view, the fact that the evaluators have been deeply involved in the design and the production process of the product represents a serious risk in terms of objectivity of evaluation. However, I consider very seriously the global impression expressed by the users as it is reported by the evaluators.

The user reaction reveals that people like products easy to use and easy to understand. This is an element which is well-known by commercial publishers: there is always a gap between expert opinions and users opinions. Experts like innovative and complex product while users prefer simple and efficient products. I would personally take two remarks from users into consideration and propose two directions for improving the prototype:

- the Guided Tour should be presented as an introduction module (differently from what it is in the actual design as an option among others in the general menu);
- quizz and simple exercises or simulations, interactive modules, should be integrated systematically in the multimedia documents.

These two conditions are required for the product to expect commercial possibilities. But they are not the only conditions for on-line publishing. More are analyzed below.

3. The perspective of on-line publishing

The perspective of on-line publishing is analyzed in the last chapter of the report (§6). I fully agree with most of the remarks which are proposed here. As far as I know, this experimentation is the first one to address directly this question which will become more and more important, as

the offer of rapid Internet access is increasing in US and Europe. This development is based on three technologies:

- **Cable** (the one experimented by POLLEN) is developing rapidly in France (France Telecom, Cegetel) in Belgium but also in the US (North-American Channel HyperLinking Organisation uses a technology developed by Worldgate Communications to offer cut-price high-speed Internet access over the TV set via a set-top converter box).
- **ADSL**, a technology that allows to use regular phone lines for high-speed data transmission. ADSL trials have been or will be launched by several European telecom operators.
- **Digital satellite TV platforms** such as Canal Satellite in France and BSkyB in the UK.

The rapid development of these three technical solutions open promising perspectives for on-line publishing. The analysis developed in chapter 6 of the report is interesting and exploits correctly the results of the Saint-Quentin experimentation. I would suggest at a further stage to analyze more precisely the new situation created by on-line publishing for traditional publishers. They will have to strengthen the service component of their offer (the servuction process as it is named in the report). It will have strong implication in terms of management of authors. Today publishers use the authors for producing initial materials (texts and medias) and each two years for up-dating this material for the production of a new release. On-line publishing will oblige them to change and to maintain a permanent relation with their authors: authors will have to answer users questions (authors become experts), to moderate forums (authors become animators), to up-date contents on a daily basis (authors become journalists). The POLLEN project has clearly shown that the implication of such modification should be considered very seriously by publishers willing to invest on-line market.