Virtual Institutes: Between Immersion and Communication

KLAUS SACHS-HOMBACH, JÖRG R.J. SCHIRRA & JOCHEN SCHNEIDER

ISG, FIN, Otto-von-Guericke-Universität Magdeburg 27. April 2003

1 Three Uses of the Expression 'Virtual'

In the two expressions "virtual reality" and "virtual community", the term "virtual" has different meanings. A virtual reality is a depiction or, more generally speaking, a sensuous representation of reality that allows – mainly by means of interactivity – to experience various features of reality without actually being in contact with the reality depicted. Therefore, any interactive depiction that is able to imitate reality to such an extent that a high degree of sensory-motor immersion becomes possible is called a virtual reality (Heim 1998, 6f). Since reality is always much more complex than its depiction and full of unpredictable surprises, hardly ever a user has doubts about the difference between the depiction and the thing depicted. Nevertheless, there are good reasons for preferring the imitation to the reality: at least, the imitation is usually not as dangerous as reality sometimes turns out to be.

Virtual communities are virtual not in the sense described above. We do not take virtual communities to be merely depicted communities – although they might employ virtual reality aspects. They are indeed real communities, because the phenomenon called "virtual community" always and necessarily includes real persons and real communicative processes. Without real agents, real intentions, and real interactions, we would not speak of a community at all, but at best of a simulation of a community. What, then, is the difference between virtual communities and real communities? One important difference certainly is that virtual communities are mediated by some computer-based devices. But as one does not have the intention to call a video conference on the internet a "virtual conference" although it is transmitted by a computer, the computerized mediation alone is not sufficient to turn a community into a virtual one. We would like to suggest that a community is properly characterized by the term "virtual" only if (a) at least the mediating devices allow the participating persons to disguise themselves, and if (b) the participants are aware of this fact (in most cases). Therefore, within virtual communities you normally do not know neither the real name of the person you communicate with nor his or her real character but only the user name and the personality descriptions the user has made public.

A virtual institute combines those two meanings of 'being virtual' into a third use. A virtual institute is virtual insofar as no physical building or meeting place is required; but certainly there must be real persons who are members of the institute. What would it mean, at the first place, to be a virtual member of such an institute? A virtual institute inherits this feature from virtual communities without using the characteristics of disguise common to the latter. From the virtual reality side a virtual institute inherits (though not necessarily) a more or (usually) less immersive 3D platform. It adheres to the building metaphor and might have an underlying 3D model of some offices, meeting halls, foyers, galleries, and libraries. Furthermore, the combination of virtual reality and virtual community can be achieved to various degrees. It is possible to maintain a rather detailed 3D virtual reality where the members of the institute can, for example, meet in a virtual lecture hall. But for being a virtual institute it is essentially sufficient that you have just some text-based information system and some communicative functions, e.g., basically an enhanced email function.

Accordingly, quite different platforms for virtual institutes may be used emphasizing either the immersion aspect or the communication aspect. The decision for a platform depends on the goals pursued with the institute: text-based chat systems allow virtual communities to flourish, single-user VRML scenes convey a highly immersive 3D impression to its users. This is particularly true for virtual institutes realized as a 3D environment, as well as for corresponding virtual communities since 3D environments are adequate for certain tasks only. As an overall framework for the evaluation it is helpful to distinguish three major application areas: research, presentation, and communicative work. The Virtual Institute for Image Science (VIB), which we would like to describe in the following (3) as a case study, is almost exclusively designed for the third task: communicative working. It intends to provide a working space persons can share for joint projects despite being physically separated. Before describing the VIB in more detail we would like to give an overview of virtual institutes between the poles of realistic immersion and of communication in a community (2). The discussion of the case study leads to some more general considerations about the balance virtual institutes must find along that bi-polar dimension (4). In the concluding remarks we focus on the technical tools for virtual communities in 3D presently available.

2 Virtual Institutes: Between Immersion and Communication

The main dimension we are interested in here is the one spanning from highly immersive virtual reality applications with a negligible amount of communication between simultaneous users, and essentially text-based solutions of the early virtual communities for the simultaneous communication with more or less overt identities. Virtual institutes have to find a balance between the two poles of that scale. Present versions of – and the still limited research about – virtual institutes provide examples for many different solutions in this respect.

2.1 Pure 3D Presentation

Figure 1: Screenshot of a 3D model of the Computer Science Department building at Magdeburg (courtesy Kitty Stockfisch and Thomas Kientzler).

On one side of the scale, a virtual institute is determined by a pure 3D model of a real (research) institute's building with little additional information incorporated directly in the 3D environment (as far as that is possible without disturbing the primary immersive function; e.g., Andrews 1993). Such models are often constructed by students of computer science degree programmes (as it was also the case for the new computer science department building in Magdeburg, see Figure 1). 3D virtual institutes in that form are usually employed to inform new visitors, and can be accessed through the (real) institute's web page. Additionally, the geometry data can be used in teaching and research, e.g., as a demo or as test data for new algorithms. Virtual institutes in this sense are closely linked with virtual museums and with virtual architecture in general (cf. Buchholz & Schirra 2002).

2.2 3D Institutes with Synchronized HTML Pages

There are 3D models of real buildings that go side-by-side with additional information in HTML presentations of the same institute. One of them, being pragmatic and ambitious at the same time, is the "Virtual Institute for Industrial Building Production" designed as a prototype for a thesis (Kuhn 1999). It is pragmatic in that Kuhn gave up his first idea of having the VR model as a basis offering textual information only inside of it because of difficulties concerning performance, authoring, and usability. He went for a setup where both HTML and a VR scene are present in two different windows automatically synchronized. The system also shows descriptions (2D) and depictions (3D) of desks of researchers (cf. Figure 2). The latter contain buttons to start video conversations since the system does not allow users to meet directly in the 3D space. The researchers can set up their "virtual desktops" themselves to show objects related to their current projects. The virtual building also contains a meeting room with a slide projector. Finally, it also provides a room depicting the relationships between the members, projects etc. of the institute as a 3D graph.

Figure 2: Snapshot from Kuhn's virtual institute with a key element to a WWW page

2.3 Virtual Institutes for Shared Interest Groups

Most web pages calling themselves "virtual institutes" are either homepages of academic institutes or homepages of special interest groups. Some of the former are founded as collaborations of real academic institutions, like *V.I.B.É – The Virtual Institute of Bioinformatics, Éire*, (http://www.bioinf.org). Examples of the latter are *The Virtual Institute of Mambila Studies*, about a people of Nigeria (http://lucy.ukc.ac.uk/VIMS) or *The R. Buckminster Fuller Virtual Institute* about said architect/engineer (http://www.newciv.org/Synergetic_Geometry/bfvi.htm Our own case study described below in more detail, *the Virtual Institute of Image Science* (VIB), is essentially an example of this type.

2.4 Text-based Multi-User Dimensions (MUDs)

A prototype for a rather text-based virtual institute is the *MediaMOO* which was developed by Bruckman and Resnick as a "virtual community" of media researchers (1992, and http://www.cc.gatech.edu/fac/Amy.Bruckman/MediaMOO/). It is implemented as a text-based system, i.e., the presentation of the world and the user's input are simply text. Accordingly, MUDs demand a fair amount of determination and imagination, and are therefore, in the words of McLuhan, "hot media" (cf. Curtis 1996). Users navigate through a command line – with the obvious disadvantages: the need to remember and write commands rather than recognize and click them is the first that comes to mind. But avatars, objects, and rooms can be easily created by just writing down their description – much easier than by using a 3D modeler (harder than picking stock objects from a list, though).

Bruckman & Resnick liken their world to the spontaneous conversations happening during conference breaks, the emphasis is on written talk, not texts to be printed (1993, cf. example below). Researchers can give a description of their research interests. There is a search engine available for all these descriptions, which might be used to find a chat partner in the first place (actually written by a user in the system's object-oriented programming language).

An example from http://www.cc.gatech.edu/fac/Amy.Bruckman/MediaMOO/symposium-00.html:

Neon_Guest says, "'i'm wendy kellogg from ibm research. i manage a group called social computing."

[VWorlds] Hannes says, "My background is in computer science, but here at the medialab i'm working with professor Justine Cassel whose background is linguistics and psychology"

Neon_Guest says, "'we're working on building software to support distance collaboration for workgropus and have a particular slant on doing so that we call 'social translucence'"

[VWorlds] Amy says, "I guess we'll take advantage of the parallelism of the medium ;-)"

Neon_Guest says, "which really means trying to make PEOPLE andt their BEAHVIARIOVIOR more visiable"

Neon_Guest says, "i teyp good too ;-)"

[VWorlds] Hannes says, "We are essentially combining these fields to produce graphical embodiments of agents and online users that behave in a convincing fashion"

Neon_Guest says, "my background is in cognitive psychology and hci"

2.5 Communication Only (chat)

On the other side of the scale spanned in this section, a virtual institute consists solely of chat channels without any spatial connotation at all, using the IRC (Internet Relay Chat) standard or web-based software (like the *Virtual Institute Network*, http://polylab.sfu.ca/vin). Such a system is sufficient to quickly set up and grow a community starting with an already existing group of people with shared interests. But it is likely that at least an additional web page for such an "institute" is desirable as an entry point to the chat system and as an archive for transcripts and documents.

3 A Case Study: The Virtual Institute for Image Science (VIB)

The Virtual Institute of Image Science (VIB, cf. Fig. 3) has been created as an electronic platform in order to simplify the coordination of projects of a particular scientific community. This informal "image science community", as we like to call it, is composed in a highly interdisciplinary manner, encompassing mainly scientists from art history, computer science, communication sciences (including film theory and media theory), philosophy, psychology, and from several social sciences. They all work on problems in the range of image science. At the moment, roughly 50 of them are active members of the VIB, and another 100 participate as passive members. It is important at this point to mention that this community is quite heterogeneous with respect to their familiarity and use habits of various computer-based media. Any electronic platform trying to ease the interactions and co-operations of that group must take these preconditions into consideration.

The initial motivation for setting up the virtual institute was essentially the attempt to support various interdisciplinary research projects between image scientists that mostly live and work at locations far apart. The general intention was to encourage the communication between those researchers. In particular at that time, several book projects and conferences had to be organized, which required a lot of coordination of the participants: in order to create a stronger link between the single contributions, the authors were expected to exchange their views throughout the preparation phases. Two of us therefore started the virtual institute essentially by installing a preprint forum with restricted access (Sachs-Hombach & Schirra 2002). However, this first approach has not been too successful. On the one hand, we decided to build our own software for the preprint forum by means of a student's project, which unfortunately turned out not to work in a satisfying manner. Developing a proper tool instead of using a standard community software had its reason in our desire to have more control when the system has to be adapted later to a growing community and its changing needs. On the other hand, a characteristics of present scientific authoring had its bad influence as it hardly ever seems to happen that scientists deliver their papers before deadline. Such a "production just in time" does not really allow for an extended discussion or coordination process before publish-

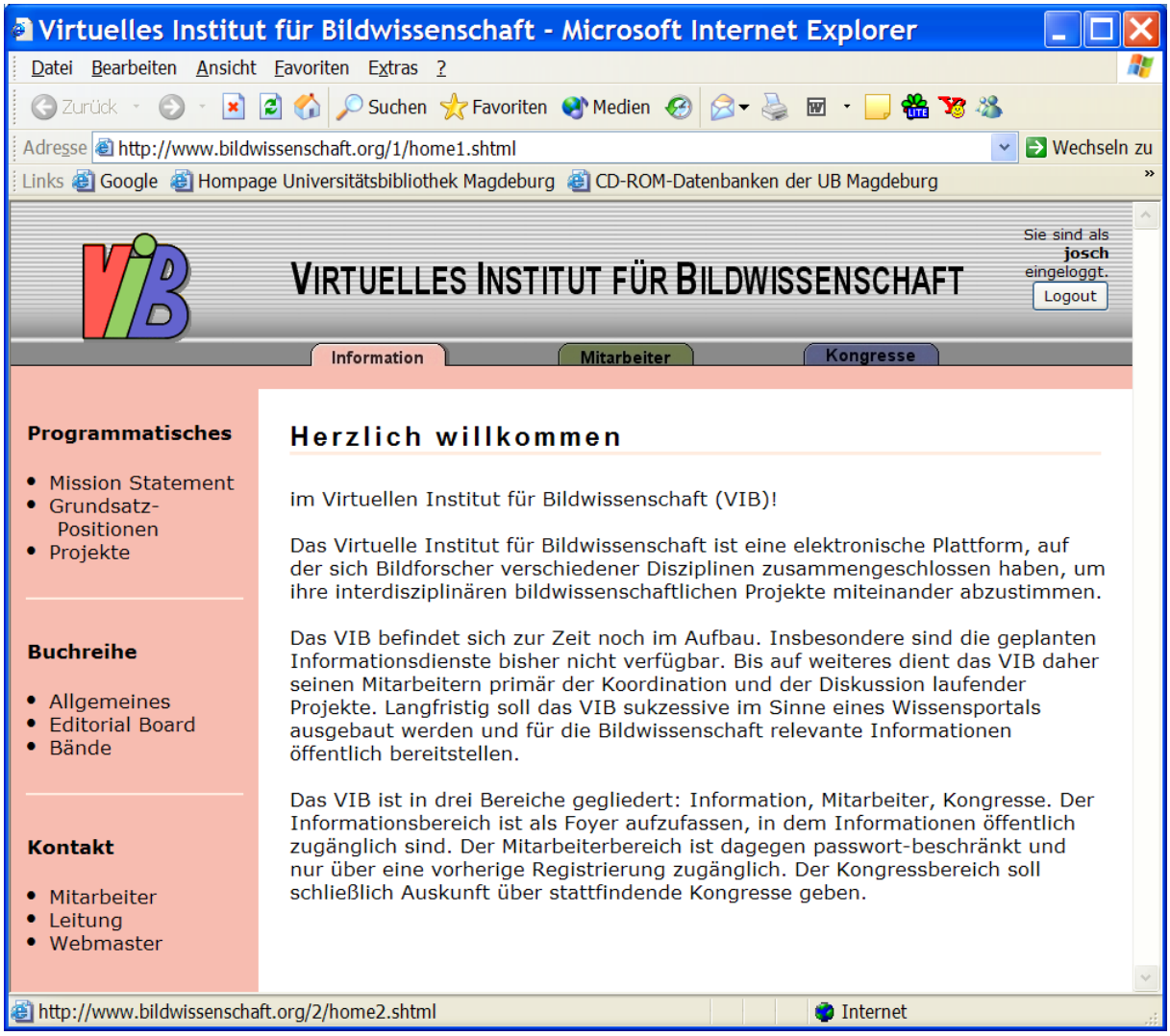

Figure 3: Entry page of the Virtual Institute for Image Science (VIB)

ing. Scientists (at least in the humanities) might also tend to follow primarily their idiosyncrasies and refuse to have somebody else see (not to speak of 'discuss') their papers in an unfinished state. Quite interestingly, if you meet the very same persons on a conference, and talk to them face to face, such reserve to discuss thoughts in the making is often absent: an observation that leads directly to considering 3D virtual meeting places as a better tool for the initial task of the VIB. We come back to this point in section 4.

Although the preprint forum did not work as intended, we have been quite successful in originally bringing together scientists from the different disciplines related to image science. After having received a lot of positive feedback (and also some funding), the motivation for the VIB changed from coordinating single projects to establishing a novel scientific approach: the "unified image science". One of the reasons that such a science has not been institutionalized up to now can be seen in its inherent interdisciplinary constitution, which, although generally traded as one of the strongly favored attributes, tends to be highly problematic in the present scientific landscape of clearly separated disciplines. A science of images in the general sense requires conceptually to consider pictures as communicative entities (signs) that

depend heavily on the special conditions of the communication media in question and simultaneously on the perceptual processes underlying image understanding. Unified image science therefore asks at least for a clarification of the concepts "communication", "media", and "perception", as well as of the relations between these concepts (cf. Sachs-Hombach & Schirra 2002). These matters are traditionally dealt with in quite separate faculties with different methodologies and with mostly a concentration on some aspects only of the overall phenomenon of picture uses. In consequence, the virtual institute of image science has become the crystallization core for developing a compensation for the lacking institutional background for image scientists.[1]

This shift in the conception of the VIB opens a wide variety of useful functions to be made available for the members of the institute but also for the general public. Although it is impossible to entertain an electronic platform successfully without having determined quite specific intermediate goals, the first step is to think about how to make the platform attractive for the members. One has to motivate them to spend time in the virtual institute, and to use the functionality it offers. On a general level, interesting functionalities for the VIB crystallize around (a) accessing data, and (b) meeting people. In other words, we need, on the one hand, a large database that contains a critical amount of relevant formal and informal information, and on the other hand, communication facilities. Over and above those main goals, the VIB should meet the following demands:

- It should stimulate informal discussions between its members. To that purpose, it is essential to provide indications about the members actually present, i.e., online. This can assumedly be done more naturally in 3D environments.
- It should be able to visualize all kinds of information. A main motive of the VIB is certainly the attempt to connect different people and different scientific approaches, possibly all over the world. Visualization are a suitable means to enhance this process since it allows, for example, an immediate orientation.
- It should address the everyday image user. It should therefore present special information around the VIB interesting for non-scientists, as well. Establishing a larger 3D virtual community and providing it with facilities for entertainment might attract people and encourage them to use the VIB located at the center of that surrounding platform.

The database essentially works as a library or media archive. It allows the users to easily access texts or other presentations relevant for their present interests. This also includes current information on talks, conferences or research projects (planned, running or past). To that purpose, adequate facilities to browse and search must be offered. Beside the user-friendliness, it is mainly a question of "critical mass" for the database (and with it the virtual

[1] This went together with the hope that the unified image science might turn out to be useful as a paradigmatic scientific study on interdisciplinary research.

institute) to become sufficiently interesting for the members of the community. One way to reach the critical mass is to allow (and more precisely: to encourage) every member to extend the data base accordingly. “If an individual is motivated in even a small way to benefit the group as a whole, the fact that digital public goods are purely non-rival can be a significant incentive to contribute toward the public good.” (Kollock 1999, 225). This also helps to overcome another difficulty arising from the heterogeneous backgrounds of the members: it is very difficult for any single person to determine the range of relevant items to be rightly incorporated into the database. Of course, this solution of divided labor asks for an initial motivation, too. However, once all the members have added most of their private collections (at least as far as they consider them as relevant for the other members), the data base has most likely grown to such an extent that it is attractive for continuous further uses by the members.

In the context of this case study, two aspects of the database are of particular interest. First, having images as a scientific subject suggests that pictures in all their different forms must play a crucial role for the database functions. Most elementarily, pictures and their uses form the empirical basis for many of the members of the VIB. The VIB not providing a multimedia database with pictures, films, and the option of extended annotations to them would be quite ridiculous, in contrast to, e.g., a virtual institute on some kind of literature. But even in a more general sense, pictures play an increasingly important role in contemporary scientific endeavors: visualizations are a prominent tool for presenting research results in an easily digestible and compact manner. In this sense, the considerations about including pictorial archives can be generalized to virtual institutes on other subjects, as well.

Second, a realization of the VIB as a 3D virtual environment may almost appear as the paradigmatic application of that technology: a pictorial representation of the science of pictures. After all, a 3D environment is a kind of depiction, too. Alluring as this idea might be, it does not lead to much new insights. More importantly, the virtual institute of image science, as the major representation of a science presently in the stage of institutionalization, has not only functions within the community of its members: it is also important as the showroom for external persons or institutions. This obviously includes potential new members, but stretches from scientific journalists (as representatives of the general public) to the members of funding boards, general scientific organizations, and the industry. The coincidence of form and content is certainly a nice by-product in this respect, but it has primarily an aesthetical value.

The databases of many scientific institutions are not intended to be generally accessible for non-members: a certain protection to internal affairs has to be guaranteed, while simultaneously the interested public should be given an adequate impression of the institution’s work or even some freely available information services. Public libraries, for example, need user cards – and in consequence also secure file systems for administrating the data of its members. In fact, password-restricted access as the standard solution to that demand requires a relatively complicated system of administration, as well.

During the process of setting up the VIB, the distinction between the different rights of non-members, technical staff, ordinary members, and chair persons for project areas have become increasingly important. In order to handle the various scopes of access, it is essential to organize the user administration with a central database. This is also relevant for security reasons. Since new ideas discussed in the projects are regarded as very valuable within scientific communities, an "architecture of trust" is certainly necessary for the project areas in the virtual institute (cf. Smith 2002). Although the encryption of documents is not needed up to now, this question will demand more consideration as the VIB gains more public interest.

In this context, another feature is to be learned from libraries: many libraries offer their users individual work spaces where they can keep the documents they currently study. Correspondingly, the VIB should offer secure individualized desktops for its members and for project groups. This includes, for example, a faster – or even an immediate, i.e., localized – access to the documents from the database used for the current work of that member. Whether or not an individualized work space is reasonable for a certain member depends mainly on the degree to which that member likes to be involved in the community. Some want, for example, to use the facilities of the VIB intensively but are not interested in the newsletters. For others the newsletter is more important while they ignore mostly the database functionalities. For the former, a stronger integration of the VIB functionality with the applications on their workplace computer is certainly much more reasonable than for the latter.

The information one can access is one reason for a scientist to spend time in a virtual institute like the VIB. Such an electronic community system may therefore be viewed as being mainly a system "that encodes the knowledge of a community and provides an environment that supports the manipulation of that knowledge" (cf. Schatz 1993, 551). But for the overall goal – establishing a novel scientific institution – the facilities to meet people, to communicate, and to cooperate are equally important. In conclusion, the VIB also needs a virtual meeting place that is easily accessible. Here, the members can contact or meet other members and organize directly – face to face – research cooperation in every respect (remember the difficulty with the preprint forum mentioned above). Beside getting in touch with experts the meeting place should stimulate and support the starting of new projects, the organizing of conferences, and other informal "networking". The corresponding facilities must also encourage novel ways for publication, which include possibilities of reading, writing, rewriting, and reviewing texts together. Since writing and publishing is a very sensible area for scientists, considerations of security, authentication, and access control are also relevant for this part of the VIB.

As stated before, the VIB is supposed to serve two main purposes: dissemination of information among its members on the one hand, and communication between the members on the other hand. There is a focus of interest on the former within the VIB, but once you consider the broader context, the emphasis changes to the latter.

4 Discussion: The Balance between Immersion and Communication

From a more general point of view, it is enlightening to sort the functions of the virtual institute in those that afford a high degree of immersion, and those that depend on dense forms of communication. Furthermore, we have to distinguish between those tasks that need the cooperation of many users interacting directly with each other from those that involve single users working solitarily at a time (cf. Table 1). Note that communication does not necessarily need direct multi-user cooperation: texts are a typical example, since they mediate communication but do not call for all participants to be present simultaneously.

Table 1	immersive task	communicative task
solitary task	*Showcase for public* *Orientation and leisure* ...	*Reading / Writing papers* *Searching the database* ...
cooperative task	*Informal discussion* *Video conferencing* ...	*Formal meeting* *Passing documents* ..

Researchers in image science are trained to, and indeed have to publish text, just like other researchers. Reading and writing texts are demanding solitary tasks in the context of a virtual institute, which need enough screen space, a familiar user interface, high responsiveness, and, last not least, a quiet, relatively undisturbed context. This is, in our eyes, the main reason why a complete switch to a 3D environment for the VIB is not desirable, as long as most users first have to struggle with usability and high demands on hard- and software. Correspondingly, most of the database functions sketched above, e.g., paper collections, are rather implemented in a "classical" form as web pages, i.e., for solitary, non-immersive uses.

Cooperatively writing a paper or research proposal depends on the solitary work of the co-authors coordinated by additional formal meetings and the exchange of documents. Web-based communication applications like file transfer, email, chat, and audio streaming are used to that purpose side-by side with classical tele-communication, like telephone and facsimile.

However, "even with all those organizational and technical facilities at hand, it will still be very difficult to deal with the way of cooperation that researchers use most, namely the informal 'ad hoc encounter' that, via exchange of knowledge as well as gossip, opinions, etc., can lead to new research cooperation" (Lubich 1995, 73). Lubich lists a number of reasons for scientists to cooperate: these are, in particular, solving specialized and interdisciplinary problems, building on other researchers' experience, getting group funding, and doing cooperative teaching. Usually, cooperation is clearly associated with a specific, formalized outcome: a paper, a journal, a research project. "Although it is acknowledged that formal meetings, etc. are

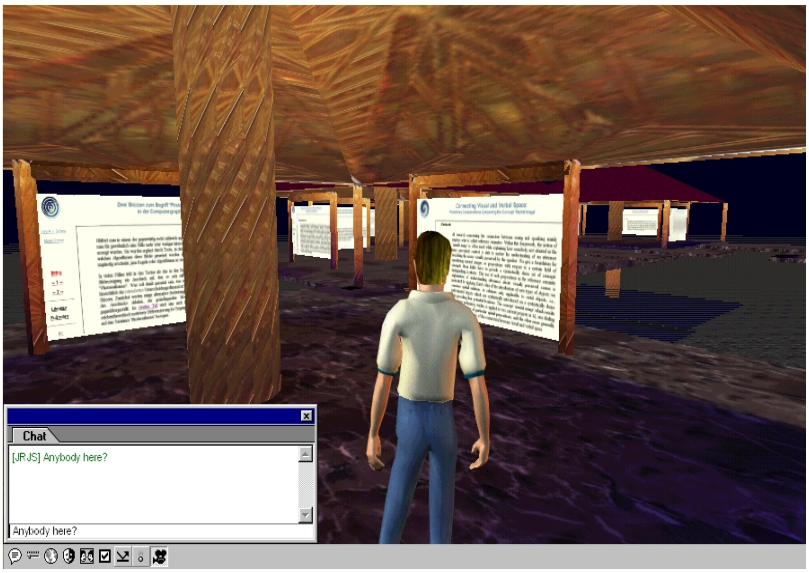

Figure 4: Experimental 3D environment combining library and meeting place functions

- online papers can be accessed in a separate browser window by clicking the posters showing bibliographic data and abstracts;
- users, appearing as avatars, can directly chat with each other (e.g., about the papers)

often part of a research cooperation, the emphasis is clearly on the informal part of cooperation, whose dynamics have been much less investigated and – in comparison to strictly formal interactions – are harder to model" (Lubich 1995, 67). Physical proximity plays a large role in successful scientific cooperation.

If we agree on that informal ad hoc encounters play such an important role within scientific communities it is likely that a 3D environment is worth a try for supporting the informal communicative functions. After all, it mimics exactly the necessary physical proximity between interlocutors. As a first test in that direction, a 3D environment has been set up by one of us to access an online paper collection also acting as a virtual meeting place (cf. Figure 4). The actual information of each paper is still offered as a classical html page. Those pages might also be accessed simultaneously by several persons without using the 3D environment; but they would not know from each other. When using the virtual reality, simultaneous users are aware of each other, e.g., as interested in the same paper of the collection. Even more, a chat function allows them to discuss matters related to the papers in a rather informal manner (among other things they may find worth talking about).

This, at least, is the theory. One major problem with such a 3D meeting place is generally that it is often accessed by a user for relatively short times only. That is, the chance to really meet somebody else (anybody!) without having an explicit appointment is usually quite small if the site is not visited by many thousands of users a day. Here we come again across the problem of motivating people to use such a functionality. Only if a "critical mass" is reached in the probability to actually meet an interesting interlocutor, the virtual reality can attract more users or more frequent accesses, and thus become a *working* meeting place at all. If we assume that a relatively closed group of users with common interests and other paths of communication are addressed, as in the case of the VIB, their effort in time and concentration used for entering the virtual meeting place must be worthwhile, or the members cease to come back and continue to use just telephone and email.

Informal meetings in a real institute may best be associated with unplanned "kitchen encounters" where one member meets accidentally another member at the coffee machine or water station, etc. A spontaneous conversation may start – leading to just those informal interactions relevant for the scientific cooperation in the institute. Similarly, tea breaks at conferences or workshops are popular not mainly for relieving thirst: they provide exactly the opportunity for unplanned encounters from which informal meetings spark off.

Quite obviously, providing the virtual institute additionally with a virtual coffee machine will not be an adequate adaptation. The characteristics of the "kitchen encounters" are not preserved. It is essential for that (real) scenario that there is (*i*) a strong physiological need for the members to move physically to that place with (*ii*) no immediate intention to perform some work there while (*iii*) being also open for social interaction. The second criterion is important since a primary intention to do some other work might certainly reduce the opportunity to chat with a colleague met by chance. This does not change for the virtual form of the institute, nor does the third item. A plausible adjustment to the virtual institute must be found essentially for the first point. Instead of the physiological cause related to the institute's tea kitchen, a high motivation must be installed unobtrusively for the members to come to or pass through the virtual environment intended as meeting room. But what might that be?

It is not clear up to now whether a scenario with all three characteristics can be included into a virtual institute in a manner not too artificial. Perhaps, the access to the database could be channeled exclusively through a virtual meeting place (while requests to the database and their results as such need not be in 3D). This scenario reminds us of the foyer of a library: whereas the main function of the library – getting access to the information in books – can be performed quite well (or actually: even better) without physically meeting other users of the library, the foyer offers a place for unplanned encounters, e.g., while waiting for the books or studying some conference posters or ads on the wall. In the reading halls and catalogue rooms, silence is demanded since point (*iii*) above does not hold there (nor does the second criterion). The foyer, in contrast, is usually rather noisy with talk, and the third item is obviously in function. Even criterion (*ii*) seems to be at least partially in reign for the foyer exactly because the work that one intends to do when passing the foyer is actually associated with other rooms and may be postponed for a quick chat on the way.

Finally, we should not forget another aspect highly relevant for informal computer-mediated communication in a 3D environment. Much of the communication happening during "kitchen encounters" is of non-verbal nature. From facial expression to intonation, from body language to eye contact, many expressive background signs enrich the verbal foreground and have an enormous impact on the communication. It is presumably the missing of this additional level of communication that makes scientists hesitate to publish unfinished scripts even in the small circle of colleagues while discussing the very same drafts without any reluctance face to face (Smith 2002, 59). It may, thus, be doubtable whether relatively rigid avatars and

written chat are already immersive enough for a meeting place in the sense intended. The integration of *viva voce* communication and even video conferencing must certainly be an option at least.

Whether a 3D environment really does work the way intended, i.e., whether it can imitate the setting of physical encounters well enough to support the informal aspects of scientific cooperation, remains mainly an empirical question and depends heavily on the quality of the 3D environment. There is certainly another quite delicate balance one should take into account most seriously, as well: the one between benefits and costs.

Let us finally come back to the distinctions of Table 1. Quite obviously, immersion and communication have very different importance for each of those categories of tasks. Table 2 associates the preferred functionality with the four types of tasks as a kind of résumé of the preceding discussion. Whereas solitary communicative tasks can be best performed without overloading the interfaces with too much "virtuality", solitary immersive tasks and cooperative communicative tasks call for the specific forms of virtuality provided already by pure virtual realities or straight virtual communities (in the wide sense), respectively. Solitary immersion is not too important for our case study so far and adds essentially an aesthetic moment for public relations. Communicative cooperation is, in contrast, highly relevant, and all the techniques of virtual communities could be applied (apart from their option of disguise).

Table 2	immersive task	communicative task
solitary task	*functionality of virtual realities*	*classical single-user interfaces*
cooperative task	*virtual reality with multi-user communication and other coordination functions*	*functionality of virtual communities (without disguise)*

Only the class of cooperative immersive tasks, which are essentially associated to informal meetings, demands the full combination of virtual reality with the synchronized interaction of virtual communities. In accordance with our "kitchen encounter" metaphor, the setting of this part of a virtual institute is highly critical: we have seen in this section that there are still many questions to be answered concerning a proper and continuous motivation of the members to employ the functionality offered in this respect. For support, a "natural" integration of the other functions is highly desirable.

5 Conclusions: Technical Requirements

Each sub task collected for the VIB determines an optimal point of balance between immersion and communication. All tasks have to be integrated in an adequate manner into the virtual institute: they have to be merged on a common technical basis that provides the necessary degrees of freedom for realizing the various demands.

The reason the VIB has been implemented as a WWW application is quite obvious: WWW browsers are well established as far as users and the number of computers they are installed on are concerned; their interface is well known, and programming and maintenance can be done at a central location. WWW browsers also allow the users to immediately read, download, and upload documents, and therefore support the function of information dissemination easily. They can be used to implement synchronous communication functions like chat, and are extendable to support additional media types like 3D scenes.

Historically, the WWW has been successful because browsers have been able to handle the then-current protocols like the *file transfer protocol* (ftp) and *gopher* (Berners-Lee 1996), in addition to allowing for authoring and distribution of information in a pleasant and easy to use manner. We expect that collaboration and synchronous communication facilities – starting with text chat, but also including (and not being limited to) voice and video communication – need to be packaged into a single, user-friendly application available on many platforms and extendable at run-time in order to come into wide-spread use.

A web-based 3D tool called 'Atmosphere' presently developed by Adobe and available in its beta version for Windows and Mac operating systems offers many of the options necessary to realize a more immersive virtual institute. The virtual library depicted in Figure 4 has been developed on this platform. Numerous examples in the sense of virtual realities and of virtual communities have been already established; the platform's distribution is currently free, the browser plug-in necessary to enter an "atmosphere world" is automatically installed when opening the corresponding web page. This certainly is an advantage if the group of users is not too familiar with computers. Access to external web pages may be integrated by means of Javascripts, so can other applications, e.g., access to databases. So far, a redirected chat channel with an intermediate web-based machine translator, and a direct integration of voice communication have been experimentally established by users beside the standard chat function.

'Squeak' (Guzdial and Rose 2002, cf. www.squeak.org) is the name of another multimedia platform promising to be a suitable technical basis for our purposes since an extension to a 3D environment called 'Croquet' is currently under way (www.opencroquet.org, Fig. 5).[2] Being based on Squeak, Croquet is freely available and runs on a number of platforms. It contains

[2] Since one of its developers, A. Raab, works at the Department of Simulation and Graphics, as well, adding particular features useful for the VIB could easily be organized

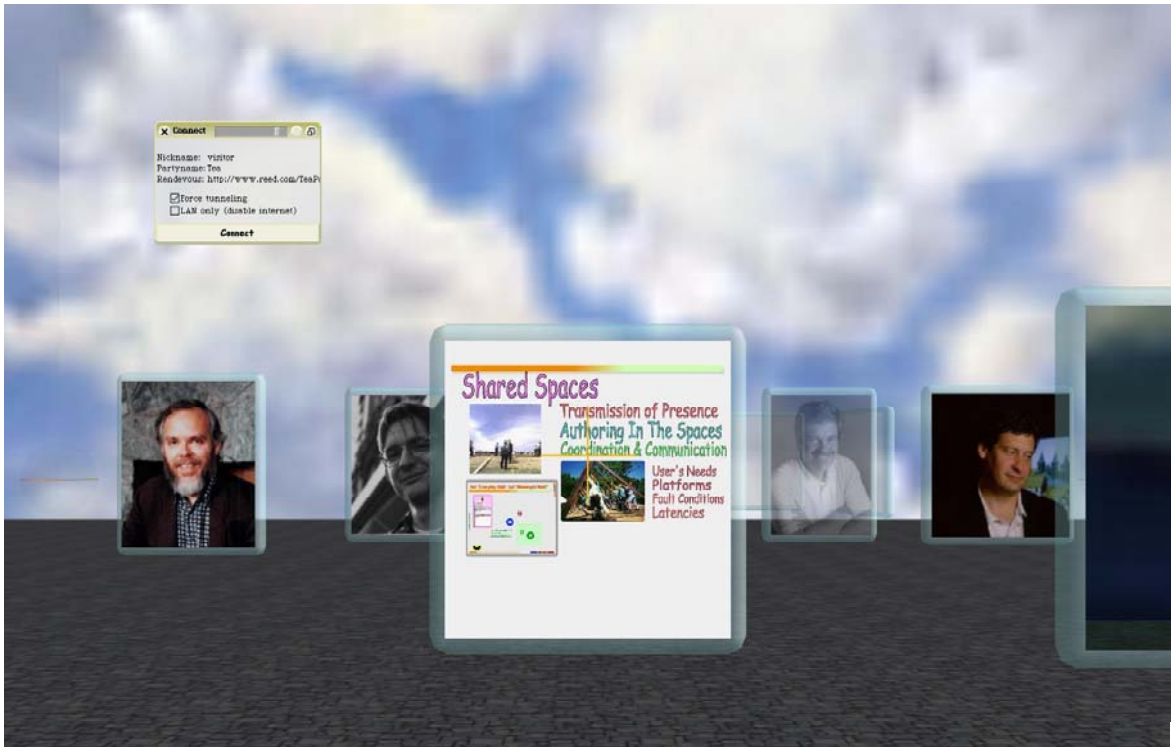

Figure 5: A screenshot from Croquet: The "picture objects" are avatars of the users, additional functions are accessible on the poster in the middle of the 3D space

sophisticated synchronization mechanisms and needs a central server computer only for login notification, not for communication between browsers itself. It supports the creation and programming of objects through users, and is completely programmable in Smalltalk (an object-oriented programming language with a long history).[3]

An important question we ought to discuss at this point is the degree of participation in the development of the institute's technical infrastructure delegated to the members. Certainly, the institute should not be a monolithic block that does not allow any adaptations to the current needs of the users. But how much are they allowed to change its architecture? To what degree is it desirable that every member should add new functions or change them? If we decide to enable greater alterations by the members we must take care of those who are not familiar with the multimedia tools necessary for it: they might be frightened by such expectations. The informal cooperation expressed by chatting with other members and the technical staff might turn out to be much more helpful for an improving self-organization of the institute's technical infrastructure than the expectation that the members are to directly re-program parts of the system in more or less complicated programming languages. On the other hand, providing main building blocks of the infrastructure to be created and arranged in a user-friendly (i.e., usually graphical) interface could be a valuable means in particular for designing specific areas for each project – including, for example, privileged access to the project's documents and a project meeting room – without the help of the technical staff.

[3] Indeed, Croquet contains a development environment for Smalltalk. Graphics can be programmed at a very low level, too, if desired.

Installing a virtual institute that supports the institutionalization of a new interdisciplinary scientific approach demands for a broad variety of functions offered to the members and the public. The functions can be classified according to the kind of virtuality in which they are employed best: between immersion and communication, solitary and cooperative tasks contribute aspects of virtual realities and virtual communities to various degrees. As a special kind of virtual communities, virtual institutes are paradigmatic cases for combining immersive and communicative functionalities. They provide an interesting research domain for novel 3D platforms that offer the relevant functionality. However, the user's motivation to enter a highly immersive institute has to be enhanced by a careful integrative arrangement of the different tasks adapted to the special needs of the corresponding shared interest group.

References

Andrews, K. (1993): Constructing Cyberspace: Virtual Reality and Hypermedia. In: *Virtual Reality Vienna '93*: ftp://ftp.iicm.edu/pub/papers/vrv93.ps.gz (as of April 2003).

Berners-Lee, T. (1996): *The World Wide Web: Past, Present and Future*. Online paper: http://www.w3.org/People/Berners-Lee/1996/ppf.html (as of April 2003).

Bruckman, A., Resnick, M. (1993): Virtual Professional Community: Results from the MediaMOO project. In: *Proceedings of 3CyberConf, The Third International Conference on Cyberspace*: http://citeseer.nj.nec.com/bruckman93virtual.html (as of April 2003).

Buchholz, K., Schirra, J.R.J. (2002): Das Haus als Gesamtkunstwerk: eine Herausforderung an die Computervisualistik. In: Sachs-Hombach, K. (ed.): *Bildhandeln*. Magdeburg: Scriptum, pp. 241-268.

Curtis, P. (1996): Mudding: Social Phenomena in Text-Based Virtual Realities. In: Stefik, M. (ed.): *Internet Dreams: Archetypes, Myths, and Metaphors.* Cambridge: MIT Press, pp. 265-292.

Guzdial, M., Rose, K. (2002): *Squeak: Open Personal Computing and Multimedia*. Upper Saddle River: Prentice Hall.

Heim, M. (1998): *Virtual Realism*, Oxford: OUP.

Kollock, P. (1999). The Economies of Online Cooperation: Gifts and Public Goods in Cyberspace. In: Kollock, P. & Smith, M. (eds.): *Communities in Cyberspace*. New York: Routledge, pp. 220-239.

Kuhn, R. (1999): *Virtuelles Institut – ein multimediales Informationssystem als interaktive Internet-Schnittstelle zwischen Benutzer und Hochschul-Institut*. Master's Thesis, Institute for Industrial Building Production, University of Karlsruhe: http://www.ubka.uni-karlsruhe.de/cgi-bin/psview?document=1998/architektur/1 (as of April 2003)

Lubich, H.P. (1995): *Towards a CSCW Framework for Scientific Cooperation in Europe*. Lecture Notes in Computer Science 889. Berlin, Heidelberg, New York: Springer-Verlag.

Mynatt, E.D., Adler, A., Ito, M., O'Day, V.L. (1997): Design for Network Communities. *Proc. of the ACM Conf on Human Factors in Computing Systems* (CHI `97), Atlanta, USA, 1997, pp. 210-217.

Sachs-Hombach, K., Schirra, J.R.J. (2002): Von der interdisziplinären Grundlagenforschung zur computervisualistischen Anwendung: Die Magdeburger Bemühungen um eine allgemeine Wissenschaft vom Bild. *Magdeburger Wissenschaftsjournal* 1/2002, Magdeburg, pp. 27-38.

Schatz, B.R. (1993): Building an Electronic Community System. In: Ronald M. Baecker (ed.). *Readings in Groupware and Computer-Supported Cooperative Work*. San Francisco: Morgan Kaufmann, pp. 550-560.

Smith, J.H., (2002): *The Architectures of Trust – Supporting Cooperation in the Computer-Supported Community*. Master's Thesis, Department of Film and Media Studies, University of Copenhagen: http://www.gamasutra.com/education/theses/20020410/smith.pdf (as of April 2003).