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Title: Virtual Studio: a Digital Repository in Architectural Education  
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### **Abstract:**

The "virtual studio" is a project exploring the potential of virtual learning environments to augment conventional studio culture in the Lincoln School of Architecture. Staff saw an opportunity to bridge the long-acknowledged divide in learning between theory, technology and studio practice by linking a wide range of digital material and media from across the curriculum within a single virtual space, both formal learning objects created by staff and work produced by students. Early in its development the project was expanded to link with Lincoln's JISC-funded Institutional Repository which aims to establish a digital repository of teaching and learning objects and peer-reviewed research across the University. The School of Architecture was to be an initial test bed

for the creation of a more generic, university-wide repository. However, architecture is an atypical discipline; its emphasis is more visual than literary, more practice than research-based and its approach to teaching and learning is more fluid and varied than either the sciences or the humanities (Stevens, 1998). If we accept that it is social interests that underlie the development of technology rather than any inevitable or rational progress (Bijker, 1997), the question arises as to what extent an institutional repository can reconcile architectural interests with the interests of other disciplines. Architecture and the design disciplines are marginal actors in the debate surrounding digital archive development, this paper argues, and they bring problems to the table that are not easily resolved given available software and that lie outside the interests of most other actors in academia.

## Introduction

Institutional repositories (IRs) are an increasingly widespread if relatively recent feature of the UK academic establishment. Their more common precursor was the subject-based repository, the scope of which can be institutional, national or international. One could argue that it is the multidisciplinary nature of today's IRs, rather than their geography, that places them in contrast to the digital archives of the past. The path to the present preoccupation with open-access, multidisciplinary IRs is well documented. Pickton & Barwick (2006), Ware (2004) and Lynch (2003) all argue that IRs offer significant benefits over single-discipline archives to a range of stakeholders: enhanced visibility and prestige for the higher-education institution; greater impact for academics concerned with publishing, as well as for funding bodies; improved learning opportunities for students; and the increasing dissemination of scholarly knowledge to the public at large. Potential pitfalls are identified, generally focusing around issues of content generation, rights management and long-term stewardship. For many authors, however, multidisciplinary is a key step in the development of digital archives, part of the potential disaggregation of academic publishing and the enrichment of scholarly communication in general. Lynch in particular believes that "the scholarly enterprise is sufficiently diverse that ... disciplinary repositories will never be fully comprehensive" (Lynch, 2003).

However, the notion of a multidisciplinary archive inevitably raises the issue of disciplinary and professional boundaries and begs the question, can academics and students working in different disciplines be easily accommodated within the same archival space? As Katherine Arens points out, "the boundaries between academic disciplines are considerably less easily interrogated than the boundaries between geopolitical entities", since they are defined not only by scholarly knowledge, but also by culture, that is, by values, norms, practices and modes of discourse (Arens, 1996).

Implicit in many conventional interpretations of the development of new technologies is a notion of progress. Technical innovation is typically described as an orderly, linear process, subject to a continuous series of refinements and improvements as it moves from pure to applied research, to development and finally to maturity (Bijker & Law, 1994: 17). This is a utilitarian discourse where maturity represents a point of closure within which the technology has achieved optimum efficiency and offers the greatest benefit to the greatest number of potential end users. Such an interpretation, it could be argued, underlies Lynch's views about the "the strategic importance of institutional repositories" and their wider benefits over earlier subject-based archives (Lynch, 2003).

An alternative reading of the processes of technological development can be found in the theory of the social construction of technology or SCOT. SCOT shows us that the ultimate form of a technical artefact is not the result of simply selecting the 'best' solution to a particular problem. Technological problems and solutions are constructed through negotiations within and among relevant interest groups. The aim of a SCOT analysis is to unravel the identity and relative position of each constituent actor in this process of negotiation and explain the interests, alliances and exchanges that underlie the definition of such 'problems' and 'solutions'.

It is not within the scope of this brief paper to undertake a full SCOT analysis of the historical development of institutional repositories. The aim here is merely to place the difficulties the University of Lincoln has experienced in attempting to create an IR fit for use by architectural students and tutors within the context of the wider interests at play in the creation of archival software in general.

### **The Virtual Studio and the LIROLEM Project**

The Virtual Studio project was established in 2006-07 and was initially supported and funded by the University of Lincoln as a 'Teaching Fellowship' initiative. Essentially it was conceived as a web-based teaching and learning resource for students and staff that would complement the practice-based activities that take place in the physical environment of the design studio. It has two principal aims. The first of these is to encourage peer-to-peer learning amongst students by permitting them to draw upon a newly created digital archive of student design projects and written work from previous years. The second is to integrate students' learning in technology, history and theory units with their understanding of design practice.

LIROLEM, or the Lincoln Repository of On-line Learning Materials, is a separate but linked project funded by the UK's Joint Information Systems Committee (JISC) under its Repositories and Preservation Programme. JISC provided funding to support the University's efforts in developing an institution-wide repository. The Department of Architecture and the Virtual Studio were to be used as an initial test-bed for the creation of this repository, prior to its rollout across other departments.

To begin, let us examine the circumstances that led to the creation of **the** Virtual Studio. The Virtual Studio was intended to address a very practical problem related to peer-to-peer learning. Previously, there was no systematic way for students or staff at the Lincoln School of Architecture to access examples of high-quality student work from previous years. Hard copies of written theses, paper-based presentations and physical models are inherently difficult to store due to their bulk and their tendency to deteriorate over time. While individual staff did habitually maintain examples of student work for teaching purposes, and students did regularly ask to see earlier work, management of and access to these materials was necessarily ad hoc. The Virtual Studio was intended to provide a visual tool for architecture students to self-archive their work in digital formats, to comment on this material themselves as well as commenting on work deposited by other students. Such comments would complement tutors' appraisals recorded during assessments, to form unified digital case studies of student projects which could be made available to all.

Beyond the practical problems of storage, the web offers a facility to draw links between diverse materials and for the user to determine what links they themselves will make in

accessing the material. This presented an opportunity to disaggregate teaching and learning. At present, as in many schools of architecture, the teaching of architecture at Lincoln is still quite compartmentalised. Design teaching takes place in small tutorial groups in a studio environment where learning is assessed through the drawings students produce. History and theory is taught to large numbers of students in a lecture setting and has traditionally been assessed through written work, essays and dissertations. Technology is taught in a lecture setting and, while integrated in design work, is most systematically assessed in separate written assignments.

Understandably, students' learning has tended to reflect the compartmentalised nature of teaching and assessment. One rarely sees references to historical precedents or debate in the design work that is produced. Equally, the depth of investigation one sees in written technology assignments sometimes does not find a parallel in the strategies employed in the detail design of studio projects.

Ideally the design studio should closely resemble the new learning environments that are being developed under the banner of 'blended learning'. The studio project is the focus for investigations of both theoretical and technical propositions and it should naturally evolve towards an integrated design.

The Virtual Studio was conceived as a comprehensive collection of web-based digital resources – staff research papers, lecture slides and notes, links to off-site material in history, theory and technology, student design work and written work, images of physical models, video 'flythroughs' of student visualisations, video clips of key buildings and places – that would encourage students to think about scholarly enquiry as something that can happen *across* all areas of study. It was to support wider efforts in the School to establish a culture of 'designerly research' where intellectual activities that have traditionally taken place outside the studio are equally embedded in design projects.

For example, a student becoming interested in the idea of “transparency” in architecture could begin research by finding material on the subject in the Virtual Studio with resources on or links to:

- texts from the heroic age of modernism extolling a crystalline architecture
- technical details for glazing from manufacturers' catalogues
- a video clip of Philip Johnson's Glass House
- related design work of students from previous years
- websites of architectural practices known for their exploitation of transparency
- a student dissertation on the topic
- a staff research paper examining the semiotics of Norman Foster's Reichstag conversion

The student would then be able to bring back into the design studio their own analysis, blending cultural, environmental, constructional and designerly ways of thinking. They would have something to contribute to an on-line discussion group preparing an exhibition on the subject. They would also be accumulating technical details ready for the detailed design of their own building. One of the outcomes of their project could be a computer-generated fly-through demonstrating the spatial qualities of their proposal, while another might be a rigorously researched design-support document. Thus the Virtual Studio would complement the physical studio by encouraging students to de-compartmentalise their thinking and draw upon a more diverse range of resources within

the design process.

Recognition of the need for a digital repository of some form and related hardware emerged early in the project when the staff leading the Virtual Studio were confronted with the limited storage capacity available within the constraints of the University's existing IT systems. Equally, it was recognised that the University's VLE software – Blackboard and Microsoft Office Sharepoint Portal Server – could not easily support a complex self-indexing and cataloguing system for stored resources. The University's Teaching and Learning Development Office was composing an application to JISC for funding to support an institution-wide repository and a decision was made to include the aims of the Virtual Studio within the broader application. JISC responded with an offer of funding and suggested that the Virtual Studio should be an initial test bed for the creation of a more generic, university-wide repository. This was the genesis of the LIROLEM project. At the time, the general consensus amongst all staff involved was that a repository that could meet the exacting demands of architecture would invariably be capable of meeting the less demanding requirements of other departments.

A project officer was appointed and a process of consultation began. In order to identify user requirements and inform any necessary, future software development 'user stories' were gathered from architecture staff and students. EPrints 3 was finally selected as the preferred software solution because of its capabilities for storage, retrieval and display of multimedia resources, such as high resolution images and video clips, alongside textual material. To meet wider institutional and funding requirements, the Virtual Studio was now envisioned as part of a larger Open Access (OA) service allowing users to develop content on a personal, departmental and institutional basis, and to manage that content so that it could not only be easily retrieved but made available to the broader HE community. It was also to follow the aims of the wider repository movement, specifically to demonstrate the interconnectedness of the processes of research design and practical resolution and to make ideas, information and illustrations more widely accessible.

While the period of funding from JISC is now over, both the repository and Virtual Studio projects are still ongoing and some fundamental problems are yet to be resolved. In many ways, the difficulties the Lincoln team have been experiencing in attempting to combine the aims of the Virtual Studio with the wider aims of the LIROLEM project emerge out of the historical and disciplinary interests that are embedded in the present-day technologies of digital archives. As will be discussed below, these interests diverge significantly from the culture that defines the discipline of architectural design.

### **Institutional Repositories, Virtual Studios and Conflicting Disciplinary Interests**

Academic repositories have largely grown out of the scientific community wishing to make their research available to peers. One of the earliest repositories of this kind is <http://arxiv.org>, a subject-based repository initially tailored to the interests of physics researchers, but now catering to a wider scientific community including mathematicians, computer scientists and biologists. Academics in the humanities were slower to take up digital technologies. In part, this can be attributed to the lower levels of funding available to support activities in the humanities, but it is also a reflection of differing publishing regimes and research cultures. Scientists typically publish in periodicals while monographs play a more central role in the humanities (Johnson, 2004). The greater drive to disseminate in the sciences, one could argue, is also attributable to a more

firmly embedded peer review process, as scientific method is concerned with the replication or refutation of research results through repeated experiment.

Historically, scholarly communication in both the sciences and the humanities has been based upon engagement with published literature. There are still arguments continuing for and against subject-based and institutional repositories, and about the relative benefits of digital archives to researchers in the sciences and the humanities. However, it is clear that the software that has emerged to support both academic communities closely follows a text-based publishing model, a means of making digital versions of pre-print or published *texts* more widely available to peers. This trajectory of technological development does not reflect the interests of the many design disciplines existing in academia, or the interests of architectural academics and students.

As Gary Stevens points out, architecture occupies a fundamentally different place within academia than that of pure science or the humanities. Obviously, communication in the design disciplines has been based as much if not more on design practice than on the textual interpretation of designed objects, and on the dissemination of drawings and images as much as on engagement with published papers. Moreover, knowledge creation in architecture does not follow the same pathways as most other disciplines where research is a "primary mission, systematically carried out by most staff and upper-level students, and expected to filter down into teaching". Innovation and knowledge creation by architects within the professional arena external to the universities arguably holds a greater importance for students and for many staff in architecture schools (Stevens, 1998: 182).

It is only now that the text-based publishing model of IRs has reached a level of maturity that development efforts are beginning to turn to meet the expectations of more marginal groups. Most significantly for the design disciplines, mainstream developers of archival systems have recently begun to integrate capabilities for the storage, retrieval and display of multimedia resources into their software solutions. Multimedia capabilities, such as provided by EPrints 3, are vital to the creation of any design-based teaching and learning archive and without them Lincoln's Virtual Studio and LIROLEM project would not have been possible in any form.

However, notwithstanding recent explorations in multimedia, it is clear that preferences of designers remain a marginal concern for the interest groups that dominate the development of institutional repositories. The partial closure of current technical 'solutions' around dominant interests is evident in the restricted list of 'problems' most commonly identified with the shift from subject-based to institutional repositories, converging as they do around issues of content generation, rights management and long-term stewardship. This presents continuing difficulties for the architect or the designer for whom actual conflicts between competing disciplinary cultures are clearly a significant problem. Indeed, without the intervention of JISC in setting the parameters of the LIROLEM project around the requirements of architecture staff and students, it is likely that the needs of designers and all of the aims of the Virtual Studio would have been forgotten within the consensus emerging from actors with coincident interests in other departments. This dynamic is clearly evident in the negotiations that took place over the appearance and functionality of the repository's user interface.

A requirement for "visual thinking" in design represents another significant difference between architecture and the science and humanities disciplines. In order to design it is

necessary to be visually aware and this visual skill is something that students learn both within and outside the design studio by engaging with design problems and designed environments in a creative, critical and often intuitive manner (Moore, 2003: 25). Equally, this is the way staff and students will engage with any web-based user interface presented as a teaching and learning tool. Staff and student criticism of tools like Blackboard and Lincoln's "Virtual Campus", an earlier incarnation of a similar tool, have most frequently focused on both the poor usability of interfaces and their poor aesthetic quality.

Within the LIROLEM project, it quickly became clear from the 'user stories' that were generated in initial consultations with architecture staff and students that a 'designerly', dynamic user interface that encourages participation is really the key to the success of the Virtual Studio. Although the repository/archive functionality is central to requirements, rather than being the primary focus of the Studio, the actual repository should be invisible to the architect who has little interest, patience or time for the publishing workflow that EPrints requires. However, the distance between what was required in terms of a user interface and what is offered in existing software solutions based on the text-based publishing model was so great that the costs of software development would have been prohibitive. The project officer describes the choice that was made:

*So at this point, I suggested that we shift the emphasis of the project. I felt that it would be a waste of resources to chase user requirements that we had little chance of meeting within the resources of the JISC Project. So I concentrated on ensuring the long-term sustainability of the repository as we really needed a repository which would attract continued and wider Institutional support.*

The consequence is a typical institutional compromise, a repository that has been adapted to accommodate multimedia resources effectively but with an interface that is largely text based, rather than visual, and that is unattractive and cumbersome to use. It will take a student a full 17 steps to upload one piece of design work, evidently several steps too far judging by the fact that only a handful of students have so far elected to upload their work.

An issue closely related to concerns about the user interface is the need to develop a sense of "community" within the Virtual Studio to promote greater participation. Unlike researchers in other disciplines using subject-based repositories who may well identify with peers through the text based materials they collectively produce, understandably, architects tend to identify closely with communicative environments that are consciously and purposely designed for their aesthetic appeal. Thus the absence of a graphically appealing interface between the user and the repository constitutes a barrier to the creation of a vibrant web-based community.

Finally, there is the issue of metadata creation, the systems of cataloguing, indexing and searching that students will use to identify and retrieve material from the archive/Virtual Studio. Traditional repositories are generally quite rigid in the way that they demand adherence to a consistent and coherent set of standards for metadata. This rigidity reflects the rational and objective processes of knowledge creation upon which research in the sciences rests. As previously discussed, designerly enquiry in architecture is

intuitive and subjective, as well as rational and objective. Anthony Antoniadis describes the process thus, "Fantasy is the catalyst of imagination, while imagination is the filter through which fantasy must pass in order to become an ingredient of reality" (1990: 11). The process behind the creation of an architectural design might easily be driven by common links originally drawn between a piece of poetry, an image of a texture and a philosophical argument. In this context conventional cataloguing systems break down.

Being aware of the multidimensional nature of the creative process, the Virtual Studio was originally envisaged as a fluid environment where students could describe and link resources incrementally, effectively creating their own indexing system by commenting on their work and the work of others and by tagging resources. The funding received from JISC was what ultimately allowed the Virtual studio to progress, but this also placed an onus upon project participants to create an archive that could achieve some level of interoperability. LIROLEM was designed to comply with the Open Archives Initiative (OAI) protocol for metadata harvesting and use of recognised metadata standards. However, the team did decide to use some project funding to develop EPrints capacity for user-tagging, creating a fluid indexing system that could work alongside the more rigid standards. This tagging facility has yet to be tested with a significant body of users.

## Conclusion

When confronted by the reality of dominant interests embedded in existing technologies, the shortest route and sometimes the only route to a project conclusion is to fall in line with those interests. On one level, the aims of the Virtual Studio were far too ambitious to sit easily within the budget and time constraints of the JISC-funded LIROLEM project. On another level, the difficulties the Architecture Department experienced in attempting to negotiate its interests within the context of a programme to develop an institution-wide repository, merely **served** to highlight the marginal status of the design disciplines in debates about this technology in general. As the theorists behind SCOT tell us, scenarios taking place in a micro-situation often reflect the interests at play amongst actors operating at a much wider scale.

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