Preparing for action: responding to requirements from practice

Vicky Mitossi & Alexander Koutamanis

The proliferation of computing in architectural practice is turning CAAD knowledge into an essential qualification for a graduate. Inevitably there are different perceptions of how this knowledge should be obtained and what it must entail. Despite these differences it appears that there is general agreement on a combination of components ranging from computer literacy to theoretical knowledge. The transition from academic education to practice means that the graduate has to re-evaluate and re-arrange these components with respect to two main criteria: relevance to practice and their potential for reforming practice.

1. The background: teaching, research and development

The relationship between academic education and practice has always been ambiguous and frequently strained as a result of differences in approach. Accusations from practice that university education is often detached from reality and dismissal of practice by academics for being prosaic and too conservative are usual phenomena which do not surprise any audience. Even in areas such as architecture where an academic degree amounts to a professional diploma (or is the essential prerequisite thereto) questions are regularly voiced as to whether graduates possess adequate knowledge and experience for direct integration in the design and management of the built environment.

In the present paper we discuss a number of basic observations made in the framework of our activities in academic teaching and research, and in consultancy and development for design practice. These activities are closely intertwined. The relative youth of computerization in architecture offers many possibilities for developing academic research products into customized applications for practice. Reversely the problems we encounter in practice often grow into significant questions for research from where they may re-emerge as possible practical applications.

The advantage of linking academia to practice is that, being confronted with the same issues in related yet different contexts, one becomes aware of the assumptions underlying each context and of the consequences of these assumptions for relationships with other contexts. Experiencing academic life and its projected picture of the architect’s work, as well as architectural practice and its conception of what professional training should be about, is particularly useful for identifying the scope of approaches and ideas currently dominant in each context. Moreover, it often presents the opportunity to encounter and work with the same people in both contexts, usually first as students or researchers and then in practice. The transition of such people from academic life to practice forms the main subject of this paper.

Our observations primarily relate to computerization, the core of our activities. We are convinced though that they are symptomatic of the wider state of building design. Perhaps the

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1 Faculty of Architecture, Delft University of Technology, The Netherlands
only difference is that the rapid pace of technological evolution and proliferation makes certain phenomena more pronounced in computerization than in other, traditional areas. Our account is primarily empirical and anecdotal. This is because it is drawn from personal experience but also because we are more interested in the nature and causes of the phenomena that concern us than in their extent and magnitude which would have been better served by statistical analyses and reviews.

2. Assumptions, projections and requirements

Current models of architectural education aspire to a mixture of academic education and professional training. Universities and practice appear to agree that students should receive a wide encyclopaedic and scientific knowledge of related areas, exposure to the practical aspects of designing, as well as some experience in actually solving design problems. Within the still dominant apprenticeship model the combination of studio, lectures and exercises purports to offer precisely these. The variability in the relative proportions of each component in the teaching curriculum — despite attempts at normalization by European and national legislation — usually determines the particular profile of each school of architecture.

Computer-aided design teaching generally follows the above pattern. The steadily increasing acceptance and support of the computer in studio teaching has added the width of design problems and aspects usually lacking in the compacter CAAD courses and exercises. In architectural and design theory we are witnessing a convergence of computational and traditional approaches which also supports the integration of computing in design education. As a result, a CAAD curriculum usually consists of the following components (Figure 1):

- **Familiarization with the computer (basic computer literacy):** This is a prerequisite to and not an integral part of CAAD teaching. It is currently necessary because large numbers of university students do not have prior practical experience in computing. It is safe to assume that this component will disappear in a number of years, as home computer ownership grows and computers enter even elementary schools.

- **Drafting and modelling with the computer:** Learning how to employ the computer for the production of visual design representations is commonly seen as the core of CAAD teaching. Other types of representation and processing of information on a design also occur in academic curricula but less extensively than they deserve and not always connected to the visual design representations.

- **Advanced technologies:** Many worthwhile computer technologies have yet to find their way into practice. The main reasons are cost, reliability, availability and relevance. CAAD teaching often pays attention to such technologies, normally in the framework of advanced courses, in the expectation that they will become part of the standard office instrumentation of the future. The first glimpses of such developments can be observed in and around the Internet.

- **History and theory of computational design:** Acquaintance with the development and the underlying principles of current techniques and approaches used to represent a major part of CAAD teaching. It took the form of lectures and small exercises, the former being part of the basic CAAD courses and the latter of the advanced courses. In recent years there seems to be less time for such matters, probably due to the rapid proliferation of new technologies which steer attention to the future rather than the past.
While the merit of each of the above components is not a subject of debate, there is no agreement concerning the relative value of each and consequently its representation in the CAAD curriculum. Obviously practical training, i.e. learning how to use the computer in general and especially in designing is deemed to be essential by all. Nevertheless, while such training is the main requirement of practice, academics are often of the opinion that currently available systems are ultimately inappropriate for architectural design and treat them as some kind of necessary evil: students should learn how to use them but merely as a basic skill, just like word processing or drafting by hand and model building.

Academics usually favour a comprehensive CAAD education, well-founded in scientific principles. This is evident in their preference for methodical and theoretical aspects and their treatment of practical experience as an illustration of these aspects. Underlying this approach is the realization that current CAAD systems are lagging behind not only the evolution of intrinsic requirements for architectural design but also the development of computerization in other disciplines. It is therefore perfectly reasonable to prepare the students for the future by exposing them to the background and methodology of computerization in architecture rather than insisting on virtuosity in the use of currently available systems. The disproportionate representation of new, often still experimental technologies in CAAD curricula follows the same rationale.

Practice views CAAD methods and principles in a different manner. Their value and potential are linked to applied issues, such as the efficient and effective utilization of current systems. For example, while few are satisfied with layer structures in drafting systems, many in practice suppose that the appropriate layer strategy can guarantee good results. Alternative approaches for the modularization and management of information and processes, e.g. those involving objects, are usually not taken into consideration, probably because they are almost
Preparing for action: responding to requirements from practice

totally unknown in practice. The academics’ expectation is that new graduates will enlighten practice on the existence and the potential of such approaches. However, the information they can normally convey — being based on a couple of lectures or small experimental exercises — is often sketchy and incomplete, and is hence mistrusted. We may therefore conclude that practice is interested in theory and methodology primarily as a source of improved strategies or as explanations of how available systems work — certainly not as stimulation for experimenting with new tools and approaches and even less for developing these.

The standpoint of practice is that graduates should be adequately versed in the use of the computer for all aspects of designing. This also includes knowledge of the theoretical background but places emphasis on hands-on experience with the available and usable computer systems. While some may stress the importance of expertise in the systems currently in use, the majority is less interested in specific programs. They would obviously welcome graduates trained in the particular systems they use but they are well aware of the transient nature of these systems. Therefore they prefer designers with a deeper and wider knowledge of categories of computer technologies, irrespective of the precise software and hardware they happened to use in their education, and are normally willing to invest in training the graduates to use their own configurations. This agrees with the general tolerance of lack of experience and practical knowledge in graduates. Practice understands that even if a graduate may possess a professional diploma, a five year university education is too short to include practical experience. Most offices require that the graduate is in the position to comprehend how practice works during a short training period in the office, when she comes to grips with their conventions and routines. This training also serves as a selection process where architectural knowledge and adaptability are the main criteria. For the most enlightened offices practical training of the new designers may also serve as an evaluation of the office by fresh minds who could propose improvements and additions on the basis of new ideas from academia.

It is noteworthy that practice often shows indifference or neglect towards new technologies. The computer forms a notable exception to this attitude, even though practice is more interested in drawing, modelling and calculating rather than the theory of computational design. The result is unwillingness to invest in fundamental research either within or outside universities. Nevertheless, the wide acceptance of the practical advantages of CAAD can be seen as a first step in the right direction. Academic research has to prove its value and cultivate investment on the basis of products which prove the validity and utility of its approach and methodology.

3. The ideal computing architect

We could view the differences in approach between practising architects and academic teachers and researchers as the stimulating basis for further development and improvement they undoubtedly are. However, this view is usually not shared by graduates, i.e. the products of academic education who are confronted with the realities of practice. In their case the differences can only be confusing and this at a critical stage of their career. The confusion is further accentuated by the wide and serious proliferation of CAAD in practice which allows graduates with computing knowledge and experience to find employment much faster and easier.

The main initial appeal of such graduates to prospective employers lies in their drafting and modelling skills. Design documentation and presentation is increasingly becoming electronic. The compactness and transformability of digital drawings is leading to the substitution of the
drafting board with the computer. Computer visualization, from rendered still images to interactive walkthroughs, is also becoming commonplace and new forms of communication are becoming popular through developments such as the Internet. Equally important for some specialized offices are skills in other forms of information processing, e.g. for project and facility management, especially if they can be linked to the visual electronic documentation. The placement of the graduate at the lower echelons of the office means that she is normally expected to devote most of her working time making drawings, models and calculations on the computer, i.e. work at the level of a draftsman. Graduates often see this as part of the training they require in order to be integrated in practice. And when it inevitably extends beyond the training stage, they may even accept it as a logical consequence of computerization, namely that thanks to the efficiency of the computer the designer can almost dispense with the services of draftsmen and other supporting staff.

With respect to computing, graduates of the middle and late nineties have several advantages over older architects. The majority of the latter started working with CAAD in practice and have acquired their knowledge and skills under the pressure of project deadlines and costs in time and material. The graduates, on the other hand, have had a more thorough grounding in practical and theoretical aspects of computing, as well as the opportunity to experiment with the integration of computer technology in design projects. As a result, they are often entrusted with more crucial tasks than drafting and modelling, such as testing and choosing new systems, coordination of computing activities and sometimes even developing new instruments ranging from databases of components to writing programs which facilitate or automate specific procedures.

The ability to propose new structures in an office is a significant opportunity for a young computing designer. However, there are several stumbling blocks which deserve particular attention. The first is the graduate’s limited knowledge and experience of how architecture works in practice. This may lead to naive, simplistic solutions which collapse early on, thereby discouraging further development. Another problem relates to the lack of knowledge of the history and theory of CAAD. Quite often what fascinates practice is intriguing ideas that have been attacked and ultimately dismissed in CAAD research (Maver 1995). The graduate’s understanding of these is often sketchy and cannot provide persuasive arguments for abandoning these ideas or for adopting better alternatives. Moreover, the graduate’s objections at the initial stage coupled to a product that does not perform as expected may appear as a negative, unproductive and uncooperative attitude on her part. Finally, another obstacle is that academic education can be detached from the real-life problems of architecture. From her studies the graduate may possess an incomplete understanding of the relevance of computational methods, techniques and instruments for a particular problem.

Concluding this sketch of a graduate’s experiences with computing in practice, we should stress that the additional opportunities offered by CAAD may lead to increased frustration. The initial ease in finding employment in a saturated profession is frequently followed either by stagnation at the level of a draftsman or by added responsibilities of a tenacity that may not agree with her knowledge and experience. It is difficult to predict what the long term consequences can be. The prediction is made more complex because of the influx of young designers with similar and probably improved knowledge of computing. One thing that is already clear is there should be a distinction between two profiles: the designer who is capable of employing the computer as the main instrument of her professional activities and the computing architect who is capable of small-scale development and management of design computing. The conventional CAAD education is probably not adequate for the latter. Practical experience and a more profound understanding of computational design theories are
essential prerequisites for graduates of this profile. (Applied) CAAD research is probably where they can be acquired.

4. The changing world of computing and architecture

In our study of correspondences between CAAD education and the application of knowledge and experience acquired in it to design problems in practice we discern two different sets of requirements for education. One set concerns practical skills and acquaintance with commercially available systems. The other addresses the utility of such systems by connecting the structure and methodology of architectural design to the techniques of computer systems. In practice we encounter the same requirements, namely that the graduate should be able to relate the possibilities and limitations of CAAD systems to the design problems in hand. It is also expected that the graduate has a thorough understanding of how each category of software works. Familiarity with specific programs is obviously desirable but less important than other forms of knowledge and experience.

Given this basic agreement between academia and practice, it is surprising than many graduates who have followed some form of CAAD education are often frustrated when it comes to the use of computers for tasks that go beyond simple drafting and modelling. Supposing that the fault lies exclusively with CAAD education, one may argue that there are two possible and alternative causes. The first is that the lofty theorizing of CAAD courses cannot be directly matched to the meticulous design problems of practice. The second is that CAAD courses are too practical (i.e. geared to specific systems) to offer sufficient knowledge of CAAD methodology. Either cause suggests that a suitable short-term solution is to temper CAAD education with realistically complex problems from practice. Such problems present suitable, understandable test cases for CAAD methods and techniques which prepare the student for the real-life applications of computing to design. Equally important is the function of such test cases in elevating computerization in practice to the level where CAAD offers more than the apparent possibilities of commercially available drafting and modelling systems.

The long-term question that arises is what will be the role of not so much the computer but of the computing architect in practice. Current patterns of employment among graduates with a CAAD background suggest that we are returning to the old model of a specialized designer who does most of the computing while the other architects contribute mostly raw data (i.e. basic drawings in the computer). This contrasts with the widely held belief that each designer should and can work self-sufficiently with the computer. However, the phenomenon becomes understandable if we consider the effects of new technologies. For example, a multimedia presentation of a design over the Internet still requires special knowledge and skills not common among computing architects who can nevertheless supply the images, models and other data for the presentation.

Even though each single new technology is readily absorbed by designers with an appropriate background, we may safely assume that the influx of new technologies will require architects who specialize in their development and integration in the standard design instrumentation – as opposed to the majority of ”general practitioners” of architecture who merely apply specific computer technologies to specific design problems. The role of such specialists can be quite distinct from that of academic research, as it concerns exclusively applied issues and not fundamental aspects of theory and methodology.
Preparing for action: responding to requirements from practice

The education and training of CAAD specialists cannot be restricted to the usual five year study period of an architect. The additional requirements of specialization suggest prolongation of the study with a combination of theoretical and practical activities essentially similar to the education and training of medical specialists. For the academia this means that awareness of practice should become an important element in the definition of fundamental research projects. Such awareness can lead to increased relevance and to concrete results (e.g. prototypical systems) which can be transferred to practice through applied research and development and with the participation of prospective CAAD specialists. If these projects achieve adequate results, we could motivate the building industry to invest in academic research. The importance of such investment is not only financial: it is an explicit commitment to the deployment of new technologies in practice.

The evolution of computing architects into true CAAD specialists can also have consequences for existing approaches to informing practice on CAAD developments. On the one hand, it becomes less urgent to train large numbers of architects already in practice. On the other hand, it is imperative that every architect should be aware of the added value of a CAAD specialist and acquainted with the potential of the technologies she represents. This means that we should shift our emphasis from propagating availability to proposing concrete ways of improving design performance, i.e. from training practice in the use of CAAD to educating practice in the history, methods and techniques of CAAD. In this respect we should not fail to recognize the opportunities offered by e.g. the Internet as an informal and informative communication between the academia and practice (Koutamanis 1995; Mitchell 1995).

5. References


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