Union Internationale des Architectes • International Union of Architects

Professional Practice Information Notes

Note 1: Computer Practice

This document has been prepared by the Professional Practice Commission of the International Union of Architects for the use and reference of UIA member sections in enhancing the practice of architecture.

It is intended to serve as an informational supplement to the policy issue, "Practice of Architecture", found in the UIA Accord on Recommended International Standards of Professionalism in Architectural Practice.

This Professional Practice Information Note was prepared by Simeon Peerutin – chair of the Practice Committee of the South African Institute of Architects.

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Preamble

This is the second iteration of this Practice Note, the first having been written in 2004. Reading through the first version one is struck by the extent of the changes that have occurred in this one aspect of Architecture over the past 13 years and because of that, and what we know about the pace of change in this technological age, it is important that the text that follows is written is such a way as to remain relevant for the longest time possible.

Another significant issue is the uneven access to technology in Architecture due to the high cost of various components, from hardware and software to the cost of data. Beyond cost there are still many places where little is available. This Practice Note does not attempt to address this issue at this stage but would welcome input from regions where solutions are being found to allow the benefits of the latest technology to be felt by all.

When reading the text below it is also important to bear in mind that all of this technology is used by people. These people are no longer a relatively homogeneous group. The older Architects who grew up using a drawing board are, in the main, not able to use the main CAD software which is so familiar to new graduates. Even the new graduates cannot hope to master the full range of tasks the various software packages offer. Technology purchases (and now increasingly, subscriptions) in a Practice is a significant expense, and decisions on expenditure are often taken by people who do not own the business or who do own the business but do not fully understand the technology. This will change over the course of the next few decades but meanwhile more support and information is probably needed for older practitioners, whether they realize it or not.

A final introductory remark. Notwithstanding the pervasiveness of computers in every aspect of Architecture now, it is clear that this technology and the use thereof is still in its infancy. As will become clear reading the text below, there are multiple platforms, multiple standards, differing legislation, and quite a few unresolved issues. Given the competing multinationals, and the current mood favoring nationalism over globalization can we see a way to maturity and common standards?

The following measures are recommended to be taken by UIA Member Sections:
1) To increase the education of members in new technologies and applications.
2) To intensify the relationships with commercial software producers in terms of long-term planning for products, technical up-dates and group contracts that benefit members.
3) To define the role of professional bodies in evaluating available software programs.
4) To further development of domestic and international standards.
5) To support the opportunity for the UIA to become engaged with the major international computer organizations.
6) To inform their members regularly about the developments in computer technology, especially in relation to collaboration, data protection and electronic signatures/verification.

I. Hardware

From massive immovable boxes and monochrome text screens to fully portable computing in 40 years. Today's smartphones have more computing power and storage capacity than the first usable CAD workstations. Most Architects in the developed world probably have 3 devices – desktop pc, laptop and smartphone. Quite a few no doubt add a tablet to that. This proliferation of platforms will be increasingly reliant upon data access across all the platforms and much development in software seems to be focusing on this cross-platform use. At present, due to hardware limitations of mobile

platforms, software has to be scaled down to work effectively. This will change but whether it will ever catch up will depend on future software development.

Probably one of the biggest issues facing practitioners is the ever-increasing need for computer power, resulting in an ever-increasing investment in the technology. Hardware failure is still a concern resulting in the requirement for protocols to ensure redundancy and backups are an integral part of any system. Having said that, the growth of cloud computing and the increase in data transfer speeds is resulting in less reliance on desktop power.

II. Software

Most Architects are now reliant on a plethora of software programs to practice their craft
Admin: Word Processing, Email, Spreadsheet
CAD: 2D drafting, 3D modeling, BIM
Presentation: Slideshow, Image Editing, Layout
Collaboration: Cloud and server based data sharing programs, and Document Management

Cloud based computing and subscription models for purchasing software lowers the initial expenditure but replaces it with and ongoing commitment. It remains to be seen whether this is a good thing in the long term but it does have the immediate effect of lowering the entry level cost and providing software companies worth an ongoing source of income with which to continuously improve their product.

In core areas, software giants dominate the market. Competition from open-source software and other vendors has forced some of the major players into continuous improvement but as this is written one cannot say the same for others who hold somewhat of a monopoly in various critical areas. Major companies that dominate the CAD market for example sometimes leave their customers bewildered by their suite of products and their continued bundling of various packages together makes the subscription unnecessarily expensive. It is almost certain that in countries where regulation is not properly policed, pirate or cracked versions are commonplace if not prevalent resulting in unfair competition with the more law-abiding practitioners.

One interesting development is the growth of relatively low cost apps for tablets, which while not replacing any of the major packages yet, have made some inroads into the dominance. It remains to be seen what place these apps will hold within the range of software options.

What skills will new Architects be required to learn at University? Is it reasonable to expect a graduate to come equipped with a reasonable level of skill across all software types?

III. Processes

1. 2D CAD

Given the cost and the learning curve associate with integrated BIM/3D modeling there is still a place for what is effectively an electronic drawing board, albeit a very powerful one. In this environment, information is most often transferred via email in the form of drawing files. These are then referenced into the files of the professional involved in the project.

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2. 3D Modelling

This process follows two different paths but it seems they are starting to converge. The first is simple modeling via another program like Sketch Up, probably the best known of the modeling packages. The second is intelligent modeling within an integrated program. This latter process is the precursor to full Building Information Modeling (BIM), described more fully below. Both paths can lead further to full photo realistic images, fly-through and virtual reality experiences, all done with yet another software package.

3. BIM (Building Information Modeling)

BIM is an integrated digital process providing coordinated reliable information about a project through all phases, from design through construction and into operation. It promises that through systematic adoption buildings will be procured faster, more economically and with less environmental impact.

Simply put BIM starts with building a 3D model of a building but this time with intelligent components which comprise both graphical and non-graphical information which can then be utilized in several ways:
- The model can be shared, resulting in a truly collaborative process albeit one still led by Architects
- Schedules can be extracted.
- Specifications can be extracted
- The number and extent of components can be measured and compiled into a cost plan or bill of quantities
- The performance of a building can be analyzed – structure, energy, water, life-cycle, etc.
- Clashes between components can be detected.
- Maintenance schedules can be extracted and alerts can be programmed. The model as the tool for managing building maintenance and cost in use. (Operational BIM)
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All of the above examples assume the components have been built with the necessary information embedded. This is most often not the case and only a fraction of the power of BIM is presently being utilized in most projects.

One problem not discussed enough at present is the difficulty in estimating how long building the model takes. Previously the focus was on 2D output and reasonably accurate guidelines were developed. Now the output is the least time consuming part of the process and the time is more influenced by the number and type of complex geometries needed and how many new components need to be sourced or built. Fee calculations are now much harder to calculate accurately and harder to compare like for like. Much more research and guidance is needed in this area.

Another problematic area in relation to the 3D model is the accuracy of the information modeled. At present, there does not appear to be a tried and tested methodology for checking the integrity of the model which is not time-consuming and difficult to record.

There is a question as to whether Architects will be able to obtain significantly better fees when able to fully load a model with intelligent components, or will most of the information continue to come from suppliers of the materials via third party vendors as is currently the case. Then the real skill will

be in manipulating the data and extracting it is usable forms. Are Architects going to surrender this area to other consultants or acquire the necessary skills?

One contested area that needs urgent and careful consideration is the question of what standards to adopt in the building and sharing of the model. There is a growing recognition among professionals of the desirability of adopting open standards and an inclusive format that does not exclude anyone form competing because of the software that they use. IFC is the only open and inclusive format available to the international market and software developers need encouragement and persuasion to integrate this functionality completely and seamlessly into the offerings.

All paths probably lead to BIM but as at the present day, the paths are numerous and uneven. BIM standards in the most developed countries are often very complex and the variances can be significant. BIM standards across most of the rest of the world is either non-existent or in its infancy. BIM adoption is equally patchy. This is not because of the availability of the technology but because of the variety and complexity of standards and the required change in attitude, knowledge and skill of the Architects who will need to lead this process.

Design Professionals need to understand more fully that their roles need to transform to include things like:
- Defining BIM expertise levels
- Familiarity and use of Level of Development (LOD) standards
- Perceived Return on Investment in BIM
- Reasons for implementing or not implementing BIM
- Factors delaying the decisions to move to BIM
- Factors encouraging BIM adoption

At the same time the importance of developing a BIM strategy (BIM Execution Plan and Employers Information Requirements) on a project by project basis cannot be overstated.

The UIA has an opportunity to engage with the major software vendors, BIM Institutes and Architectural Associations around the world in an attempt to harmonize simplify and promote a common standard. This is unquestionably the issue around which Architects can regain some of the ground lost to other construction professionals and it should not be left to others to define the terms of this engagement.

4. Procurement

From the procurement of professional services through the procurement of construction tenders to the procurement of trade-or sub-contract packages, the electronic distribution of information is now almost universally adopted wherever there is a robust enough data network. Two aspects require specific attention. The first is the maintenance of anonymity with submissions for competitions. (How is this done?). The second is the maintenance of transparency when opening and evaluating tenders. (How is this done?).

5. Communication

There is no doubt that electronic communication is fast and effective. For some time, email was the only electronic medium but now the plethora of media results in problems of organization. How is

the data organized and maintained when a SMS or other instant message format can be an acceptable means of communication, often with an image attached? While no doubt many projects have clear protocols, this is by no means universal. Should there be one or a few acceptable protocols or is it incumbent upon every project team to define the protocols? Communication is one side of the coin; the other is data transfer, more fully described below.

6. Document Management

Soon after the beginning of drawings/data transfer via email the need for an independent platform for data exchange and record keeping was identified. These platforms, now web/cloud based, are well developed but not as widely used as they should be. One of the obstacles is cost; the other is ease of use, and a third is the development of an alternative to document sharing, namely a Common Data Environment. How this is to be managed is not entirely clear where the model, accessible to all parties including the Contractor, is updated incrementally and continuously, and by different parties.

7. The Virtual Office

With the increase in data transfer speeds, shared servers and cheap reliable video conferencing the age of the virtual office – architects working in different locations in real time on a shared model is upon us.

Currently this mostly manifests itself in Outsourcing, where a portion of the work is done in a location remote from the project and/or the Architect's office, it is puzzling that more practices in the first world have not taken advantage of the possibilities inherent in forming a team or practice comprising highly skilled experts in market sectors in the country where the work/project is sought with skilled general operators in a country with a lower cost base.

8. Standardization

The International Standards Organization publishes various standards related to IT security, CAD, BIM, use of the internet and other related issues. Members are encouraged to follow the developments of these standards by regularly visiting the ISO website at https://www.iso.org/home.html

IV. Legal and other Issues

1. E- Commerce - General Information to be Provided

It is recommended that UIA Member Sections ensure that service providers should render easily, directly and permanently accessible to the recipients of the service and competent authorities, at least the following information[1]:
- The name of the service provider;
- The geographic address at which the service provider is established;
- The details of the service provider, including his electronic mail address, which allow him to be contacted rapidly and communicated with in a direct and effective manner;
- Where the service provider is registered in a trade or similar public register, the trade register in which the service provider is entered and his registration number, or equivalent

means of identification in that register;
- Where the activity is subject to an authorization scheme, the particulars of the relevant supervisory authority;
- Any professional body or similar institution with which the service provider is registered:
- The professional title and the Member State where it has been granted;
- A reference to the applicable professional rules in the Member State of establishment and the means to access; and
- Where the service provider undertakes an activity that is subject to the Value-Added Tax (VAT), the relevant identification number.

In addition to other information requirements established in the relevant jurisdiction of a UIA Member Section, it must at least be ensured that, where information society services refer to prices, these are to be indicated clearly and unambiguously and, in particular, must indicate whether they are inclusive of tax.

2. International Contract Law

As more fully discussed below, there is no clearer indication of the maturity (or lack thereof) of this technology than in the legal frameworks and precedents governing the exchange of information.

Verifying authenticity is the first key area of potential contention. Not only the author and the recipients but also the contents of any electronic document. It seems most Practitioners just trust that if a problem is ever encountered it is surmountable. Is this acceptable or should there be tighter controls?

The second critical area is authorship and responsibility in the age of BIM, where a building model is truly collaborative and origination blurs. Will a collective responsibility emerge?

Per international contract law the parties to the contract themselves can determine the law to be applied. This must be done expressly and should always be included in the contract in writing. In case the law to be applied has not been determined, the contract is subject to the law of the State which it is most closely connected to. According to legal assumptions, a contract has the closest connection with that State in which the contracting party, who shall render the characteristic services, is normally based at the time of signing the contract. The characteristic service of an architectural contract is the planning service so that the residence of the architect is principally decisive. However, in the case of drawing offices being commissioned by an architect in a foreign nation, the legal situation is different. In this case, the characteristic service is the drawing of plans which means that in the absence of a legal choice, the law of the respective foreign State will have to be applied.

It is recommended that UIA Member Sections inform their members about the implications of international contract law as regard to electronic commerce.

V. Data

As mentioned in various paragraphs above, the explosion of data as well as the various forms data is created, combined, transformed and transmitted presents serious technical, management and legal challenges.

Authorship and authenticity have already been mentioned in relation to the BIM model but it applies equally to all data. If technical/supplier websites are continuously updated whose responsibility will it be if outdated information is used?

File size is problematic in countries with slow networks or high data costs. This is limiting full collaboration on a 3d model in real time.

File formats can also present challenges and so in order to safeguard against even greater monopolistic practices it is essential that open file formats be adopted. In this regard, and in relation to various CAD/BIM/modeling packages, IFC format is particularly important.

Data security, storage and back-up are mission critical areas of a business but, anecdotally, all except the larger practices (with IT staff) do not pay enough attention to this matter. Vulnerability to theft, alteration, virus, malware, cookies and ransomware needs to be considered and the development of best practice guidelines would be most useful.

VI. The Internet and the Cloud

Cloud computing means storing and accessing data and programs over the Internet instead of your computer's hard drive. Provides the ability to collaborate with others to keep the projects, files, and team up to date whether you are at the office or in the field.

There are increasing number of web-based and cloud based programs and apps that require network or Wi-Fi access. This allows a high degree of mobility and inter-platform synchronization. The proliferation of these programs is to be welcomed as healthy competition and web access is highly desirable. However, as with most issues relating to the Internet the sheer volume of options presents its own problems.

VII. Advertising

The importance of representing architectural offices on the Internet and social media will continue to increase. Yet, due to different advertising regulations in force, widespread uncertainty prevails with regard to the legal admissibility of such appearances. Using the Internet and social media for advertising purposes cannot be prohibited as such. Instrumental will be the content and the form of the advertising notice. On the one hand, the advertising architectural office must observe the laws governing unfair competition, which demands correct advertisements; on the other hand, advertisements must not contain any self-evident facts or unlawful circumstances. On top of this, freelance advertising principles need partly be observed according to which information advertising is admissible provided it is neither importunate nor unfair.

The architect continues to advertise for himself by means of his/her performances, i.e. advertising notices must refer to certain services. The publicity-like boasting does not comply with the professional principles in most Nations - and this applies to Internet advertising just as well. The principles of the UIA Accord Guidelines on Ethics and Conduct should be respected appropriately.

The Future

While the recent past clearly tells us that whatever we think is going to happen in the future is likely to be wrong or at least only partially correct we can see some trends for the next decade:

The steady adoption of BIM Protocols and all that it entails: Collaborative working on a single building model which is accessible to and used by the Contractor and sub-contractors is surely the way of the future but there is still a long path to relatively simple, unified internationally accepted standards and processes a full understanding of the legal ramifications of this collaboration.

The growth of 3D Printing: At present devices are expensive and the results are uneven but it seems clear that their use will grow from model making to building components and finally to whole buildings.

The growth of Virtual Reality: Virtual Reality headsets are now widely available but the output is both expensive to produce and variable in quality. However, with the continued increase in computing power and further software and skills development it is likely that still photo-realistic images and fly-through will steadily be replaced by full immersive environments. Alongside that is the development of Alternative Reality (correct term?) where, with the use of a HUD (Heads Up Display) virtual 'components will be superimposed on a real view. Beyond that, will Architects one day be able to design from within a 3D world?

The changing definition of the Work-stages of a Project: While at present it seems the current work-stages which are similar across the countries is still being used but the time is fast approaching where the logic of the collaborative model building process blurs the boundaries such that a new set of definitions will be needed soon.

The changing curriculum of Architectural Education: Because of the continued evolution of the technologies with which Architects conduct their business and the different skill sets now in demand, the course content is already evolving but will surely have to change more fundamentally. This will no doubt need a sea change in the mindset of the educators as presently analog processes, such as drawing and model-making, are still part of core competencies.