VIRTUAL SPACE

虚拟空间 3

图软大奖作品选

GRAPHISOFT PRIZE, International CAD Competition

中国计划出版社

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The Graphisoft Prize: Development of the Virtual Building

“人类用距地面5英尺6英寸的眼睛来观看建筑物。人们只能用眼睛看得见的目标来衡量，用由建筑元素证明的意图来衡量。”

-柯布西耶著《走向新建筑（Vers Une Architecture）》，1923年

Graphisoft公司每年举办的Graphisoft Prize设计竞赛吸引了世界各地的学生。他们面对挑战，探索着建筑设计和教育领域中虚拟建筑（Virtual Building）的概念。我们将ArchiCAD用作一个设计工具，同时将“虚拟现实（VR）”技术用作一个视觉化工具，我们感兴趣的是演绎那些从未实际建成的或者已经从现实景观中消失了很久的作品，因为它们依然真实地存在于我们今天的文化之中。竞赛面向世界各地的建筑学或相关专业的学生。我们一直对过去三年来广泛多样的参赛作品颇为满意。作为第一个面向三维物体的建筑CAD软件“ArchiCAD(r)”的开发者，我们对电脑技术怀有极大兴趣，因为它不仅是工作自动化的手段，同时还是创造新作品和新工作方法的途径。完备综合的3D CAD技术使得建筑专业的学生和专家有机会使用桌面计算机进行设计，其细致度、精确度和复杂度都是原来难以想象的。桌面虚拟现实（Desktop VR）使他们能够互相间就其设计方案进行交流，与公众进行沟通，而这种一目了然的方式也许只有实际的建成结果才能一比。

强有力的电脑3D模型和VR视觉化效果将超越常规的建筑领域，在电脑空间中创造“虚拟的”圣殿，使得构想那些仅存在于电脑中的建筑成为可能。此类建筑也许要受制于数字环境中一些新的规则，但是却再也不会受到基地、太阳、重力之类现实因素的制约。

这一激动人心的前景促使Graphisoft公司要推动建筑设计及CAD技术的向前发展。我们希望学生们使用ArchiCAD及VR进行设计，将我们带到他们的虚拟建筑中去。但是成功的建筑必须要有某种界定。我们试图开发出一种设计程序，它既要求严格的建筑学理论，又能鼓励产生一些非传统的、富于刺激性的设计结果。

我们从历史和文化中选择了一些有普遍意义的参照物，请参赛学生在电脑上的“虚拟现实”中将这些存在于我们文化的“虚拟现实”中的参照物创造出来。

这些参照物均来自历史、音乐、大众文化和文学。每年我们都会从数十项建议内容中筛选出一些尽可能刺激有趣、富有思想性和文化多样性的项目。

参赛者提交的作品皆为3D ArchiCAD模型、VR

"Man looks at the creation of architecture with his eyes, which are 5'-6" from the ground. One can only deal with aims that the eye can appreciate, and intentions that take into account architectural elements" - From "Vers Une Architecture" by Le Corbusier (1923).

Through the annual GRAPHISOFT PRIZE, Graphisoft challenges students from around the world to explore the concept of Virtual Building in architectural design and education. Using ArchiCAD as a design tool and "virtual reality" (or VR) as a visualization tool, we are interested in the interpretation of works that have never existed physically or are long missing from the physical landscape, but are nevertheless real in present day culture. The competition is open to students of architecture and relateddisciplines around the world, and we have been gratified by the international diversity of entries over the past three years. As the developers of ArchiCAD???(R) - the first 3D object-oriented architectural CAD software - we are interested in computer technology not just as a means to automate work, but as a way to invent new work and new working methods. Integrated 3D CAD offers architecture students and professionals the opportunity to use desktop computers to design at a level of detail, accuracy and sophistication that was previously unthinkable. Desktop VR allows them to communicate their designs to each other and to the public in a compelling fashion surpassed only by actual construction.

Beyond the realm of professional practice, powerful 3D modeling and VR visualization offer the chance to speculate on architecture that might exist only on the computer, providing "virtual" sanctuary in cyberspace. Such architecture might be bound by new rules of the digital environment, but is free of earthly constraints such as site, sun and gravity.

场景及电脑生成的效果图。传统的图纸只不过是用以辅助评审团理解设计意图而已。和任何设计比赛一样，参赛作品千奇百怪，有的偏于极端，不过仅三年时间里参赛作品就在质量和复杂性方面有了如此进步，我们甚感惊讶。

评审团也完全依赖于电脑对参赛作品进行评判，这也产生了一些有趣而出乎预料的结果。例如，参赛作品不像以往那样布满在房间里，而是通过电脑一幅接一幅投射到墙壁上，这样就迫使评审团以一种线形进程来评判作品，更加依赖于他们的记忆和印象，而无法在作品之间进行直接的比较。对于评委来说，通过虚拟媒体评判虚拟建筑的好坏无疑是一个充满挑战和令人愉快的过程。

三年大奖赛中产生了数百件的虚拟作品，我们希望 Graphisoft 此举能够为建筑界作出一点贡献。我们所编制的软件自然是供建筑专业人士用来提高其生产效率和效益的，但是，正如以往很多发明一样，我们也不能忽视我们的技术对建筑造型、设计过程，甚至建筑本身的定义等等将会产生的长远影响。我们期待着今后的 Graphisoft Prizes 大赛会更成功。

撰文：大卫·马拉特

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软图软件开发有限公司营业副总裁，
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This exciting prospect began a thought process at Graphisoft about pushing the limits of architecture and CAD technology. Using ArchiCAD and VR, we wanted students of architecture to design and take us through their virtual buildings. But architecture does need some boundaries to be successful and our search began for a design program that would require rigorous architectural thought yet encourage unconventional and provocative results.

We turned to common reference points of history and culture and invited students to make manifest selected references in our cultural "virtual reality" by generating them in a computer-based "virtual reality."

References are drawn from history, music, popular culture and literature. Every year, we sort through dozens of suggestions to create a list that is provocative, fun, thoughtful and as cross-cultural as we can make it.

Students (and this year professionals) submit their entries as 3D ArchiCAD models, VR scenes and computer-generated renderings. Conventional drawings are only used as a backup to help the jury understand the design intent. Like any design competition, entries have ranged from the sublime to the truly bizarre, but we are amazed at the evolution in the quality and sophistication of the entries in only three years.

The jury is also entirely dependent upon the computer to judge the entries, and this has provided some interesting and unanticipated effects. For example, viewing the entries one after another projected on a wall from a computer, rather than as a group strewn about a room, forces the jury into a linear process where they may rely more upon memory and impressions than direct comparisons between projects. For the jury, judging virtual architecture on a virtual media has proven to be a challenging and exhilarating process.

With three years of prizes and hundreds of virtual projects created, we hope that Graphisoft has been able to make a contribution to the field of architecture. The software tools we create are certainly used by the architecture profession to improve their productivity and profitability, but - as happened with many inventions in the past - we should not lose sight of the long-term effects of our technology on the architectural form, design process and even on the very definition of building itself. We look forward to many more great years of GRAPHISOFT PRIZES.

Text: David Marlatt

David Marlatt
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of Graphisoft R&D Software Development
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电脑里的建筑

Architecture Through the Looking Glass

建筑设计软件正在从平面图纸“自动绘图机”迅速转变为立体建筑模拟器。建筑师不但成为虚拟建筑的创造者，同时还是它的管理者，因而即便在该建设项目入住启用后建筑师仍将在其间发挥作用。这一技术的发展结果使得建筑师能够在桌面电脑上建造一座“虚拟大楼”，在其尚未实际施工之前直到其竣工后的生命周期中都能模拟这幢大楼的运作情况。这必将改变建筑师的设计方式、费用架构，以及他们和客户、承包商及社会的关系。此外，这还将改变建筑师自己的执业状况。由于他或她拥有大楼的三维电脑模型，这样就会在今后争取所有与该大楼有关的项目时拥有非常重要的竞争优势。

事实上，围绕着虚拟大楼产生的新的维护、服务架构将把建筑师推向社会的中心，因为他们是受过训练的通才型专家，惟有他们能通过其构思设计解决社会和经济的相关问题。

为了更好的理解这一技术的沿革进程，我们有必要看一下建筑行业发展的三个主要阶段：

“史前期”，这时建筑师实际上就是“建筑工人主管”，直接指挥参与城堡、庙宇和教堂的施工建造；

“现代期”，这时建筑师用绘画表现建筑，形成作为施工依据的综合复杂的建筑说明和图纸；

“镜像期”（the "Mirror" phase），这时候建筑师用软件（而不是锤子）在模拟环境（而不是真实环境）中来“建造”大楼。

显然，下一个重要时期将会依赖于先进的电脑技术。可是电脑和CAD软件运用于建筑这一行已有约20年历史了，为什么建筑师们仍未完全适应当前的“镜像期”呢？

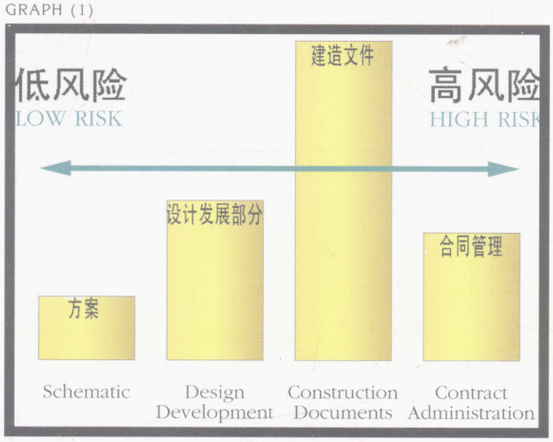
答案在于在过去20年里建筑师们只是将电脑用作自动化绘图的工具。作为这一行中启用一项新技术的第一步，这自然是合乎逻辑的。不过，在以后20年里建筑师将要模拟建造大楼。这点细微

Architectural software is evolving rapidly from an "automator" of two-dimensional drafting to a three-dimensional building simulator. The architect is becoming the creator of the virtual building as well as its caretaker, and consequently his or her role in the building project can continue after the occupancy permit is issued. As a result of this evolution, the architect's ability to construct a 'Virtual building' on a desktop computer, to simulate the building's behavior both before it is built and throughout its life cycle, will change the architect's design process, fee structure, and relationship with the client, contractor and the community. In addition to transforming the architect's own practice, his or her ownership of the 3D computer model will carry important competitive advantages in procuring all future work associated with the same building. In fact, the new set of services surrounding the maintenance of the virtual building will bring to center stage of society the only professional who is trained as a generalist to conceive geometric solutions to social and economic problems: the architect.

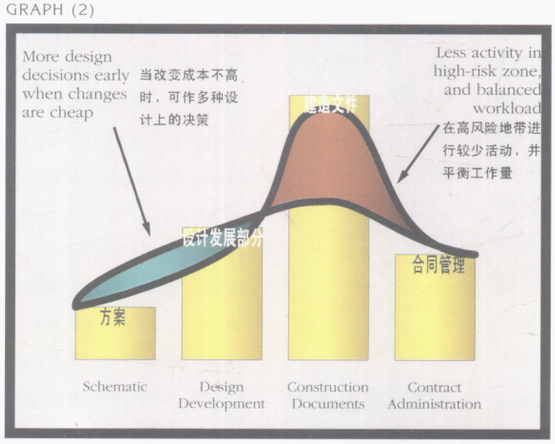
To better understand the course of this evolution, we should think of the practice of architecture through the ages in three major phases:

- the "prehistoric," when architects were actually the "master builders" who DIRECTED the construction of temples, castles, and cathedrals;
- the "contemporary," when architects represented buildings using drafting techniques to generate complex instruction sets and sophisticated illustrations from which others could build;

图表(1)
GRAPH (1)



图表(2)
GRAPH (2)



的差别代表了自从400年前建筑师们停止切割建造大教堂用的石块并开始以画图作业以来，建筑设计这一行得到了最让人难以置信的机会来为其自身下一个新定义。

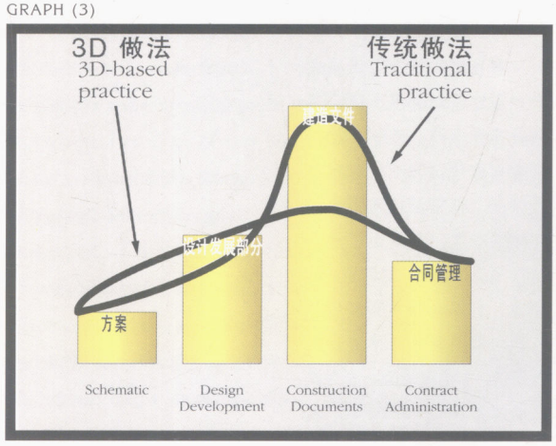
这意味着建筑师们的专业教育和文化传统将有重大改变。他们将转而采用医生和律师那种面向过程（process-oriented）的运作方式，而放弃那种建筑学神话中霍华德·卢克（Howard Rourke）之类英雄人物的面向项目（project-oriented）的方式。他们与客户的关系会比与大楼的关系更紧密，因为他们不断在自己的办公室里利用电脑模型建造、维护、升级和销售其客户委托设计的大楼。他们的收入将减少（！），不过自意大利文艺复兴以来他们就不得不忍受的忽盛忽衰的建筑周期将被一个新的隐喻所替代："收入流（Revenuestream）"（意即收入将相对较持续平稳，不会忽有忽无、忽高忽低－译注）。

图表（1）应为所有执业建筑师所熟悉，这是根据传统建筑合同列出的建筑设计费用细目表。费用结构基本上是以某特定建设项目中建筑师的工作量及劳务支出为基础，其中大部分开支体现在施工文件及图纸的编、绘制阶段。

可以理解的是，设计早期所作的任何工作其风险和支出都是较小的。说它风险小是因为尚未实际施工建造；说它支出少是因为几乎没多少要修改的图纸，涉及要作相应设计修改的工程师和其他顾问专家也更少。相反，设计过程越深入，所需投入与支出就越大，因为要作的相应修改就会越多；而所冒风险也会越大，因为它有可能导致无法顺利地在所有工程师、顾问专家和承包商之间进行协调。而且正如大多数建筑师明白的那样，设计过程越走向深入，打官司的可能就越大，从而就越有恐惧感。

计算机辅助建筑设计学会（ACADIA）去年发表的一项研究结果发现，建筑业中不使用CAD软件或仅用2D绘

图表(3)
GRAPH (3)



- the "Mirror" phase, when architects will CONSTRUCT buildings using software instead of hammers, in a simulated environment instead of a real one.

Obviously, this next major phase is dependent upon advancing computer technology, yet computers and CAD software have been with the profession for almost 20 years. So, why aren't architects well into the "Mirror" phase today?

The answer is that architects have been using their computers for the past 20 years to automate drafting, which is a logical first step to introducing new technology in any profession. But, architects in the next 20 years will simulate buildings. This nuance presents the profession of architecture with an incredible opportunity to define itself since architects stopped cutting cathedral stones 400 years ago and started drafting.

Implying massive changes in his or her professional education and culture, the architect will adopt the process-oriented approach of doctors and lawyers, and abandon the project-oriented approach of Howard Rourke and other heroic figures of architectural mythology. Architects will become more closely associated with their client base than with their buildings as they work continuously to construct, maintain, upgrade, and sell their clients' buildings using computer-based models in their offices. Their revenues will flatten (!), but the peaks and valleys of building cycles by which they have learned to live since the Renaissance will be replaced by a new metaphor: the 'Revenue stream.'

The graph (a), which should be familiar to any practicing architect, illustrates the breakdown of architectural fees according to the traditional architectural contract. The fee structure is more or less based on the historical workload - and labour expenses - incurred by an architect during a typical building project with the majority of the fee and expense occurring during the construction documentation phase.

Understandably, any work which is done early in the design process is low risk and inexpensive. It's low risk because nothing is built and inexpensive because there are fewer

图软件的公司在人工方面的支出与传统费用架构的运作模式基本相同。

然而使用3D系统的公司则有着相当不同的运作模式。他们更侧重于前期工作，也就是说在设计早期耗费的时间更多。但由于这里付出多了，使他们在后面的文件编制阶段节省了不少时间。因此他们能够清楚规划自己的工作量和劳务支出，从而避免在传统的设计公司中常见的“候鸟式农夫效应(migrant farm worker effect)”--有活儿时干，没活儿时停。

如果更仔细研究会发现：使用3D软件的建筑师花费大量的时间正是支出最少、又最有乐趣的时候，他们可以无拘无束地尝试各种不同的设计方案。他们用在出图上的时间相对较少，因为图纸都来自设计完善的3D模型。此外，由于这些建筑师在前期拥有更多信息，他们在确定更好的设计方案时就更有信心，从而可以避免在以后的进程中出现大量既多花钱又更担风险的设计修改。

总有一天标准的费用结构要做修改。传统的方案及设计发展部分将合并为一个阶段，因为3D设计软件具有越来越强的（也是相当危险的！）能力，可以进行最具试验性的设计（它们具有出色的、又常常容易令人误解的精确性和完整性），给人一种设计非常完善深入的印象。讽刺的是，这种实际上使试验性特点重新体现到电脑生成的图纸中的软件正在建筑师当中变得越来越流行！

结果，因为这当中所花人工少了，客户为实际的施工图阶段支付的设计费也就相应减少。同时，高标准施工管理方面的费用仍将保持不变，因为虽然3D模型、膝上型电脑及与自己公司通过调制解调器连接的技术使得管理更高效、更不易出错，它们仍然不能代替走访现场、与承包商协商、编制报告等等。

不过其中更重要的是建筑师将承担两组新的服务内容，它们都来自于那座“虚拟大楼”--它由建筑师创造，由客户掏钱，并将与实际的大楼同在。

首先一组新服务内容是为客户在租售其楼盘时提供市场营销方面的帮助（如效果图、动画、快捷的成本评估等）。此类服务项目在目前使用3D软件的建筑设计公司中已日见普遍，他们使客户看到了3D电脑设计比实际建筑具有的更大潜力。如果建筑师能够创建并为其客户、政府机构和承包商等展示其设计成果，那么当需要向预期中的买家和租户提供同样的资讯时，建筑师同样也会成为其客户当然的拍档。

在传统的建筑设计模式中，要建筑师提供上述服务将会花很多钱，要不就是在三维立体建筑领域相对容易的事在二维平面艺术世界却有相当难度。可是为了赶上MTV（音乐电视）时代用户的期望，有越来越多的客户正在转向使用新的媒体进行市场营销，如电视录像、交互式电脑屏幕和CD-ROM等。这

drawings to change and fewer engineers and consultants to re-engineer and re-consult. Conversely, the deeper change occurs in the design process, the more expensive it becomes because of the number of subsequent drawing changes, and the riskier it becomes because it may not be co-ordinated among all the various engineers, consultants, and contractors. And, as most architects know, the deeper in the design process change occurs, the larger the spectre of litigation looms.

A study published last year by the Association for Computer-Aided Design in Architecture - or ACADIA - found that the labour expenses of architectural practices using no CAD software or 2D drafting software followed roughly the same work pattern as the traditional fee structure.

Practices using 3D-based systems, however, showed a very different pattern. Their work was 'front-loaded,' meaning more time was spent early in the design phase, but, because of that invested time, they saved time in the documentation phase. They were able to level out their work loads and labour expenses, and avoid the "migrant farm worker effect" of hiring on and laying off that is common in traditional practices.

A closer look reveals that architects using 3D-based software spent their time where it was cheapest - and the most fun - and they were the most free to explore design alternatives. They could produce working drawings in less time because they were starting with a well-developed 3D model. Also, because they had more information up front, these architects could make better design decisions with greater confidence and avoid many costly and risky changes later in the process.

In time, the standard fee structure should change. Traditional Schematic and Design Development should merge into a single phase as 3D-based software offers the increasing (and dangerous!) ability to render even the most tentative designs with great and often misleading precision and completeness, giving the impression of being well-developed. Ironically, software which actually puts the tentativeness back into computer-generated drawings is becoming popular among

些媒体都更侧重于三维立体表现，而且正如很多平面设计师了解的那样，它们不适用于那些无法摆脱二维平面思维方式的人。此外，既然客户已经花钱请建筑师做出了三维模型，为什么他还要再另外花钱找人将几乎差不多的事情再做一遍呢？

这些市场营销方面的服务并不意味着建筑师一定会取代广告商及出租代理商。相反，建筑师将能够有效地向那些代理商提供原始营销材料，同时也永远是其客户的信息来源，有助于其客户和他们自己的客户作交流。

如果说第一套新服务是通过虚拟大楼进行大楼的营销，那么第二套服务则是在实际大楼运作的同时对虚拟大楼模型进行平行的管理。这些管理服务可能会包括一流的设施管理功能（不过是以三维模式），以及租户服务、各种设计及维护方案的探讨，还有大楼整个使用周期中相关的设计修改所需的模拟和计划。

例如，设想某建筑师建立了一个3D模型，并由该模型生成出施工图纸，客户最后建成了大楼，也开始入住启用。那么为什么该建筑师要就此罢手呢？他或她对于客户的价值其实才刚刚开始。

通过输入来自ASHRAE图表的气候数据及制造商的测试数据，就可以利用该3D模型预报屋顶铺填及防漏方面的变化情况。

可以利用地毯制造商提供的有关地毯损耗方面的数

architects! As a result, clients will pay a lower fee for the actual construction documentation phase, reflecting the fact that less labour is expended. And, the same fees will remain for standard construction administration because although 3D-models, laptop computers, and modem connections to the home office make administration more efficient and error-free, they do not substitute for the time needed to visit the site, consult with contractors, produce reports etc.

Of greater interest, however, are two new sets of services for the architect which will evolve from the "virtual building" which the architect has created, the client has paid for, and which exists alongside the real building.

The first set of new services are providing sales and marketing aids such as renderings, animated movies, and quick cost estimates, to help the client sell or rent his projects. These types of services are already becoming more common among architectural firms using 3D-based software whose enlightened clients see the potential of 3D computer-aided design as more than building. If architects can create and present their projects to clients, government agencies, and contractors, they are also their client's natural partner when the time comes to present such information to prospective buyers and tenants.

In the traditional architectural practice, the architect was often too expensive to provide these services and/or had difficulty mastering the two-dimensional world of graphic art with the same ease as the three-dimensional world of construction.

As they race to keep up with the expectations of the MTV generation, however, clients are turning increasingly to new media such as video, interactive computer screens, and CD-ROMs to market their projects. These media encourage the expression of the third dimension, and, as many graphic artists know, can punish those who do not break out of two-dimensional thinking. In addition, the client has already amortized the base cost of the 3D model with the architect. Why should he pay someone else to do largely the same work again?

These new sales and marketing services do not necessarily mean that architects will replace advertising or leasing agencies. Architects will be effective suppliers of raw marketing materials for these agencies, however, as well as a constant resource of information to help the client communicate with his or her own clients.

If the first set of new services is based on marketing the building using the virtual building, the second set is based on managing the virtual building model in parallel with the real one. These management services might include classic facilities management functions - but using the third dimension - as well as tenant services, explorations of design and maintenance alternatives, and the simulation and planning of design changes required over the life of the building.

For example, imagine that an architect has developed a 3D model, created working drawings from it, the client has built the building, and the occupancy permit is issued. Why should the architect's involvement stop there? His or her value to the building owner is only beginning.

- Climatic data from ASHRAE tables, and test data from manufacturers, can be imported and the 3D model can be used to predict when roofing and caulking should be changed.
- Data for wear and decolouration provided by carpet manufacturers can be used to render photo-realistic images of what carpets will look like after five years, thus helping the client make intelligent choices that weren't possible before.
- Visual and financial effects of changing glazing, lighting, or other energy conservation strategies can be accurately simulated and effectively communicated to focus groups, zoning commissions, financiers, and others for a small cost.
- Each new or prospective building tenant can see their space fitted out in three dimensions and walk away with a "living brochure" on video cassette because the cost of the base 3D model
- which the architect maintains - was amortized by the original construction.

据作出逼真的照片效果，模拟5年后的地毯模样，从而有助于客户在不同产品间作出明智选择，而这在以前是根本不可能的。

有关更换玻璃、照明或其他节能措施等视觉效果和财政资产均可以精确模拟，并针对相关类别、任务划分和且费用很低。

每个新的或预期的大楼租户都能看到其所要空间的三维立体场景，离开时还可以带上一盒作为“活的宣传册”的录象带，因为由建筑师保管的基本的3D模型的费用已在最初的设计过程中付清了。

最引人注目的是，试想如果10年以后大楼易主，其新主人希望将大楼彻底翻新。那时，在以图纸为基础的传统模式中，这位业主将拿着一套设计原图或施工图纸另寻建筑师。而原来的建筑师尽管是原图纸的设计者，通常就会对此无能为力，虽然法律保护他或她的设计版权。

但是，如果该建筑师拥有并保留有该大楼的3D电脑模型，那么他或她就会在今后获取所有与该大楼有关的项目时拥有非常重要的竞争优势。当然，这有好有坏，但无论如何它将大大改变客户和建筑师的关系，并真正体现建筑师设计工作的价值。

由于建筑师现在既是虚拟大楼的创造者，又是它的管理者，因而即便在该建设项目入住启用后建筑师仍将参与其间。他或她将在未来大楼的维护和发展变化中起到非常关键的作用。

这一新的建筑设计模式意味着建筑师将始终和客户保持密切关系，不断提供相关服务，费用虽然降低了，但多少是以一种持续的状态支付；也意味着在建筑师从客户那里获得连续的“收入流”的过程中，“建造大楼”已成为一种持续的行为，而不像现在那样是一种巨大的创伤性事件（the great traumatic event）。

此外，对于保护建筑师自己的设计版权的现行法律来说也增添了新的意义和内容。直到现在为止，拥有一项设计并没多大意义，因为基本上该设计的一切都以整套蓝图方式传递，而这些是很容易被复制和改头换面的。但是，一份电脑文件不是用来说明如何去建造大楼，而不过是大楼本身的模拟。它要容易保护得多，而且更重要的是，它的价值更容易得到防护，这样他人就不会试图首先侵犯版权。

以汽车的发展为例来看，我们就能够更好理解先前的论点，即以3D为基础的建筑设计与纸面上或者以2D为基础的建筑设计之间的差别就是绘图自动化和模拟建筑之间的差别。这一代和以前20代的建筑师都习惯于用图纸来表达即将建造的大楼是怎么回事。但是，正如建筑师们从其神话般历史中得知的那样，事情并不总是这样。建筑师曾经就是“建筑工人主管”，直接监督设计和施工状况，并现场指导工人的具体操作。

随着经济的发展，建筑类型日益复杂，专业性也越强，这时以图纸方式代表建筑物的做法就开始从建筑过程中分离出来。图画成为表达建筑的语言。但是，和诗人或小说家笔下的文字不同，绘画语言本身从来就不是建筑的终极目的，而只是说明建筑物建成后状况的一个手段。“建造大楼”过去一直是 -- 也仍然是 -- 建筑师的目的。

随后，电脑的出现使科学家、教师、银行家、保险公司以及地球上几乎每一个人的生活发生了革命性的变化。数十年后，Autodesk等公司先行开始着手让电脑为工程师和建筑师工作。他们选择的方式很合乎逻辑，那就是使绘图自动化。

他们将建筑师工作中最枯燥乏味的部分变得效率更高，但他们没有对建筑师数百年来的工作模式提出疑问。正如最早的汽车如同没有马的马车一样，他们的软件加快了制图速度，实现了自动化，但却没有对现有做法提出任何问题。讽刺性的是，随着2D CAD软件的发展，随即有了一套自己的绘图符号和“语言”，制图本身被分离出来，建筑师反而越来越远离其建造大楼的初始目标，却导致出现了“CAD部”及“CAD课程”等反常现象，甚至还出现了CAD方面的大学学位。真所谓尾巴摇狗 -- 本末倒置。

建筑师以及那些为建筑师提供电脑软硬件设施的人真正应该扪心自问的一个问

Most significantly, imagine ten years go by, the owners of the building change, and the new owners want to perform substantial renovations to upgrade the building. The reality of the traditional paper-based system is that the owner takes a set of the original or as-built drawings and shops for an architect. The original architect, although the creator of the original documents, is quite often powerless despite the existence of laws protecting his or her copyright.

The architect who already owns and maintains the building's 3D computer model, however, will have a tremendous competitive advantage in procuring all future work associated with that building. Of course, this will be interpreted as both good and bad news, nevertheless it does announce a significant change in the relationship between the client and architect and in the true value of the architect's work.

Because the architect is now both the creator of the virtual building and its caretaker, his or her role can continue after the occupancy permit is issued. The architect can stay with his or her creation and play a pivotal role in its maintenance and evolution well into the future.

This new model for architectural practice implies that architects will stay with their clients and provide ongoing services at reduced fees on a more or less continuous basis, and that the act of 'building' will become an uptick in the architect's revenue stream from that client rather than the great traumatic event that it now is. It also adds new meaning - and meat - to existing laws which protect the architect's copyright to his or her own design. Until now, ownership of a design had little meaning because essentially all the design could be transmitted by a set of bluelines that could be easily copied and altered. A computer file, however, which is not a representation of how a building should be built, but a simulation of the building itself, should be much easier to protect, and, more importantly, its value should be much easier to defend so that others are not tempted to violate the copyright in the first place.

Using the development of the automobile as an example, we can begin to understand better the earlier point that the real

题是："如果我能在电脑上造出一堵墙，我为什么还要在上面画上一大堆平行线呢？"综合性的3D软件就是要为电脑在建筑领域的运用实现一个最基本的功能：即模拟大楼的建造，而不仅仅只是绘图自动化 -- 具有讽刺性的是，这又回到了数世纪前建筑师们的根本上去了。

建筑师们正位于建筑领域"镜像期"的尖端。显然，为了生存和发展，他们必须适应这一深刻的变革。今天所有的3D软件也许都只是能够启动建筑执业新模式的第一代技术，但它们的潜力远不止于此。不过，对于建筑师来说，为了自我教育，为了掌握新的建筑执业模式（而"不是"电脑技术本身），掌握现在已有的最好技术总是不嫌早的。而这种技术必将不可避免地导致新的建筑执业模式的产生。

建筑师应该学会掌握现在已有的工具，这样他们才会知道怎样掌握未来将出现的工具。最重要的是，作为建筑师，他们应该停止学习绘图的自动化，而要开始学习如何模拟建造实际的大楼。

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difference between a 3D-based practice and a paper or 2D-CAD based practice is the difference between automation and simulation.

Architects of this generation and 20 generations before are accustomed to drafting to communicate how buildings ought to be built. But, as architects know from their history and mythology, it wasn't always this way. The architect was once the 'Master builder' who directly oversaw the design and construction of buildings and taught his workers on site how things should be built.

The development of drawings and drafting to represent buildings was an abstraction of the building process itself made necessary by expanding economies, increasingly complex building types, and increasing specialization. Drafting became a language to communicate building, however, unlike a poet's or a novelist's words, the language of drafting never became the end in itself for architecture, just a means to instruct how architecture is to be made. Building always was - and still is - the goal of the architect.Then, the computer arrived to revolutionize the lives of scientists, educators, bankers, insurance companies, and in time, almost everyone else on the planet. A few decades later, pioneering companies such as Autodesk also arrived to help engineers and architects put these computers to work. How they chose to do it was logical. They automated drafting.

They made the most tedious part of the architect's work go faster, but they didn't question his or her centuries-old methods. Like the horseless carriage which preceded the modern automobile, they accelerated and automated, but they didn't question any of the existing metaphors. Ironically, as 2D CAD programs developed their own sets of drafting symbols and conventions - their own "language" - they themselves began to abstract the abstraction of drafting and pulled the architect even farther away from his original goal of building as well as leading to such aberrations as "CAD departments" and "CAD courses" and even college degrees in CAD. The great tail of technology is wagging the dog.

The real question that architects should be asking of themselves and those supplying them with computer hardware and software is, 'Why should I use a computer to draw a bunch of parallel lines when I should be able to use it to build a wall?' The promise of 3D-based integrated software is to find an original use for computers in architecture: to simulate building rather than merely automate drafting - ironically, to return the profession to its roots of centuries ago.

Architects are on the cusp of the "Mirror" phase of architectural practice. Clearly, the architectural profession must embrace profound changes to survive and to prosper. All 3D-based software available today might be considered as first generation technology that allows this new architectural process to begin, but cannot deliver on its full promise. It is not too early for the architect to embrace the best of what is available, however, in order to educate him or herself and to master NOT the technology, which has the half life of a rap video, but the new architectural process, which this technology will ineluctably engender.

Architects should learn the tools available now so that they will know how to learn the tools of the coming generations. And, above all, they should stop learning to automate drafting to be architects, and start learning to simulate buildings.

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“信息时代”意味着什么（一个长达40000年的故事）

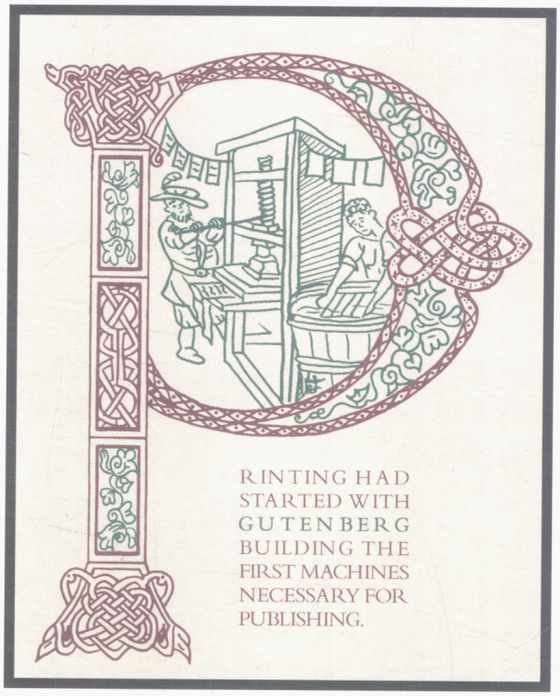
What does it mean "Information Age" (a 40000 years story)

在划分科学技术发展的不同时代时，我们传统上都以构成当时器具的典型原材料来命名，比如“石器时代”和“铜器时代”。另外，如果要选出最伟大的单项发明，那么最可能的答案将是轮子。轮子的发明真正地改变了我们的生活方式，其影响远大于铁的发现。如果我们从运输和旅行这一更广泛的意义上来看，这一点尤为明显。对我们的祖先来说，骑马当然要比铜器能赋予他们更大的能力；同时，随着航海技术的进步，人类征服了地球，可见旅行对历史的影响远远大于铁的影响。同样，天然石油既是汽车燃料来源，又可以从其中提炼出塑料等新材料，但是就对于我们每天的生活所作的影响而言，前者远大于后者。所以，也许更恰当的办法是将历史划分为“骑马时代”、“航海时代”和“机动化时代”。

To identify eras of technological evolution, we traditionally refer to the raw materials of tools such as 'stone age' or 'bronze age'. On the other hand, as the single greatest innovation, the wheel is the favorite choice. The invention of the wheel truly changed our way of living, more than the discovery of iron, if we consider it in the broader context, transportation and travel. Horse riding certainly provided more power for our ancestors than bronze tools and, as seafaring progressed, man conquered the earth, travel having a greater impact on history than iron. Similarly, crude oil influenced our everyday life more as fuel source for cars than providing us with new materials such as plastic. Therefore, it is more appropriate to classify history into the 'Equestrian age', 'Sailing age' or 'Motorization age'.

But there is another line of inventions that have had an even greater impact on civilization than the means of commuting. The ways of *communication*: the amount of available *information* and ways to access the information. The development of the *human language* has had a greater impact on our life than anything else. The stone axe and arrow were not the most important tools used by our ancestors in hunting huge and strong animals such as mammoths. These were only second to man's ability to co-ordinate the chase through sophisticated communication skills resulting from the linguistic revolution some 40,000 years ago, at the time of Crô-Magnon caveman. Neither anatomically, nor in the way of living, had the human ape really changed for millions of years but the evolutionary process exploded the moment we started to speak. All other innovations, such as metallurgy and even horse riding, resulted from our ability to collect and transmit information easily and effectively.

The "age of verbal information storage and communication" (in short "Tongue Age") started 40,000 years ago and ended some 6,000 years ago when *writing* was invented. Before writing, the only source of information was verbal communication with other people



然而，有另一条发明路线对人类文明的影响更大——其方式不是通过物质的交换，而是信息的交流：那就是一定量的可以获取的信息，以及获取这些信息的方法和途径。人类语言的发明和发展比任何其他东西都更大地影响了我们的生活。我们的祖先在捕猎强壮的大型动物（如猛犸象）时最重要的东西并非是石斧和弓箭。大约在40000年前穴居的克鲁马努人（Cro-Magnon）时代，语言学的革命使他们拥有了复杂的信息交流能力，在捕猎过程中这才是第一重要的因素。无论从解剖学来看还是从生活方式来看，人猿确实经历了数百万年的发展变化。然而也就是在我们开始说话的时候，我们的进化才发生了爆炸性的飞跃。诸如冶金甚至骑马之类所有其他的创新发明都是我们有能力便捷有效地收集传递信息的结果。

“口头信息贮存和交流时代”（简称“舌头时代”）起始于40000年前， 直到6000年前文字发明后终结。在文字书写发明前，唯一的信息来源就是和他人的口头交流，而收集可靠信息的时间又受到人类寿命的局限。这就是对年长者形成崇拜的原因，因为他们是“信息的仓库”。一旦我们发明了一个切实可行的贮存信息的方法，我们关于这个世界的知识就能够被积累起来，我们的进化也就换上了更快档。如果不是通过书面方式由一代代人收集和保存，使后人可以获取这些信息，那么要建造金字塔或画出世界地图就根本没有可能。

到了“书面信息贮存和交流时代”（简称“纸张时代”），印刷术的发明成为最重要的里程碑之一。阅读不再是某个受过教育的精英分子的特权。由于更多人能够接触到书面信息，阅读被“民主化”了。这种“可接触面的爆炸”导致了“信息爆炸”，因为有更多人创造并贮存了更多的信息。这条专有名词通常是只和现代社会联系在一起的，而事实上当古藤堡（Gutenberg，15世纪德国发明家，发明了活版

and the range of reliable information possible to collect was limited by a lifetime. This was the reason for the cult of the elderly as the "Depository of Information". The moment we invented a tangible way to store information, the knowledge about our world became *cumulative* and our evolution switched to a higher gear again. The creation of pyramids or to map the Universe would have been impossible without the access to information, collected by generations and preserved in a written form.

Within the "age of the written information storage and communication" ("Paper Age") *printing* was one of the most important milestones. Reading ceased to be the privilege of an educated eite, it was "democratized" because of its access to a wide range of people. This "accessibility explosion" generated an "*Information explosion*" as a lot more people could create and store more information. This term is usually associated with modern days only, however, it happened right after Gutenberg's great invention.

The information explosion provoked the end of the Paper Age by challenging its limits. The incredibly huge amount of information on trillions of pages became virtually inaccessible. The limit is not the capacity of our brain because we use only a small percentage of our cerebral storage capacity. However, *to search for* the appropriate information and *to process* it (in other words to organize and present it in a perceivable form) became a task outgrowing the boundaries of the Paper Age. Whole civilizations are simply forgotten and we repeatedly reinvent the wheel. It is amazing how much of our "recent" knowledge was already known to the ancient Greek. The challenge of the Paper Age is to organize and process information which is met only by the next age in Information History. It is slightly misleading to call it the "Information Age" because both previous ages were classified by a certain way of storing, accessing and forwarding information. It would be more appropriate to call it "the age of electronic and digital information storage, processing and communication" or in short

印刷术。不过中国的毕升发明活字印刷术更早，约在11世纪。--译注）的伟大发明一诞生，信息爆炸就已经发生了。

信息爆炸由于挑战其自身极限而导致了“纸张时代”的终结。数万亿张纸上贮藏的难以想象的巨大信息量实际上已让人很难在其中选取有关信息。其限制并不在于我们的大脑容量，因为我们其实只用了我们大脑存储容量的一小部分。然而要找到有用的信息并对其进行处理（换言之对其进行组织并以直观的形式表达出来）就成为纸张时代难以胜任的使命了。一个个文明被遗忘，我们一遍又一遍地重新发明着轮子。我们“新近的”知识当中有很多早已为古希腊人知晓，这一点令人感到非常惊异。纸张时代的挑战在于要对那些信息史上只有下一个时代才会遇到的信息进行组织和处理。称之为“信息时代”其实稍有误导，因为前两个时代多少也是以某种形式贮存、获取或传递信息来进行划分的。更确切的叫法应该是“电子和数字信息贮存、处理和交流时代”，简称“电子时代”或“数字时代”。不过“信息时代”的叫法已经相当普及，而且也反映了这一科技发展的真实本质。

信息时代的发端要比大多数人猜想的早。贝尔（Bell）发明的电话已经代表了某种电子信息的交流，甚至早在约翰·冯纽曼（John von Neumann）采用二进制算法之前，摩尔斯（Morse）就已经实现了文字数字信息的数字编码技术。和大多数技术革命一样，很难将它归结于某一个特定的发明家或者说出某一个特定的发生日期。1946年的ENIAC是最早采用二进制编码的电子计算机，毫无疑问也是信息时代最重要的里程碑之一。但是“计算机(computer)”一词并非恰当，它常常导致对这一整个技术产生不当的定位。计算机的主要好处在于它们能够处理（存储、组织和展示）信息，而不仅仅只是进行复杂的计算。在这里，法语“ordinateur（数据处理机）”一词也许更为恰当准确。但是不管我们用什么名词，我们必须明白它所指的意思。与其把计算机看作生产工具，还不如说它们是获取和交流信息的工具。从当今技术和工业潮流来看，与计算机关系更密切的是电话和电视，而不是飞机之类的动力型工具。Internet之类全球网络压倒性的成功虽然出乎人们意料，但却最终证明了数字技术真正的命运趋向。这并不是说计算机没有使我们变得更具生产力。语言和书写技术都提高了我们的生产力（实际上它们也是提高生产力最有效的发明）。但是和计算机一样，它们首先是信息交流的工具。生产力的提高只是信息交流和获取能力提高的结果。

"electronic" or "digital age", however, the "Information Age" term is widespread and highlights the real essence of this technology.

The Information Age started earlier than most people imagine. Bell's telephone already represented a kind of electronic information exchange and even the digital coding of alphanumeric information was realized by Morse well before John von Neumann's genuine binary arithmetic. As with most technological revolutions, it is hard to assign it to one particular inventor or to one particular date. The binary-coded electronic computer, ENIAC being the first one in 1946, was definitely one of the most important milestones of the Information Age. However, the word 'computer' is not a proper term and inappropriate wording often leads to inappropriate positioning of the whole technology. The main benefit of computers is that they can process (store, organize and present) information rather than just execute complex calculations. The French name ???“ordinateur" seems to be a more appropriate word in this context. But whatever name we use, we must know what it is for. Rather than being productivity tools, computers are tools for information access and communication. Telephone and TV are closer relatives of computers than powertools or airplanes as illustrated by recent technology and industry trends. The unexpectedly overwhelming success of global networks, such as the Internet, is the ultimate proof of the real destiny of digital technology. This does not mean that computers don't make us more productive. Language and writing both increased our productivity (actually these were the inventions that increased it most of all) but they are, just like computers, primarily communication tools and the productivity increase is only a result of improved communication and information access capabilities.

We can illustrate this with the most common use of computers, accounting. Is the key benefit of a complex accounting system that bookkeeping becomes faster and cheaper? Let's face it, computerized accounting is usually much more expensive and sometimes slower