

Constructing New Urban Culture and Infrastructures: Computers and Architecture in the Digital Era

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It seems that when architects think and talk about computers, they only reflect on very narrow images of the phenomenon. Architects think that the impact of computers in their profession is only related to how PCs, CAD/CAM, networks, software, peripherals, can improve the way they work today. Architects, by enlarge, are unable to reflect beyond the screen of their computers and the wall of their offices when it comes to recognize the real consequences resulting from the new technological advances.

In this paper we argue that we should think differently. We must recognize that computers are having much more profound impact on the profession. Computers—the technology of the fantastic, par excellence—are changing the city! They are fundamentally transforming the way we use space, and buildings! Computers are beginning to create new kinds of urban cultures and infrastructures. Building types such as offices, banks, retail spaces, and museums are being transformed into virtual workplaces, telecommuting centers, networks of automated teller machines, home banking, smart stores and multimedia experiences. Computers are transforming the concept of working, the concept of banking, the concept of shopping, etc. In the end, something fundamental about the architecture of these activities.

THE QUESTION

This article will be focused around the following question: “what are the impacts of the technology in architecture and urban design?” This is a major question most architectural firms and design schools have been confronted with, in the past ten years, as computers seem to have emerged everywhere.

THE TYPICAL ANSWER

In a three year research of 100 firms in the US and Japan, the author found that architects are integrating information technology in their practice in three different ways—computer as simply a better tool for doing existing work, computer as a vehicle for changing the relationships among partners in the design process, and computers as an engine driving the development of new organizational cultures and structures. The central claim of that research is that the profession of architecture is pursuing more or less three types of changes when implementing computers in their everyday practice: 1. Skills; 2. Processes; and 3. Organizational, Strategic and Cultural (Andia 1994, 1998).

First, CAD technology and personal computers have primarily impacted only the “skill” base of the profession. Secondly, a second wave of technology: networks, groupware, and collaborative computing, are impacting “processes” by integrating more effectively the various design-build participants. And lastly, computers and new business processes will become the engine for more effective orga-

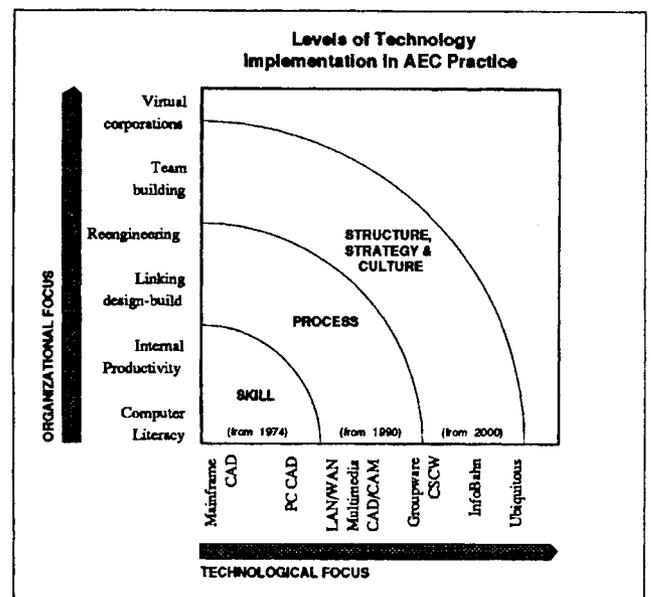


Fig. 1. Three major levels of change in AEC firms implementing information technology. Source: Andia, A. (1994, 1998).

nizations by allowing new kinds of structures and team cultures, such as the ones emerging in the manufacturing and aerospace industry.

But, are computers really “revolutionizing” the profession? We stated that computers are undoubtedly transforming various aspects of the profession. The three stage models presented exhibit how we think architects are integrating the technology in their practice. However, we should be concerned with the tone of our claims. What is disturbing is that many professionals think the way they are integrating computers are completely “revolutionizing” their profession, and may confuse our initial conclusions with their own convictions.

The evidence we found, in the offices and universities we visited, is that computers are transforming skills, processes, and organizations. But at the same time, this evidence suggests that architects are not using computers to “revolutionize” the profession. On the contrary, they are using them to produce in a more effective manner what they have always done in this century—a subtle, but very important, difference. In order to illustrate this point, follow the case of two very popular firms that are innovatively integrating information technology in their practice. The firms are Peter Eisenman, in New York, and Frank O. Gehry, in Santa Monica.

Eisenman's office has brought a lot of attention to their practice recently because they have extensively used 3D CAD, in order to explore and refine their complex architectural designs, during schematics. Gehry's office on the other hand has gone one step farther. This firm is using the technology to integrate data among contractors, fabricators and all kind of consultants in order to achieve better economies in the whole design-build process. Even though these two firms are recognized as pioneers in this area, computers have not fundamentally changed their own vision about architecture. Eisenman architects have only changed their drafting and modeling skills, during schematic design, while Gehry's professionals have only brought AEC professionals together, in order to control the cost of their sculptural designs. Both Eisenman and Gehry continue to design similar projects to those conceived in the past, before they used computers.

Until now, the role of the artist-architect, their concerns for the physical aspects of design, and their architectural subjects have hardly been touched by the new computer technology. Thus, how can we talk about "revolutionary" changes in Eisenman or Gehry's case—as in most of the architectural firms visited for that matter—when it is evident that computers have had a minimal impact in the design concerns of those professionals?

THE REAL IMPACT OF THE COMPUTER IN ARCHITECTURE

It seems when architects think, and talk about computers, they only reflect on very narrow images of the phenomenon. Architects think the impact of computers in their profession is only related to how PCs, CAD/CAM, networks, software, and peripherals, can improve the way they work today. Architects, by large, are unable to reflect beyond the screen of their computers, and the wall of their offices, when it comes to recognize the real consequences resulting from the new technological advances.

We should think differently. We must recognize that computers are having much more profound impact on the profession. Computers—the technology of the fantastic, *par excellence*—are changing the city! They are fundamentally transforming the way we use space, and buildings (Mitchell 1995, Boyer 96, Benedikt 91). Building types, such as offices, banks, retail spaces, and museums, are being transformed into virtual workplaces, telecommuting centers, networks of automated teller machines, home banking, smart stores and multimedia experiences. Computers are transforming the concept of working, the concept of banking, the concept of shopping, etc. In the end, something fundamental about the architecture of these activities.

THE IMPACT OF TECHNOLOGY ON THE CITY

A simple observation, of any American city, should demonstrate that something is happening to many of the functions and activities in our traditional buildings and urban fabric. Human functions are gradually been removed from physical space and recombined into a digital environment. The traditional one to one relationship between function, form, program and the physical place, in which functions are performed, is being broken by the introduction of computers. There is a de-materialization of the functions in space.

The new conditions of space have tremendous implications for the principles of 20th-century architecture. Twentieth-century architecture, the way we practice and understand what is the realm of architecture today, has been the process of designing and constructing buildings with a particular set of contemporary concerns, such as function, program, form, structure, schedules, building, and space. Born in the late 19th century, these concepts first removed architecture from the Beaux-Arts concerns about classical orders and large monumental structures, and then positioned the profession timely into the new realities of industrial urbanity, workplaces, and the new city. Ultimately, a genuine desire by architects to understand the

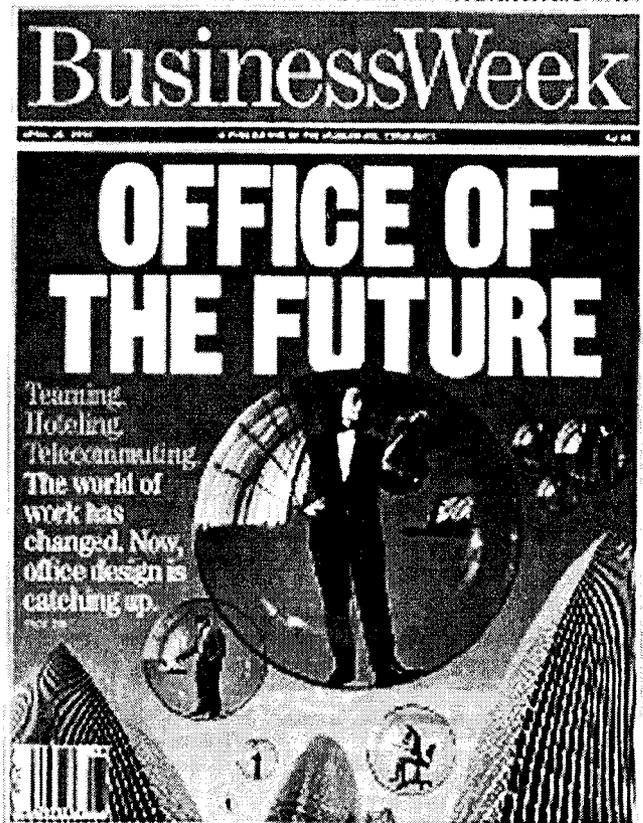


Fig. 2. The office of the future. BusinessWeek cover story about how office work is changing: "Teaming, Hoteling, Telecommuting. The world of work has changed. Now, office design is catching up." BusinessWeek (1996).

changes caused by the industrial revolution which led them to develop the discipline we practice today.

CHANGING 20TH-CENTURY ARCHITECTURE

Today, as in the industrial revolution, our technology and cities are changing. Similar to the late 19th-century Beaux-Art practitioners, today's design professionals look at the future and whine. Will the foundations, principles and soul of 20th-century architecture change? Human activities in the 21st century will no longer be "exclusively" centered around built environment. They will appear as a flow of urban events that occur in various places and in digital environments. We are not saying that buildings and cities are disappearing, but what we are saying is that human activities can no longer be tracked down to the function and the program of buildings or cities. The era of the exclusive concern for building, space, and light is over for architecture. Human activities take place today in larger metropolitan infrastructures, in media. Many human activities are no longer "functions" in space but "actions," which can occur anywhere and anytime, due to information technology.

21ST-CENTURY HUMAN ACTIVITIES AND 21ST-CENTURY ARCHITECTURE

Twenty-first-century architecture will not only be exclusively concerned with buildings, but primarily with "concepts" of how we use space. Architects such as Michael Brill in Buffalo, Francis Duffy in England, Jim Lennon in San Diego, among others, are part of a first generation of architects who, instead of designing buildings, design "concepts," "scripts" for 21st-century activities. Their work is not only concerned with the design program, function, light, and space,

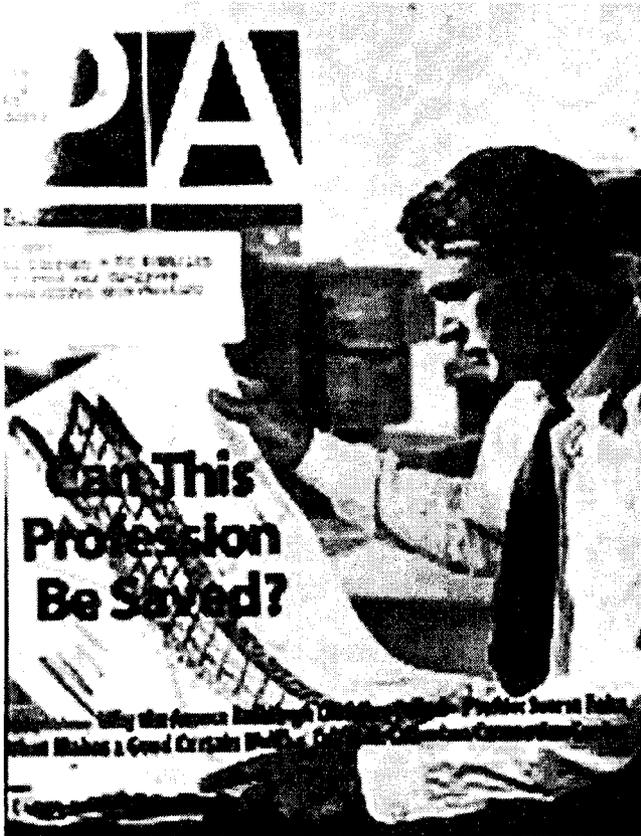


Fig. 3. The current conditions of 20th-century architecture according to a cover story of *P/A* magazine in 1994. "Can This Profession be Saved?" Fisher, T. (1994).

however, but also with new ideas such as the "offices of the future," "hoteling," "virtual banks," "multimedia museums," "smart stores," "staffing efficient design," etc. If these professional practices still do not appear to be the territory of an architect, it is because of our own difficulties in moving forward beyond the 20th-century image of the role of designers. This new view of the profession is indispensable if one is to understand the new realities of urbanity of today. This is the biggest impact of the technology, and it constitutes in itself a subject worth considerable exploration in the future.

QUESTIONS THAT STILL REMAIN UNANSWERED

The conclusions presented above are similar to a growing number of books, articles, and reports (Mitchell 1995, Boyer 96, Benedikt 91). In fact, the subject of "architecture in the digital era" has become an important topic, in academic circles, as it is demonstrated by the large number of papers presented in this area at the ACSA '97 Annual Meeting. It has also become a fashionable theme in architectural magazines who traditionally dedicate their pages to feature the avant garde aspirations of architectural design. In spite of the apparent importance of the subject, and the abundance of literature in this area, little has been advanced in trying to redefine a new role of the architect. Most of these reflections have been oriented toward wondering the audience about a so-called new kind of "cyber-condition" or "digital-condition" of every day life. The most important questions of this topic still remain unanswered: Can this reflection about digital technologies and its impacts on the city produce a parallel kind of architectural practice and thinking? Can this new reflection remove us from associating the profession of architecture from exclusive meditations about buildings, space, form, program, and other paranoia so well entrenched in late 20th-century design thinking? It is possible to engage in a different kind of architectural thought in the 21st century?

NEW RELATIONSHIPS BETWEEN DESIGN AND INFORMATION TECHNOLOGY

In an effort to address these major questions we have developed a series of seminars, research, and studios, for a year and a half, at the University of Cincinnati. In those courses, we sought ways to understand how the impacts of computers, in society, can be critical for developing new types of practices in architecture. An emerging number of pioneering examples, concepts, and technologies that allow architects to focus on design solutions that are not only exclusively based on terms of physical arrangements, but also based on better ways of using information technology as emerged—consider the following example:

ACTIONS, WORKFLOW, AND SPACE IN EMERGENCY ROOMS

Jim Lennon and Associates, a small architectural firm in California, is developing and using information technology tools to analyze and solve complex design problems in emergency departments. These computer programs analyze and simulate the "activity workflow," inside those departments. These simulations demonstrate that emergency rooms are over-designed, and what occurs in them is extremely predictable. Lennon's studies show that the size and shape of emergency rooms are not only dependent of physical requirements, but also on how people communicate, act, and converse, in space. The simulations demonstrates that typically a patient spends 2.5 to 5 hours in the emergency department while the time spent with the doctor is only 5 minutes. The communication among the staff is precarious and the time lost is enormous.

The image in the left of figure 4 shows a typical example of the activity workflow that occurs when a patient enters an emergency departments in many hospitals today. As part of the design solution, the architects specified a computer system that will act as an information system, for doctors and nurses, which will improve the activity workflow. The new information system includes several technologies such as hand held computers connected to the hospital computer network by wireless modems and ear phones. The image, on the right, shows the diagram of the redesigned process. The new process improved considerably the time a patient spent in the emergency departments. This had tremendous implications on improving the efficiency of the physical design of the building. The Lennon case is not isolated, firms such as NBBJ in Ohio and others in the hospital design business have been trying to conceptualize this new type of practice in the past years.

DESIGNING BASED ON ACTION

The example shows how information technology can drastically impact the design of spaces and fundamentally restructure the way architecture has traditionally viewed the design stage in cases such as emergency departments. This case also has larger implications for architecture. It provides a whole new understanding of what the architectural case is all about. Architecture in the emergency department example is more curious than ever before in understanding what occurs in a particular place. It expands the realm of architecture to observations of human actions and conversations. Human activities are no longer enclosed in the program of the building but are defined by the actions, conversations, or communications that are performed in real place and/or digital environments. Design (either of infrastructures, computers, or human systems) can improve the capacity of people to interact—the ultimate potential of urbanity. The main theoretical claim of our work in Cincinnati is that architecture in the digital era can no longer be based exclusively on traditional notions of function, form and aesthetics, but on the study of "action" in a tradition that grows from the writings of Philosophers Austin (1962), Searle (1969, 1979), Dreyfuss (1972), and computer theorist such as Flores and Winograd (1986). In fact, observations of "actions" has become one of our most important

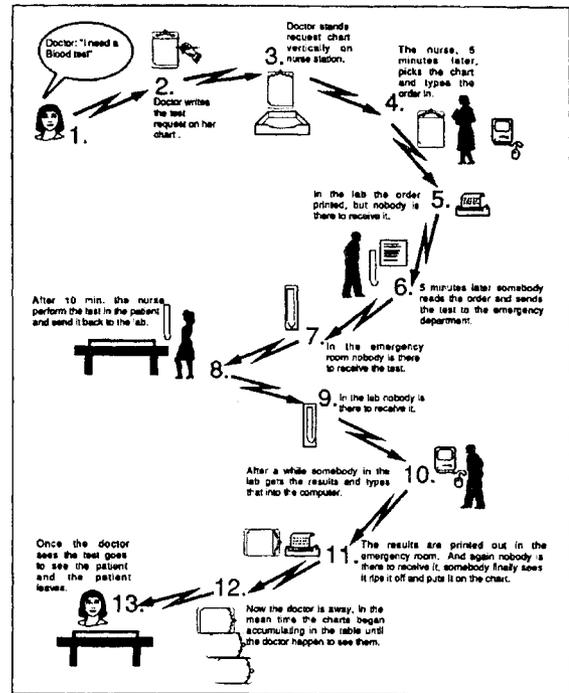
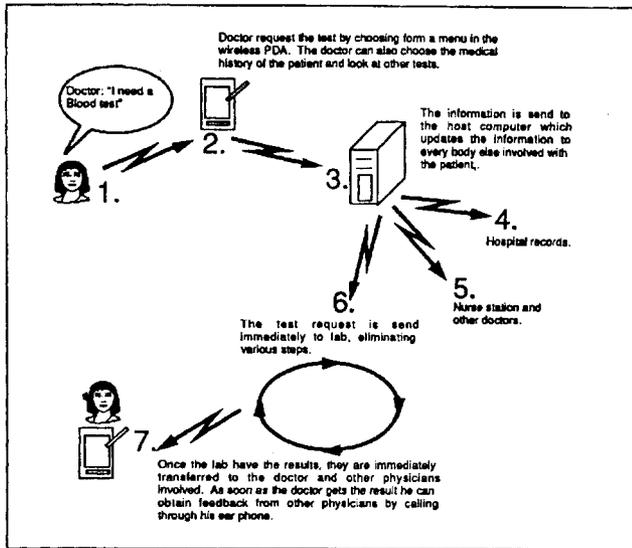


Fig. 4. On the left side there is example of the conversation workflow that occurs when a doctor requests the activity of performing a lab test in patient, in a traditional emergency department. On the right side there is a diagram showing the redesigned activity workflow by using hand help computers and audio communication devices in the same emergency department.

strategies in understanding places or human activities that have the potential to be transformed by information technology—consider the following example of retail shopping:

THE ACTION OF GROCERY SHOPPING

In a couple of courses at Cincinnati we studied the action of grocery shopping which occurs in supermarkets and hypermarkets in an attempt to understand how information technology might change the activity and current facilities that house this type of occupation. Americans in average spend around 25 minutes every time they enter into a grocery business and around 70 % of those who shop do not like the experience. Moreover, the action of shopping in most metropolitan areas in the US involves the action of driving, making the whole experience a more than an hour long chore that includes activities such as finding parking, getting lost in infinite aisles, reading about extraterrestrial abductions in magazines along check-out lines, deciding about paper or plastic, carrying heavy bags, and placing the goods in the right shelf at home. The weekly grocery shopping chore seems to be a bigger burden in every day life considering that at least 50% of the groceries American families buys every week are staple goods that just replace previous purchases. Computers have improved many of the operations that help run grocery businesses but have had little impact in re-engineering the experience, activity, or space in which grocery shopping takes place. For most Americans the once-a-week shopping ritual has not changed that much.

Commerce on the Internet is attempting to transform that. For example, Wal-Mart's Web site already sells 800,000 items: from a Maine lobster sold for around \$48 and delivered alive in 24 hours, to a pecan pie sold for around \$17, and chewing gum sold for less than \$1. Although, it seems that Wal-Mart has put a lot of energy in designing this Web site, it seems that little effort has been placed in understanding how we can get the goods. Wal-Marts delivers the products with an overnight carrier, however, the inconvenience and the price increment makes this experience very unattractive. Other companies have attempted to solve the problem at the receiving end. New companies such as "PeaPod" already delivers Internet or phone grocery orders for a small fee to home, and is attempting to change grocery shopping as Domino's

Pizza changed the pizza business.

In the studio we explored other possibilities for combining shopping for groceries in the Internet and receiving those goods in a timely fashion. We reflected on the reality that in many metropolitan areas in the US the action of shopping is very much related to the action of driving. So several of the proposal from our work attempted to integrate both activities by creating metropolitan infrastructures that will allow people to order groceries on the Web or by phone and receive them as people perform their every day driving.

Several of the proposal such as the one depicted in figure 5 created drive-thru shopping strips located in highways and freeways with more than 25,000 cars per day in which people could receive their grocery orders in special mail boxes. Payments could be collected at time of ordering or at pick-up. The image is that this drive-thru strips would act as pits sections in car racing competitions. This strips will also attract other kind of activities such as ATMs, gas stations, coffee and donut shops, newspapers, fresh produce and bread markets, recycling centers, cleaners, drive-thru food and post office centers, and also be a place for other retailers to deliver their products.

These drive-thru infrastructures do not have definitive form, they are constantly changing. They are always contemporary. They are like biological organisms that grow and evolve over time. They will follow a similar process of development as ATMs have pursued in the last 10 years in the US. ATMs initially appeared inside traditional banks, they latter moved to outside of those banks and finally expanded to supermarkets, malls, airports, and other locations. Similarly, drive-thru grocery strips may initially emerge close to existing supermarkets and slowly move to zone of heavy automobile traffic.

THE EXPERIENCE

We have also began to study several other activities such as buying glasses, buying a bed, delivering express mail, buying a car, taking a plane, working in the suburban office, the activity of buying clothes among young adults, buying music, etc. Always our intention is to understand how computers might transform the current activities, culture, and infrastructures. Many late 20th-century architects are left in disarray with examples such as those we are exploring at the University of Cincinnati. Our love for buildings, the architectural

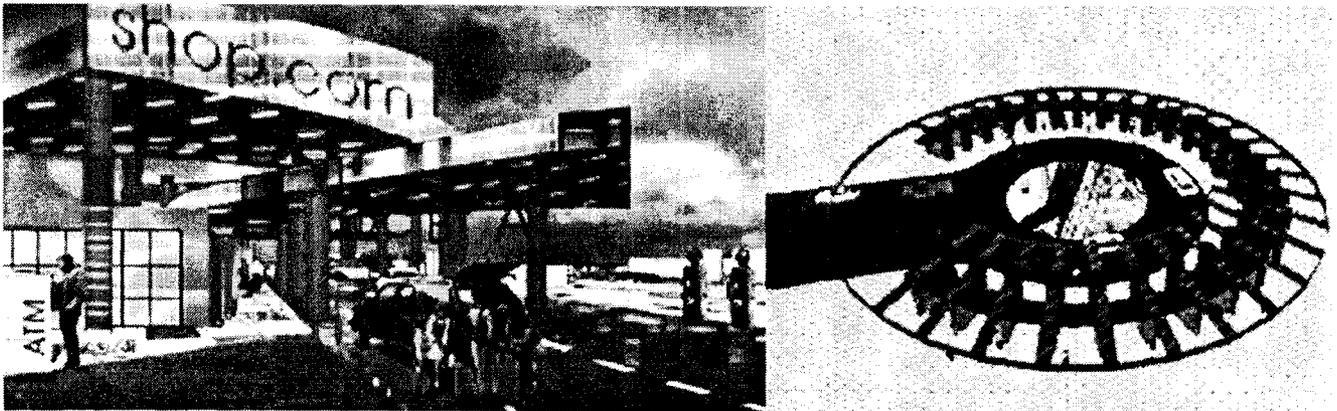


Fig. 5. The two figures above show two different schemes of drive-thru grocery pick-up places developed in design studios at the U. of Cincinnati.

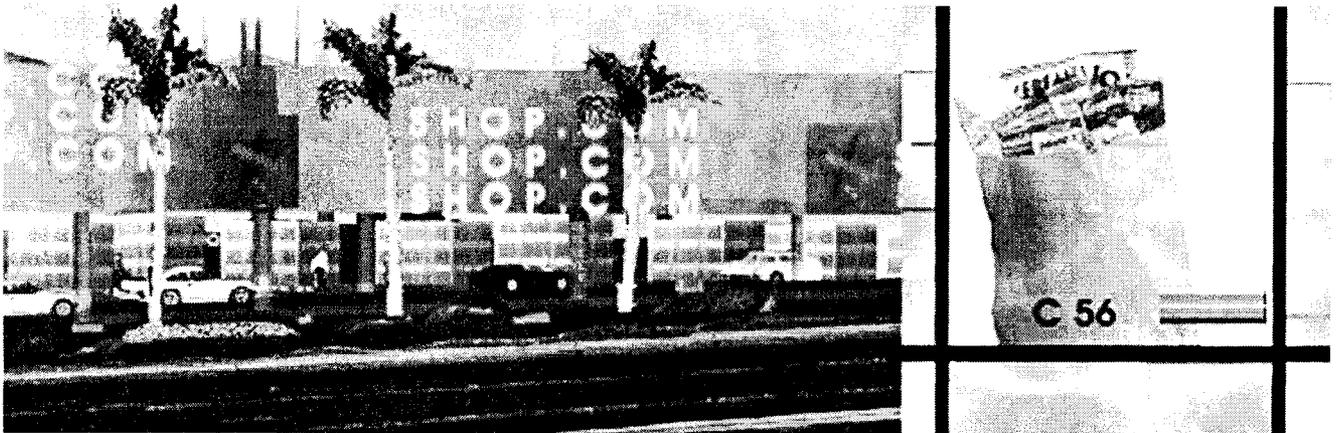


Fig. 6. Drive-thru grocery pick-up places developed in design studios at the U. of Cincinnati. Groceries are ordered by Internet or phone and are distributed through these drive-thru centers.

promenade, the geometrical problems that occupied the inner logic of our discipline for so long, makes it extremely difficult to make the mental shift. We think that the advancements are slow but revealing. In the very nature of our work is an attempt to understand the hypothesis and new conditions of urbanity in mature capitalist metropolis. Our intentions and instincts are born from the observation that late 20th-century architecture is an impotent profession in the American metropolis. Late 20th-century architecture with all its heroes, styles, and battles to appear in the latest issue of "El Croquis" continue to move with the strength of a bull, we live in a bull's ring. This is paradoxical, while contemporary architecture insists in its attempts to build its powerless fantasies in a hostile territory, the American city, since the 1970, has become the largest and hungriest enterprise in human history. Metropolitan areas such as Chicago in around 25 years have expanded an astonishing 45% while its population has barely increased only by 5%. In the end, we claim that the program for building an architecture in the information era it is only possible if we are able to identify and propose an architecture that has potency in the contemporary metropolis. We claim that the era of the building is over for architecture, the era of the urban infrastructure, infrastructures that combines action, place, activities in digital environments and a reflection of the contemporary metropolis is the ultimate subject of architecture for the beginning of the next century.

THE MORAL OF THE STORY

So, what is the moral of the story? You will find many architects talking about computers these days. That is reasonable: CAD lit-

eracy is almost a requirement for employment, most architectural firms in the US have invested heavily in computers, the technology is changing rapidly and nobody wants to be left behind. However, architects usually narrow the issue to technological competency, very far apart from the artistic and professional quest of the profession.

Late 20th-century architects will undoubtedly continue using computers to do more effectively what the profession does today. They will continue using the technology to maintain their love for new built forms, improve their design-build process, and boast efficiencies in their practices. The changes will be gradual, and will closely follow the steps we summarized in figure 1.

Along the way, architects may discover the impact of computers extends far beyond what occurs on their computer screens. They will discover something fundamentally is happening: the technology is changing the city. Once this is discovered, the various impacts of technologies (including PCs, CAD, high-end visualizations, networks, virtual reality, etc.) will seem insignificant compared with the mental shift, and the new role the profession will have to assume to design for 21st-century activities. We are consumers of a new reality for architecture.

So the next time you encounter someone who wants to talk to you about computers and tries to convince you of its "revolutionary impact on architecture," consider that his or her claims are only part of an evolutionary process of change, in the profession. Furthermore, you will probably be able to fit that person's claim into the periods and framework we have developed, in the first part of this article. Above all, you should remind him or her that the profession will not change much with only the integration of technology inside

the office, but that major changes will occur only when architects begin to reflect on the consequences, of the technology, in buildings and the city. This area has been explored in numerous books and articles. However, most of that body of writing has been descriptive or reflective but has been unable to propose a new type of in architecture practice. In this article, we show some examples of the work we have done in this area at the University of Cincinnati. As we developed our projects we discovered that there is perhaps a parallel way of practicing architecture. An architecture that does not treat buildings as its ultimate subject. But an architecture that observes the mundane of urban culture and finds in contemporary human actions—including those which are being removed into digital environments—the real subject of architecture.

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