CAD Systems for early design phases or CAD systems for designers' early phases

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ABSTRACT

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Most of the problems, related with the use of CAD systems are the results of some general principles; the philosophy that, those systems are based on. Therefore, mainly the relation between these principles and early design phase performance of CAD systems and designers are discussed in this paper. The circumstances of novice CAD user architects in Turkey is considered first. In formation of the research, the knowledge gained during my personal experience based on real cases from the university (education, research) and practice (design, consulting) is used. Beside this the results of a survey including a serious of interviews projecting the opinions of the architects is used. Vendors of commonly used CAD systems were interviewed. In this manner to answer the main question about the relation of "CAD" and "early design phase" the answers of some following questions and facts were investigated: What means CAD for architects? What are the main purposes of using CAD? Are CAD systems sufficient to be used in early design phases in terms of either hardware and / or software, or should we say thinkware?. The advantages and disadvantages of using CAD. The target user fact and its consequences (the difference between general purpose systems and the sophisticated architectural systems). Should we adapt to computerized way of thinking? Is 3D a basic feature? What are the education related problems of CAD? Is software integration problem solved? Modularity concept for CAD systems. What is the minimum time, and the budget required for a start? The illegal software use problem Complaints, demands, needs and thanks of architects? Simply, what do architects expect from CAD during design process and particularly in early phases (both of design and designer)? Do CAD systems match this?

1 AIM

Most of the problems, faced during the use of CAD systems in early design phases, are the results of some general principles; the philosophy that, those systems are based on. Therefore, mainly the relation between these principles and early design phase performance of CAD systems and designers as beginners in CAD are discussed in this paper. As an architect I preferred to put the emphasize on my colleagues. The aim is to provide a sort of feedback to software developers and highlight some related points to be discussed among architects and software developers.

During my personal experience in the field of architecture starting from the first year of undergraduate study, I particularly had / have interest in method, and as a natural consequence of that in the theory, philosophy behind this concept. At that time I didn't have a "scientific knowledge" about the concept of "method". In other words my interest about method was not that conscious. It was more

problems of this majority : The private sector (totally 64%), and on small size offices (between 1 to 10 people).

A. Criteria

9 architects have been selected to be interviewed due to the criteria listed below. I myself filled the tenth form. So totally the survey projects the opinion of 10 subjects.

I. Position

In this group the architects have three types of employment. The subjects of the research are coming from all these groups:
- The owner
- The employee
- Freelance working Architects

II. Job potential

Although there is a huge demand for new buildings - especially housing- in Turkey; the macro economical conditions and the general conjunctures are effecting the architects as well. Vast amount of architects, lack of public appreciation of the profession (the mentality), lack of proper legal conditions, leads the professionals to an unfair competition.

III. Classification

In terms of performance, there is a commonly accepted classification for the quality category of architects in Turkey:
- Ordinary - market- architects
  Extremely cheap and low quality service
- Average architects
  Who try to produce better. If succeed may become even famous.
- Names
  Successful average architects and exceptional genius ones.

I tried to have subjects from the last two groups or at least nominees, who approach their profession in a sincere and serious way.

IV. Income

The annual income of an office determines the budget for CAD. Though there is not any up to date and reliable statistical data about this fact, it can easily be said that especially the software prices are anyway far beyond reasonable numbers for the majority of Architects in Turkey. So I didn't put any threshold.

V. Computer use habit

Again in the same survey of the Chamber of Architects the group who are mostly interested in CAD are those who have five years and less job experience (45 %). Now this should have changed to ten years. I also belong to this age group. Actually our generation who studied and graduated between 1980 - 1990 should have a special importance for CAD business specialists. We had the chance to witness the transition process of CAD from a science fiction tale to an everyday reality, parallel to our education. In 1985, in the courtyard of our school, we

were gossiping about a CAD system, which you can walk through your design in the screen virtually, and it cost nearly 75 thousand US Dollars (software + hardware). Wouv! One of the subjects I interviewed for this research was a member of that group, we had such discussions. Actually almost all the architects I have interviewed are from this age group, some I knew for a long time. I was lucky to be one of them (particularly for this study) because it was indeed fun and comfortable to work with. I thank all of them for their serious and helpful approach. The older generations, who had been shaped by conventional / traditional way, approached this new tool skeptical. The younger took this technology for granted. They even don't care about traditional design techniques, tools, which are still being taught in the university (e.g. technical drawing, perspective). They wander, why they are still forced to learn these "old fashioned" techniques since they are going to use (or they already use) computer technology. In all the groups mentioned there are exceptions.

VI. CAD experience

Due to their CAD experience the Architects can be divided into three main groups.
- Novice Users
- Experienced Users
  Preferably who have the experience with more than one software and have the possibility to compare them
- CAD Specialists
  Originally architects who are specialized on either side of CAD. These are mostly working freelance and / or as consultants.

Our main concentration point in terms of experience are the beginners or the novice users. So I interviewed some of them. Since every experienced one was a beginner ones upon a time, it was meaningful to have the opinions of the experienced as well about their first experiences. There were also CAD specialists among the interviewed architects.

VII. Software / Hardware platforms:

The economy determines the platform as always. Personal Computers are commonly used by the majority. Especially IBM Compatibles are the first choice. The prices of these clones are relatively cheaper than famous brands and Apple computers. Beside that it is possible to find almost all major software products illegally on this platform.

The most common software being used in Turkey (legal + illegal) are AutoCAD and ArchiCad[2]. Thus, PC platform and related software choices are preferred to be included in the research. In addition to the mentioned two main software options some other (Architrion, DesignCAD, MiniCAD) which are also commonly used in both hardware platforms were examined.

To support the interviews with reliable specific information about related software (plus some others) an interview with a representative from each of these software vendor is made.

3 PHILOSOPHY

The approach preferred in this study is not a pure technical or methodical approach, searching or proposing a solution for a major technical problem of this mainly technical subject (CAD). Although in the research conducted here there are some technical points and search for answers to questions beginning with "**How to**...",the main questions start with **Why**...? Due to my opinion formed during my personal experience (thinking, searching, proposing, applying) in this issue (use of computers in architecture) and related technological / scientific aspects; the philosophy, ideology and related issues are the main points of consideration to be able to reach a reliable and sustainable solution.

We human beings mostly start by a question like "How can this.....problem be solved in a better way then the existing solution?" Then we start straight to invent, re-invent or contribute to the evolution of an existing solution. Only few ask such questions before they start with their so called "**creative**" process:" Why it is like this? What are the reasons behind? What is the natural context of it? Is it really necessary to change it?

It took as really long time to understand the cost we would pay for our "**genius inventions**". The ecology case is a sharp, heavy and real expensive one. Though some of us still do not take it so serious. May be this concept is far beyond their conceptualization / abstraction ability. That's how we blame the illiterate squatter settler who pump their sewage to the main drinking water reservoir of the city. This is a true case in Istanbul. The municipality formed an armed department for the security of the water reservoirs of Istanbul.

However I don't think we, the so called literate people do have a different behavioral pattern. I know researchers, who change their field of interest / research parallel to the major trends. For example "Sustainability" concept is finally trendy (the American Indians already knew it centuries ago) all the scientific organizations, institutes, conferences (Habitat II, CIB 95, IAPS 14) choose it as the main subject. I am absolutely not against, but aren't we too late so far? . Thus, we should concentrate more on the question of "why", in order to prevent the repetition of this general methodical mistake, related with our research philosophy or scientific philosophy. I know especially to those who are proud of the quantity of abstract technical terms, equations, tables, schemes (especially difficult to understand) this approach may sound to naive, speculative even not scientific at all. They may even assume that everybody is already aware of this, since their first research experiment. If so, is there somebody to explain the reason of why we are in this situation now. Did the scientists who invented all sorts of plastics which don't get deteriorated for centuries also knew it?

3.1. Why CAD ?

Can't we do without? Sure we can. That's how our predecessors build those cities we are amazed to visit as fool camera tourists. They didn't have CAD to design Hagia Sofia, Selimiye, La Sagrada Familia Can <u>they</u> exist without us? For sure no? So why we are not getting the respect, attention we think we deserve? Not only from computer specialists. from the rest of the society as well. Is our

profession out of fashion? Don't they need us anymore? Maybe in Western Societies this can be partly a reason but not in developing countries like Turkey. The need for housing is much enough to reject that economical argument based on demand / supply theory.

3.2. Why not CAD ?

There is a new concept called techno-imperialism. Which is similarized to another form of imperialism from our age: drug imperialism. The base is our weakness for addiction. First we invent it or discover it then try it. Like it? Go on, till we become addicts. When we realize that we are addicted; it is too late. We are asked to pay much more than we can afford. The immorality of this is that there are always some "clever" people, organizations, who can abuse this and make the profit out of it.

If we forget about this techno tale the answer is: As long there is a better way than the existing one, why not use it. On the other hand some are fanatics of CAD use while some other hate it. I do remember lots of nonsense discussions with those "paranoid, certainly, against (everything except statue)" architects trying to approve the reason of being absolutely against CAD. I am trying to be as open minded as I can for every new concept. However, this doesn't mean I should accept them straight as they are introduced. I would like to have the most realistic, critical and complete (holistic) view of the potential. Only then I can consider involving it into my life.

While doing this there are still some conditions we must keep in mind. We should not loose any of the possibilities / potential we had before. We shouldn't omit the possibility of having new disadvantages (e.g. sore eyes, orthopedic problems, loss of all the work done in two months in a fraction of a time) and finally we shouldn't accept being abused.

3.2.1. Legacy of software use

Some of you may ask like "What to do with this issue?" I think there is a lot. Especially in countries like Turkey where the income of an average office is low in comparison to software prices, and where copyright, patent concepts are not yet recognized by the majority of the public. Most of the architects beginning from their student life, meet CAD software illegally. So do small architecture offices. Imagine a student who is almost forced to have computer skills to be able to find a job. Is it acceptable, that he / she should pay much more then his / her annual income, for this reason? Above all the budgets of the architectural schools are too less then is needed to supply their students in terms of technology.

The ability to reproduce the software (we know that even hardware locks don't work) also helps this corrupt but almost only available choice for the majority. Everyone plays the three monkeys game. They don't see, hear, say anything. Actually they forced the government and we have now in Turkey, a copyright and patent law in western standards. The software prices are in western standards as well. But unfortunately we still have the same (even worst) economical circumstances. There are real heavy legal penalties, but no support for those who

make lots of money out of that technology. What about nonprofit organizations (research, education, etc.)? Who cares about small size private organizations? I don't have a statistical number showing the market share of these different group of software customers but, it is obvious that the number of non profit and small size potential users are big enough to be considered realistically during price policy determination by the software developers. This vicious circuit, shown below, should be changed, but not by force by intelligence

Expensive software --Less people can buy----Less people should pay for the investment and the profit--Expensive software-- Less people can buy--Less pe....

Although the aim of this study is not to develop a marketing model for CAD software some simple and obvious can easily be made. However it is known that to find an applicable one won't be so easy. Here they are:

1. Sell it cheap. Sell more with less profit rate but , make more money.

2. Relative price policy: Change the price due to customer

3. Use advanced finance / credit tools such as mortgage

4. Take a share from the customers profit. No profit no money. Lots of profit lots of money.

Probably these points listed above have been already discussed, or are in use by some vendors somewhere. But as far as I know not in Turkey. Maybe the vendors prefer to punish legal users because of illegal users, by these high prices as an easy solution. I hope not.

4 ARCHITECTS AND CAD

The ways architects make use of computer technology is naturally limited with the facilities provided by the technology developers (both software and hardware). For example if you have a software with good 3D features you will use it for that purpose. Architects may have some specific demands, and theoretically there may be a possibility to answer this demand, but if practically the supply is not there then it doesn't exist. I do believe that the potential benefit of today's technology, not only CAD is much higher then it is now. For example each software has a unique feature where all the others do not. If it was possible to collect the best aspects of different software in one, maybe then we could have a complete solution.

In this part of this paper the results of the interviews done with architects will be summarized in a combination with the comments and opinions of the author.

4.1. The Computer Use Purposes

Due to the reply of the interviewed subjects the main purposes of computer use are as follows.
- Sketch
  Only three out of ten uses the computers for this purpose. But they are not that satisfied with the existing performance at all. They don't find computers

convenient. The remaining seven are skeptical. None of the interviewed architects prefer to use **only** computers for sketch. One is totally against it.

- Drafting
General purpose CAD software are mainly used for this reason. For those who use software which developed for architects and has better 3D possibility it is not a priority.

- 3D modeling, Rendering
General purpose software users need a second software (e.g.. 3D studio) while the users of Architectural packages enjoy this features very well.

- Graphic Design
This is used as a touch up tool for presentation. It is also mentioned as a supportive module (see 4.8.3./I. Modularity).

- Bill of material, Cost estimation, Project management
The majority still prefer conventional methods. For small size jobs they don't find them necessary Though some software have automatic bill of material and cost estimation features they don't use them.

- Communication
They would like to have a better integrated communication environment. Now this subject is a bit abstract for them.

- Word processing
They request it integrated to the CAD software.

- Accounts
Generally They have no idea about it. Somebody else is doing it for them.

4.2. Introduction to CAD

"Starting is half finishing"

A famous idiom

4.2.1. Education

In most cases the decision to shift to CAD has been difficult. The fear, the suspicion for the unknown can be symbolized by these questions: "Will I be able to manage it?" ,"How long it will take me before I am going to be able to use it efficiently?". The main difficulties for this introductory phase can be summarized as follows: A different approach, a different syntax, another vocabulary; a different language (for those who are not native speakers of a major western language), different norms, standards. Above all a different mentality.

Design is an individual activity. The process, method used for design vary from person to person.[3] Since CAD is another tool developed for design purpose, this issue "individuality" should be taken into consideration. Therefore, CAD software should provide more flexibility in order to fulfill the demand of different types of user, who have different approaches.

It is observed that, the introduction phase is passed easier, if the software is developed especially for architects, than those, which are developed for general purposes. The average time needed to learn using an architectural software is one month, for someone who has no previous computer experience; while this time decreases till three days for more experienced ones. For general purposed software this time varies between one to three months. The main reason hidden behind the difference is the answer of the following question: "Should architects adapt to computerized way of thinking? Or should the technology be adapted to the architects way of thinking?"

There is a huge demand for qualified architects in this field. The universities in Turkey are to far from being able to give this supply. As it can easily be estimated, the main reason for this is economical. Although some software vendors provide this education service free of charge for their customers, in general the private courses are almost the only alternative.

The methods used in education courses were not found that convenient by both the subjects and the author. In such programs mainly the menu structure is been taught command by command. For instance first the "File" than "Edit" and so on. A procedure based education system would be a better solution. In such a system a simple subject can be constructed using a combination of basic commands, tools from different menu groups. The details and alternate, advanced techniques can be given gradually as the user becomes more experienced. Moreover a user who has passed the beginning phase can learn more by him / herself easily.

4. 2.2. Budget

The minimum budget for a start, including one PC and an A4 printer, is between 2 to 3 thousands USD, if the software is obtained illegally. Software prices starts from 600 USD and goes up to 10 thousands of USD for common software brands (AutoCAD, ArchiCad). The legal users, who have paid more than 10 thousand USD, still have doubt about the necessity of this investment. They are not sure, if it worth or not.

4.3. Support

The information sources they use in general vary. Due to priority they can be listed as follows: The manuals, experienced friends (especially colleagues using the same platforms), CAD specialists, vendors, help utilities of the software, magazines, books. The structure of the manuals and help utilities are seriously criticized by the users. They want something more than a command reference. A procedural structure (such as "How to?" type help routines) is needed instead.

4.3.1. Software

If your software is illegal, you should naturally forget about support. This is the worst disadvantage of illegal software usage. The strongest reason to convince the architect to be a registered user, is lack of support. Actually an easy to use software, which won't make you dependent on volumes of manuals and busy,

annoyed technical support personnel of software vendors, would be the best solution. Actually, the good intention and effort of the vendors is appreciated. However, the number of personnel dedicated to this is (even) now hardly able to deal with the existing number of users. Future projections are not so optimistic.

4.3.2. Hardware

The No-name machines are the first choice in Turkish PC market. The strategy of such firms is mainly based on marketing. The smile on their face mostly fades as soon as you pay the bill. They hardly recognize you. Big names are relatively better in terms of support but you have to pay for it.

Another important group of critique have been made by the subjects, was on design faults of some hardware equipment. You shouldn't have to develop some skills to be able to load the A0 size paper into a plotter which has a zero tolerance against your mistakes. Moreover you shouldn't need a supervisor, who is going to give you some hints about how to "treat" the machine, for such a regular job.

4.4. Equipment

There are seven IBM compatible users against three MAC users in the interviewed group. This ratio is almost equal to the market share ratios. The average number of computers in one office is two. All have at least one A4 size inkjet printer. One has A3 size printer. One has a pen plotter which is not used anymore. The plots are generally made in copy shops who give this service. Non of the users have a network. The information management, office automation, concepts are not yet acknowledged that well. They are maybe reducing the equipment costs, but they don't realize the other costs created by this approach (efficiency of time, labor etc.). The lack of coordination between the software and hardware vendors can be a reason for such ill structured CAD systems.

4.5. CAD Use Efficiency

Five of the subjects think that they use 80% of the software efficiently. For two of them this number is 60 %. For another two it is 40 %. The average is 62%. This can have a few meanings. Due to the average number (62%) it can be said that the remaining part (38%) is not needed. That means it was possible not to buy that part and pay less, since it is not going to be used,. This supports the hypothesis related with modularity. The user should have the possibility of purchasing only the parts of the software, which he / she is going to be use only. Another reason for not using the remaining part can be the difficulty or complexity of those parts.

4.6. CAD Experience

The average time spent with CAD, by the interviewed subjects is five. Five of them can be counted as CAD specialists. The experience of this group changes between five and ten years. These are working either as freelance CAD

consultants or CAD responsible of the office. Three of them have three years of experience. The remaining two have just started this year. One of the subjects have been working since years as a software developer (he is an architect as well), and had already developed an add-on architectural software to be used with AutoCAD.

4.7. CAD and Design Process

4.7.1. Early Design Phases

I. Sketch
Are CAD systems sufficient to be used for sketch in terms of hardware and / or software? Only three out of ten, use CAD for sketch. The responses of the interviewed architects resulted in the question following question: "Are the architects interested in using computers for sketch?" This should be taken into consideration seriously, apart from the potential of technology. Some of the architects were attracted by the science fiction story about sketching on computers[4] (Visual Pattern Recognition, shape grammars, pressure sensitive digitizers with cordless stylus, pen based notepads) during the interviews. The possibility of transforming a handmade sketch to an architectural precise scaled dawning sounded interesting but not that charming as I expected. In conventional way you can keep each phase on a separate paper. So backtracking tracing is always possible. The existing software options are not easy to be used in this way. All of them agree in one point: The emotional or semantic dimension. The symbolic value of a hand made sketch will always be there and nothing can replace this. For example the value of a free hand sketch remained from a school time can not be a matter of discussion for any of us.

The users of software with poor 3D capability have problem with this. The architects deal with a 3D environment. Actually the human being in general have 3D imagination capability. Although they are using mainly 2D models for sketching the subject of design is in 3D and computer technology should provide this possibility from the beginning, since it is technically possible. Another technical problem is the lack of a better visualization of the model. In electronic media, the size of the working area does not give the possibility of having a proper visual control on the whole, in comparison to real media. Maybe the later generations will approach it different but, now there seem to be a strong resistance against using computer for sketching. Moreover both hardware and software possibilities are far beyond the needs of an architect for sketch purposes.

II. Preliminary Design
Early design phase is not only sketching. Although most of the architects interviewed, who do not prefer to use computers for sketch, are using CAD in this phase. Especially those who use software with better 3D + Rendering facilities find CAD very useful for early phases. They say visualization of the building in 3D both for themselves and the client is much quicker and easier than conventional. The possibility of being able to work on material, color, light,

texture aspects in an almost photo realistic way adds a lot on the design quality. They also say that it improves the communication with themselves, with their partners and most important, the client. Additionally, bill of materials and cost estimation modules may have a strong positive effect on this phase.

4.7.2. Design Development

The transition from early design phases to the development of the design is much quicker and easier, compared to conventional way. Automatic 3D model production, rendering facilities with light, material, color, texture features, automatic dimensioning, easy scale transformation, easy reproduction, revision, symbol libraries etc. are useful tools. In offices where there is a chief designer and assistants, this enhances the communication between the designer who makes the preliminary design and the assistant, who is developing the design under his / her supervision. For solo workers, who prefer to work on all the phases alone, the contribution of CAD is even more vital. Now they can work much more comfortable, without having to be dependent on others.

4.7.3. Presentation

A high quality, precise, sterile drawing is impressive. Easy 3D modeling, rendering features enable a better visual communication between the partners, with the client. The easy, quick revision and reproduction shortens the time left for presentation. Some times they are not sure whether this is an advantage or disadvantage. Because of relying that much on this advantage they don't know when to stop with design phase. Sometimes the time, which is left for presentation becomes less than it is actually needed, and this may cause serious delays and lots of problems for sure.

4.8. User Satisfaction

4.8.1. The Advantages of using computers in design :

Speed takes the first place the other advantages are as follows: Accuracy, easier editing revision, compact, neat and tidy work space, easy drawing, easy and quick reproduction, precise material, light, color, texture control, automatic 2D to 3D conversion, integration potential, efficiency, longer lasting concentration, mobility potential, less storage space for drawings, easier scale transformation, symbol libraries, higher satisfaction with presentation quality, better communication possibility with client, difficulty of consciously wrong drawn elements, fast design thinking process, less employment costs.

4.8.2. Disadvantages of using computers in design :

The mostly pronounced ones are as follows: High equipment costs, health problems caused by computers (sore eyes, headache, back pain), data security (virus, system crash, copying), small displays (14" to 21" compared to A0 size drawing boards), poor contact with the whole drawing surface, addiction and dependency, because of easy revision longer total finishing time, hardware noise, high output costs.

An important issue which we started to discuss is whether we are getting addicts of this new tool. Are we developing another tool which will end with another malfunctioning natural skill? Will there be a time that we won't be able to design without all those artificial systems?

4.8.3. Comments, Complaints, Demands,

I. Modularity
Architects are asked to give their opinion about modularity as a solution proposal for high starting budget problem. They all agreed in modularity as a financial solution. Another reason for having a modular software is the length of the time needed to be able to use the all included features. Most of them still can use only 60 % of the software after three years of experience. All, except one person prefers to have a modular software. They are also asked to rate the modules in a modular software proposal prepared by the author as a guideline. They were also able to propose additional ones to the existing ones. The modules in order of priority are as follows (the numbers in bracket shows the average relative weight as an indicator of importance, from architects point of view):

a. Main Modules

- 2D+3D Geometrical Modeling, (39 %) : All except one consider buying this one in the first phase as the basic module. Architects do not prefer to buy separate 2D and 3D modules.

- Rendering (15 %) : Since light, color, texture are basic design elements, this feature should not be considered as an final presentation element. The majority wanted this module in the second phase.

- Bill of Material + Cost Estimation (13 %) : Though some programs already have it and the architects are not using it, the economical aspect is always vital. Especially for illuminating the client. Most of the architects consider buying this in the third place.

- Project Management (10 %) : Actually they do not have a clear idea about the concept. They think it should be used only for big, too complicated jobs. When the benefits are mentioned they are too quick convinced for having it in the third phase even.

- CAM Module (8 %) : This module consists of a software and a hardware part. Architects would like to have both if they can afford. But only the software model can be sold separately and some service providers can be used to have the 3D model manufactured. Though they can have photo realistic 3D models in electronic media they always prefer a real one both for themselves and the client interaction.

- Sketch Module (7 %) :Architects do prefer pen and paper rather then computers for such a basic activity. The existing technology is not efficient for this purpose. They approach skeptical even to future technology.

- Architectural Symbol Library :(5 %) Although most of the architects consider buying this module in the second phase, they are not satisfied with the aesthetic quality of the existing modules. They prefer to have or create their

own sophisticated library. Because of this some do not even think buying it. They prefer a convenient symbol library development tool. They find "Block" command of AutoCAD and parametrical control of ArchiCad practical.

b. Supportive Modules

- GIS Module : This module may include realistic 3D information about the man made environment. Especially historical, monumental elements.

- Legislation Module : This sounded more like a DSS for legal issues.

- Graphic Design / Presentation Module : They already use software developed for this purposes by import / export utilities but, they are looking for a better integration or a sophisticated architectural presentation module with photo editing facilities.

- File Management module : None of the existing software have such a utility. All files are treated like ordinary data files. Especially DOS based systems with their eight digit abstract file names are difficult to manage.

- Word Processor : Instead of the poor quality "Text" functions. Both for design and related writings. May be an integrated multi purpose compact desktop utility module would be fine (Word processor, spreadsheet, database etc.)

The basic module which can not be done without is the 2D+3D Geometrical Modeling Module. An easy to use flexible module can easily be used as a base for the rest of the modules needed by different types of users (not only architects). The possibility of add-on or add-in software development may open a wide spectrum of choices.

II. Lacking points
The list of lacking points, from most to the less mentioned one, is like this: Affordable price, bigger display, integration in office, integration with other location, interdisciplinary integration, software integration, better support, real WYSIWYG output, better pointing device, compatibility (between versions, with other related software), drawing standards (symbols, line types, layers, dimensions), local language support, easier setting control, comprehensive detailed, procedural help, communication standards, a better GUI, better CAD education possibilities in architectural schools, more ergonomy, emotional value, user newsgroups / forums, long rendering time, integrated 2D-3D modeling environment (in 2D general purpose software), better libraries (especially aesthetics), color standards, norms, better and more fonts, parametrical design (in 2D general purpose software), better programming facilities, better shortcuts, better geometrical definition abilities, more customization possibilities, easier custom library creation, a more serious looking GUI, better technical support for hardware, a more secure environment (virus, data loss, espionage, system crash etc.). In addition to these mostly technical issues there is a point which needs to be emphasized : the humanity aspect, the social issues such as culture. Can a CAD system developed by Americans for Americans (and all fans of American culture all around world) fulfill the needs of a Turkish or Italian, Chinese architect? The discussions about the relation of culture and design occupies an

important space in the field of architectural theory. If the "D" in "CAD" stands for drafting than no need to argue, but what if not?

The second issue I personally would like to emphasize is the communication aspect. An architect does not "stand alone" during design process. So, is it proper to have "stand alone" systems? As a coordinator of the whole design (sometimes plus building) process shouldn't he / she has an integrated design environment[5] maybe an "intelligent CAD system" (as it is named by some experts[6]), instead of a high-tech modeling system?

5 CONCLUSION

Beginning has been to most too challenging. Expensive, time consuming, annoying, sometimes even depressing. One said she wanted to throw the machines out of the window (no she wasn't using a DOS PC) several times.

Education possibilities are not satisfactory, neither during undergraduate study nor after. Maybe the problem is the education itself. Why this systems, particularly each different one should require a special education to become a user?

The architects prefer "architectural" systems rather than "general purpose" ones. They can start using this ones much quicker in an efficient way because the conceptual base, general principles, philosophy and the methods used are similar to the ones they are used to.

They are dealing with spaces and the elements forming or completing those spaces rather than surfaces. Thus, there is no discussion about the necessity of an 2D / 3D integrated modeling environment.

They would like to use the potential of new technologies for a better integrated design environment. They need a better tool for information management.

Early design phase is the most creative phase. Concepts are generated, main points are developed. Architects don't want to give the initiative to tools such as Artificial Intelligence, even for modeling, forget about idea generation. May be this is a science fiction phobia maybe not, but it is a fact. Additionally, they don't find existing systems (both hardware and software) adequate for sketching yet. The symbolic / emotional values are important. A hand made sketch - especially because of its semantic value- is not something replaceable.

Humanity is a dismissed issue. Architects think that, cultural differences, the highly individual process of design, generally semantic issues such as style should be taken more serious, and involved in CAD systems in a way.

As it can also be seen from above, Human Computer Interaction aspects are seriously highlighted recently[7]. Technology developers first looked for solutions of the problem, then they enhanced the technology for better performance, after a while they realized the importance of the users (customers?) who are not computer scientists now they should see that not all the users are the same. Each user has an individual value. A general purpose system may not fit to anyone

except a few. Flexibility concept should be taken more seriously into consideration.

Better and fair marketing models may not create huge firms as today, but the probable profit and satisfaction of both developer and user (customer) will still worth to consider.

Although CAD brings that much extras, they dislike the way they have been forced to adapt the computerized way. They believe that, it should be totally the opposite A point almost all interviewed architects agreed was really interesting. They say: "We can easily do without this technology. But, can the world be imagined without architecture?"

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