Emmanuel Tzekakis
I would like to welcome you all to the last session of this workshop, which hopefully will be a fruitful one. We have a panel here made up of all the chair-persons of the previous sessions, and our objective is to try to reach some conclusions and to try and see dynamics and tendencies. This means that we will attempt to draw conclusions from the other sessions, and with this the chair-persons are going to help us try to see what comes next. Before asking the members of the panel to make their comments on the sessions they presided over, I would like to say two things: first that what the chair-persons should do is not, of course, to summarise or repeat what everyone has said, but to try to draw conclusions from the sessions in order to help the proceedings move forward. The second point is that everybody should help to draw conclusions on what to do next, which is the basic question we have to answer. What to do next about this network, what to do next about issues that have been raised these past few days, what future activities will be organised, how good the work we have done is, what we see as questions or items that should be addressed in the future, and how we can organise this work next year.

Maria Voyatzaki
You never tell your students that you are stressed when you deliver a lecture; but since you are not my students, I can tell you that I feel very nervous to be the first one to sum up. I am very pleased that I do not have to sum up from the people on my panel, because it is better to hear things from the horse's mouth rather than have them paraphrased and perhaps distorted. So I will paraphrase only myself. I will be very critical of myself on this, because I bear a huge responsibility in setting up this workshop. People have been very politely saying that they are happy with both the organisation and the content of the discussions, but I can also sense that there must be some disappointment in some people's hearts; and since it is not in my nature to be complacent, I will not stick to what is successful in this workshop, but will stick to the theme. I tried to listen last year to what you wanted us to set up for the next workshop, and we came up with this title: *(Re)-searching and Redefining the Content and Methods of Teaching Construction*. We could have stopped there, but we added the words *'in the New Digital Era'.* Language is a very tricky tool, and we could just as well have chosen 'in contemporary architectural education', 'nowadays', or 'in the future'; but I think that perhaps in that case we would not have had all this debate. This wording was something that I have worried about all along. The trouble may be that we have to question our existence as a network all together, because this artificial separation of what exists and what will exist is similar to us as distinguished construction teachers: we are educators, under a general umbrella, but we are also designers, theorists, and so on. Perhaps we can claim, as the Aarhus School of Architecture claimed, that we are getting too academic; but that, if I may say so, is a narrow viewpoint, because all of this heated discussion would not have occurred if we saw as the one unifying word the word 'context'. History, theory, design, research and construction are one thing; it is the context that changes, and with it all the other things change, including, of course, perceptions of architecture, construction, and the ways in which they are taught.

As I said, language is a very tricky tool, because while it provides us with nice words to allow us to express ourselves, when we put them together we run the risk

of creating artificial polarities and separations. These past few days I have been writing down words that came up, like 'physical' versus 'digital' or 'virtual'. If you go back to word context you will realise that there is no such separation or that if we would separate them we would add other things such as 'fusion' and 'continuity' to overcome and dissolve these polarities. There is a danger that we see things as either/or situations, as Dimitris Papalexopoulos stressed; and this is simply because if we stick exclusively to the fundamentals we run the danger of being naïve, while in the other case, if we see everything as virtual, we run the danger of being utopian and extraordinary just for the sake of it. So no one around here is claiming an either/or situation, but there is a plea for a both/and situation.

Another thing I want to stress is the aphorisms that have been around in the doctrines on which some people have based their track of thought. I think that there is a danger here, because, to quote Dimitris Papalexopoulos again, resistance should be there to make people more creative, because they have something against which to fight; but if you just take the aphoristic position of simply abolishing, deleting, wiping something off a screen, then all you do is strengthen it and give it power to exist and become stronger. So, as far as I am concerned, it is very important to have creative exchanges of ideas, to be able to sustain our views or refute them, but based on in-depth theories, ideas and philosophies, rather than just ruling things out without discussing them. The other thing that I feel is important is this tendency that I think we have of attaching derogatory or negative connotations to words. This, I think, is a conservative view for everyone, but even more so for teachers who are trying to feel the pulse of the young people around them. We had this discussion a little while ago, where someone was saying that something was not rational, and I asked him what was wrong with that. Statistics say that most car accidents happen within three kilometres of the driver's home; this shows that what is predictable is not necessarily safe, because it is when you are relaxed and not expecting trouble that things can go wrong. So the word 'unforeseen' should not necessarily be seen as something wrong, derogatory, negative, because it is something that allows you to create – and after all we are architects and we are here to create, either as architects or as educators or both.

One of the themes that was raised was ethics. I think that it is very important in our discussion, whether it concerns the digital, the virtual, research, teaching, industry, students, or all of the above, for us, as educators, to define the ethical framework that would allow us and free us to do things.

Last but not least, I want just to return and justify the title of the workshop. It is like the woods and the trees, and I will just give you a personal story because people like this, but I promise that it is relevant to what we are discussing. Eight months ago Dinos and I became the parents of a baby boy. When you ask him "where is your mother?" or "where is your father?', he does not know to look at us, but he can spot an aeroplane. Every time we say "where is the plane?" he turns and looks into the sky, and I find this particularly interesting, as well as funny. The thing is that when he is actually in a plane he does not realise it, and when we try to get him used to the idea that he is on a plane and we say to him "here is the plane, you are in the plane", all he does is look up, trying to find the sky to spot it. And I think that this is the case with the digital era – we are in it. Let's not pretend that we do not see it and that we do not feel it. Thank you.

Emmanuel Tzekakis
I do not know if it will be fortunate for this session that we made Maria speak first; we will have to wait and see how it goes. In the meantime, Ramon, could you please add your remarks?

Ramon Sastre
When we chose the wording of the title of the workshop, I was pleased with the phrase 'the New Digital Era' because you can read it in two senses: simply as the time we are in or in relation to computers. So we can talk about teaching in a digital era, or about music, or anything, because it is a time, an era. In the history of the centuries the 20th and the 21st century will be the digital era. I had the chairmanship of the panel that addressed the new in relation to the other. This is a theme that I suppose you in your universities have every day. We have relations with the other subjects in architecture. Sometimes we talk about design in construction, which covers many things: for example, in our schools we have construction, conditioning, insulation and structures – separated, not together. Construction is just a part of technology. Maybe the use of computers, if we talk about this sense of the digital era, can help us to be closer together, or maybe not. It depends. Someone said earlier that he could programme, and that is real; sometimes with friends at my school I say that programming is like speaking English, so it is not so bad. All the students learn to speak English, and in the same way they can all learn to programme. So you learn programming – there are many languages in programming as well – but that is nothing if you do not have something to programme. What I find particularly interesting is that if you programme you understand programmes, and you can understand what is behind any programme. Programmes are like books without their authors. You have a book, but you do not know who the author is. It is the same with programmes. It is not necessary to be an expert in programming to create something. Maybe you will never use it, just as people sometimes learn a foreign language but never use it; but you will understand it, and that is important. You can read, you can surf the Net and read things. So when you learn to programme you learn what is behind it, what is important and what is not. In the same way you look at the computer and think how beautiful it is, the images, the colours. Colour, though, is just a number in programming. You have red, green and blue, you can mix them together and get new ones, but it is still just three numbers. When you reconnect to the others – I mention this because we also have this problem of connecting with other fields in the school, like design, construction, history – maybe there is a possibility of working together through the new digital era of computers. We can share things. The obvious example is databases, of course, but this is only one thing: there are many other things, just by way of the means that we have. And it is important that we have lived this transition. Our children will have lived only with computers. They will not have lived the transition; there will be no before and after computers for them. So we have this obligation not to be archaic with regard to computers. We have to be with them, otherwise we are dinosaurs. This connection with the other subjects in the schools may help us to be obdurate, because when everyone is making something of these new rules, of this new era, you have to be a saint to connect them. Otherwise, when we find ourselves in the studio, or when we speak with professors of history or design or urban planning, if they speak a different language – and maybe this

era has another language – we will not understand one another and will be unable to make a team. That is the theory I have seen emerge these days. And sometimes we see presentations that are very good in themselves, but somehow do not connect with the others. This is just a means, of course; but, as Maria said, we are within these means and we have to use them. So that is all I have to say for the time being. Thank you.

Emmanuel Tzekakis
Thank you very much, Ramon. Can we have Donal's comments, please?

Donal Hickey
I always wonder at the end of a conference how useful it is to come up with a final solution, to put an underscore beneath what has happened; so I do not think that I am going to do that myself. The questions that were highlighted in the session I presided over related to creative tools – which is strange, really, because tools are not creative – and means of transferring knowledge. Certainly there seem to be two camps: the camp that was about navigating and the camp that was about tools or expert tools. And I think that for me the important thing that came out of that session was that as teachers we have to take responsibility for both the knowledge that we are trying to communicate and the way we communicate.

The last thing I wanted to say was that an issue about lighthouses was mentioned in an earlier session. And I would like to leave you with the notion of lighthouses and ways that help us to navigate. Maybe navigating will be more interesting if we help students to navigate a certain number of things and ways of working and thinking, if they were able to determine where they are going to go without lighthouses. So maybe we are lighthouses only in the beginning. Recently I watched a programme about mapping in Scotland, 250 years ago. Lighthouses are a means of fixing points, so if we fix a number of points in space then we can use those points to move on to other places. I think our responsibility is to place lighthouses so that our students can find new places to go. Thank you.

Emmanuel Tzekakis
Thank you very much, Donal. I find what you just said a very nice thought. Can we proceed with Nadia, please?

Nadia Hoyet
All presentations by the participants in the session I chaired confirm that digital tools are well present in our Schools. Students, their best consumers, are evidently familiar with them. Digital tools are used accordingly by teachers, modifying the ways they teach thanks to the new possibilities offered in managing information through data banks, the Internet and software of all sorts.

More globally, the different interventions showed clearly the advancement of our teaching and research practices. But this mutation also poses certain important questions to which we have to respond. I could distinguish three main questions that correspond to three types of using digital tools. Concerning the access to information, we could realise that complete data banks are now available. The example shown by Herman Neuckermans is remarkable from that point of view. Hence, databanks,

irrespective of their origin, provide a great deal of knowledge with the aid of search machines. However, this instantaneous access to information poses the question on the validity of the information offered. In effect, we have to recognise from the sources what is serious and valid. We must rapidly possess this type f recognition in order to exploit data from the data banks we find on the Net. Another important question that appeared in relation to the use of the available information through the Net: a number of construction teachers are confronted nowadays by the use of their students of prefabricated construction details which they 'paste' on their projects without really comprehending what they represent. This type of import, with the method of pasting parts of information produced in another context of conception, becomes another interesting question which risks leading us to the opposite results. The databanks we possess today pose the question of good use.

Concerning the representation of information and the great facility with which students manipulate software to treat an image, certain teachers submitted their difficulty. Some believe that the seduction driven by the image is a masque which hinds away the real architectural thinking. We are confronted here with the terrible power of the image, which we have to debrief with difficulty. The image possesses a specific language, which we do not entirely grasp. We must our best to understand, by giving it sense, in order to have a better discussion with our students who leave in the world of image.

Finally, concerning the use of a number of applications for our profession, beyond the traditional CAD software, such as AutoCad for example, we note the appearance of small software designated for teachers; what we would call in France 'didacticiels'. What was shown by Ramon Sastre and Oliver Fritz is representative of this new trend. We possess here a way to amplify our capacity to demonstration and we imagine that those of our students mostly interested in IT will find here a real means of expression. This last point represents mostly an opening rather that a problem to solve. But that supposes that students must be educated in programming. We are facing new ways of thinking of a project and probably of new ways of producing architectural and urban space; it is still hard to appreciate the implications for our teaching as we miss the hindsight to known the effects; but this encourages exchange with the other disciplines, which are probably confronted with the same questions.

One of the results of the diffusion of new technologies is found in the interrelation of the complexity of our entire environment which lies in the social, financial and physical domains. The complexity represents the state of contemporary society. This implies new attitudes, where we are capable of managing the data of our practices and professions.

It would be interesting to ask ourselves on the way in which our teaching deals with the question of the management of complexity. How to teach the management of different domains where the data are numerous and often confused? The architect is one of the actors of this process; what is the management of the participants of the deign process? The information produced on the occasion of a project is getting increasingly wide; how will our students be prepared to manage this?

Our young engineers (who graduate from schools of engineering) are educated to this type of management; will the architects remain absent in this? It seems to me that questions on management and methodology belong to our discipline (in the area

of technology) and they are subscribed within our education. How will we take them on board?

Donal Hickey
If I may, I would like to suggest as a future topic of discussion the materiality of how we make architecture.

Emmanuel Tzekakis
We will come to that. Let us finish with the summations of the panel and then we will discuss such and other issues.

Jeremy Gould
This is probably easy, because it is the freshest one in your minds. We, of course, also talked about computers and computing, and we looked at the dangers of computing, the competition by posters as Rodica said, and marvelled – I hope – at the work that Oliver Fritz showed us from ETH and from Liechtenstein, which I think is a real pointer, perhaps together with the lecture last night, about the way that computers will seriously change the way we look at form and materials and so on. Another thing we touched upon were the practicalities of how we demonstrate construction on a scale of one to one or two students. Or rather how the students demonstrated it to us, as at the Grands Ateliers, which, incidentally, I think is a really great experiment. What I liked about this wonderful work is that it is truly experimental: it might easily fail, and by failing one would learn a lot about it. I think that that is a truly useful exercise for students, but, of course, one that for individual schools is very difficult because it costs money, takes a lot of time to set up, and so on.

We also talked about the nature of research, and what research is in architecture as a whole, and what research is that might label itself research in construction. Lightweight structures, structures in general, the use of materials, technical detail, and so on, were mentioned; but I had a slight frustration that I again wanted concrete examples – that is not a good expression: let me say definite examples -- of how that research was being done, by whom it was being done, and what effect if any it was having upon the world of architecture; and I would certainly suggest that this is an area that we ought to have demonstrated to us here. I think that it would be extremely useful to look at that. On a personal note, I want to add that I am completely ignorant about computers and computing, and that is something that does not worry me at all. I do not lose any sleep whatsoever over computers, because I think that within the world of architecture there are greater issues that we have to deal with. Computers will help us solve some of those issues, and we should not be afraid of them – the younger generation, as has been pointed out many times during this conference, has no fear of them whatsoever. The only problem with computers, I think, is one of too much, too soon, too quickly. Our generation just has not had enough time to get used to them. Also, they are not censored and, like the Internet, are uncensorable. The Internet is full of uncensored information, and the only thing we have to teach our students, as we have always been teaching students, is how to filter information, how to analyse and question information that is given to them, and how they can then use small pieces of information to inform their world. And I do not have any difficulties with that at all. Thank you.

Emmanuel Tzekakis
Thank you very much. Before opening the discussion let me add a few words of my own on one or two points that I noted during the other sessions. I observed that there is a tendency to see today's student work, which has to do with computers and mainly with producing images, as something that is perhaps not so positive, because it focuses them on virtual things and not on real things. This is, of course, a very valid position. I would like to point out here that design, as a concept, has always been a good selling point. Design always sells; so in our days, when image is so dominant in everything, because we live in an era when the virtual is there all around us, I do not find it negative that our students use these opportunities to express themselves. Personally, I feel that we also have to keep them connected to reality, to material things as well as to virtual things. Nevertheless it is not a bad habit that they have. Also I am not so negative towards the marketing that hides behind this love of images; this is the world that we are living in now, so we cannot fight it directly. We have to understand it, and perhaps somehow introduce changes into it, but we cannot fight it head on. Computers in themselves are nothing; they are just tools. You can all see the difference since the time when the way to represent reality was to commission a painter to make a painting. After that we developed photography, then the cinema, and now we have an infinitely better tool for recording or representing reality as we like it. So we have to see computers as tools and nothing more. The real work we do is always there; the question is how to use this tool to make our work better.

I put these thoughts down in order to stimulate the discussion and to urge you to connect, if possible, what has been said about images and their role in today's architectural work and the tool that the computer represents. Finally, we must keep in mind that the ultimate aim of this discussion is to find out what we are going to make or not make in the future as a group of people and as a group of teachers. So let me now open the discussion.

Nikolaos Panagiotopoulos
Maybe we would not have such a long debate and discussion about this if we could arrange two things: thinking and designing. If we could teach people how to think before they grab the keyboard, this would not be an issue.

Jeremy Gould
I would like to make a comment on that, if I may. I speak only for England, as opposed to the United Kingdom. We are finding that the children that go through the school system, and have what are called A-levels, which are the exams they finish with in the school system, are becoming progressively worse educated. We are now running courses in the university for basic mathematics for engineering students, and we are running English language courses not for foreign students, but for English students. And this, as you can imagine, is a real problem for us. So, yes, I agree with the comment Nikos just made; but unfortunately the education that we are inheriting, the educational system that we have, does not appear to be giving us students that are good enough to do what he proposes. The idea of a foundation year, a year after school before university of doing general courses at what we would call a liberal arts school or a polytechnic (not quite the same word as in mainland Europe) is a good

one, but very few students these days can afford to do that. They go straight to university in their semi-educated state. Thank you.

Per Ola Wedebrunn
I have a question about what we would address as problematic. We have been talking about navigating in the network. We are gathered here, people from European schools, who have 'tasted' a new system in all our schools. We have three years of Bachelor's and then we have two years of Diploma and we all work to have some kind of Master's, and we are trying to get these kinds of things, research and specialising, and research into the realm of what architecture is. So, since we are teaching in schools of architecture, we are also occupied with the question of what architecture is. We are talking about constructions, we are trying to map what architecture is, and we are trying to do this in the light of the new digital media that we will be working with. We also talk about the problems we face; we are very worried about the environment and what environmental issues there might be. Environmental issues might be about natural sciences, but they may also be about cultural sciences, of course; the environment is both cultural and natural. This is not just a romantic view of the world; it is, I think, a real thing that we have to face. We have to look at problems from these kinds of aspects, and the digital media provide us with possibilities for trying out how things work before we put them into the real world. This could be an idea, thinking in terms of two kinds of worlds, or parallel worlds, or parallel technologies existing from different times. We, at this meeting here, have been talking about digital media and the digital world and virtual realities and how these could be brought into practice in the real and material world. Perhaps we should also talk about the relation between teachers, students and the material world. That could be an issue for discussion and further development, because our relationship with the environment is a reciprocal one: if you treat the environment well, it will treat you well too – or at least so we hope. So perhaps this will bring us from the virtual, the digital media, into the real media, into reality. It might offer a possibility for going a step beyond this year. Thank you.

Donal Hickey
There is an old saying, a carpenters' saying, which I think might sort of tie the real and the measuring together, it is: measure twice, cut once. I think it is very interesting, and maybe it will help us in terms of how to think about things.

Constantin Spiridonidis
Since there is no one ready to intervene at the moment, I would like to make some remarks concerning the last three days, when I had the opportunity to follow your discussions. To the question of teaching construction in the digital era, the participants in this room, it seems to me, reacted primarily in three different ways, with three different understandings, three different strategies, three different ways of answering the question raised by the title of this workshop.

The first approach was that the digital era is a totally new paradigm, a different way of understanding our world and our place in the world, of understanding architecture and thus of doing architecture. From this point of view the new digital era is a new thing, a totally new thing, which obliges us to rethink

and to redefine the whole discipline, the whole doctrine of our teaching. That is one approach.

The second approach that I noted saw things in terms of an evolution: we are living in a digital era; it is therefore natural that new things are appearing, and so we have to include them in everything that already exists and thus to enrich our knowledge, techniques and approaches. Computers have indeed entered our world, but they just do things faster, they facilitate our representation needs, they help us. We have the same logics, understandings and considerations as before, and we simply have to incorporate computers into our understanding and everyday work. That is the second approach.

The third approach accepts that we are in a digital era, that things are happening around us, but sees this as something bad, or dangerous, or as a threat that we have to do something about it, that we have to protect ourselves from, and to which we have to react through our teaching, or through our actions, or through our behaviour.

I think that these three approaches coexist in this room, and the question we are faced with is whether these three different views are mutually intelligible. Do the members of these three camps, as we might call them, have things they can discuss with one another? I am sure that within each of these camps there will be interesting things to be discussed, internally, but I doubt whether there is any real possibility of communication between the three camps. So I am wondering if a future event, like the one we have had the opportunity to experience these past few days, has any meaning, and if so what that meaning could be. Will it be just to reproduce the same discussions or the same arguments or to redefine more clearly the differences that exist? I think that if we are considering another event of this type, we have to take into account the difficulties of communication associated with these, to my understanding, radically different ways of approaching and feeling the issues raised by the workshop.

Dimitris Papalexopoulos

I have a small comment to make on the digital era. The digital era is a moving reality. It is already here, and we cannot describe it. Derrida said 'give a name to our monsters to make them our pets'. We could say that we are in this situation in the digital era, and that we have practically moved on from digital reality, which is the computer: are we with the computer or not? The IT engineers have passed on to the network society: are we with the networks or not? And now, during the last year, there has been a shift towards ambient intelligence, as we call it here in Europe, and what the Americans call the disappearing computer. There is a cultural difference in this approach. So the digital era is a moving reality, with two shifts during the last ten years: **from the virtual reality of computers to network society, and from that to the ambient intelligence society. What we can say with assurance is that the shift from network society to ambient intelligence society is accompanied by a very strong return to materiality, and that does concern us. So there is a digital return to materiality, which I think changes the whole way of thinking in construction, architecture and design.**

Spyros Raftopoulos

I have been thinking about whether to react or not to what has been said over the past few days; but, taking a lead from what Dinos and Dimitris said, I would like to make a few comments. Being from the older generation, myself, I am not, as Jeremy mentioned, a computer addict; but I use a computer, I live with computers and I think that we can no longer live without computers. These are facts. I think that as teachers our problem is how we react in relation to our students. What do we do? Our students are there, they have their computers, they too live with the computer. So, do we encourage them to use computers or do we restrain them? How do we react, how do we ask them to use this tool? I think we should try to let the students know that this tool has to be directly related to the skills an "ordinary" architect should have, which include using their minds, using their imagination, using their five senses, using their hands to sketch, and the ability to have a perception of space. Personally, as I said, being of the older generation, I would react negatively if they use computers in a mechanical way. I think it was Maria who spoke on the first day about the young generation that from the age of four play with computer games, later with cell-phones, and so on; but they use these things in a mechanical way. The problem is that when they start designing architecture they will do that in a mechanical way as well; and that is what I am afraid of. **When we design buildings, when we design for human beings, when we formulate human habitat, we have to use certain qualities that cannot be found in a machine.** It is something beyond that. There are a lot of things that are beyond the actual use of computers. What I am afraid of, and I think it was evident in some of the presentations, is that a lot of the younger generation use the computer and create images without any depth, whatever you may understand by the word depth in terms of architecture. I think also that Jeremy mentioned the lack of history. We do teach history, especially in Greece, where we have a very long history and our students spend a lot of time learning it, but it is not related to what is happening now. They learn history as if they were reading a novel, and once they put it aside they continue with something that is completely different and, as they see it, unrelated. When I said I was wondering whether I should react or not to what has been said here, it was because I do not have a definite or concrete opinion on these things. I am wondering, I have many questions, as we all have, and I do not have the answers right now. These are just the worries that we all have about what and how our students are producing in their architectural work, and that is one of the basic problems we are faced with. Thank you.

Emmanuel Tzekakis

Thank you very much, Spyro. We have already had four reactions, so I think it is time I gave one of my own. Let me begin by saying that I have done a lot of work with computers. I have worked for many years in designing tools to design acoustics, so I know things from the inside. I do not think that we should make a division between those who are fond of computers and those who are afraid of computers. I think this is a wrong categorisation. We now have in our hands a new, invented tool, and that is all there is to it. The question is, what is this tool? My response to that is that we should start by helping each other understand. Those who are for the computer should understand the questions raised by the others, and those who do not want to work with computers should understand what it is that they are afraid of. So I think that this is what we should be focusing on, rather than making theories about what

is happening around us.

Project designing has always been about putting on paper a representation of what we imagine the future work to be. The computer is all about representation; it is a new tool for representation, and as such it can be used for many things. For instance, when I look into the future of designing by computer I see something like this: how do we build a building? We take certain materials and we put them together in a certain way by programming what is going to happen next. So the future of designing by computer is going to come about when all these elements are already programmed entities in computer software that has all the parameters they really must possess – weight, colour, temperature, and their reaction to other things around them; so that in the same way that we build a real building we can build a virtual one, not only as an image but as a real model. For instance, let us imagine we have designed the structure of the building, and then we go on to put in certain material features like walls, ceilings, and so on, all of which add weight to the structure. The software should be able to continuously calculate whether the structure we initially designed is now adequate for these weights. The same is true for many parameters that affect the design of a building. Nowadays we use very simple models of this. For instance, we make drawings more or less by using AutoCAD or something similar – the best way is to make 3-D models there – and we export them to software tools and these tools give us back answers about acoustics, thermal insulation, and so on. This is a very primitive way of using computers as a design tool. We still have a long way to go before we reach this end. Thus, we do not have to be so emotional about computers, either being afraid of them or loving them. The only thing we have to do is to try to understand their possibilities, and also try to understand the questions those who do not work with computers have with regard to what is happening with what we are doing as a profession. So if this can add to the life of the discussion, I will be very happy.

Maria Voyatzaki

In response to Spyro's comments, and I suppose it is a general viewpoint that many of you share, I will go back to what I said in the beginning about the tricky tool which is language. The word 'mechanical' and the word 'thoughtful' are polar opposites, but when we drive a car, for example, although we drive it mechanically we do use our brain to distinguish it from just a mechanical thing. Similarly, when we use computers, or when young people send SMSs to their friends, you cannot say that they use them mechanically, because the mechanical part is only the typing: they use their brains to produce the message, and they express themselves, and they have even invented a substitute for facial expressions, using symbols made of colons and brackets. So they are inventive, and they use their brains to communicate and express themselves, but they use a different tool to send a message, rather than their tongues and mouths.

Now the other thing I want to touch on is this issue of the self-evident skills of our students to sketch and draw. Have you seen the sketches and drawings of first-year students? They are terrible in most cases. What is this myth, and where does it come from, that our students can sketch, can make models, can communicate architecture with physical means? It is not true, and you all know it very well. **If you take someone as ignorant as a first-year student, they know nothing about comput-**

ers, they know nothing about physical modelling and they know nothing about communicating architecture, either physically or digitally. They are tabulae rasae. So we cannot really say that when people design with digital tools they produce something that has no depth, because I can assure you I have a whole archive of hand-made drawings that have no depth at all.

Now, about humanity and architecture. Architecture has to be felt. Architecture is for humans, and therefore it has to be produced by humans in the most tactile, physical way possible. That is one position, but I can give you an extreme example of using computers to free human beings from complex difficulties integrated into the social context. I was reading in the plane on the way here an article on bioethics and face transplants. There are computers that can simulate what the face of someone who has lost their face after a serious injury looks like, and they want to reintegrate such persons by giving them a facial transplant using the skin of a dead person, to let them live on this planet that has no shame. So really, **I think that computers have great potential to do microsurgery, and so to tackle even much more important issues than architecture, when they are used properly and carefully.**

Nadia Hoyet

Thank you. This is not linked to the previous speakers, because I think we have said enough about this. I would like to suggest another idea for our next meeting, and that is the question of complexity, which is a reality of the digital era. And we have not mentioned project management, which is something our young engineers are working with. They are involved in the management of their projects, and this represents a field of knowledge that we scarcely touch on in our schools, although it is growing. We must ask ourselves how to manage projects, how to manage data, how to manage the various players in building, and how architects are situated in relation to that.

Ola Wedebrunn

I want to return to the relation again, but I want to focus on paper, white paper, blank paper, because with white paper we can establish signs, we can establish relations, and we can also establish these within the computer. We can, in other words, use paper in the same way as we use the computer. I think that they are very similar: just as you can make signs and images on the computer, you can also do them on paper. We could also make signs, or talk with our hands, and we could make sounds, and we could then start to make a language. We have to make a language. We want to develop a language of architecture, and we want to develop it as it has been developed on paper, as visionary projects of architectural schools and of architects who have sometimes brought it into reality. We also want to do this through the computer. So it is about making a possibility to speak through the computer as you have been speaking through paper; using the paper for images, using the paper to establish relations, to establish all kinds of words, drawings and whatever else could be filled in. As you can mechanically press down a button to make a letter, you can write the same letter with one finger in the sand, for instance. So I mean the relational thing is very important, and I also think that it is not about one person interacting with one computer, but we are many people interacting with the computer as a scene, as a network, as a place where we can meet and discuss things and this is what we

want to bring out from this meeting.

Boel Hellman
I would like to comment on some things that I have experienced these past few days. First of all, I want to tell you where I am coming from, because in terms of using computers I am halfway between the older and the younger generation. I used computers when I was in school, and the whole idea for me behind using computers was not because I thought they were so sexy, or something, but because of geometry. I did a very difficult thesis about the space of some intricate geometrics, and it was the only way for me to be able to express it in an image, which was what I was supposed to do. I mean, we were producing images all the time, and representations of our thoughts. And I thought it should be possible to do it with the computer, but although I had five or six computers to work with it took three months to do something that now I could do in one day, because the power and the interface and everything else about the computer have reached a totally different level today. That was the first thing I wanted to say, that the whole question of using the computer has to start with the fact that you know what you want to do with it. If you have a task or an interest in something and you try to solve it or learn more about it, then you also have to be smart enough to know what the computer is or could be good at. And I think the teacher's role in this is, of course, to navigate; and in order to do this we have to know a little bit about computers, because otherwise it would be impossible for us to teach anyone to navigate and to do the right thing with the computer. For me, geometry is the basis of using computers, and it is much, much smarter in a computer. The second thing is that you can also learn things the other way around: playing with things is another way to learn. Because today the computer is so advanced that everyone can use them just by association; with the tools and symbols you can navigate through the computer in a totally different way than the linear way of thinking that used to be taught in our schools. So I think that this way of association and links between things is much more important for educators today to understand, and it is also a way to give things a depth and be able to link them to history. Students do not have to learn the whole history in a linear way anymore: you can focus on one word, like stacking, and learn in depth all there is to know about stacking throughout history. You can go via words. You do not need chronological linear thinking anymore to get what you want, and in any case there is too much of that all around us: we could be seventy before we get to know all the things that exist in the Internet; but **the capability of navigation through links, through words, through associations, is for me the most helpful thing about computers.**

So those were the two things I wanted to mention: **navigation through the Net, through other words, being able to make associations and pair things together; and geometry,** which is also very easy for testing a person, if for example you get problems with pasting, as some people said. When I was a student we used to take cut-outs from books to paste into our assignments, if there was some detail we liked and needed to use; so I do not understand what the problem with the computer is. Perhaps the problem is with the assignments, which ought to require you to transform it into something else – a perspective, an axonometry – that proves that you are in the realm of geometry. So, finally, I think that everything begins from under-

standing the logic of the computer.

Alain Sabbe
You said that computers and paper are tools, and I agree with this; my only objection is with the building. **There is a big difference between paper and the computer. With paper you stop time, and you have the chronology of your meaning; but with computers the student never stops time: they just go on and on, and they never conserve the history of the meaning for the project.** And I think that it is very important to go back and think of the whole meaning of the concept.

Jean-Marie Bleus
We were just talking about the same thing. Perhaps the main thing in all these different visions is this relation with time. I would not say that we have to return; rather, we have to go in the future with a little more time on the project, in any way or with any tools that we use to make enough time to think, to make and to enjoy.

Antonino Saggio
I think the issue is to make a contribution to the future years of your organisation. This is important, so I would like to put something on the table too, if I may; but before going to that I want to make my position a little clearer. So this is a kind of a footnote to the lecture, but I think in the end it is important to make things as direct and straightforward as possible. It is clear that there are many important differences here. I agree with you, Constantin, about the way you divided us into three camps of thought, and I very much liked your metaphor, Maria, of the baby being in the plane and looking at the world in which he is. I always remember the citation of a famous philosopher who asked "who talks?", and the answer to this question is "it is the word itself that talks". I think this is very important in introducing what I wanted to say, which is this: there are people around the world – not too many, but definitely some – who think that **Information Technology is more than a neutral tool or is not a neutral tool at all; but the whole challenge is to understand how the world is in some way changing because of its impact. There is a transformation of knowledge, a transformation in the way we approach the world, in our understanding of time, space, and how we do things; and thus it is a completely different world. And because of that architecture is passing through an age of transformation, a very important historical transformation; and the only way to understand that is through the word revolution.** That is why – since words are important – my book series is called "IT Revolution into Architecture". We really believe that there is a total paradigm shift within that. So does this necessarily mean that I cannot relate to other persons? I love other people, I love other points of view; and I understand that in teaching this particular strategy is a little bit dangerous. Not everyone can do it, not always, not on all levels. Culturally, my position is that I really believe that this is the real problem – the problem of finding a new generation of architecture that is able to incorporate some features of Information Technology. That is why one of the key images that I presented is the one of Steve Jobs looking inside the chip, because through that process a revolutionary architecture is in a way actually happening. So of course I agree very much with what Boel Hellman just said. For example, **the whole idea of jumping, of moving non-linearly, the**

whole idea of interconnectivity is something that comes from Information Technology. And the important thing is that it is not just there, outside us: it becomes a feature that is incorporated in a new generation of architecture; and that is the real problem. **The computer is not only a tool for representation; it is not only a way to express knowledge: it is a new characteristic of a new generation of architecture.** That is the problem. Just like the problem of how to enter a kind of standardised way of thinking, a linear analytical way of thinking, which was incorporated into the architecture of the Bauhaus generation. This is absolutely crucial in order to make our different positions clearer. This is my position, and these are the lines along which my work runs.

Now, coming to the possible agenda for next year, which I think is an important issue, of course, I would like to offer some proposals. Continuing on with this idea, what I will say is that now we have new things, and these new things are happening because of this process. When we talk about a keyword like mass customisation, **we must remember that the whole concept of mass customisation could not exist without computers. Certain aspects of production exist because we have Information Technology. The idea that it would be exactly the same thing to make each shoe different as to make all identical is a consequence of information technology. It is not as simple as that, of course, and then there are other things as well. But there are aspects of construction that are completely new because of this, and I think that this is very important. Mass customisation is one, of course; the use of movable sensors and intelligent buildings is another. More and more we are making structures that are really site-sensitive in many ways. So there are topics that are new, conceptually new, and they are strictly related to this. Complexity is another one. This is a key word, and it is important that we understand what we mean by it, for it is one thing to deal with complexity within a traditional set of issues, and quite another to address new issues. Complexity could be another of those key words that can bridge different meanings.** In brief, then, I think that there are new issues which are related to the last part of that, and it is very important that they are dealt with in the real world. How much of that we teach and which techniques we should use is another story.

Henk de Weijer

We have been talking about programming and about the potential of computers, and yesterday I also heard someone mention the word nature; so we are interested not only in the technical side of living, but in the environment we live in as well. We are learning that we are part of an environment; so what interests me is less what the programme is than who or what programmes the programme. And if the nature of nature is not inside our own nature, then what is the use of what we are doing? In the 13th and 14th centuries, when the Renaissance was beginning to develop, the essential human values were heavily discussed; and if we are not learning to apply these human values, then what are we doing at all? This morning we heard some discussion about the superficial application of technology in some universities, and the sensorial perception of what we are dealing with is just the start. What we need to think about, whether we do it explicitly or implicitly, is the search for meaning and what we do with it. And we can have full confidence that, **if the students learn how to shape their sensorial perception, the very first approach, and if in the long**

run we are able to continue to look for meaning, then they will also look for meaning; and computers can be a tremendous aid in contributing to the expression of what we are looking for.

Donal Hickey
I think there is something interesting in what you said about "in our nature". There is an expectation that our buildings and the environments around us will be able to sense us, and I see this as kind of inanimate. I think that there is an area of technology that we always miss. We see technology as being about inanimate things; but there is a technology that is inherent in us, which is how we experience what is around us, that I think will become more interesting as time goes on, whereby things like the human genome project will help us begin to understand more about how the computer that is in us functions and how it understands what is around us. And I wonder, is there a technology that is beyond how computers see things or how we react to what is around us?

Herman Neuckermans
I would like to say something, because I thought, when we started the idea of the thematic networks in 2000, and later, when the Council decided on the title of this workshop and the focus on the digital era, and now, having heard all the presentations, that we would have focused more on those issues in which there is a strong connection between Information Technology and construction. A lot of interventions had to do with what I would rather call architecture and IT. Construction is, of course, part of architecture, but it is only one part of it, and I think that there has been a lot of general discussion that transcends the issue of construction. That is one point. The other is that there is an on-going in-depth debate on computers – there is ECAADE, there is KEDRIA, there ARCADIA, there is CIGURADI: there are plenty of associations that discuss the issues in a very specialised manner – and we are not on that level. I thought, when we decided on the title "...Teaching Construction in the New Digital Era", that we would be more focused on that aspect. I am not trying to be narrow-minded, but many things have been said that pertain to a much more general level. So, since this is the concluding session, if I had to say something about the future, it would be that perhaps we ought to decide on which level of discourse we want to discuss this topic: a general, cultural, philosophical level – What is IT? What is IT in relation to architecture? What is the new position of architecture? – or a more specific and practical level? Perhaps a better articulation of this broad area could help.

Ole Vaangaard
I think that it was nice to hear the suggestion that this could be a revolution in architecture and in architectural thinking; but on the other hand, a revolution never starts with a committee, and this is not the place to develop a revolution. If there is going to be a revolution it will come, and I for one believe it will. I know that there are a lot of people in this room who think otherwise; but to me it is very important that we are listening to each other. In all the subjects that we have touched on in the last four years, there have been considerable differences of opinion; but I think that it is very important that we get the European landscape of what is going on in

different places, so you can put yourself in another's place and rethink your position. And on this matter too, although we have all these very different views and expectations, I think the fact that we are bringing them out and listening to them all is important.

This brings me to my next point. I think that it is important that these sessions continue in some way. I am less interested in what the specific subject is, because whatever the subject the fact remains that we are different and that we do things in different ways; and whether it is materials or theory or computers that we are talking about, we see the same pattern. The point is that we develop each other, we work with each other into getting a kind of understanding of each other – as I said, we are not making revolutions here.

Ola Wedebrunn

I am always very happy to hear what Ole has to say, and I agree that we need to know what each of us is doing so that we can really exchange what we need to exchange, because we all have a lot of problems to deal with. I would like to refer to Bruce Bowen and the issue of making this relation between what we are and what the environment is and how these issues could be addressed in the context of construction for designing the world – not design for the world, but designing the world. He raises this issue, that perhaps we will not be not doing constructions in the traditional architectural way, but in a totally different way. In any case, as long as we share our views and experiences we will have a much better idea than if we just discuss in philosophical or theoretical terms.

Dimitris Papalexopoulos

The question of whether the computer is a tool, although perhaps a bit vague or philosophical, is nonetheless a worthwhile and critical one. But if we think that the computer is a tool external to us, we cannot advance very much. A little mapping is not bad. **I think that there are new subjects related to Information Technology, which I could divide in the following way: new subjects in the building and new subjects for the building. This categorisation is not mine – I think I got it from one of the books of theories** (perhaps De Luca's), but I like it. So there is Information Technology for the building, which includes 3-D models, production and databases, and then there is Information Technology in the building, which is interaction devices and – something that we have not referred to – the monitoring of new and old buildings. In relation to other specialisations we have to manage our cost relation to civil engineers that are called upon to deal with the informal, the mechanical engineers that are called upon to deal with building management systems and ambient intelligence company integration, and of course we have to manage our relations with IT engineers, that is, with the people that develop software, which is something we cannot do. We can perhaps learn how to programme and collaborate with them, but – and this is a totally new situation – **we must recognise that there is now another and extremely critical partner to architecture, and this is the IT engineer.** Not a mechanical engineer, not a civil engineer, an IT engineer. **How do we develop a language to speak with them? These are the people who can create intelligent environments, who develop software for 3-D productions for mass customisation. This is not a job for architecture. Architecture's job in mass cus-**

tomisation is to define, for an object, what is stable and what is parametric; and this is a very big job, which can revolutionise the whole of architectural thinking at the moment, because architecture is not a stable form, it is a form that changes. That is easy to say, but very difficult to design, believe me. So this is an open question. I think that there are three crucial areas here: the area of production, or construction, the area of sustainability and the area of monitoring buildings and environments, which could also be prevision of reactions to catastrophes, earthquakes, and also building sustainability. And all this, I believe, always comes as an intervention to what exists. Do not forget that Information Technology never pretended to have made a revolution; that is the interpretation of those who have tried to understand IT. IT is parasitic by nature: it works its way into what exists and, slowly, transforms it radically. IT is not a collage, it is morphing. I think that is all.

Maria Voyatzaki
I am not going to speak about forthcoming events, but thanks to computers it is possible for us to stay in touch until the next one. Once more, thank you very much, and I hope you have had a fruitful and enjoyable time.