

**Debate on the Presentations
Third Theme**

Chair:
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Jeremy Gould

Thank you, Nadia. I will say a few words on your presentation. I think there is clearly an issue about what architectural research is. This has been debated long and hard in the United Kingdom for some years now, because as you probably know the funding of university courses depends upon the research output of the university. What has tended to happen in those universities that have elected to do research is that there has been a division between researchers, who bring in the money, and undergraduate teachers, who merely do courses; and the two do not quite meet. This is a problem that many universities in the United Kingdom are facing at the moment, and therefore there is a huge debate about what architectural research is. Nadia has tackled the idea of the energy issue, which is clearly one major strand of architectural research and I would suggest that that implies that the divisions between construction as a subject and energy as a subject and built environment as a subject, and so on, are actually very artificial; and those divisions that we have seen in various diagrams in this conference probably should not exist, because actually they are all the same subject. I think that Ramon is ready to begin, so please welcome Ramon Sastre. On Ramon's presentation, I think that what he said about not losing touch with reality is quite important for students. I find that particularly with giving them a computer programme that always works. They get a sort of satisfaction in making it work, but they actually have no understanding of what they are doing; and I think that giving them bits of cloth and wire and other things is rather important, because they do at least have some simulation of what the problems of the real thing might be. There is an instant gratification to computer drawing that sometimes worries me. Let us now welcome Francesca Muzzillo from the Second University of Naples in Italy. On Francesca's presentation, I very much liked the idea that all our students should spend the morning building and the afternoon in the studio or in school. I am reminded of Le Corbusier, who spent the morning painting and the afternoon doing architecture. Although one would hope that our students build rather better than Le Corbusier painted. But that is just prejudice, of course. Alain Snyers from Les Grands Ateliers de l'Isle d'Abeau, I know the reputation of Les Grands Ateliers that is indeed large. In Britain we are very jealous of this institution. Visiting the website one sees these really extraordinary things that undergraduate students have experimented with and built, and the whole thing is really the most extraordinary experiment. I would just like to add one little thing to that: research is only research when it gets published. That is, research has to be shared; you must not be jealous of research, you must not keep it hidden. Sometimes, of course, when you reveal things to people they think that you are just being silly, they think it is light-weight, they are rude about it, and so on; but I think that is a risk you have to take. You have to be upfront with research. The website is obviously the easy, low-cost, easily edited, easily censored way of doing it. Maybe that publication edited by Maria is actually a thing of the past, very nice though it is – maybe that does not have to happen anymore. We will leave the subject of research for the moment, although I am sure we will come back to it during the discussion, because we have three other things to fit in. Thank you, Fraser Hay for your presentation. Those of you who have not seen the Parliament Building in Edinburgh should really go there and see it. It is the most extraordinary amalgam of detail that you will ever see in your life, and one that will keep Fraser and his students happy for the next twenty or thirty years, I would think. I

am sorry I have got the running orders slightly wrong, and I apologize for that, but we are going to continue even though we started late and will finish late. On Rodica Crisan's presentation, I do know what I think and I may say that images of that sort, which I would call pornography, as a much easier way of describing it, are much supported by the architectural profession. The architectural profession love all that stuff, because it is a good way of selling the product. That is the world that we are part of, whether we like it or not, and we have to sort that one out for ourselves. The last presentation for this session is from Oliver Fritz, who is Assistant Professor for Digital Media and Architecture at the Liechtenstein University of Applied Sciences.

We can begin the debate on the presentations we just heard. The last two presentations talked about computers again and, adding that to the lecture we had late last night about the Sagrada Familia and other things, it seems to me that there is a clear direction emerging about computers. Computers can, of course, do whatever the operator wishes them to do, and certainly producing those pornographic images of buildings, as I called them earlier, is **one thing that computers do very well, and I think that our students learn how to do that sort of thing very quickly. But it does not really prove anything; those images can be of anything, they do not really matter. The other use of computers that Oliver showed us seems to me to be far more interesting, both in terms of our architectural output and in terms of this word construction, as well as in terms of what future architecture might be, how it might be conceived, how it might be drawn and how it might be made.** So I suggest that the beginning at least of our discussion should be about these things. I would like to ask Oliver to explain, simply, how all that work was produced: that is, was it done by undergraduate students, was it nineteen-year-olds, or was it post-graduate students who had been through a more conventional – dare I say old-fashioned? – architectural education?

Oliver Fritz

Most of the work I showed was from the ETH, where I was teaching for the last five years, and all but one of the pavilions were done by post-graduate students, who worked very hard on computers for a full year to understand all the aspects. They learned programming, they learned scripting, they learned parametric design, they learned production in CNC; and it is not possible to learn all this in a short course. One of the examples, the second one, is not complete as a structure. It was made in one week – a seven-day pavilion. We prepared the parameters, we prepared the construction, and we made some experiments before we took it to the students. Then there was a week when we had the students for the whole day, like a workshop; and after seven days this pavilion was done. It was worked on by first-year to fifth-year students; it was not a special course. I think that the students need to learn the tools by themselves in the first two years. It is really not possible to give a lecture about AutoCAD, or any kind of CAD field, really. Each student must decide for himself what software he wants to use. All you can do is give them something fun to work with, things like this; and if they are really interested or if they need a programme or software for a new project I am sure that they will learn about it, they will buy a book and learn about it. **You have to open their eyes. Students have to understand what different formats are for. I think that it is very important for students to learn to write a small programme, a very small programme, just so they understand**

what a loop is, or an 'if then'. That is my opinion. Now I work only in Liechtenstein, where I am teaching students in the Master's class. We bought a CNC mill, a big one, that can produce six metre pieces – personally, I would like to build houses with it. This is my first semester, and I am surprised at what they learn. I do not have any experience in this, but I think it will work. I just have to prepare more than for post-graduate students, but I think that the results will be similar.

Herman Neuckermans

I would like to comment on your point, but first I would like to make some remarks about two or three of the presentations. In my opinion, the interesting developments that we have been seeing were done by people like Ramon Sastre, or our other speakers, who called themselves masters of the technique of programming. If Ramon has a problem – well, I do not know if it is really a problem, but if he wants to do something different – he goes ahead and does it. He does not have to go to somebody and beg them to make this or that, and waste his time explaining what it will do once it has been done. This brings me to a point that I have been arguing about for many years now, because I have been in computer-aided design since 1971. **Of course we cannot avoid IT. It is an illusion to be against it, and I think that that has been explained, so it is not an issue.** In my school, where I am the programme director, all first-year students have to take a programming course whether they like it or not. The reason for that is that it represents a very important recent development in human thinking, which is algorithmic thinking. Algorithmic thinking did not exist before IT; and society today, the many developments in society, and even all these things that have been built here, are based on algorithmic thinking. In my view it is something fundamental, which should be part of architectural education. I think that if we really want digital tools to be our tools, this has to come also, and maybe even primarily, from architecture. So that means that the bulk of architects have to be confronted with this during their education, and then some will grow and develop. But it should not be done only by very specialised people: I think we should all do it. If I may say one last thing, in regard now to the first presentation: research is endless in its subjects, and by definition it is innovative. So I will not attempt to answer the question of what should be researched. However, if I had to suggest something in relation to what has been said here, I would say research in representation, as at least one thing that should be researched.

Jeremy Gould

Rodica, may I be slightly unfair and ask you what your answer was to your final question?

Rodica Crisan

Well, this will be an instantly formulated answer, but it will have to do. I was thinking that what is lost could be compensated by exercises of learning by doing. Normally, I do not like this kind of exercise very much, but I think that we could partly compensate by using them. Computers are obviously a part of our life, and even more a part of our students' lives. I agree with what Maria said yesterday, that they are living in another world – I see this in my seventeen-year old son, who is already living in a different world from mine. We have to accept this as a fact; but I think we

can improve, we can develop this kind of exercise of learning by doing, for the moment anyway. Although I think that it is a very delicate problem, because the situation of a practising architect using a computer but who is educated in a traditional school and can use a computer without any problem as a tool, is totally different from the situation of young students, nineteen-year-olds, that enter a school and are fascinated, drugged by computers, by the force of the image. So, I repeat, it is a very delicate problem that should be deeply studied.

Jeremy Gould

Yes, thank you.

Henk de Weijer

I would like to tell you one example of an exercise we give to students in our academy. For me, and I think for all of us, **it is very essential to see the relation between the technical foundation of the design**, the structures and the form; so one exercise we do is to give a very rough sketch of a part of a building, and tell them what materials they are going to be using in this or that situation, and then ask them to find out for each different situation which is the mother, the leader. So there is one mother and there is another mother and there is a father, and then I ask them to try to find out the relationship between the mother and the father. Or if there is a grandmother also, I may ask them to discover the grandmother. And then after all this I ask them which is the first detail they need to take care of. Many details are solid and many are taxical. And then I ask them to try to discover the technical prerequisites of the different situations. So there is one detail here, one detail there, one detail around the corner, at the bottom, at the foundations, and so on, and they all have some influence on each other. I do not let them go very deep into the detailing, because it does not matter if you do not go very deep into detail on 1:1, or 1:20, or 1:10 at the maximum, as long as the essential items are dealt with. And you may find out that a detail that is at the far back corner of something proves essential in finding the solution for a detail somewhere else entirely. So these relationships between details are very helpful and very creative in finding the relation between the needs of form and function, and this is very illustrative for students.

Donal Hickey

Over the past number of years I have noticed that the image is presenting a serious problem in terms of how students understand work. **They believe that the image is total, and their understanding of projects is solely based on the image. And in some respects this is separating them from the idea that they need to physically experience architecture, and that is directly translated into how they conceive their own work, both in terms of materiality and how it is expressed, that it is not fixed.**

Jeremy Gould

I agree with you, and I am assuming that you are disapproving of this notion of the image. What do you do about it? I apologise for intervening, but I agree with you, and I am interested to see how you and others propose to deal with this.

Donal Hickey

We must stress the critical importance of the physical experience of architecture, because it is so fundamental. One problem that we have in our school in Dublin is that insurance conditions rule out school trips to other countries; and we are fighting a continual battle to retain our right to make trips to visit, to physically see buildings, as part of the curriculum. I am sure it is the same in most universities, because we believe that the physical world is fundamentally important as a teaching tool, that in some respects can balance the issues that are now being confronted by the accessibility that multimedia platforms give for expressing architecture.

I have just one more point to make; I have a very good friend whose father is a joiner, and for the first time I brought to the studio maybe forty or fifty little cubes of timber of different types and handed them out to the students, so they could smell what timber smells like, so that they understood that when you paste a piece of timber on a surface, a 3-D face, it has a quality greater than colour, and that when you photoshop timber and change the scale it is not representative of the reality of texture, surface, absorption in terms of light, and so on, and that the materiality of the world we exist in is fundamental in terms of our understanding of how we make architecture.

Jeremy Gould

I should just say we made a building out of cedar some years ago, and it was the best-smelling building site I have ever been on – a wonderful experience.

Dimitris Papalexopoulos

My question to the panel has to do with parametric design and algorithmic thinking. I think that one of the main design problems is **how we define in an object what is stable and what is parametric or changeable.** This is a capital design decision. What is your opinion on that? Do you have a theory, do you have paradigms? Do you have something, or are we still at the research stage in this domain? We do not define a form once and for all; we define a kind of form that has stable and changeable parts.

Jeremy Gould

I certainly do not have an opinion, because I have no knowledge with which to form an opinion, but Herman might, and Oliver might as well.

Herman Neuckermans

I think that the only real example so far of parametric design, as it is known in the area of computer design, has been given by Mark Burry. It means that when the shape is defined by mathematical equations, we have the parameters; that is where it comes from. You may be able to extend it to other concepts, but then you will come to something that will be very vague, and that, I think, is the reason for your question. Basically parametric design is when, instead of saying that this is an idiosyncratic object that measures 9x6x19 and is called a brick, you say that it is an A,B,C parallelepiped and has a certain matter. And then you instantiate the values, as was said earlier. Whether this methodology can be applied to any shape you like, I do not know.

Dimitris Papalexopoulos

To make my question clear: my point was, of course, that we have very good work; but to be clearer, and I want an answer from mass customisation people, do we have a new problem in the definition of habitat, for instance, because you presented some objects there, or do we have a new design research area? My personal opinion is that we are in the open, redefining old subjects of architecture, or new subjects, in a double way. **There is a *homeopoetic* dimension and a *heteropoetic* dimension: that is, the part that is their core of identity and the part that can be changed by others. This, I think, is a new design problem,** and I would like an answer also from the people who spoke about mass customisation. Thank you.

Nadia Hoyet

The last thing I showed was a diagram giving the idea of how you can enter the prototype information. In the tests for different origins, scientific, parametrable, measurable, they introduced human parameters and tests in all their great variety. To deal with all this information you need to be able to parameter human factors, so that you can find the interface between all these pieces of information. It ends with works that are close to what Fritz showed, and the question is the iteration of the work.

Jeremy Gould

I will go back to your question of whether things are new. As a historian I always think, and I actually know, that there are no new things. There are different ways of doing things, there are slightly different ways of approaching things; but it is interesting that both the lecture last night and Oliver's introduction today were both showing ways in which historically the same process had happened. It had happened differently, the technology was different, and so on; but historically the same process was always there. We started with Gaudi's geometry in the early part of last century; now there is another way of looking at it and another way of making it, and so on, but the idea was always there. And I like the idea that we are part of a progression; it makes things much easier to understand, I think. One of the problems with today's students, it seems to me, is that they have no sense of history; and I find that a very curious thing. They do not understand what is old and what is new – everything is new, because they press a button and it comes up on their screen. Think for a minute about the two details that Christian Schittich showed us – a very cold house designed by Tadao Ando and a very warm German building designed by someone else. I think that it is very difficult to explain to the students the difference between these things, because they see them both as current modern architecture; but actually, the one by Tadao Ando I call heroic architecture, it technically belongs to the heroic period of modern architecture, and the German example belongs to maybe the 1990s or something. If you have a historical perspective on these things it is much easier to understand the form, the materials, the technology, and so on. So, I am afraid to say, the top of my list for first year students is to teach them architectural history, because then you can start to put things in a very wide perspective. And then the connections between Gaudi and parametrics and the modern computer are much easier to explain and to understand. It is just an idea.

Dimitris Papalexopoulos

I partly agree and I partly disagree with you. Durant in the 19th century was a catalogue under a total concept. Now maybe this is an overture to the unforeseen. The lesson of interaction today is a kind of liberation, a freedom, that surely must know Durant and all the things and the variations very well, but here with Durant we have a catalogue "Les plus beaux bâtiments et la construction et details qu'il faut faire" and here we have an opening to the **virtual ethic**.

Sabine Chardonnet

I just have one thing to say, and one question. The thing is that of course we have problems in our schools, because we have so many issues and so many disciplines that we will never have the staff required to handle that. So you have to select. And in our school we selected two fundamentals, one of which is history, including history of building and construction, and the other is geometry, which had disappeared but which we re-introduced into the curriculum, because I think that in the digital era we need to give our students a geometric culture that is fundamental to the discipline, not just a matter of forming images. These are two things that are complementary. Then, regarding the question I had in mind: this summer I was in Iceland, and in Iceland they have no more wood, they have destroyed all the forests, and they have brilliant architects, who build public buildings; but when they want somewhere to live they just go to the Net and buy a house from Sweden, which is delivered by boat. They have to give dimensions and say what kind of thing they want. I was at a farm where the farmer wanted to build a house, and when he discovered that I was an architect he asked if I could help him, because he did not know how to deal with the catalogue. And suddenly it occurred to me that in these kinds of situations we need a mediator. A mediator between a new way of access to everyday products, which is what a house in Iceland seems to be, and these people who do not know exactly what is going to happen to them with their houses being delivered and built in front of their noses, and there is something new happening with that. This is something that we should perhaps think about, and maybe develop a new profession somewhere between architecture and building and management and merchandising and customising.

Jeremy Gould

Yes, I see what you mean. You can buy your house from IKEA, and it can come with all its furniture, I assume; and just as you hire someone to build the IKEA furniture, you can hire someone to build the IKEA house as well. IKEA could maybe even make it the same person.

We have a comment from the back.

Joan Luis Zamora Mestre

For many years I longed to see a meeting of the EAAE in my school, the school of Sant Cugat des Vallès, and now it has happened. So first of all I would like to thank all the organisers, and especially Ramon Sastre. Now, I would like to make some remarks on the three speakers that I have been listening too. I must say that although this is not my field – I am a professor of architectural representation – I found the concepts you have been addressing interesting, and I liked the questions that were

put forward by our colleague from Ion Mincu University, the school of architecture in Bucharest. But what is representation? There are three issues (these are not my concepts): mental set, meeting and the notion of equivalence. For me, the concept of equivalence is the most vital: whether what we are representing can be equivalent to what is going to be built or whether it is biased. So I think we can link this aspect with what has been put forward, that the way of thinking that is relevant today is that of computers, and computers are here and they are here to stay. So we are probably in a moment of transition. I say that we are hybrids, and I see that Ramon is not a pure and devoted computer designer of programmes ...

Jeremy Gould

Yes, none of us are pure.

Joan Luis Zamora Mestre

Ah, but there is more to that. It is quite interesting to see the issues explained, but they have got to be linked to other information. I have information from students who have come here from Bucharest, who are quite serious and hard workers, which is of one kind; and I have information from the building in Edinburgh, which is of another kind. Having had an opportunity to work with Van Eyck, de Carlo, and so on, I know that the leaves come from Van Eyck, out of Van Eyck, with a special meaning, and that was the way to start a process. But what concerns me most is that it would be a pity to lose the seriousness of building. Our colleague from Liechtenstein made two points in that respect. The example put by D'Arcy Thompson On Growth and Form is formalistic, and in fact Thompson was trying to offer an example of the relation between function and the environment. He was attempting an organic way of explaining forms, so I cannot accept this as a good example – in fact it is completely biased. And I prefer not to give any opinion about the little houses in the plot. The future is fascinating but, as has been said, the drawing of architecture is the first construction of architecture.

One final point and I will finish. Candella was a very strong critic of the Sydney Opera House; and when they defended it, it was in terms of the fact that the work of an architect is a service, not like the service performed by a rubbish-collector, but in terms of creating new types, new modes of seeing the future of architecture, and that is a challenge.

Jeremy Gould

We have had presentations from the people from Warsaw, and I talked to the representative from Wroclaw about how teaching was done in Poland. I am conscious that the eastern end of Europe has a particular tradition, and that it is a much more methodical, systematised, separated, perhaps, tradition than is the tradition now in western Europe. And I am wondering if they have thoughts about these things. You are in a state of revolution in the nicest possible way, and I wonder if you have thoughts about the use of these strange machines and how your course and what you teach might be altered by them.

Rodica Crisan

I was thinking that there is also another important difference, not only between east

and west but also between big schools and small schools. It is very easy to make experiments when you have 80 students; but we have 300 students in each year of study, and that causes a lot of problems. For instance, I teach constructions of wood and steel: what kind of experiments can I make when I have 28 hours and 300 students?

Jeremy Gould

Do not think this is a problem unique to Eastern Europe. In fact, your numbers may even be a little modest. I know what you mean, and you have to work out ingenious ways of breaking that number down into smaller and smaller groups. I have a theory that it is very difficult to teach a class that has more than fifteen students. I am sure that we are all teaching classes of 150 or 300 students and so on; but if we really want a discussion amongst a group of students, to really talk about what they are doing, then I think fifteen is a good number. Anyway, I just wanted to say that we all face such problems, and therefore problems with money and so on. But then, of course, we have to find solutions – our job is not only as teachers of facts and theories, it is also about practicalities like these.

Donal Hickey

There is something I find interesting about the new programming languages, how students hyper-text in terms of how they read images, that sometimes we look at our students and believe that there is an irrationality in terms of how they play. **What I would suggest is that we have to allow for unstructured things to happen. So playing and dreaming are really important. It is not just empirical facts that allow us to understand the world; to dream is important too, and to play with programmes is very important as well. And to look at play as being critical to how we learn is also very important. And maybe it is not about looking at the world in an absolutely structured way.**

Joan Luis Zamora Mestre

Federico Fellini said: *Nulla si sa, tutto s'immagina*: Nothing is known, everything is imagined. Something that is quite interesting is the representation of biologists when they are researching viruses. The way they explain them has nothing to do with the advances that are made. As the research is going on; new ways of describing it are put forward, and they vary enormously. So, for us, what is an image? Is it what we have, or what we know? A means of putting forward our knowledge? But this is not complete. It has always got to be revised and it has always got to be complemented.

Jeremy Gould

Should we maybe just change, move the subject slightly towards research in architecture? We touched upon various issues in the presentations just now, but there are many issues that we have not discussed. For example, I am interested in research into actual materials, which I guess never comes into schools of architecture. Is that right? Does anyone have any experience of actually dealing with the things in the building industry? As far as I can see, the products in the industry are becoming more and more globalised. You can buy the same roofing tiles in China as you can in Eng-

land, which I think is appalling, actually, but the point is that it is possible. They are made from the same moulds, they have the same licence and so on. So increasingly these products, owned by a corporation, are the common currency of the world. And these products often do not come near the schools of architecture, but as architects we are asked to use them all the time, and that seems to me to be an extraordinary gap. We saw a diagram yesterday that had the three circles of academia, research and practice. I would add another one for industry. We have no connection with that, am I right? Does anyone have any experience in researching a building material? You see? It is interesting, is it not? It is interesting because we put ourselves forward as thinkers – that is what we say we are – and actually all the pieces that go into a building are rarely designed by us. Most buildings are an assembly of standard products.

Ferenc Makovenyi

My opinion is that it is unfortunate that the construction industry is not part of the military industry: if it were, we would have much more money and many more opportunities. From what I know research in construction means, for example, how it is possible for someone to start from a basis and in twelve hours to build a landing platform and have the concrete stable and even. That is interesting, and that is research. **We, on the other hand, use the products, but we have lost the game. The game is that normally, traditionally, universities and schools were bases of research; and we gave this away. We outsourced this, unfortunately.**

One more point, connected with something Nadia Hoyet said about a Doctorate in Architecture. I think that there is quite an important connection between research and doctoral studies. Because if we want to reproduce our profession of, let us say, construction, building construction, we need educated people, and we need doctorates. That means, especially in my region, that you have to be a DLA, Doctor of Liberal Arts, or a PhD; and then you can have doctoral schools. I know that the ACE, for example, is fighting to get a special Doctorate for architecture, so that we are not PhDs, because we are neither like chemical engineers nor artists. Our knowledge is a little bit different, and that is why the ACE is fighting in the Chamber of Architects to remove PhDs and DLAs from our profession and to form our own doctoral courses. I think that this is very important for research; so we can say that this is a special task.

Nadia Hoyet

It is a problem, and we have to build it. It is researching itself. We have to build this kind of knowledge, what we could call hybrid knowledge.

Maria Voyatzaki

I want to go back a step as we talk about research, because there are questions that are emerging, firstly relating to the generalist nature we want our diplomas and effectively our graduates, the architects, to have, which means that automatically we are not specialists in any area. When we talk about researching materials, there are other disciplines out there that are specialists in the matter who will do it better than we can – materials scientists. You talk about acoustics, and you get mechanical engineers or acousticians that have a physics degree, and then they specialise with doc-

torates, and so on and so forth. That is one problem that we have been discussing for years: what are the specific fields in which we can, and have the authority, to do research? The other thing, is what is the milieu, what is the platform, what is the physical sphere in which we do research? For even assuming that we overcome the first part of the problem and we have specialisation and higher degrees, with doctorates in special areas, and even though research has traditionally been a sphere or an asset of the universities, the contemporary reality is that research is funded by industry. We all know who or what drives the RAE exercises in British universities – the needs of the industries to produce and to be productive. Which leads to another point: where do we do this research? Because if research is funded by industry, then we have to find the links and the ethics to create the framework to allow research to flourish. And finally, research has to become a common ground for all of us; and this is also something that we have been discussing for quite a few years. The more specific so-called serious journals, the scientific journals, with their scientific committees, and so on, could theoretically host the research that we as construction or other teachers undertake. People mentioned last year publications like the *Architectural Education Journal*, which is produced in the US; but if you flick through it, it is exclusively American universities that publish in it – and what they publish is always, in my opinion, more or less irrelevant to the title of the journal each time, but that is a different story. At least they have played it clever; they have invented a journal and they publish in it. We Europeans, and we, as a network of teachers of construction, have no niche in which to publish, not only for our CVs and our promotions, but to promote research as a whole. We have nowhere to publish.

Francesca Muzzillo

I would like to say something regarding the field of our research. Because of my architecture history, I have always had to deal with engineers; and I remember that when I was younger I decided at one time to become an engineer, not because I did not like being an architect but only to explain to them that there is no difference between us. In that sense I think that every field is my field as an architect, if there is, as someone said before, a passage from a dream to a construction. Obviously I am not able to do all these things alone; I have to do them with other people. Generally I begin my courses with twenty centimetres, because I think that the first thing the students should know is how big their hand is. Then they will not say that something is twenty centimetres when it is five or fifty. I think that the first important thing is for them to be able to calculate length, how big something is, and physical space. So you see everything is my field, and in everything I could work with others; but there is a dream in between. Yesterday I was in Barcelona, and while I had seen the new architecture, Gaudi architecture, before, I had never seen the *Barrio Gotico*. For the first time in my life I saw ceramic tiles from the outside, steel and ceramic. You get the feeling that they endure for years and years; they are not eaten away. That is an obsessive way of thinking. I calculate like an architect, and that is my field: to imagine, to dream and to try to arrange. That, I think, is our field.

Maria Voyatzaki

In response to this I would very quickly like to put on the table two realities, unfortunately very cynical, as all realities are. **The one is that industry funds people and**

ideas with prestige, status, acquired through past experience, specialisation, studies and work. They do not fund dreamers. The second reality, which is even stronger and is based on fact, is European Commission General Directive 13, which does not include architecture as one of the research areas that is funded by the EU.

Ole Vanggaard

You postulated that there was no research at architectural schools. Seen from the Scandinavian point of view, we started off with the Aarhus style, and I know that in Bergen they are doing a large scale research operation at the design school, 1:1 building in timber – there is an architect working up there – and very closely related to where the Norwegian timber industry is, that is doing full scale structures every year. Well, one year a structure fell down – it is, of course, very dangerous to work with full-scale structures. Then in Copenhagen we had a PhD student in architecture, who was working closely with Wienerberger, which was financing half of the project. This meant that our research in brick was not limited to the architectural site, but it also meant that we were working on the structural part; and our exploration of reinforced brickwork and reinforced brickwork industrial components can be included in architecture. I think that going into the materials is a possibility, and it is strengthened when we work together with the industry. There are examples, and they are important. It can have an impact on the whole situation in the school when someone brings you input and others react to it and include it in their research.

Jeremy Gould

I would add that that is also true in England. Research into materials is done via the routes of low energy materials, or the so-called green materials – glued brickwork is one example I can think of – and so on, particularly in the use of so-called green insulation materials. I think that there are examples; and for those who wish to get into that sort of research, what they should do is to find out how those existing researchers manage to work the system. I think you will find that it is done through collaborations with other university departments, and gradually you build up a simple network which allows you to be both an architect and a researcher into materials and to get the necessary money from industry. This is forthcoming, but it requires a lot of effort and persuasion to make it happen; and, again historically, I would say that architects have been very bad at that over the last century. If you look at the 19th century, architects were very much involved in the production of materials of all sorts. In the twentieth century, generally speaking, they were not; and there were very good historical reasons for that. Partly because architects wanted to be famous, and were spending too much time being famous and had not enough time to do other things. However, I am digressing, so I will stop.

Herman Neuckermans

I wanted to answer your question of whether we know a school that is working on materials. Of course we have schools that are working on materials, and I think that our friends from Denmark have proven it. Our school also, does so, in an engineering context. So I will not go further into that. Instead, I will take the question further and ask you not to forget that education in architecture has a full scale of diver-

sity, which I hope and I am convinced will subsist in Europe. In your school you start with history, my school starts with theory, another school starts with construction, another with raw materials, and so on; and this diversity will persist. In the new structure of the Bachelor's and Master's degrees, the Bachelor's will probably be more uniform, since the European Union will impose similar elements; but in the Master's you will be free to specialise: some people will do materials, others can do history, others computers – and I hope that this will happen. The second remark is that maybe, and I hope that you know, the EAAE, which I think is the model of this network, also has a network on research.

My last remark is in answer to you, Ferenc Makovenyi. The EAAE has established a joint working party with the Architects Council of Europe, which I think will meet again next month, and I will bring that matter to the fore, because it is new and very strange for me. The joint working party is now working on the critical issue of how we access the profession after the abolition of the Architects Directive that has been in operation since 1985, and which has been replaced by a Qualifications Directive that I presume does not concern you much, but that is very fundamental, very important for us. And there we tackled the problem of the PhD, because I fully agree with you that research is primarily fed by PhDs. What I do not agree with, although people have said it three times here, is that research is funded by industry. That is not entirely correct. It is also funded by industry, but there is a lot of research, for example, into energy, where many industries may be involved but that is funded by the European Union.

Per Ola Wedeburn

One of the biggest resources that we have for research at schools of architecture is rooted in the diversity of culture that we have in Europe, and that is the students. This is one of the greatest resources that we have: not the economy, but the students. And the students will experience things and will help us to develop things because they come to us with new ideas, and we will pass on ideas to them.