David Speiser

Nexus Architecture and Mathematics

Aims — Methods — Criteria

David Speiser, frequent Nexus conference participant and presenter, discusses what the aims, methods, and criteria for research into the relationships between architecture and mathematics should be.

Aims

The aim of all Nexus activities must be to contribute an understanding of the nexus between architecture and mathematics, which is diagrammatically sketched by the two arcs connecting “A” and “M” in the figure above. The figure shows schematically, distributed on the two arcs, some of the many fields that connect A and M. On the “lower” one are grouped technology and engineering, with Mechanics on the “A” side and Euclidean and differential geometry on the “M” side.

The upper arc is devoted to “the arts”, represented by the sister arts—painting, sculpture and decoration—on the “A” side and by the art and science of symmetries on the “M” side. On the significance and importance of the two arcs more will be said below. Here it is only important to realize that there is a full list of domains that all play their role in the Nexus A-M, and to all of them one must pay attention. To this list one must further add the equally full list of the histories of these domains, such as the history of the arts, the history of mathematics, etc.

Add to this that most of the traditional histories of the “A” as well as of the “M” fields deal almost exclusively with Western A and M, with which we are all more or less familiar. But since its very beginnings Nexus went global, and rightfully so, by adding Indian, Chinese and Mexican architecture to the working fields. But these new fields, since they are much less accessible, demand from many participants great efforts, efforts that can sometimes be considerable.

Thus while it is impossible to be a specialist in all these fields, one should, indeed, be one in at least one of them, either on the “A” or on the “M” side, and a “connoisseur” of at least one field and its history on the complementary side.

From this it ensues that conference presentations should be followed by extensive discussions to facilitate interesting dialogues during and interesting conversations after the conference sessions.

These are highly demanding postulates, but I do not see how they can be avoided; they are indispensable. The most important condition for success is that there exist a general atmosphere of intellectual curiosity of each participant towards the domains listed (or unlisted) above. Even if this may seem amateurish, it is still the best we can do.

Perhaps we should concentrate on one or only a few fields at each conference.

Methods

The method to be followed is determined by the aim of NEXUS. But there are so many fields on the two arcs of the Nexus A-M, which in addition, differ so much between themselves, that correspondingly there are, of course, many, many different methods we should speak about. But this is impossible, and I doubt that there are many people who even have an overview all of them: it is precisely this richness which makes Nexus so interesting!

The only way out of this dilemma that I can see is round table discussion, where various speakers present their views and ideas. Such discussions are, of course, an interesting Nexus topic in themselves.

Thus the most useful thing I can do here is to concentrate on the methods of how best to present one's insights and discoveries to a mixed audience and how to communicate one's ideas.

The experience of Nexus conferences seems to show that it is best to explain one's ideas through concrete examples, which are always interesting in themselves to begin with and also stimulating for further discussion. One always learns from examples, and they make discussions easier.

There should be contributions and discussions especially where quite different domains on both arcs are involved and confronted. As an example I propose the study the construction of Gothic churches and especially their towers (for over 400 years the highest in the whole world!) from the point of view of modern skyscraper design and engineering. Such an investigation by a professional would, I am sure, lead us to new and perhaps more congenial insights into the enormous ambition of those who built the towers and especially into the daring of the architects and engineers than those presented by art historians. It is certainly not an accident that the first inquiries into the mechanics of elasticity emerged, as noted by Clifford A. Truesdell, at the time of these buildings. From such confrontations, the domains on the lower, and even more so on the upper arc, would greatly benefit.

Criteria

Like method, the criteria for communications are determined by the aims. They should be solidly grounded in at least one field belonging to one of the two Nexus A-M arcs, and possibly look to others, in order to establish and illustrate connections between various parts of the arcs; for as the name says, this is the central aim of NEXUS.

We live in an age of highly specialized knowledge, which is indeed indispensable today. Yet, this does not suffice for a deeper understanding of the questions regarding where the arts, science, and technology, even history and philosophy, not only of the West but of the whole world, meet.

In this sense, Nexus rightfully claims to do pioneering work, at least as concerns the upper arc! And for this reason it is not possible that the results of a piece of work are always "correct". Even in

the domain of the sciences pioneer work inevitably falls prey to errors; and when a new domain starts, methods and proofs necessarily lack rigour.

So one should not be embarrassed if this happens in Nexus contributions: it is inevitable. And, of course, one might do worse; for instance one could be uninteresting or even outright boring. While experience teaches that in a 45- or 60-minute conference presentation concrete subjects are always the ones that are the most easily grasped and understood, abstract, philosophical contributions should not be banned. They are sometimes even indispensable. However, they too should be well backed up by concrete examples and references to our visual intuition. This holds especially if one attempts to speak on what is perhaps the most fascinating Nexus question, namely, What does Mathematics contribute to the beauty of Architecture?

About the author

David Speiser is Professor Emeritus at the Catholic University of Louvain, where he taught physics and mathematics from 1963 to 1990. His research concerned elementary particles and mathematical physics. He has been giving lectures and seminars regularly at the Scuola Normale di Pisa since 1990. Since 1980, he is the general editor of the complete works of the mathematicians and physicists of the Bernoulli family. His work on the history of science includes various publications, some of which are related to art history. He presented “The Symmetries of the Leaning Tower and the Baptistery of Pisa” at Nexus ‘96, now available in *Nexus: Architecture and Mathematics* (1996).