

*La onde io certo lodo sempre grandemente lo antico costume delli edificatori, che non solamente con disegno di linee, e con dipintura, ma con modegli ancora, e esempi, fatti di assicelle, o di qual altra cosa si voglia, si esami, e pensi, e ripensi, piu, e piu volte con consiglio di huomini esecitatissimi, tutta la opera, e tutte le misure delle parti sue, prima che noi ci mettiamo a far cosa alcuna alla quale si ricerchi e spesa, e cura*  
Leonbattista Alberti (1)

Lambert Rosenbusch

The architectural model – a medium in the art of building

Early polyphony

In March this year, at a colloquium on centralised buildings held in the Pantheon in Rome, an experiment was made that is well worth considering in a contribution on architecture. During the night of 21 March (equinox) one of the colloquium participants placed himself at the centre of the great domed hall and intoned the notes of a chord. With brief interruptions of a few seconds he sang the three basic tones and their inversions (2).

The result was amazing, because the prolonged echo at the centre of the building resulted in one person generating the sound volume and the harmony of a polyphonic chant.

From a historical perspective this experiment leads to the remarkable hypothesis, that the cause of the development of western polyphony was hardly an invention but rather a discovery of something that was already there. In this sense polyphony is the result of a particular perception. Here, the architect in question asks himself whether the phenomenon of this interesting musical process, which is highly relevant to the development of the western theory of harmony, probably came into being because only European architecture operates with 'space', that medium which, like the great dome of the Pantheon, is able to generate 'early polyphony' as a result of its size and layout.

The introductory hypothesis precedes these observations on the architectural model in order to counter that widespread error of judgement, especially in architectural circles, that a maquette is able to reflect the phenomenon of 'space' in a manageable, miniature form.

In the described experiment with the polyphonic chant, the hollow interior of the Pantheon acted as a reverberating sound

box, the medium for creating harmony from a few sung musical intervals. To the architect, the same space, its dimensions and geometry, is itself an object of action and, beside photography and plans, his medium is the reduced-scale representation of the object as a model.

The model helps the observer to form the image of a planned, ideal, no longer existent or actually existing, building as perfectly as possible. The architectural model is a three-dimensional plan. It is most easily characterised and categorised by seeing it in analogy to the diverse possibilities open to a drawing. Just as in the graphic profession the finely etched drawing exists alongside the ink drawing, depending on the producer's intentions, the model also permits similar differentiations in its constitution depending on the wishes of the client or the model maker.

The model maker has a wealth of possibilities ranging from the subtly accurate, meticulously detailed model created from finest materials to the roughly sketched, patchwork mass of cheap materials used in the design process. Almost anything goes, so long as it serves the prime purpose in hand of aiding perception, by freeing and sharpening the thought processes for the fully matured project.

Illustrative and interpretive models

Research into the area of the architectural model soon leads to a point where a first differentiation can be made between the objects. On the one hand we find examples which serve exclusively as a means to an end, because they are needed and produced to satisfy a far greater purpose, such as the construction of a building or the work of a research commission. This type of model is generally developed with the aim of helping an invention to become reality. (fig.01)

In contrast to this function-oriented group, there is a second type of model. These are created mainly to communicate something to, or raise the awareness of, the observer. In this respect these products should be seen as independent works. (3) These models are miniature replicas of often large buildings through to whole city layouts. They are usually produced after the construction of a building has been completed, often many years, even centuries, later. Such models are usually costly to produce. They often use colour and mainly serve the purpose of illustration. In the past they were placed in the libraries of principalities and monasteries, or in a special chamber of rarities to enhance the status and reputation of the ruler. (4)

As this is more of an essay on the theory of draft design than

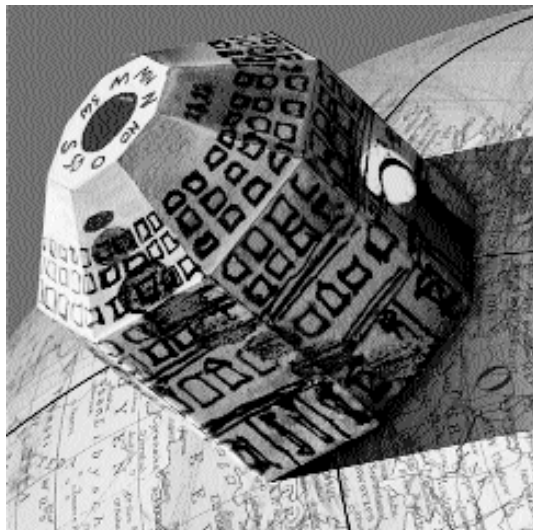


Figure 01

Pantheon, model photograph from the northeast

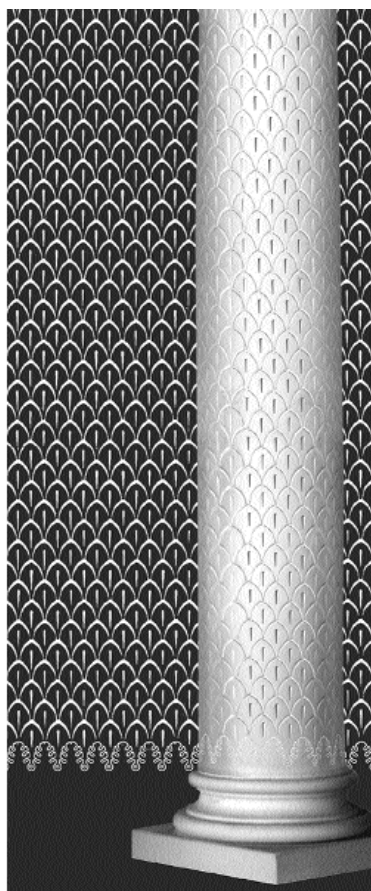
This picture shows a roughly built model of the Pantheon in Rome made of translucent cardboard, which has been glued onto a medium-sized globe in correspondence with the geographical location of the city. It was needed for a quickly arranged experiment in the framework of a discussion dealing with a hypothesis on the relationship between the cosmos and space. This simple model confirmed a vague theory which maintained that, during the equinox, the sunbeam, which at midday is oriented directly north, enters the body of the building and strikes the arch above the entrance precisely between the upper and lower cornice. This discovery was the beginning of research work lasting many years. (19)

an art historical study, a closer look at the function-oriented models could greatly benefit the discussion. Here, we will first address the enduring question as to which of the mentioned groups is to be preferred as far as aesthetic value is concerned. As can be expected, there is no satisfactory answer to this, as the two groups treat completely different themes.

Though it is true that, for professional reasons, an architect will give preference to the second group, because the working or design model is indispensable and thus of great practical and intellectual value. Even the small-scale example is essential in finding and developing ideas. For the initiator this process forms a special experience. The early type of model is often the first, fleetingly recorded moment of inspiration. Usually this initial product is embryonic, often highly inaccurate, but frequently, in fact almost always, enhanced by that special unbridled

#### The simple design model

When looking for a suitable theme for this category, it seems best to characterise this type of model as a spatial sketch. Its prime advantage is that this type of initial sculpture generally employs very few means which, although providing only a limited variety of expression, are in fact extremely intense and immediate in their approach and able to directly relate to the core of a design. More than at any later stage in the development of an architectural work, they are able to powerfully expose its essence. These often small-dimensional works reduce their information to a highly concentrated level, and it is precisely because of this that their stereometric composition conveys more than most drawings. The perceptive process is heightened by the fact that, in their material form, simple models provide generous scope for the imagination.



*Figure 02  
Spoleto, Tempio Fonti di Clitunno  
Model to a scale of 1:10, plaster  
of Paris, detail (20)*

*This detail showing part of the eave gives an impression of the representational accuracy which can be achieved by a craftsman working with plaster. Precision can be achieved to within a tolerance of half a millimetre.*

*Figure 03  
Spoleto, Tempio Fonti di Clitunno  
Southern central column prior to  
ornamentation (21) The two central  
columns of the temple are decorated  
with scale-like ornamentation. The  
accompanying finish is visible in the  
background of the photograph. This  
drawing served as the basis for  
producing a rubbery stencil of the  
ornamental surface by photo-mechanical  
means. The stencil is then applied to  
a wooden cylinder. A two-piece plaster  
mould is then made and finally filled  
to produce the positive plaster model.*

enthusiasm of the creative process, comparable to the natural improvisation of the first, pencilled sketch. The miniature already conveys the direction of its creator's imagination and the confidence that the design concept will overcome all obstacles, no matter how big they may be.

There is, however, one major difference between the sketch made on paper and the model. In the case of the latter, and in contrast to the plan, the model is concerned with the real integration of the third dimension, with the representation of the bodily, despite its reduced form, and with stereometry. (5)

The above-mentioned definition already referred to the quality of the spatial with which all professionals in the plastic arts have to contend. This is particularly true in the case of sculpture, notably followed, of course, by architecture. Here, it should also be briefly mentioned that in the history of building, the client held the architectural model in high regard as a planning guideline. (6)

#### The material

In a design model a thought is materialised. In order to produce it the artist needs some form of mass, or he feigns a resemblance in the formation of his design by using an everyday, usually smooth, material which he shapes or distorts by assembling, bending, folding or inclining to create stereometry. Irrespective of the medium the architect actually uses, the model gains materiality, the sculpture can be experienced with the senses and as a body it becomes haptic, it can not only be seen but also be touched. (7)

This is where we return to the introductory thoughts on the singing of the chord in the great dome of the Pantheon, because in a scale model, it is just as impossible to down-scale material as it is to express that acoustic phenomenon experienced inside the hollow resonating chamber. What this implies is that the down-sizing of architectures for illustrative purposes can only be achieved linearly for certain aspects. In the strict sense this

also applies, with the exception of pure geometry(8), to almost all the characteristics of an architecture. Neither the material, the colour, the ornament nor the structure of an architecture, or parts of it, can be satisfactorily reduced in size. This is particularly apparent in the final appearance of specific materials used in surface finishes.

Disappointments are often experienced, even by the specialists, because when inspecting the small-scale model of an architecture, there are always noticeable discrepancies between the model and reality. This conflict is attributable to the problem of proportionality in the details.

The following example illustrates this: when attempting to represent a planned sandblasted architectural concrete wall, reduced for instance to a scale of 1:50 and when the surface is

instance there are minutely uneven structures in the sunning him. We only have to recall that the popularity of frescos painted onto freshly limewashed walls was partially due to the fact that they enabled the observer looking at the picture to gain an insight into the depth of the plaster, as if each grain of sand were still recognisable in the surface. In this way the picture actually possessed a three-dimensional quality because of a few millimetres in reality. It is impossible to reflect the full impact of such phenomena in a scale model.

And now, to limit this contribution: when giving instructions for the production of a model, the artist can only conclude that it is best to keep the choice of material as neutral as possible. The above example is transferable, and practice has proven that the materials the architect chooses for his building are

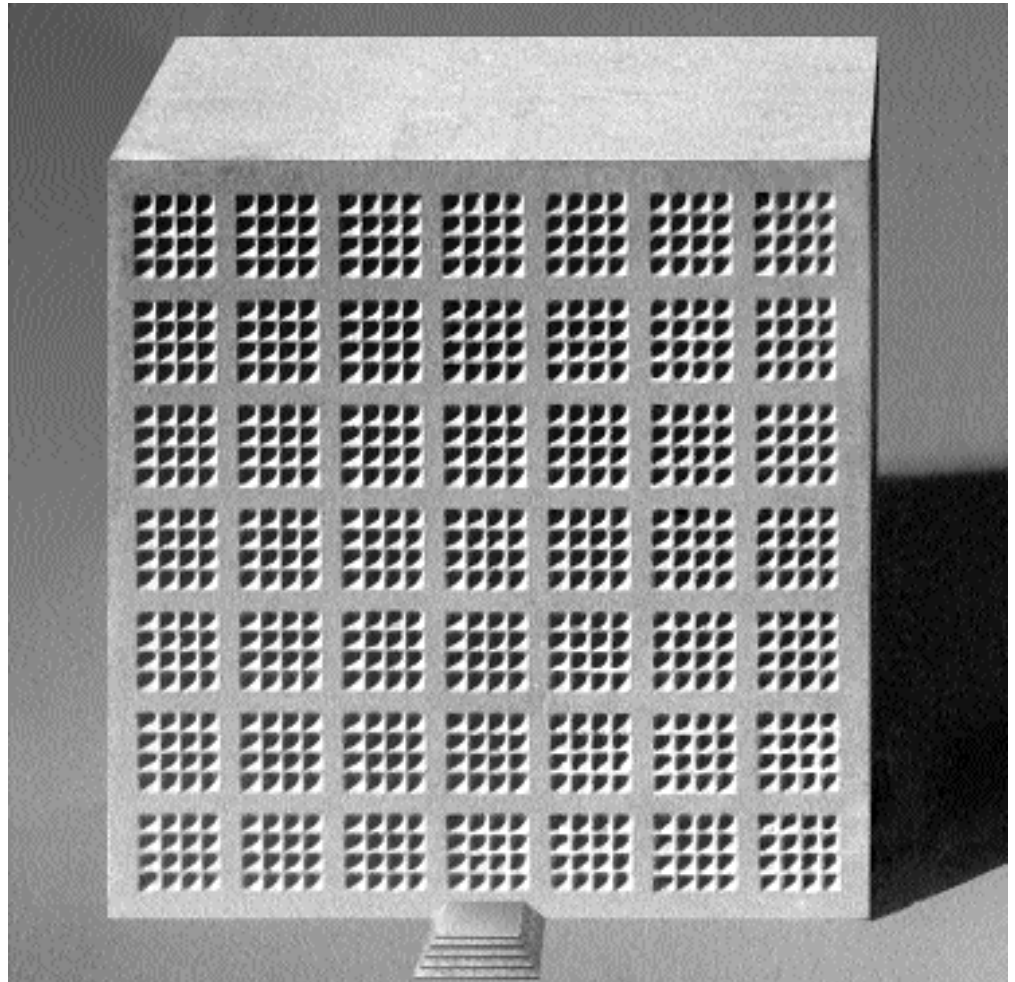
Figure 04

Lambert Rosenbusch, Architect

Art academy 1980/2001

View from the southwest, model 1:500, plaster of Paris

Because of its cool objectivity, plaster was chosen as the material for the model of this planned industrial building with its seven extra-high, hall-like studio storeys. Despite the model's small scale, this material succeeded in conveying the hard geometry of the building and the intended industrial appearance.



presented proportional to the model, its miniature rendering will look as soft as velvet to the observer, i.e. the geometrical-ly correct reduction of the 'structure' creates a surface appearance that makes the material look more like plaster than the desired, rough-grained concrete.

In the final instance the discrepancy between the model and reality lies in the difference in size between the object and the eye level of the human being, the utiliser of architecture. He or she normally perceives a building from a distance, gaining a long-range view of the proportions of the 'mass- model'. Later, having approached the building, standing in front of the façade or even inside the hall, the observer will perceive the immediate surroundings and experience the quality, the materiality of the architecture. When questions arise he can even touch the object. It is not simply an inspection with the eyes. He feels with his hands and notes, often subconsciously, that for

almost invariably unsuitable for creating a model.

Consequently, an experienced model maker will use a suitable substitute.(9) He selects a material which does justice to the particular task even in miniature form, and as far as possible emphasises the distinctive character of the represented object.(10) Plaster of Paris is one of the recognised and popular basis materials for creating architectural models. It is no accident that this material has proved its own worth in this sphere and has been elected for generations. For certain models requiring strongly defined details this medium remains unsurpassed in every respect. The material is light, almost white, inconspicuous as regards colour and has a fine, hardly noticeable surface structure.(11) This simple material is especially prevalent in the scientific field because its neutral characteristics favour the necessary detachment.(fig.2)

It is also preferred for particular scientific purposes, such as

building surveys, the preservation of historical monuments and creating replicas for collections and research series. (fig.3) The fact that the use of plaster has decreased in the modern age, in favour of works produced mainly from synthetic materials, is chiefly attributable to the prevailing, partly very fashionable, attitude in present-day architecture. Certain topical, occasionally superficial and unverified, guiding principles such as transparency, levity, flexibility etc., which are currently widespread among architects, markedly shape the prevailing aesthetic or design ideal and, consequently, the model as one of the major communication forms.(12)

Despite this, plaster is still in demand as a material in certain small circles, not least for the simple reason that its outstanding qualities espouse discreet modern architectural approaches. It promotes, supports and, because of its modest form, even elevates them. In this context we must refer back to the already mentioned, necessary neutrality of the material in the design. As in research and science, detachment from the object is highly recommended for the purpose of design.(13) (fig. 04)

This defence of plaster as a material, well-known in artistic circles for innumerable generations, should in no way exclude other materials. On the contrary, the example of the plaster model makes it easier to illustrate a governing principle which exists in the area of possible representations of architecture, or which is open to discovery. Although the material is neutral in colour, reserved and accurate in reproduction, it is also extremely sensitive to mechanical damage and particularly to moisture.

As there is doubtless a relationship between the architecture, or its design, and the form of the representation, it goes without saying that in certain circumstances materials other than plaster will be chosen.

This may occur for a number of reasons. First of all the client may wish for a resilient, hard-wearing model which cannot always be handled with extreme care and may have to be fitted with special features to enhance its expressive potential.

At this point the original theme of the interior, the spatial, is again of importance. One of the special features of western architectural development is the duality between the internal and external aspects of a building and their mutual influences. Here, the model is invaluable to the architectural theoretician, because neither plans nor photographs nor specially created perspective drawings (14) are so well suited to investigating the formal and constructive relationship between the internal principles and the external appearance as the scale model. Models which show both characteristics of the building, the internal space and the external characteristics, are only rarely made of plaster or a similar material. They usually consist of wood, as a certain level of stability is essential for this type of construction, especially as they are often fitted with devices which permit insights into the interior.(15)

This can be achieved in numerous ways, for instance by omitting parts of the construction. Mobile elements are often integrated which can be removed, shifted or unfolded on hinges. In each instance of this type of model the manufacturing process is technically similar to cabinetmaking. In this respect the models not only fulfil the task of representing an architectural design, they also reflect the art of building in itself. The cabinet-maker who manufactures one of these models regards the task as a crowning challenge to his individual craftsmanship. This type of commission enjoys pride of place, and the resulting object is often a work of art in itself.

An architectural model for the Biennial (fig. 05)  
A Tribute to Gerrit Rietveld.

A topical example of the last group is the model of the German Pavilion for this year's choreography of space in the pavilion itself.

In somewhat simplified terms, the building, constructed during the 1930s, consists of three exhibition rooms. The pavilion is concentrically arranged. The central room is adjoined right and left by the two other rooms, each of which is again divided in the lower zone. The exhibition in each of these is dedicated to the treatment of the architectural theme of the central, empty hall. The theme is discussed, varied and transformed in some eighty, similar sized, scale models regularly arranged beside and behind each other. It provides the public with illustrative material while acting as a teaching and learning aid to the authors. They all focus on the central room and the volume enclosed within the six sides, i.e. the four walls, the floor and the ceiling. The challenge is to make a statement on non-mass, the intangible, the unfilled inside of the central part of the pavilion.

This process will be illustrated in the following by the discussion of one particular model. Similar to the metre in a musical score, it determines the rhythm, because precisely this is absent in the above mentioned centre of this building's massive body. This central block has been extracted from the model, and rests freely beneath it. It lies there as if it had been dislodged and had fallen, thus symbolising the counterpoint in the assignment: Space as emptiness, 'omitted mass' versus volume.

The block represents the opposite. It shows with particular clarity the negative of a production as inversion: It represents the alternative programme.

This aspect is emphasised by the way the block is pieced together. Its geometrical division into three different but equally sized and two identical bodies - the first kind occupies one quarter, the latter one eighth of the original volume - is not only a playful intellectual puzzle and an ingenious study in proportion, but also a piece of modern art. The three large blocks carry each twice the proportion of the block of one eighth of the original obtained by triple division. This elementary body, identical to one of the corner blocks made from maple wood, was joined to itself along each of the three dimensions. These new bodies modelled from industrial plywood are displaced with respect to each other along the three space directions. They remind of the first construction of this type namely the spatially coiled node after Gerrit Rietveld.(16) His invention was conceived in northern Europe (Utrecht) at the beginning of the modern architectural era. A few years later, in Venice the German pavilion 'Germania' was renewed historically oriented.(17)

*Tempora mutantur, nos et mutamur in illis.*(18)



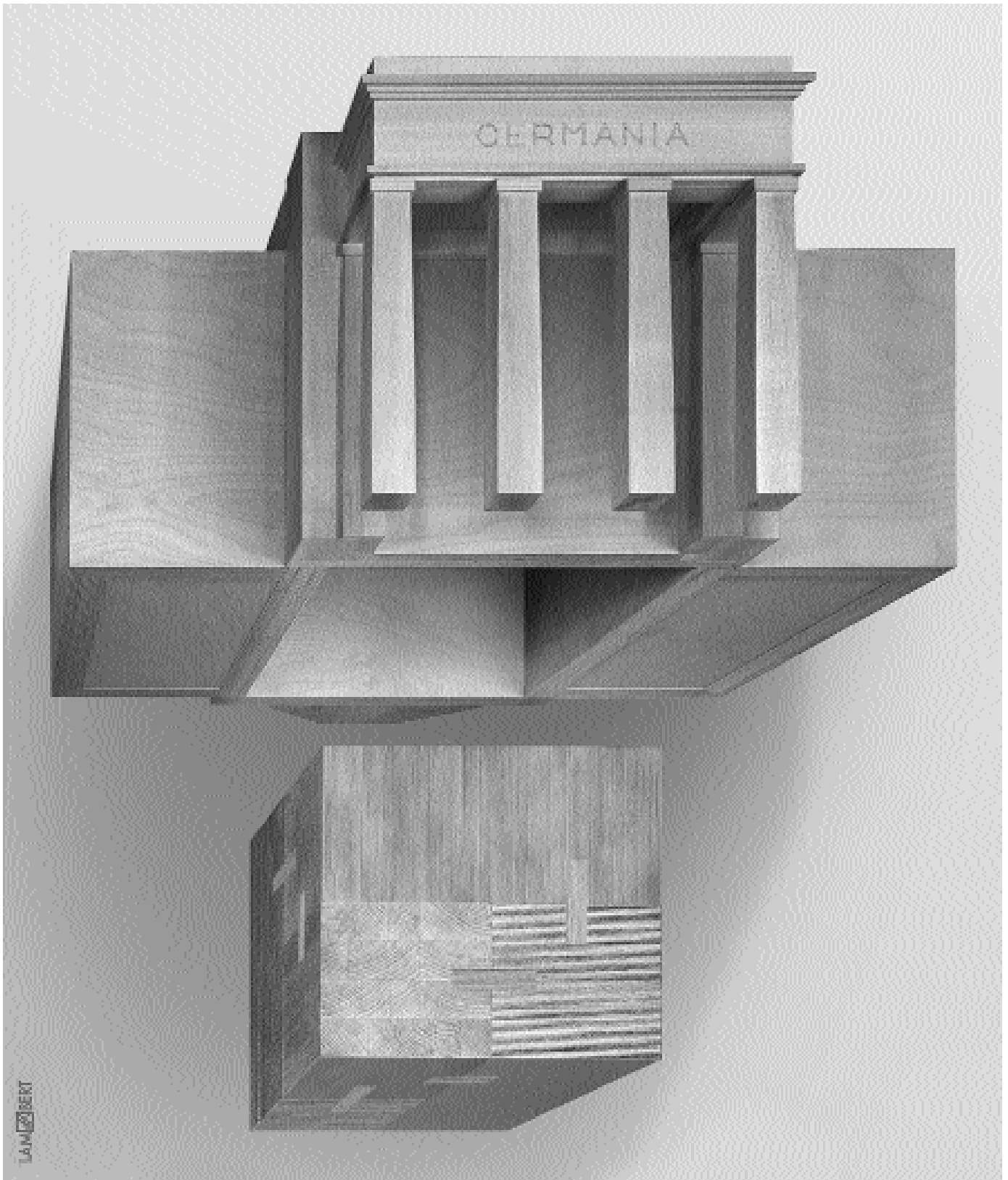


Figure 05  
 Lambert Rosenbusch, Max Steinberger  
 Model for the Biennial  
 View from the north, scale 1:33, plywood, maple.  
 Block of the central space as a study in proportion  
 The model demonstrates the contrast between space and body. The extracted block with the dimensions of the interior space has been formed by interlocking five sections by means of six tongues. The two sections at the lower left corner and the upper right rear corner were made of maple wood, as too

was the portico. Their volume is an eighth of that of the basic block and thus corresponds to this in its dimensional proportions. The three other industrial plywood sections are each twice the size of the maple corner pieces which, if one alters their positions in a variety of ways, fit exactly twice into each of the three. The materiality of the block is emphasised by the fact that the plywood units are arranged around the central block axis following the principle Gerrit Rietveld applied to his red and blue armchair. The block is a three-dimensional interlocking system.

## Notes

1 Della Architettura, libro secondo, cap. 1, p 2

Therefore I will always commend the custom of the old, capable master builders to use not only plans and drawings but also handmade models, crafted from wood or whatever other material, to consider and reconsider the whole building and the measurements of each individual part on the advice of the most astute experts.

2 Gert Sperling, Pantheon scholar, author of 'Das Pantheon in Rom'

3 Both types of model have been in use since the beginning of the Renaissance as an ideal model, see: Tempel Salomonis, Museum f. Hambg. Geschichte (Reuther/Berckenhagen p 26).

4 For instance the collection of cork models belonging to the Prince-Bishop of Mainz who commissioned Carl and later his son Friedrich May to manufacture small copies of ancient buildings after models made by Antonio Chichi of Italy. Now preserved in Aschaffenburg castle (Heimberger / Kockel; Büttner).

5 *σπερέωμα*, strength, firmness, also firm body, Gemoll p 688; *σπερεόν* the spatial figure, spatial content (Pfeifer p 1357).

In the representation of architecture, plan drawings exist which, with the aid of special rules, contain details on the third dimension, e.g. contour line plans, diagonal or profile sections. And in the area of perspective there are cutaway perspectives, isometric representations, modern computer simulations, virtual spaces etc.

6 Studying the development of the loggias of the Pal. Ragione in Vicenza is useful for gauging the significance of architectural models as an important medium in the client's decision-making process. Almost all of the architects involved presented their plans to the city council. 'Antonio Rizzo received the fee for his wooden model' (Puppi p 267). Also noteworthy is the construction of a model of a bay in a 1:1 model, a practice which later became more widespread, *ibid.*

7 In many European states the welcome practice has developed of setting up 'hands on' models as an information aid for the blind. Usually made of solid material (bronze) such models are generally found near imposing squares and often in the entrance areas of large churches. These 'models' are created to scale with language systems (e.g. braille) experienced through touch. Sometimes they appear as views or 'spatial ground plans'. As a result these 'tangible plans' have a slightly raised surface i.e. the horizontal section though the building runs slightly above the ground level.

8 Even the linear geometrical reduction of a model has its limitations as far as human perception is concerned. This is particularly true in the case of the visual perception of space. As the eye distance of the observer remains constant, i.e. it is disproportionately large in relationship the model, the spatial dimensions of the latter appear exaggerated. This effect intensifies with the increased reduction of the represented reality.

9 Brunelleschi made the sketch model from carved turnips (Lepik p 16); in modern times architects and sculptors prefer paper, cardboard and foam plastics for their models.

10 Ever since Augusto Rosa (18th century Italian artist), the use of cork in the Baroque era became popular for making replicas of ancient monuments and sculptures. This porous material can be easily modelled with simple tools, and its natural qualities produce a surface reminiscent of travertine (E. Stenger).

11 In addition to the described qualities, plaster possesses other technical characteristics, such as volume expansion, casting ability etc., which are highly valued by model makers (ID 10 p 11, note 4).

12 Perspex, a plastic resembling glass, is often used as a suitable material for electrically illuminated models, which have become quite fashionable. The example of the huge model of the 'Five Boroughs' simply has to

be mentioned here, with its 1:100 representation of New York (Queens Museum, Flushing Meadow, Corona Park, N.Y.).

13 ...you should not therefore produce any artistically executed, elaborate, eye-catching models, but plain and simple ones, in which you can admire the inspiration of the inventor rather than the craftsmanship of the manufacturer (Alberti 2/1 p 69).

14 So-called cutaway perspectives are a very popular form of architectural representation. The English architect John Soane employed a draughtsman, J. M. Gandy, who had an excellent command of this technique. One of his most famous drawings was based on Soane's design for the Bank of England (Watkin p 62).

15 One widespread method involves composing a model of separate parts which can be removed in order to gain views of the inside (Rome, St Peter's in the Vatican, Sangallo the elder, Lepik et al. p 351). Some use the additional aid of a mirror (Pantheon model by Hartmut Bonk, exhibition at the Kunstbibliothek Berlin, 1995). The model is presented in such a way that the observer can immerse his head in the interior from below (Pavia, model of the cathedral, Lepik pl 60). Also popular is the production of models which have been cut open (Paris, model of the Pantheon, in that building, upper floor).

16 So-called 'triadic pivotal symmetry C3' in the framework (Wolf, Wolff p 13 ff) of the Gerrit Rietveld red-and-blue-armchair, 1925; forerunners of this type in natural oak were already created in 1919 (Küper/Zijl p 35).

17 Ernst Haiger, architect, Venice, German Pavilion, 1938 (Völkischer Beobachter, 10 May 1938).

18 Ovid, *met.* 15, Reclam 235 ff

19 Sperling, p 112, and others

20 This building is a late classical temple in Umbria, first published by A. Palladio in the 'Quattro libri' (4/25 p 68). The model was produced as a research project in the studio of the author at the art school HBK in Hamburg. It was developed by Dipl.-Des. Bernd Grimm and Dipl.-Des. Jan Christoph Kraege. For a detailed description of the object see: *Industrial Design* 10 p 11.

21 The photograph shows that technology has entered the process even in such a traditional craft as plaster moulding. The photo-mechanical transfer of drawings derives from the printing profession where such things as rubber stamps and printing plates are produced. The capitals are individually produced in clay then reproduced in quantity in a moulding process.

## Literature

L. Alberti, *Della Architettura*, 1782; Trans. M. Theuer, 1912

A. Büttner, *Kormodelle von Antonio Chichi*, 1978

K. Downes, *Wren and the Cathedral of London*, 1991

W. Helmberger, V. Kockel, *Rom über die Alpen tragen*, 1993

M. Küper, I v. Zijl, *Gerrit Th. Rietveld*, 1992

F. Kurrent, *Raummodelle*, 1996

A. Lepik et al., *Architekturmodelle der Renaissance*, 1996

A. Lepik, *Das Architekturmodell in Italien 1335-1550*, 1994

A. Millon, M. Lampugnani (ed.), *The Renaissance*, 1994

A. Millon, (ed.), *The Triumph of the Baroque*, 1999

R. Pacciani et al., *Rassegna 32, Maquette*, 1987

A. Palladio, *I Quattro Libri*, 1581

L. Puppi, *Andrea Palladio*, 1977

H. Reuter, E. Berckenhagen, *Dt. Architekturmodelle*, 1994

L. Rosenbusch (ed.), *Industrial Design 10, Architektur*, 2000

G. Sperling, *Das Pantheon in Rom*, 1999

E. Stenger, *Phelloplastik, die Kleinkunst d. Korkbildnerie*, 1927

D. Watkin, *Soane and his Contemporaries*, John Soane, 1983

K. L. Wolff, R. Wolf, *Symmetrie*, 1956

