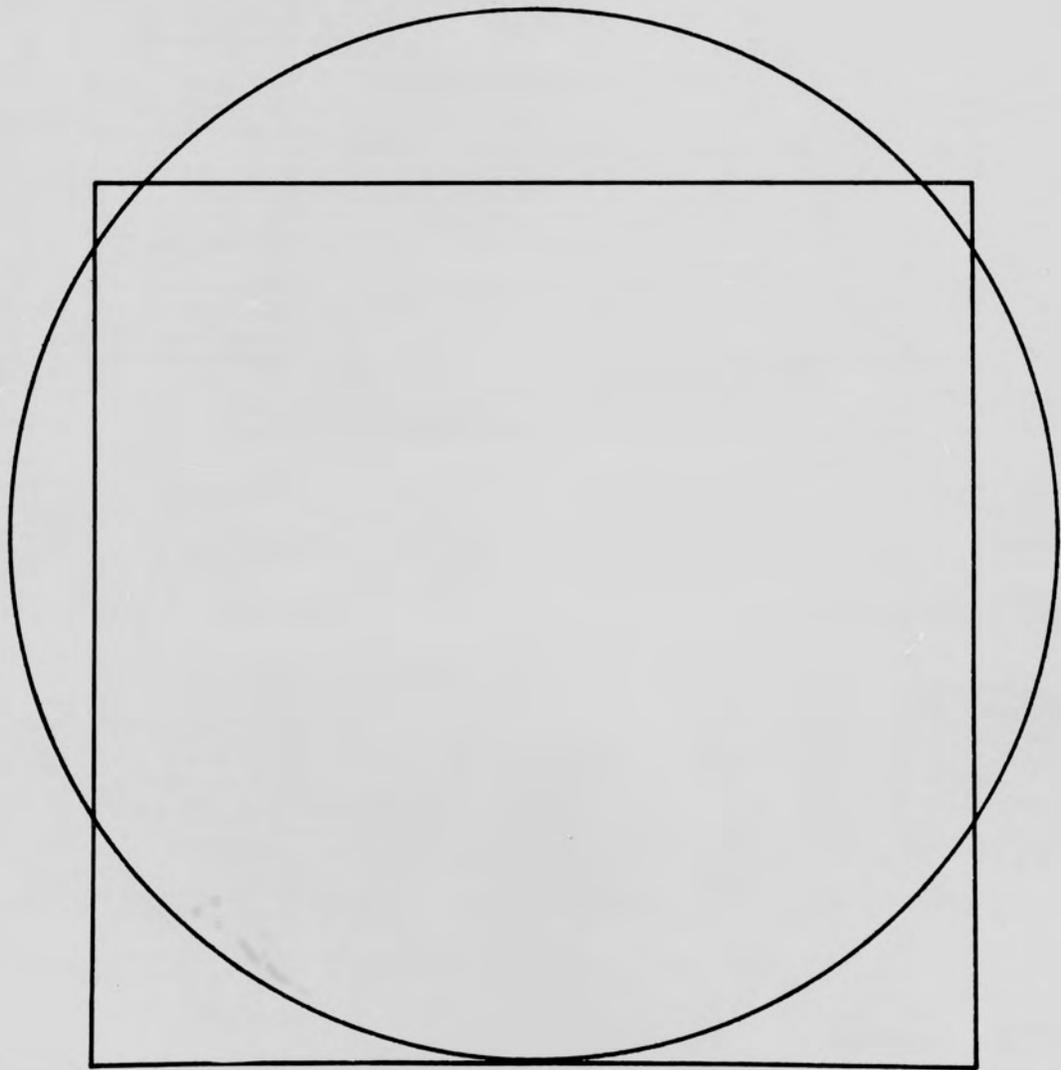


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Special issue on Design research
Guest Editor: **Patrick Purcell**

CONTENTS

PAPERS

- 130 **Editorial: Design, a process of enquiry, experimentation and research**

PAPERS

- 132 **Problems, frames and perspectives on designing**
D A Schön
- 137 **Design as the exploration of constraints**
M Gross and A Fleisher
- 139 **On writing form**
N J Habraken
- 142 **Computer model of design**
M Gross
- 146 **Architectural design as a system of research programmes**
S Anderson
- 151 **Architectural research programmes in the work of Le Corbusier**
S Anderson
- 159 **Conceptual and artefactual research programmes in Louis I Kahn's design
of the Phillips Exeter Academy Library (1966-72)**
L Andreotti
- 166 **Regionalism as an architectural research programme in the work of Dimitris and Suzanna Antonakakis**
V A Metallinou
- 175 **Architecture and culture: a research strategy**
E Robbins
- 178 **Collaboration and context in urban design**
G Hack and M Canto
- 185 **Reflective practice in engineering design**
L L Bucciarelli

BOOKS AND PUBLICATIONS

- 191 **Anthropometry and biomechanics**
191 **The trouble with technology**
192 **The arts of artifice**
192 **Building design for trainees**
IFC **Calendar**

Architectural design as a system of research programmes

Stanford Anderson

MIT, Cambridge, MA, USA

Keywords: design research, scientific programmes, falsificationism, architecture

'Design' has various meanings ranging from purposive planning to plotting with evil intent. In any case, it invokes notions of rationality and carefully conceived effectiveness. To speak of 'design method' only increases the stakes. If we are to conduct 'design research', it seems we must seek to reveal the orderliness which can be brought to human action.

Yet we are dismally aware of the numerous failures of design — be it low-income housing or nuclear energy systems. We are also aware of designs that have succeeded in ways unintended. What are we to make of these puzzles and problems of design? Will a more concerted inquiry termed 'design research' reveal the ways to avoid failures and anticipate the unintended? I think not.

In every field, our knowledge is imperfect, is not open to ultimate verification, is the product of a particular history. Our knowledge and other cultural forms might have been otherwise, and to that extent we recognize their conventionality — that they are, to a degree, arbitrary. But it is arbitrariness to a degree. Who is to say whether the medicine of the west or the cognate practices of China has set out on a better course? Yet it is clear that both systems, marked by some arbitrariness of beginnings and course, have improved themselves because their respective conventions eventually encounter empirical problems which challenge them and channel further inquiry.

While avoiding notions of total arbitrariness, pure conventionalism and utter relativity, it is necessary to

recognize the conventional, partially arbitrary construction of a culture. These conventions encounter testing and limiting empirical conditions which we may hypothesize as the sources of problems and thus as the impetus for change of our conventions.

A decade or more ago, some of the searchers for design method may have thought that a rigorous and infallible design procedure might be revealed. Today, in our own group, I doubt if anyone harbours such hopes. The question now seems to be where will we locate the arbitrariness embedded in our practices, and how will we seek to deal with it rationally?

One way to compare discussions about design method or design research, then, might be to characterize where and how one proposes to deal with arbitrariness. Alternative positions can be suggested without attempting to characterize any specific proposals. One can imagine, for example, the proposition that some level of infrastructure, perhaps even including certain space-defining architectural elements, can and should result from a thoroughly systematic design process, but that the completion and transformation of that environment will be set by the conventionalized, partially arbitrary actions of its inhabitants. Under such a model, design is conceived to be a nonarbitrary process, but its domain is restricted.

One can also imagine a participative design process in which numerous people with differing and not fully-known values, resources and persuasiveness engage in the resolution of design decisions. The most sanguine

view of such a process is clearly attractive relative to authoritarian design imposition, though this sanguine view may not be easily sustained either in concept or practice. In any case, under such a model of design process, arbitrariness is not eliminated but rather diffused.

Both hypothetical examples raise difficult questions. If one accepts the first model, is there a fundamental arbitrariness of human thought and action which is not addressed within the realm of design it retains? Does the participatory model, in its pursuit of immediate conflict resolution, obscure the arbitrariness embedded in its own process? In both cases, does the avoidance of direct address of the arbitrariness which must be present in some degree undermine the search for a rational process and a coherent product?

If these two models are 'straw men', they may nonetheless sensitize us to alternative positions on design process, including the one explored in what follows.

HYPOTHESES

In the initiation of any human activity some ultimate arbitrariness will be introduced. Design only begins with that risk. The search for rationality in design is not a matter of eliminating that risk, but rather one of turning that gamble to our advantage. Alternative risks are available, or can be invented by us. Both the design process and its implementation are means to give those risks coherent fulfilment while also testing, revising, learning from, and, if need be, rejecting them.

Design, seen in this way, is not some arcane, special process, but is rather allied to common sense and to the pursuit of rationality. As such, it may be hypothesized that other studies of rational thought and practices may serve as the basis, or as models, for the understanding of design.

In the discussion that follows immediately, and in three studies of architectural production by our group, we seek to investigate whether a qualified version of Imre Lakatos' methodology of scientific research programmes may provide an explanatory and normative model of design processes.

LAKATOS' METHODOLOGY OF SCIENTIFIC RESEARCH PROGRAMMES

Only a sketch can be attempted here of the epistemological programme which Lakatos advanced.¹

Lakatos developed his programme within the epistemological tradition known as 'falsificationism'. A naive version of falsificationism might run like this. In science, we seek to put forward internally consistent theories from which we may deduce empirical claims that are subject to experimental test. Now, since true consequences may follow from false premises, a corroborating experimental result is no more than that — a corroboration, not a verification, of the theory under test.

However, false consequences cannot follow from true premises, so negative test results assure us that the theory is wrong. By this asymmetry of test results, it is claimed that our only secure knowledge comes in the failure of our theory — thus falsificationism. Since falsification is our only secure ground, it is claimed that the success of science relies on its construction of falsifiable theories, the strenuous pursuit of experimental failure, and thus the establishment of the ground for a new, more advanced cycle of theory building.

Such a naive falsificationism is subject to both logical and historical criticism. Every experiment has among its premises not only the theory under test but also initial conditions stated, for example, as meter readings or other measures. Not only might these initial conditions be stated in error, but they also assume other background knowledge, perhaps theories of optics or heat or whatever that are not considered to be under test. Yet, logically, one can as well direct the negative test results against these initial conditions or against the background knowledge as against the theory under test. Not only can one do this logically, but the history of science is replete with instances of such deflection of falsification away from the theory under test. Furthermore, such deflection need not be, and often is not, an *ad hoc* stratagem wrongfully saving a pet theory. The deflection may reveal weakness in the background theory and provide a step in the corroboration of the theory under test.

Thus we must recognize that we always test large systems of theories rather than isolated ones, and naive falsification cannot account for the locus to which negative test results are directed. A sophisticated version of falsificationism, primarily associated with the work of Karl Popper,² recognizes the difficulty just discussed, but would solve the problem through an appeal to the institutional structure of scientific inquiry. Popper recognizes that large systems of theory are under test, but he argues that the scientific community can, and does, guess and agree as to what part of the system has failed. It is then by convention, by agreement among those scientists who succeed in deciding for the whole of the scientific community, that falsification is saved from its logical and historical critique. This is a conventionalism introduced at the level of fact, or at least at the level where fact will be directed against the theoretical system.

The possible arbitrariness of this procedure is highlighted by the further epistemological problem that falsification offers no unique characterization of the background knowledge which is assumed to be necessary for corroboration. It is quite conceivable that a redrafting of the background knowledge would lead to a different agreement within the scientific community.

It is within (or is it from?) this epistemological setting that Lakatos makes his contribution. Lakatos abandons the notion of a strong test even as modified by Popper's conventions of the scientific community. In abandoning strong tests, Lakatos, nonetheless, wishes to maintain an account of the success and rationality of scientific method.

Lakatos' distinctive contribution is the shift of the

methodological unit of epistemological analysis from the theory to the 'research programme'. A research programme is strongly temporal and historical, though Lakatos is concerned more with the logic of its development than with a historical account. A research programme is built around a particular problem situation. Lakatos recognizes that more than one research programme may be addressed to any problem situation. Indeed, it is in the competition and comparison of research programmes that Lakatos locates much of the success and rationality of science.

CONSTITUTION OF A RESEARCH PROGRAMME

In the course of a research programme there is a series of theoretical states. Each of these theoretical states retains a common element, and it is the constancy of this common element which identifies the series as a single programme.

Lakatos refers to this common element as the 'hard core', the postulates upon which the programme of research is based. According to Lakatos' construction, the hard core is methodologically inviolable. That is, from within its own research programme, neither criticism nor test results may be directed against the hard core. Neither the origin, nor the structure, nor the completeness of the hard core are stipulated by Lakatos; these would be historical questions. It may indeed be that the hard core was not articulated by the researchers within a programme and that important elements of the hard core were held implicitly. The rationality of assuming the hard core is not known *a priori*; it is a matter of agreement, of convention, to assume the hard core. The fruitfulness of doing so, the efficiency of this particular agreement in the pursuit of knowledge, can only be adduced through the development of the programme itself.

With Lakatos, then, the conventional element of science has invaded, to accept his terminology literally, the very core of the scientific enterprise. Convention is an aspect of that which assures the maintenance of the programme. It is also this hard core which yields and shapes what Lakatos calls the 'negative heuristic' of the programme: those possible hypotheses or steps which are *not* to be entertained because of their inconsistency with the hard core. This conventionalism, this resistance to criticism, this degree of arbitrariness is necessary to the construction and development of the programme, but it is tested and controlled in the larger construction of the scientific enterprise.

While coherent development of the programme is, on the one hand, facilitated by the maintenance of the hard core, there must also be that which is open to change. So Lakatos' hard core is surrounded by what he sometimes called the 'protective belt' of auxiliary hypotheses. It is these hypotheses which must bear the brunt of test. Negative experimental results are directed against the auxiliary hypotheses which are then altered to maintain

the coherence of the hard core with the data.

This account of the protective belt explains its logical role, but one can also note a more positive aspect of the auxiliary hypotheses. Additional, or improved, hypotheses, perfect and extend the reach of the hard core.

So then, anything goes? May it not be that the hard core is accepted by convention and protected while auxiliary hypotheses are adapted *ad hoc* to maintain and elaborate an illusionary explanatory power? Such an inadequate state of affairs could indeed arise and be recognized within Lakatos' account, but it would not be justified by his account. Much of Lakatos' text is devoted to the analysis of the development of a research programme and the comparison of competing research programmes. Lakatos seeks to distinguish progressive and degenerative problem shifts within programmes. For his detailed position and some of its difficulties one must consult the literature, but one may say that the inadequate programmatic course mentioned in this paragraph would be recognized as a degenerative programme expected to suffer neglect and extinction. But even here, Lakatos expects no death blows. Artificial maintenance of an apparently weak programme may yet prove to have been the courageous tenacity of its researchers. Such assessments may change and are unpredictable, but the information on which those assessments are to be made is rationally structured and publicly available.

Finally, a summary and one addition in the explication of Lakatos' methodology of research programmes. The research programme is characterized and maintained by its conventionally accepted hard core. The hard core is protected by a body of auxiliary hypotheses which can be adjusted to maintain internal agreement among the hard core, the auxiliary hypotheses, and the data. The negative heuristic is closely allied to the hard core, a set of injunctions against possible hypotheses or research strategies inconsistent with the hard core. Finally, Lakatos also posits a positive heuristic, methodological directives or suggestions which help to drive the programme. So much for the nature of a research programme, but it is the assessment of that programme in its empirical, explanatory power and in its strength relative to competing programmes that lends us conviction, at least provisionally, about the programmes and thus also about the risk that was taken in asserting its hard core.

LAKATOS' METHODOLOGY AND DESIGN RESEARCH

If now, one proposes to adopt Lakatos' methodology of scientific research programmes in the consideration of design — more specifically of architectural design — is one committed to a view of design as science, or to the scientizing of design?

Such a concern is usually advanced by critics who hold that science is positivistic. Whether the enquirer defends or attacks such positivism and whatever may be the implicit valuations of science and design is irrelevant in the face of the critic's conviction that science and design

are distinguished by the positivity of science.

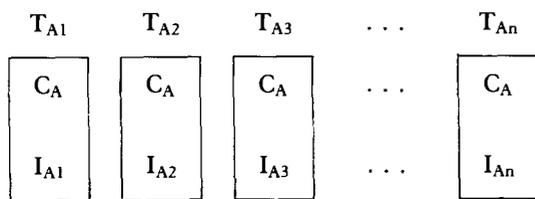
But it is just this positivist view of science against which Popper fought as he confronted the Vienna Circle. Lakatos goes further in his increasingly conventional and historical reconstruction of science. He is not just interested in the history of science; the history of science becomes integral to the epistemology itself. From the other side of the divide, the historian, Thomas Kuhn, contemporarily forced reconsiderations in the epistemology of science.³ Yehuda Elkana presses the issue to the point where the distinction between the history and philosophy of science hardly exists. Science comes to be seen as one more — very important, but one more — cultural system.⁴

Arriving at this point, we are neither forced nor inclined to deny distinctions between such cultural systems as science and art, but neither are we inclined to draw hard and fast boundaries. The acceptance by convention of certain assumptions in order to initiate and drive a body of work; the examination of a body of work for internal structure and for its relation to other systems and to empirical conditions; the embedding of this work in a historical and cultural setting; the necessity of institutional support and constraints — all of these appear as crucial features of human production. Insights into the condition of this production within one subdomain may serve, at least, as a potential model for other domains.

Thus the ambition of the current work is not to make a science of architecture or design. Within the broader claim that such activities as science and architecture share certain features as cultural systems, there is no desire to deny distinctions or to force methodologies from one of these systems upon another. Rather, we propose, Lakatosian style, the agreement that one attempt a research programme concerned with architectural design as a rational enterprise subject to an analysis related to Lakatos' methodology of research programmes. How our programme ends up, how different it may be from that of Lakatos, is best left to the results of the effort itself.

ARTIFACTUAL RESEARCH PROGRAMME

Whether one thinks of a single work of architecture or



Heuristic X → ... →

Figure 1. T (theoretical state of the conceptual programme) = C (hard core) + I (auxiliary hypotheses). C = hard core, which remains the same for any single research programme. I = auxiliary hypotheses, which is that part of theory to which the modus tollens is directed

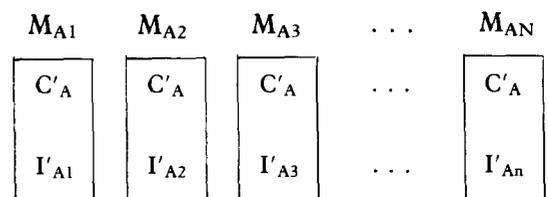
certain sustained patterns of work by one or more architects, it is not implausible to think of something like a 'hard core' that sets and maintains the direction of the work. Other architectural projections or hypotheses might well be adaptable in the way of Lakatos' auxiliary hypotheses, adaptable in order to maintain a coherence between the hard core and empirical conditions. Lakatos' elimination of the concept of 'strong test' and his consequent acceptance of the elusiveness of definitive rejection of a programme are more consistent with criticism in architecture than earlier emphases on decisive experimental results.

If, then, one begins with some positive associations between Lakatos' methodology of scientific research programmes and programmes of architectural design, where does one identify problematic distinctions between these two areas of cultural production?

In Lakatos' case, one has a nonmalleable hard core and an equally obdurate empirical reality mediated by the adaptable auxiliary hypotheses. In architecture, the very nature of the enterprise is to transform the empirical conditions — obviously within physical constraints, but nonetheless significantly for the cultural system under consideration. Thus the artifact that is architecture is malleable; it, along with the auxiliary hypotheses, may be shaped to maintain coherence within the entire programme.

To speak a bit poetically, the architect is involved in making his own reality as well as his theory. As just mentioned, this new reality may serve as the fulfilment of the theory rather than as its empirical constraint. Still more important, however, is that every artifact will also be something other or more than the fulfilment of one programmatic theory. The artifact will be open to other interpretations; it has a quasiautonomy relative both to any given theory or interpretation and relative to external factors. This argues that the architect (or any designer and no doubt many other actors in cultural production) is simultaneously involved in two related but not deterministically controlled activities: a conceptual programme (similar to that of Lakatos) and what might be called an artifactual programme, concerned with the systematic exploration of physical models.

In Figures 1 and 2, I propose parallel research programmes in which certain propositions (the conceptual hard core) form the conceptual research programme,



Heuristic X' → ... →

Figure 2. M (artifactual state); ie, artifacts serving as models and forming a research programme. Here we are concerned with physical objects which are configured in such a way as to embody propositions about themselves and the role of artifacts generally. C' = hard core. I' = auxiliary hypotheses

while another set of (perhaps implicit) propositions form the hard core of an artifactual research programme.

Models (artifacts in the artifactual research programme which may include graphic representations of other artifacts) always implicate more than is intended or than can be subsumed under any single conceptual programme. Consequently, there is necessarily a quasiautonomy between the two series. While the two series of theories and models may alternate in providing a critique of one another, they do not exhaust one another. Other conceptual research programmes may be directed to any given artifact just as other artifacts may stand in a rational relation to a given conceptual programme.

In positing these two parallel research programmes, no priority is given to either one. The two programmes are not deterministically linked; either one may anticipate and influence the other; one may terminate without implying termination of the other. As already stated, each may provide a critique of the other, but no more than in science does one expect a 'strong test'. Perhaps still more than in science, competing programmes can and should proliferate. Yet in practice, such programmes do thrive or falter according to their perceived fruitfulness, their success at innovating or in better meeting perceived needs. The attempt to adapt methodology of research programmes to architectural production is not seen as a revolution in architectural thought and practice, but rather as a potentially more detailed and rigorous manner of clarifying and judging competing practices.

INTERNAL AND EXTERNAL HISTORY OF RESEARCH PROGRAMMES

For Lakatos, the structure of a research programme and its logical development establishes a quite autonomous, what he called 'internal', history. Indeed, he sees science, properly conceived, as possessing such autonomy. Lakatos recognizes an 'external' history as having its place in accounting for sociological and psychological features that may enhance or impede the achievement of science; but such matters do not, for Lakatos, effect the rational reconstruction offered by the internal history of a research programme.

Whether even science possesses this degree of autonomy is widely challenged.⁵ In a field such as architecture, I would suggest that this issue — the degree of autonomy of the practice — is usually part of the theoretical programme. That is, explicit or implicit claims are made within the programme's hard core or auxiliary hypoth-

eses as to whether and how social, economic, political, technological, psychological or other factors are internalized in the theory and practice of architecture.

Thus in proposing a schema of two parallel research programmes for the analysis of architectural production we may parallel Lakatos' distinction of an internal history (that history required by the programmes themselves) versus an external history. But in doing so, one is not prejudging the issue of the degree of autonomy of a field such as architecture. Rather, one is making two other claims. The first is that the range of factors to be considered and the manner in which they become determinant are formulated in terms of the programme's own methodology. Thus, second, important debate on the degree of autonomy of a discipline such as architecture may be sharpened and advanced by a more rigorous comparison of programmes.

The three essays that follow, by the present author, Libero Andreotti, and Vivianna Metallinou, cannot attempt exploration of their subjects under the full analytical apparatus of the methodology of research programmes. Nonetheless, in a more discursive manner, they do provide an anticipation of such analyses. The study of Le Corbusier examines the development and refinement of an architectural programme through a series of works. The examination of Louis I Kahn presents the research programme of a single design within Kahn's remarkably Lakatosian design theory. Finally, a number of works by Dimitris and Suzanna Antonakakis are studied as a succession of architectural research programmes driven not only by internal logic and empirical concerns, but also by their participation in a larger sociocultural research programme (regionalism).

REFERENCES

- 1 **Lakatos, I** *The Methodology of Scientific Research Programmes* Cambridge University Press (1978)
- 2 **Popper, K** *The Logic of Scientific Discovery* Hutchinson (1959)
- 3 **Kuhn, T** *The Structure of Scientific Revolutions* University of Chicago Press (1962)
- 4 **Elkana, Y** 'A programmatic attempt at an anthropology of knowledge' (typescript offset and distributed at the conference Conventions, Canons and Criticism, MIT, Cambridge, MA, USA (April 1982)
- 5 See, for example, Elkana⁴

Architectural research programmes in the work of Le Corbusier

Stanford Anderson

MIT, Cambridge, MA, USA

Keywords: research programmes, Maison Dom-ino, architecture

The following discussion seeks to extend Lakatos' methodology of research programmes to a domain which includes architecture. In a departure from Lakatos' formulation, I suggest two or more parallel but related programmes must be considered: one or more at a conceptual level and one or more embodied in the artifacts themselves.

The present essay does not offer the scope for a detailed analysis of an architectural research programme, but will rather illustrate such an approach through selected works of Le Corbusier. Two early projects, the young Jeanneret-Le Corbusier's sketches at the Acropolis and his *Maison Dom-ino*, will be presented as independent, not fully developed architectural programmes. These rudimentary programmes are then seen as weakly conflated in the *Maison La Roche*. With the Five Points of the mid 1920s, the *Maison Dom-ino* receives an important reinterpretation capable of subsuming the earlier concepts in a new, coherent programme which is progressively realized in the major villas of the late 1920s^{1,2}.

PROMENADE ARCHITECTURALE

The first fragmentary programme turns on the concept which Le Corbusier was later to call the *promenade architecturale*. Perhaps this term could be read as 'architecture considered as the orchestration of spatial experience'.

Such a concept may not sound so startling today, but one must remember that well into the nineteenth century treatises on architecture relied primarily on an objective view of the autonomous rules of architecture itself, best exemplified in the study of the classical orders. Even movements, such as the 'picturesque', that put new emphasis on the viewer interpreted the relation between viewer and object as one based more on association than on abstract issues of perception and comprehension.

When Jeanneret-Le Corbusier, on his 'voyage d'orient' of 1911, came to the ultimate canonic site of Western architecture, the Acropolis in Athens, he did not repeat or seek to make more precise the earlier researches into the orders, the temple form, or their sophisticated formal nuances. Le Corbusier rather produced a set of sketches which vividly evoke the sequential experience of the ascent of the Acropolis (see Figures 1 and 2). From outside the Propylaea, we are already embraced by the heights of the Acropolis and the Temple of Athena Nike above. Passing into the Propylaea, the Parthenon appears through a screen of columns. Though these columns are just before the viewer, or precisely because they are so near, one does not see them as wholes. These columns *are* a screen, not sophisticated elements of precise proportions and prescribed relations to the whole of which they are a part.

The Parthenon itself, more distant, suggests an ordered whole, but for now that order is a matter both of prior knowledge and the anticipation of our fuller experience of it. For the moment, the Parthenon appears

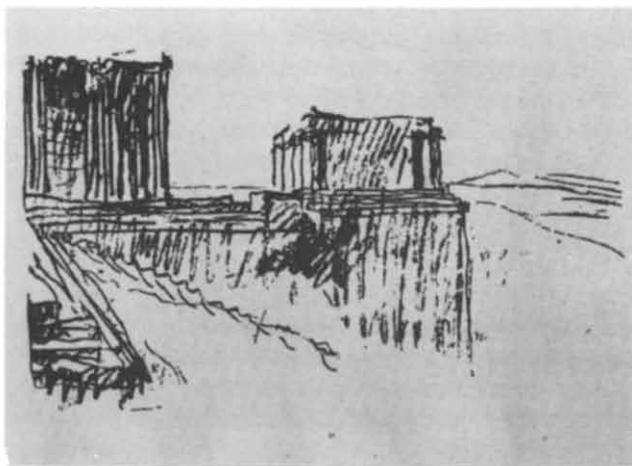


Figure 1. The heights of the Acropolis and the Temple of Athena Nike*

not only partially obscured but also viewed from angles, from the side and from below. We hold no vantage point from which we may possess the building objectively. And if we did possess such a vantage point, this drawing tells us we would be missing something else – experience itself and the knowledge which comes only through such experience. Architecture is known by the temporal experience of a sentient being, and Le Corbusier's drawing reveals the Acropolis in such a way as to make this proposition plausible.

Though this material offers only the rudiments of a programme, I do see here elements which fit the model I am advancing. At a conceptual level, Le Corbusier is concerned with how we correlate experience and knowledge. He proposes an abstract experience of architecture. We need not know anything of Greek architecture or culture; we do not rely on associations. The manner of experience and how we learn through that experience is transferable to other settings. If it is important that this exercise considers the Parthenon, it is precisely because this insistence on experience is more forceful when made in the presence of a work for which we have previously instilled modes of appropriation. Yet the 'physical models' — the Acropolis itself as well as Le Corbusier's drawings — are crucial to this fragmentary research programme: the Acropolis affording the opportunity to test out the propositions which the drawings advance.



Figure 2. The Parthenon from the Propylaea²

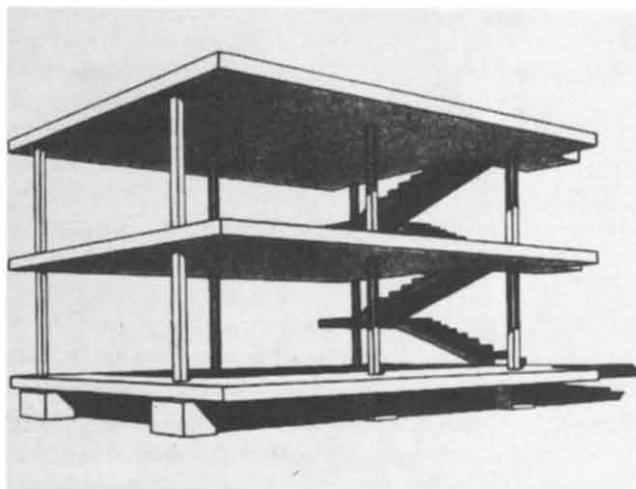


Figure 3. Dom-ino standardized skeleton, Le Corbusier*

THE MAISON DOM-INO

For the moment, we turn to another rudimentary and wholly independent research programme well-known under the name Maison Dom-ino³. The devastation of Flanders in the first World War urgently required the rehabilitation of that region at the earliest possible date. Already interested in the relatively new building material, reinforced concrete, Le Corbusier sought a way to provide a rational and economic solution to the emergency housing need.

The drawing which shows the standardized skeleton used in this research project (see Figure 3), a drawing summary in nature and rich in suggestive ambiguity, came to stand for the Maison Dom-ino. We too will wish to return to this famous drawing, but if we are to understand the housing research programme which generated it, we must also consider other contemporary drawings. The reflected ceiling plan (see Figure 4) reveals that floor and roof slabs of the construction are not monolithic as they appear in the Maison Dom-ino drawing, but are rather articulated as girders and joists formed by lightweight tiles. Thus the floor construction is directional and has preferred locations for attachments such as non-bearing partitions. Indeed, possible floor

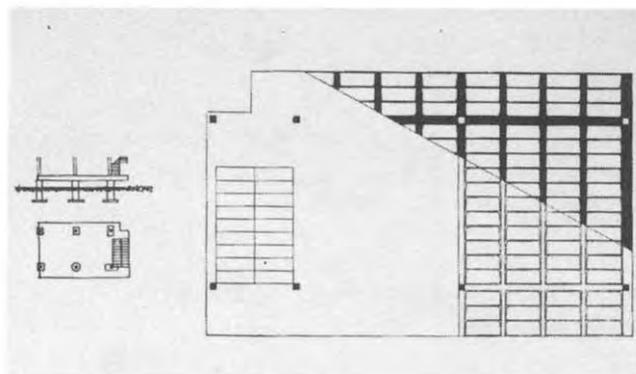


Figure 4. Reflected ceiling plan*

Figures 1, 3-5, 9, 12, 13 and 17 from Boesiger, W and Stonorov, O *Le Corbusier et Pierre Jeanneret. Oeuvre complète de 1910-1929* H Girsberger, Zürich

plans drawn by Le Corbusier (see Figure 5) show close adherence not only to the structural lines of the floor construction, but even especially to such dominant structural characteristics as the columns and the edges of the slabs. Nonbearing walls bury the columns at the end walls. Nonbearing partitions uniformly frame into internal columns. These partitions, not as thick as the columns, are normally placed so as to obscure the presence of the columns in the more important rooms; the projecting part of any column remains in closets, vestibules, or service spaces.

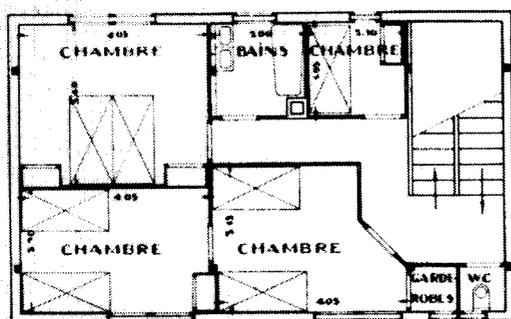
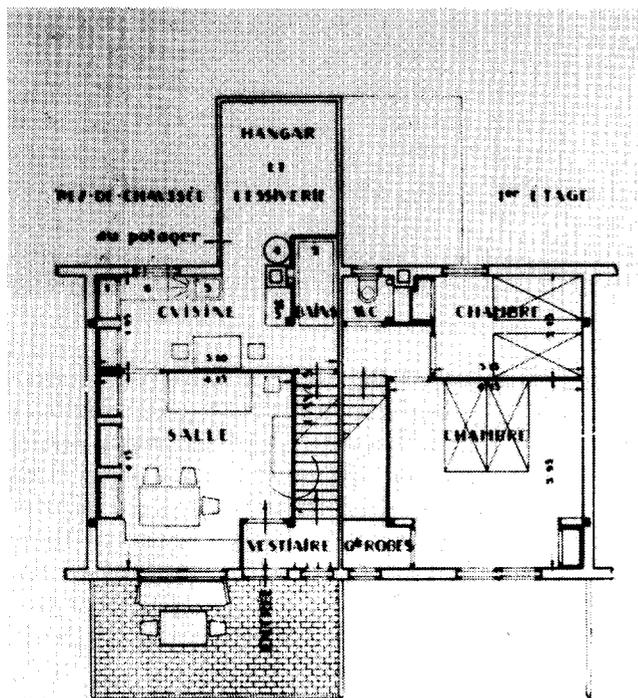
These few observations together with the architect's own commentary permit a reconstruction of the main lines of Le Corbusier's Maison Dom-ino research. The reinforced concrete frame provides the entire structure and thus permits a rationalization of the construction process. Government, in support of a modern construction industry (which Le Corbusier sought to form), would effectively provide the standardized structural frame. The infill of that frame could be carried out according to the needs and constraints imposed locally;

on whatever schedule local, not necessarily skilled, workmen using local, perhaps rubble, materials would complete the houses to variant plans and elevations.

Conceptually, the Maison Dom-ino as a housing research project, proposes that new materials and new techniques in the hands of a rationalized industry can efficiently provide a primary structure which will facilitate the solution of a crucial housing problem without inhibiting the efficient and positive employment of local resources.

The Maison Dom-ino, seen in the context of the entire housing research project, does not imply other readings which the skeletal drawing (see Figure 3) has induced. That famous drawing appears to emphasize primary structure so forcefully that an unintended reading must also have been immediately available: architecture, or this new architecture based on a modern technology, should give direct expression to structural elements. Yet the plastering of the ceiling surfaces in this drawing and the burying of the columns in the typical plans render the structure mute. Neither here nor in any work in his career did Le Corbusier make expression of structure dominant.

Other readings of the Maison Dom-ino, some of them proffered and exploited by Le Corbusier later in his career, were not immediately available if we consider the original housing research as a whole. Some of these readings are: the primary structure as the ordering of space, as an aesthetic order, as the facilitator of the 'free plan', as a module of an indefinitely vast system, as a modernist self-referential system⁴. Most of these readings are too commonly diffused to be given specific references. Le Corbusier's 'free plan' is discussed below. The Maison Dom-ino as a modernist self-referential system is an anachronistic reading offered by Peter Eisenman⁴. Such readings reveal the fruitfulness of continued inquiry into such a rewardingly ambiguous drawing as that of the Maison Dom-ino. It is a nonconservative model. But the very limits of the complete Maison Dom-ino research project preclude the inclusion of these innovations in the historical moment of the Maison Dom-ino.



Variante

Figure 5. Possible floor plans drawn by Le Corbusier*

TOWARDS AN ARCHITECTURE

The remainder of this paper argues that the two rudimentary research programmes already introduced gradually merged in the career of Le Corbusier, yielding a series of brilliant works within a research programme (or programmes) of increasingly rich implication.

The first work I introduce, the Maison La Roche in Paris, offers a marvellously diverse architectural promenade which can still be enjoyed today in this house which is now the Fondation Le Corbusier. Indeed, the Maison La Roche is so dominantly 'architecture considered as the orchestration of spatial experience', that one wishes only to encourage a visit. If words can have any hold on this house, they must be used almost solely in the service of description.

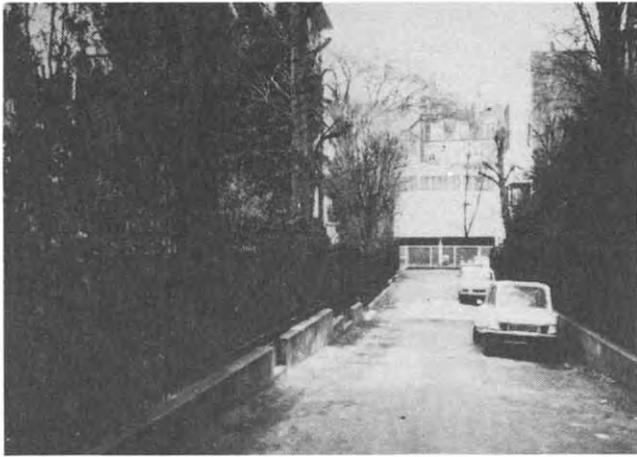


Photo: S. Anderson

Figure 6. *The Maison la Roche*

The Maison La Roche flanks and closes the end of a small private street (see Figure 6). The house, or one part of the house, announces itself from afar, a taut convex surface that immediately conveys more of the interior volume than of the entrance, or plan, or larger organization of the house. To the left of the convex surface projects a small balcony, too small but to be a moment for recapitulation in our later itinerary. Coming nearer, the flank of the house at the right side of the street becomes more prominent (see Figure 7). The humble openings of the ground floor of this lateral wing, the now obvious open space under the convex volume, and the retreat of that convexity into the juncture of the two wings continue to lead us into the angle of the 'L'. Near enough, the recessed wall in that angle finally reveals a still simple, but larger blank metal door (see Figure 8). The conviction of entrance is given less by the door than by the large window above, through which we perceive a small skylight obliquely above the entrance space which rises to the flat roof. Just behind the second floor window is a bridge that assures continuity of movement between the two wings. Admitted to the house, one is under the bridge, initiated to a large space that is compressed in its depth by the proximate, blank party wall, but released in the three-storey high volume of this central, communicating space (see Figure 9). The party wall beyond slides continuously out of the entrance hall to the left defining a



Photo: S. Anderson

Figure 7. *Flank of the Maison la Roche at the right side of the street*



Photo: S. Anderson

Figure 8. *Entrance door in the recessed wall*

small, high space for the stair, confirmed by another small balcony at the head of the stair, projecting back into the space in which we now stand, and a perfect pendant to the exterior balcony we still anticipate at the far end of the convex volume. Turning on the half landing of the stair, at the furthest corner of the house and site, we are afforded the best, most distanced view of the entrance hall with its galleries at each floor (see Figure 10). At the head of the stair, the balcony suspends

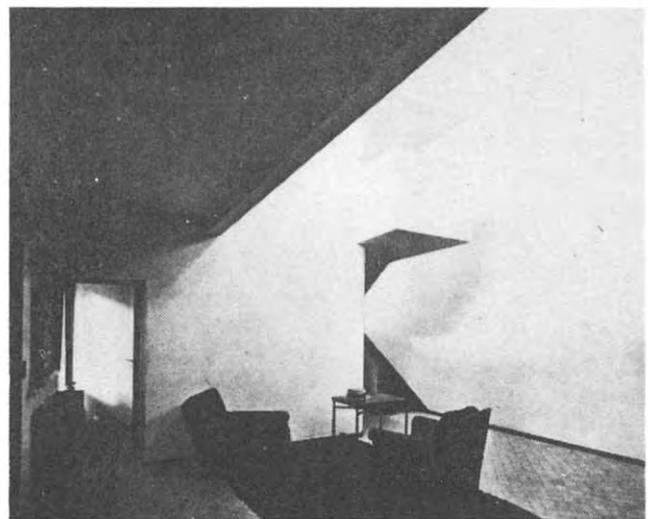


Figure 9. *Entrance hall (see p 152 footnote)*

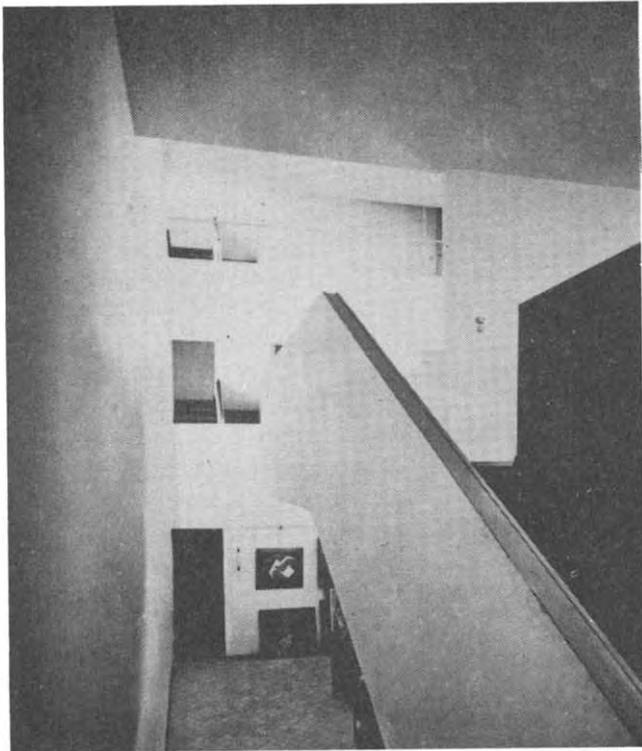


Photo: Dr. Stoedinger

Figure 10. Entrance hall with galleries at each floor

us in the entrance hall, a gallery carries us either to the bridge to the lateral wing or directly to the salon in the convex volume: a two-storey space lit by high clerestories (see Figure 11). To reach the curving ramp that ascends at the interior of the convex, now concave wall one must go to the far corner, to the exterior balcony from which one can recapitulate one's every movement from initial entrance to the street to the interior bridge we have yet to cross (see Figure 12). Ascending the ramp (more of a sensory-motor experience than any code would permit) one comes first to a gallery overlooking the salon and then to a gallery room overlooking the entrance hall. The flat roof is now so close over one's head that that plane too plays its distinctive role, as have so many other surfaces, in defining place and movement within this orchestration of spatial experience.

One could, and perhaps should continue this verbal tour, particularly to do justice to the roof garden and its potential link with the other unit of this double house



Photo: S. Anderson

Figure 11. Two-storey space lit by high clerestories

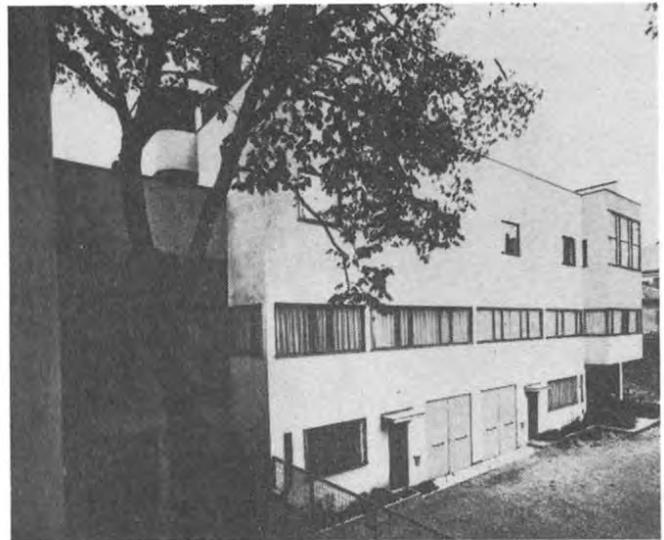


Figure 12. View from the exterior balcony (see p 152 footnote)

fully known as the Maison La Roche-Jeanneret. Enough has been said to expose one's conviction that Le Corbusier achieved here an exceptional architectural promenade, devoid of easy associations, yet as lyrical and compelling as it is abstract. If at the Acropolis, the concept of architectural promenade afforded another and valuable reading of a canonic site, then at the Maison La Roche Le Corbusier invents an architecture that offers another compelling promenade.

Still, there are reservations. For all the qualities of this house, of this promenade, the experience is very particular, self-indulgent, lacking in convincing relation to other aspects of architecture. The awkward narrow L-shape of the La Roche site is well-exploited by Le Corbusier, but the only generalization to be drawn is just that: exploit the site. The Maison La Roche does use some reinforced concrete construction; but this and all other matters of structure, form and function are placed in *ad hoc* service to the promenade which is, finally, too arbitrary. The Maison La Roche offers an artifactual research programme that is all enticing auxiliary hypotheses, devoid of hard core principles and played out in a special context that constrained all empirical conditions to ensure realization of the not fully developed programme.

If Le Corbusier creatively advanced a new reading of the Acropolis, there his architectural promenade stood alongside, did not displace, earlier formal, systemic and iconographic readings. Architecture, and most notably the Parthenon, remains for Le Corbusier 'a pure creation of the mind'¹, even as it is revealed to us experientially. The architectural promenade of the Maison La Roche received too little support from the other dimensions of architecture.

THE FIVE POINTS

A few years later, in his well-known 'Five Points' (see Figure 13), Le Corbusier economically integrated many aspects of architecture including a new reading of his

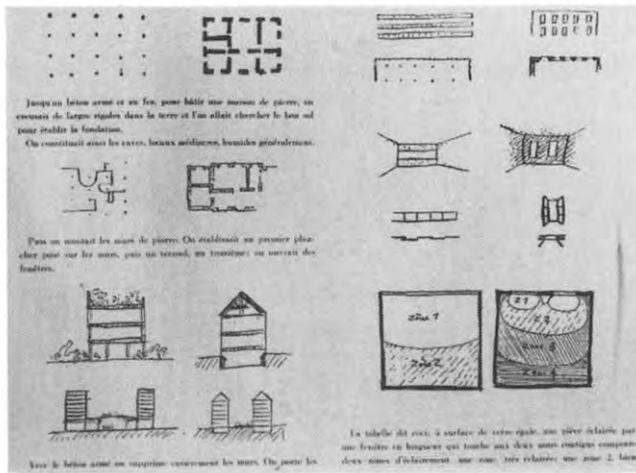


Figure 13. Le Corbusier's Five Points (see p 152 footnote)

Maison Dom-ino and an implicit architectural promenade.

The crucial and first of the Five Points is the point support of the modern concrete or steel frame. The minimal footprint of these columns — *pilotis* in Le Corbusier's terminology — was an obvious feature of the new structural systems, but Le Corbusier drew some not so obvious, pregnant architectural conclusions.

Contrasting the modern frame system with traditional bearing wall construction, Le Corbusier emphasized that walls as space dividers and enclosure need not coincide with structure, indeed need not be present at all. The building need no longer stand on a basement but could rise free of the ground save for its sparse array of columns. At each floor, and without traditional constraints due to vertical structural continuities, walls and partitions could be located at will, yielding a 'free plan'. The structurally efficient flat slabs also yielded the flat, and thus usable roof surface. Cantilever construction placed the columns inward from the edge of the building, further enhancing the free plan and fulfilling what was already implicit in the free plan: the free facade. At all points, the wall might be present or not. No vertical structural element existed at the outer limits of the construction; thus the facade might assume any configuration.

It is here that one notes a significant anomaly both in Le Corbusier's diagrams and in his inclusion of a fifth point. The diagram for the free plan suggests a bold exploitation of this freedom except at the edges of the building. The implicit radicalness of the free facade is not diagrammed save in the inclusion of a fifth point: the strip window. Logically, the strip window (though importantly distinctive in that it reveals the absence of vertical structural members) should be only one instance of the general freedom of the facade. Indeed, the strip window is in many ways a rather constraining element; it requires uniformity in the extension of the facade and limits variation of the floor levels or other manipulations in section.

The Five Points reveal a distinctive, positive relation of architecture and new technology as conceived by Le Corbusier. The new architecture Le Corbusier proposes

is not possible without the new materials and new structural systems. Yet what Le Corbusier advocates is neither the necessary conclusion (the modern frame had been, and continues to be, used otherwise) nor the ultimate exploitation of the new technology. Le Corbusier is not concerned with the exhibition of structure or of structural principle, but rather with the architectural potential afforded by the new technology. By the time of the Five Points, Le Corbusier seeks an architecture that is consonant with larger forces that he wishes both to identify and advance: an *esprit nouveau*⁵. The free plan and free facade are generated by new conceptions of the environment and the city, of manner of life and thought — generated by such matters and only facilitated by the new technologies. By the same token, there is no compulsion to use the technology to its limits; one uses technology to the extent and in the way it serves one's programme. And this *esprit nouveau* is not solely about new potentials and freedoms; it is also heir to a Western rationalist tradition that expects these freedoms to exist within a cognitive and moral order. It is for such reasons, I believe, that Le Corbusier restrained himself from the more extravagant readings of free plan or free facade. In the Five Points he sought what was not adequately present in the Maison La Roche, a knowing interrelation of many aspects of architecture, including materials, structure, pragmatic use considerations, systemic relations of elements, iconography, and intellectual order.

THE FIVE POINTS AND THE 'SATISFACTION OF THE MIND'

The first projects for the villa at Garches reveal a coincidence rather than a coordination of the subsidiary research programmes we have been tracing (see Figure 14). Early sketches show Le Corbusier considering a systematic use of a reinforced concrete frame: a system of square bays, one of which provides a central enclosed core throughout the height of the building and off which other bays radiate to form a complex of enclosed and open spaces, terraces and covered gardens. The L-plan of the Maison La Roche reappears and a passion for the architectural promenade overwhelms all else including the facilitating frame.

After several such early projects, Le Corbusier quickly

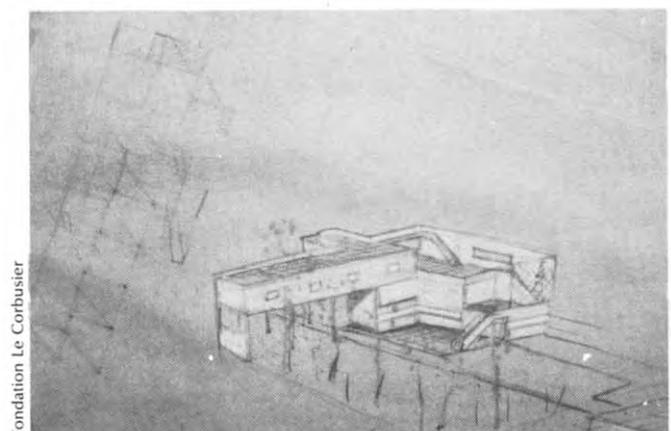


Figure 14. Early sketch for the villa at Garches

designed the villa Stein much as it came to be built: a compact rectangular volume coherent with the implications of the Five Points.

A photograph taken by or for Le Corbusier (see Figure 15) is a key to the understanding of the Villa Stein. The photographer places us just off the suburban street, under the functionally gratuitous canopy of the porter's lodge. From this position, just as when one viewed the Maison La Roche from afar, one can anticipate much about the eventual experience of the house. However, unlike the Maison La Roche, here the first impression also yields many clues that are simultaneously part of our intellectual framework and characteristic of the house. The ground surface on which we stand not only extends in a continuous plane up to the facade of the house but implicitly extends through the body of the house itself. It is extraordinary for a European house, particularly a house of distinction, to provide such unmediated access to its interior. The Villa Stein, as built, does not stand free on pilotis, but virtually it does.

Reflecting again on the photograph, we are positioned under the too high canopy that stands in the midst of a huge suburban space, distant from the house to which it refers. Such a canopy has little reference to our actual physical needs. It reaches out into a space with stronger reference to the distant villa than to the lodge to which it is attached. It documents the scale of the villa. Between ground and canopy we already know the physical reality of floor planes marked out by the strip windows of the facade of the villa. The orthogonality of the spatial grid of the villa and its site is immediately available to us in the planes of the ground, the canopy and the perspectively recessive plane of the wall of the lodge at our right which contrasts with the frontal plane of the villa. The necessity of our movement and sequential appropriation of this site is obvious, but we also know that this acquisition will be facilitated by correspondences between our preexisting mental structure of a gridded space and the actual deployment of architectural form. There is an assumption that our rationality rests on certain categories and an order which architecture — 'pure creation of the mind' — makes manifest.

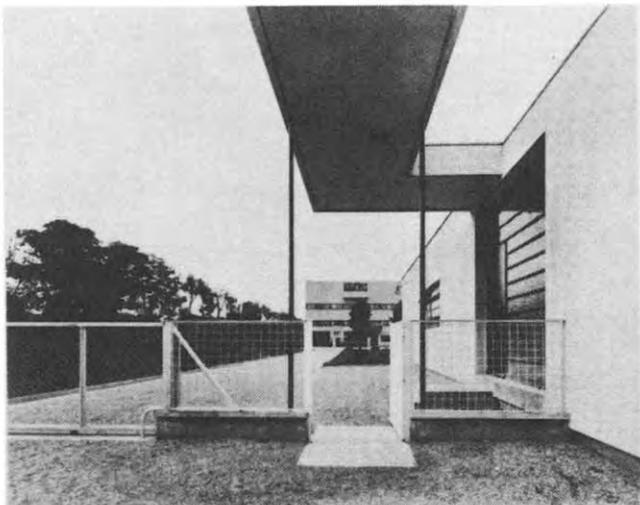


Figure 15. Photograph of the Villa Stein from under the porter's lodge canopy. (A Sartoris *Elementi dell'architettura funzionale*)

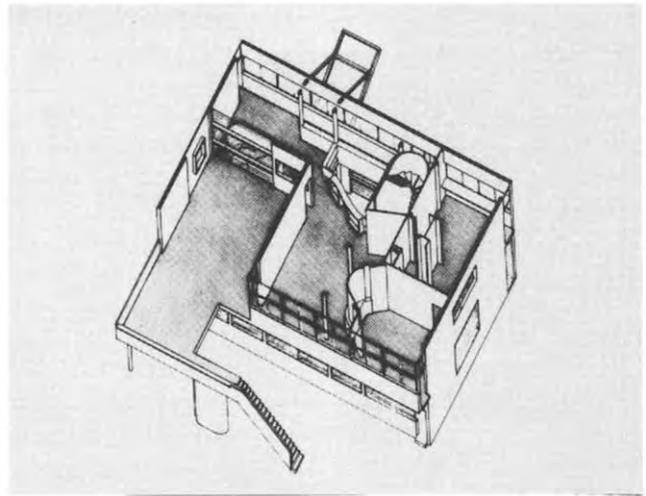


Figure 16. Villa Stein plan with the end columns suppressed (John West, *Four compositions of Le Corbusier*)

The present context does not permit a description of the experience of the Villa Stein comparable to that already given for the Maison La Roche. But if this were done it would be clear that the vitality of the architectural promenade has lost nothing for being located within an ordering framework which the architecture makes concrete just as the framework facilitates the appropriation of the architectural order.

The Villa Stein is a successful integration of the architectural promenade and of the Maison Dom-ino programmes, but only if we recognize an interpretation of the Maison Dom-ino other than that of its origins. Like the Maison Dom-ino, the Villa Stein distinguishes primary structure and infill. Now, however, this distinction has nothing to do with staging of construction or other pragmatic issues. Nor is the primary structure assertive in the establishment of a spatial or other architectural order. It is well known that the Villa Stein is set out on a plaid grid of 3×5 bays or 4×6 columns^{6,7}. Here as in the Maison Dom-ino the columns at the end walls are suppressed (see Figure 16). At the principal floor of the house, if we consider the 16 internal column locations, two columns are completely eliminated and only five stand free, in positions that yield no easy clues to the larger order. The architectural order of the Villa Stein relies on the structurally secondary planar organization; the concrete frame permits a free plan which secures this desired order.

Space does not here permit discussion of another of the great villas of the late 1920s, the Villa Savoye at Poissy. While the columnar system of the Villa Savoye takes on architectural prominence, a sustained analysis would show, I argue, that the columnar system here too is subservient to the planar organization of the secondary structure. The columnar system becomes apparent; it is not, however, an overall coherent system and, where it is ordered, it reinforces the planar system.

THE FOUR COMPOSITIONS

After the design of the Villa Savoye, Le Corbusier made a

diagram which reflected on the research programme presented here (see Figure 17). The diagram is called 'The Four Compositions', presenting a sketch plan, aerial view and comments on four houses: the Maison La Roche, the villa at Garches, a house identified as that at Stuttgart though it has more affinities with the villa at Carthage, and the Villa Savoye.

Only the aerial view of the Maison La Roche is in perspective, a fact that accords with Le Corbusier's own comments, freighted with implicit criticism. He sees this house as of a 'very facile genre, picturesque, eventful; one could, however, discipline it by classification and hierarchy'. In contrast, the other three houses are first grouped as 'cubic compositions (pure prisms)' and then differentiated. Of the rigorous, prismatic composition of the villa at Garches, Le Corbusier notes 'very difficult (satisfaction of the mind)'.

The third composition exploits the five points as they seem literally to invite but which, as we have seen, Le Corbusier resisted. The column grid is taken as given and the plan and elevation may be what they will. Le Corbusier again appears to imply a selfcriticism of the third composition: 'very easy, practical, combinable'.

Le Corbusier's comments on the Villa Savoye suggest his sense of a satisfactory conclusion of this search for an architectural order simultaneously practical and satisfying to the mind: 'very generous; one recognizes at the exterior an architectural will; at the interior, one satisfies all the functional needs (admission of sunlight, contiguities, circulation)'.

CONCLUSION

In this presentation I did not seek to marshal a detailed analysis of Le Corbusier's work using the full battery of Lakatos' methodological concepts and terminology. I did seek to present a number of works, the earliest of which are too limited to represent architectural research programmes but which nonetheless contributed to such a full programme as delineated in the period of the Five Points.

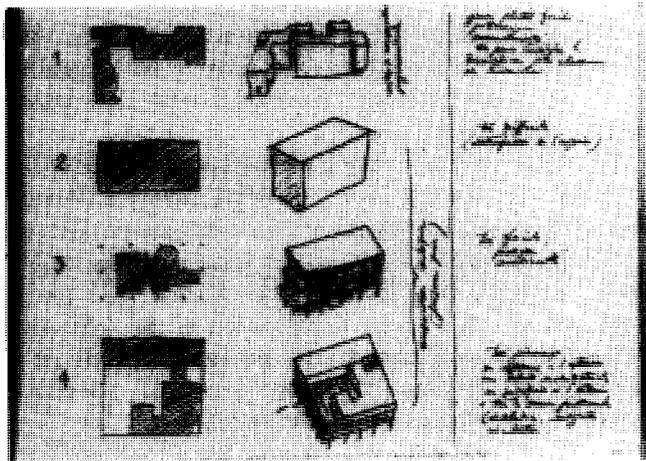


Figure 17. Le Corbusier's diagram 'The Four Compositions' (see p 152 footnote)

What was constant before and after that juncture is a dialectic conducted between sets of conceptual issues and developing physical models which explicate, test, and induce revision of those conceptual issues.

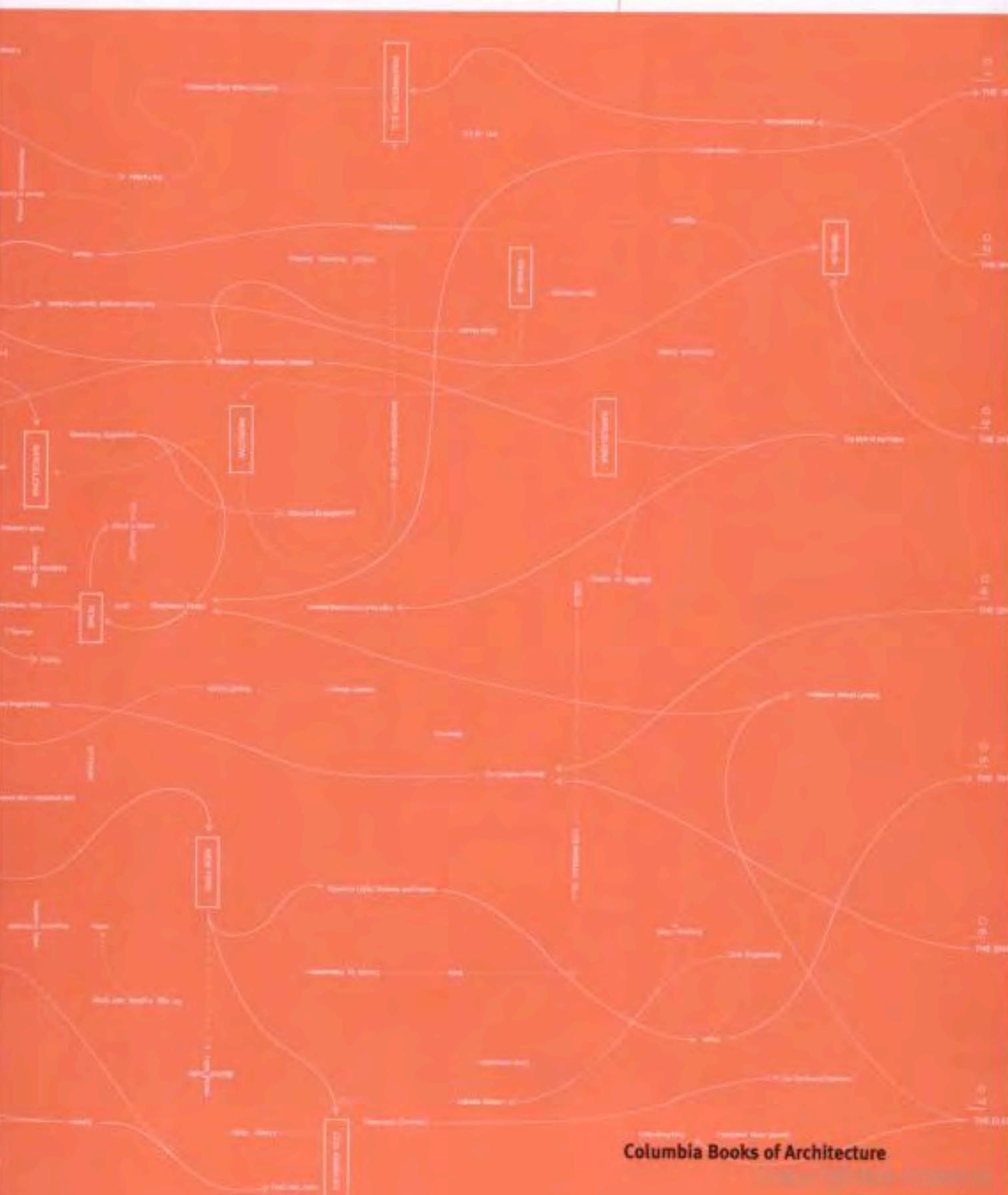
A detailed analysis of these works, making claims as to what constituted the hard core, the auxiliary hypotheses and the heuristics of both the conceptual and artifactual research programmes would itself be a historiographic research programme. No doubt a first version would fall to criticism, but in that exposition and criticism our understanding would be enlarged and reinforced. Even the present informal presentation correlates certain physical features and programmatic concerns, denying other available readings and thus opening an arena of debate.

An important issue arose with the most famous of the Maison Dom-ino drawings (see Figure 3). Its ambiguity as a source for influential alternative readings is readily welcomed. However, these alternatives are not acknowledged until they are identified and employed in larger patterns of discussion, quite possibly new research programmes. This is true within the career of Le Corbusier himself. The Maison Dom-ino bore meanings in the mid-1920s which it could not have possessed before. In a full exposition I would like to continue this story down to the Carpenter Center for the Visual Arts at Harvard. By that time Le Corbusier's understanding of architecture and cognition was sufficiently different that a much fuller exploitation of the freedoms of the Five Points was necessary and, with that, the acceptance of another reading of the Maison Dom-ino. On the success or failure of such claims stand not only our understanding of a work such as the Carpenter Center, but also what value and role we accord it in the career of Le Corbusier and in the continuing debates about architecture.

REFERENCES

- 1 *Le Corbusier and Pierre Jeanneret* Les Editions d'Architecture (1964, first published 1929)
- 2 *Le Corbusier Towards a new architecture* The Architectural Press (1964), originally *Vers une architecture* Editions Crès (1923)
- 3 **Gregh, E** 'The Dom-ino idea' *Oppositions* Vol 15/16 (Winter/Spring 1979) pp 60-87
- 4 **Eisenman, P** p118-128
- 5 **Jeanneret, C-E, Le Corbusier and Ozenfaut, A** *L'Esprit nouveau* (1920-1925)
- 6 **Rowe, C** 'The mathematics of the ideal villa' in **Rowe, C** (ed) *The mathematics of the ideal villa and other essays* MIT Press (1976)
- 7 **Rowe, C and Slutzky, R** 'Transparency: literal and phenomenal' in **Rowe, C** (ed) *The mathematics of the ideal villa and other essays* MIT Press (1976)

Architecture | **Theory** | since 1968 | edited by K. Michael Hays



Stanford Anderson "Architectural Design as a System of Research Programs" *Design Studies* 5, no. 3
(July 1984)

compare Pérez-
Gómez
(466-469)

While many theoretical positions since 1968 insist on the centrality of a naïve but perniciously instrumental functionalism within modern architecture, Stanford Anderson, in almost all of his writings, has infused his critiques of modernism with an ideologically very different spirit intended to reawaken us to the modernist principles of worldmaking. Le Corbusier's private houses can stand as an example. Commenting on a photograph of the kitchen of the Villa Savoye, Anderson notes,

Le Corbusier offered a vision of certain eternal goods: the loaf of bread, the can of milk, the bottle of wine, light and air, access to the earth and the sky, physical health, all made available more fully and to greater numbers thanks to new potentials that were both spiritual and technical. . . . To the extent that the Villa Savoye permits *that we live according to that vision*, it does something more [than engage the iconographic dimension of architecture]. It "makes a world" that does not determine, but does allow us to live and think differently than if it did not exist. If this fiction can only exist, precariously, in the Villa Savoye, it may indeed be "merely" a fiction, as valuable to us as other great stories. If its vision can be generalized, we may have a literal grasp on a world that could not have been ours without the originating fiction.¹

Where some would see modern architecture bowing to technical or social imperatives, Anderson sees in modernism (or at least much of it) more of an invitation to dwell differently, to invent new forms of habitation that are the psychological, ethical, and political consequences of changes in architectural form.

Even with his Popperian revulsion against any kind of determinism or any suppression of competing social aims, coupled with his desire to articulate the plurality of modernist stories, Anderson must nevertheless find a theoretical way to grant the architect a nonarbitrary, reasonable conviction about the new life being proposed, about the story being told.² It is Imre Lakatos's notion of scientific research programs that provides Anderson with a model of the construction of competing architectural conventions (or what, in the present essay, he calls competing architectural research programs).

Anderson draws two basic premises from Lakatos's model. First, from the field of competing architectural programs (whether this is understood to involve the work of a single architect or many different ones) it is possible to reasonably say that some are more "progressive" or robust than others. Conventions of architectural production are epistemologically compelling only insofar as they involve considerations of relevant alternatives to the beliefs they support and the worlds they construct, and can show themselves capable of being sustained over time. Second, though a convention must have a degree of autonomy and internal coherence, architecture is never fully independent of larger concerns. A convention will be methodologically compelling only to the extent that the domain it organizes can be systematically and rationally related to other features of the cultural world, independent of those of the primary program. It is these two features that can account for architecture's social value. Anderson states:

compare Rowe and
Koetter
(100-102)

A triumph in the construction of conventions that is not simultaneously a triumph of discovery is less than the highest triumph of which the construction of conventions is capable. That is to say, a convention is not to be valued primarily for its novelty, beauty, or internal consistency, or for its autonomy, or for the law and order it brings to practice, but rather for its (culturally framed) true or liberating relations to other conventions of practice. This mitigation of the autonomy of the convention, this insistence on the convention's quasi-autonomous address to social practice is what protects the convention from the suspicion of being merely made up. It is only this reciprocity of convention and practice that can sustain the convention. But it is also only such a critically sustained convention that can guide practice without the appeal to arbitrary authority.³

While Anderson construes the architectural propositions themselves—their conceptual and artifactual programs—as the proper level of convention construction, it should be observed that the model of competing conventions works at the level of interpretation as well; the same kind of adaptive equilibrium between background theories, interpretive conventions, and social practice can help decide between alternative accounts of architecture.⁴ Anderson's effort, in general, is to remind us of the extreme *generosity* of architecture, its working through the immense variety of human cultural production and offering new ways of thinking and inhabiting.

Notes

Anderson's essay was originally published as two consecutive essays, "Architectural Design as a System of Research Programmes" and "Architectural Research Programmes in the Work of Le Corbusier," in the same volume of *Design Studies*.

1. Stanford Anderson, "The Fiction of Function," *Assemblage* 2 (1987), pp. 24–28.
2. Anderson's early involvement with the thought of Karl Popper is most apparent in Stanford Anderson, "Architecture and Tradition That Isn't 'Trad, Dad,'" in *The History, Theory and Criticism of Architecture*, papers from the 1964 AIA-ACSA Teacher Seminar, Cranbrook, ed. Marcus Whiffen (Cambridge: MIT Press, 1965). The paper is a critique of Reyner Banham and an attempt to resolve what Banham sees as the conflicting claims of science and tradition.
3. Stanford Anderson, "Critical Conventionalism in Architecture," *Assemblage* 1 (1986), pp. 21–22. This paper was originally presented in April 1982 at a conference held at the American Academy of Arts and Sciences, Cambridge, Massachusetts, organized by Anderson and entitled "Conventions, Canons, and Criticism." The conference served to focus Anderson's thinking regarding the construction of conventions and propelled his subsequent research. See also Stanford Anderson, "Types and Conventions in Time: Towards a History for the Duration and Change of Artifacts," *Perspecta* 18 (1982).
4. For a discussion, see K. Michael Hays, "Theory-Constitutive Conventions and Theory Change," *Assemblage* 1 (1986).