DESIGN AS A CONTEXT FOR RESEARCH


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The thesis itself is composed of six parts:

- **Section One** introduces the premises for this enquiry. It discusses the kinds of design knowledge embedded in buildings and elaborates on using design as a context for extracting this specific kind of knowledge.

- **Section Two** describes the two design exercises. It introduces the sites in Helsinki and Boston and discusses the pedagogical intention behind conducting two design exercises for this enquiry. It also includes the interpretation of the program of a Museum of Modern Art used in the design exercises.

- **Section Three** presents the specific design of the Helsinki project in plan and section.

- **Section Four** is a collection of some of the general observations on Aalto's work which emerged during the enquiry. These observations are grouped under 12 subjects.

- **Section Five** presents selected examples from both the Helsinki and Boston design exercises to illustrate the design setting of these decisions and their relationship to the parallel enquiry into Aalto's work introduced in section four.

- **Section Six** is a critical reflection on this enquiry. It highlights some of the most important questions raised by this investigation and offers some proposals for how this kind of design research can be continued.

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CONTENTS

TITLE PAGE i
ABSTRACT v
CONTENTS vii
FOREWORD 1

SECTION 1: DESIGN AS A CONTEXT OF RESEARCH 3
1.1 Buildings as Artifacts of Knowledge 3
1.2 Knowledge and Design 4
1.3 Codified Knowledge 5
1.4 Uncodified Knowledge 6
1.5 Disciplined Design Process 8
1.6 Pedagogical Objective 8
1.7 The Method 9
1.8 Design Process and Practice 10

SECTION 2: DESIGN EXERCISES 13
2.1 Description of Design Exercises 15
2.2 An Interpretation of the Program of a Museum of Modern Art 26

SECTION 3: HELSINKI PROJECT 29

SECTION 4, GENERAL OBSERVATIONS ON AALTO'S WORK 37
4.1 Themes and Historical Types 37
4.2 Geometry as Apparatus and Territorial Structure 44
4.3 Shape and Type 58
4.4 Section 72
4.5 Site and Hierarchy 78
4.6 Access, Continuity and Place 92
4.7 Territorial Exchange 100
4.8 Structure 108
4.9 Light 113
4.10 Program 120
4.11 Complexity 122
4.12 Generative Design Principles 123
FOREWORD

This thesis began with questions about architectural research and the process of uncovering architectural knowledge in design. How can the analytical activity of research be integrated with the projective enterprise of design?

In addition to this interest in design research, this investigation was prompted by a dissatisfaction with conventional forms of criticism in architecture as a means of uncovering knowledge about built artifacts. Buildings are not typically accepted as a form of physical knowledge with an objective foundation. Similarly the design process is seen as a mysterious and subjective process. The thesis is an attempt to make the process of design more explicit and sharable and to demonstrate that it is in fact based on some broadly shared knowledge and values of the discipline.

The choice of focusing on Aalto's buildings for this design enquiry was first initiated by a personal interest in Aalto's work. But as the investigation progressed it became a more directed effort to connect and integrate my own study and practice to an existing body of knowledge. This is achieved by trying to understand what is common and perhaps universal in a different method of working.
I. INTRODUCTION: DESIGN AS THE CONTEXT FOR RESEARCH

1.1 Buildings as Artifacts of Knowledge

The basic premise of this thesis is that the architecture design process is essentially a complex visual thinking process, or language, which uses specific kinds of knowledge to resolve the confrontation of different material conditions with each other.

The nature of the material conflict and the dilemmas that are raised in the design as well as the design knowledge used to resolve these conflicts is encoded in the physical form of the built artifact. Therefore buildings are the sources of knowledge not only of the specific design process and strategies that generated them, but also of physical form in general.

A large portion of this knowledge in the completed building, however, is not explicitly available since it is encoded in the physical form. A building is seldom experienced and read as a valuable artifact of knowledge and furthermore, the layman who is not versed in the language of design has no context for understanding the physical form and design decisions. This lack of experience in design language, however, does not prevent the layman from appreciating, understanding, or using the building as a found environment with its own physical properties.

The contention of this thesis is that valuable knowledge about design and physical form embedded in buildings can become available in the context of some specific design. This is because the setting of an active design process is engaged in the same sphere of thinking, or language, that generated the design decisions of the building under question in the first place. The most important criteria for using design as a vehicle for studying buildings is a disciplined and reflective design process which is conscious and systematic in the knowledge
it draws on for the design. However, before continuing further, it is important to establish what kind of knowledge is available for architectural design which will in turn provide some framework for understanding this way of looking the design process.

1.2 Knowledge and Design

The evolution of a design process is seldom linear or clear since the design issues raised are often parallel or intricately nested. Nonetheless, the design process is akin to a complex process of problem solving where design decisions are loosely structured by a procedure that resolves conflicting and sometimes mutually exclusive priorities of different issues raised within the same design. This process of decision making requires knowledge.

For any given design problem there are broadly speaking two kinds of resources and knowledge readily available. There is project specific knowledge which is generated and circumscribed by the boundaries of the specific design itself, e.g. functional requirements of program, the subtlety of the physical characteristics of site, and the constraints of economics. In addition, the design requires the use of knowledge not specific to the constraints of the design itself or external knowledge.

In reading a design or building, there is little difficulty in identifying the differences between decisions informed by these two kinds of knowledge. Decisions based on project specific constraints can be understood easily with respect to the physical context. For example, an inflection of the building form may be a decision to adjust for a distant view. Physical decisions that cannot be reconstructed or understood based on a knowledge of the place and
other project specific constraints are more likely to have been driven by knowledge which originate from outside the boundaries or parameters of the design itself. For example, there are institutional, sociopolitical and cultural expectations for every building in addition to self-imposed standards or tradeoffs that are made by the designer. The scope of project specific knowledge or constraints is generally fairly well defined for most projects. However, the kind and nature of the external knowledge that is useful for a design depends on the specific design and the way the designer chooses to conceive of the design problem.

1.3 Codified Knowledge

In the most general terms there are two kinds of external knowledge that are readily available for the use in architecture design. The first kind of external knowledge is knowledge that has been codified within the discipline of architecture. For example, historical and functional typologies for building organizations as well as standard building methods are all codified architectural knowledge or part of the convention of the profession. This kind of codified knowledge can be applied directly to a design as in the case when a specific architectural reference is used as a model to resolve particular dilemmas for another design. In any event, the power in using codified knowledge is that it defines the nature of the design dilemma very clearly and in established architectural terms. But this way of designing does not generate any new knowledge because it deals with limited number of unknowns and is essentially variations of a previously known method.

By in large, for more complex designs, codified architectural knowledge is to be mistrusted since it has a tendency of reducing the complexity of a specific design dilemma by
generalizing them and excluding other concerns. They serve, however, as useful starting points for any design process since by criticizing these codified methods the specificness of the design at hand becomes more apparent. Looked at this way, codified architectural knowledge is no different than other material constraints operating in the design. The various material conditions are the enabling and constraining forces of the design and building process. In other words, in addition to defining the design dilemma they permit and demand the restating of the problem setting.

The way a design problem is conceived and interpreted raises its own intrinsic and unique set of difficulties and dilemmas. Therefore, in addition to knowledge that can be used as a device for solving the problem, any knowledge that allows the designer to redefine the problem setting and see the problem in a new way is equally useful.

1.4 Uncodified Knowledge

The second category of external knowledge useful in design is not codified within the discipline of architecture. They are by nature interdisciplinary, a kind of general knowledge that can range from being very specialized to very ordinary. Likewise, the source of this kind of knowledge can be very objective and shared by many or can be completely personal and subjective. Uncodified knowledge can be invaluable in helping the designer to define or redefine the nature of the architectural problem.

For example, a problem of organizational relationships between different uses can be seen either as a problem of adjacencies or more profoundly as a problem of spatial continuity
between uses. Similarly, the constructional problem of spanning and supporting can be rephrased in social terms as a physical manifestation of collective shelter. Sometimes less knowledge can also help the designer to see a problem in a different way.

One of the difficulties of using uncodified external knowledge in architectural designs is that it is by nature less direct in leading to architectural or physical solutions. Unlike codified architectural knowledge which is already framed in conventional architectural terms, and therefore have physical corollaries, uncodified knowledge often reconceives the design in non-architectural terms. Thus unless there is a concerted effort to reframe the newly redefined problem in architectural terms, it is less likely to lead to physical results. In some cases they may even reject physical solutions. But at the same time, the use of uncodified knowledge can occasionally lead to real architectural invention precisely because it does not appeal directly to conventional architectural practices.

In any case, each of these two kinds of knowledge inform the design process in very different ways which in turn can lead to very different physical decisions. Codified knowledge is often ready made solutions which can be copied directly. The process of applying this kind of knowledge is mimetic. Uncodified knowledge, on the other hand, relies on the understanding of the relation between specific things as a model for projecting new relationships in design. In other words, the process of applying this second kind of knowledge is analogic. In general, any design requires a strategy that is a combination of these two kinds of knowledge since they are not mutually exclusive, but symbiotic.
1.5 Disciplined Design Process

Under normal circumstances, the use of external knowledge in the design is taken for granted since the architect uses all the knowledge at his or her disposal to resolve the conflicting demands raised by the specific design. There is usually, however, no clear logical order in the way the design is approached and very little rigor as to what knowledge is used and why. Seldom are any of these working methods explicit or documented. Because of this general lack of rigor, the design process is often misunderstood as a mysterious and ineffable process.

This thesis proposes that the design process is a discipline that can be rigorous and systematic. Designing is a particular kind of thinking process, or language, that can be deliberate and reflective about what knowledge or resources it uses. The systematic use of external sources of knowledge in resolving design conflicts can lead to a more informed design. The design process can therefore be analytical and critical of the external knowledge it has extracted from the physical sources. In other words, a disciplined use of external knowledge in design can constitute a critical study of the knowledge itself. One avenue of investigation into this external knowledge is the study of existing buildings and the work of an architect.

1.6 The Pedagogical Objective

This thesis is a case study into this way of thinking about the design process and physical knowledge in architecture. The vehicle for this case study is the design of a Museum of Modern Art and the focus of the study is the work of Alvar Aalto.
1.7 The Method

The line of enquiry that I am proposing in this thesis sets up the design exercises as the context or environment for engaging Alvar Aalto's work and practice. The design exercises raise many issues and questions on physical form making. The determinants of each design decision are complex and varied and draw on various sources of knowledge. But each design dilemma may raise some architectural issues that Aalto may already have confronted in his own work in a different context. The specific design dilemmas provide an active generative design setting to extract the knowledge that is embedded in the physical decisions that Aalto made for a similar problem.

The study of the specific Aalto buildings conducted through the design process itself would therefore generate an active dialogue between Aalto's work and the specific design problem at hand. Since the design exercise is necessarily more exploratory than expository, the thesis is more inductively oriented than deductive. This in turn affects the way Aalto's work is studied and presented in this thesis.

Each design conflict encountered guides the direction of the study and therefore affects the subsequent discovery in design. This in turn will have a direct impact on the mode of the next analysis and design decisions. Thus, the driving concerns for both the design exercises and the focus of the study of Aalto references will take several forms as more desirable directions become identified through comparison with each other. In other words, the design exercises and the enquiry of Aalto conducted through the process are constantly redefining
the problem setting for each other. More important, this non-linear but active and topical engagement of Aalto's work may still reveal something general about Aalto's buildings or his methods of working in a light which conventional methods of analysis are less likely to present since it is couched in the language of design.

1.8 Design Process and Practice

In strict terms this thesis is primarily a case study of the process of design, and only secondarily about Aalto. The design process presented in this thesis adapts itself to deal effectively with the specific conditions encountered in each of the design exercises. Although the enquiry occasionally draws on Aalto's own way of working and practice to illuminate the design problem at hand, it would be a mistake to consider the method employed in the design exercises as an imitation of Aalto's own process. Furthermore, no single design process can be exactly replicated since no two architectural problems are identical and every architect proceeds in a different way. Even if the replication of a process is able to recreate certain forms, it does not necessarily extract the knowledge embedded in the physical form and liberate it for use in a different context.

The contention of this thesis is that an imitation of Aalto's own practice is not the responsible or proper way to continue the work of Aalto. At best the mimetic method might produce designs approaching the level of competence of Aalto himself, but at worst the designs are mere superficial reworking of Aaltoesque themes. On my visit to Finland, I saw many buildings done by the Alvar Aalto Atelier. These included buildings that were designed by Aalto, but built after his death as well as new buildings that are designed in the
spirit of Aalto. Many of the buildings appeared somewhat stylized because the firm was obligated to work artificially within the Aalto mode.

The line of enquiry pursued by this thesis suggests that Aalto's knowledge is not confined to his particular process of working or practice, but is embedded in the physical decisions of the buildings themselves. This knowledge embedded in the physical form can be assimilated and internalized and eventually dynamically applied in a completely different process. A process that can arrive at buildings that share similar physical attributes and behavior as Aalto's own buildings. The assimilation of Aalto's knowledge, however, requires that the information not be simply analyzed but transformed and applied. The most fertile environment for this kind of assimilation is in the context of design itself.
2.0 DESIGN EXERCISES

Given the premise of this enquiry, the building designs presented here cannot be seen as autonomous products. Instead it is a record of a continually evolving thinking process which is specifically concerned with engaging Aalto's work. A dialogue with Aalto's work alone is however insufficient to confront all the complex architectural issues raised in the design exercises. Other external knowledge as well as design agendas are operating continually in parallel with the Aalto studies throughout the design process, some of these formal agendas and advocacies are presented in Appendix D. However, decisions that are derived from these other operating criteria are de-emphasized in the main body of the discussion of this thesis for the purpose of studying Aalto. Consequently design decisions that have an explicit and probing dialogue with Aalto's own work are highlighted and elaborated. Hopefully, the special emphasis and elaboration of particular Aalto themes does not diminish the sense of complexity of the whole design exercise.

The study of Aalto's work does not determine the outcome of the design, it merely informs it. In turn, the specific design issues raised by the design exercises inform the study of Aalto. In short, the analytic and projective activities are parallel and mutually informing. The line of enquiry pursued by this thesis emphasizes the physical knowledge embedded in Aalto's buildings as primary inputs to the design process, while it acknowledges that in doing so it necessarily deals with the physical form in general terms and consequently may not do full justice to Aalto's original intention. Nonetheless, these external sources of knowledge help to clarify the architectural problem and to translate intentions into physical form. Moreover, they allow a way to understand why and how each physical decision in
Helsinki, Toolo District site plan.
the building was developed in context of some design problem or issue. This is not a historical reconstruction, but a plausible account of the building decisions from the design point of view. By way of this kind of logical reconstruction, the enquiry may reveal some generative design principles prevalent in Aalto's buildings.

2.1 Description of Design Exercises

2.1.1 Helsinki

The project is a combination of the program of two design competitions. The first is "Silhouettes of Helsinki," a student competition for a museum of modern art in Helsinki; and the second is a pan-scandinavian urban design competition for the Kamppi and Toolo lake district in the city of Helsinki.
Helsinki, plan of site.
Helsinki, view down Mannerheimintie looking northwards with Parliament to the left and derelict rail yard and site to the left.

The site for the new museum occupies the derelict railway marshalling yard and goods depot in the center of Helsinki between the railway station and Toolo Bay. This location is bounded by the commercial downtown to the south, Hesperia Park to the north, Toolo Bay to the east, and Mannerheimintie, one of the main north south vehicular arteries of Helsinki, to the west.

The site occupies an extremely significant position in the city. The vicinity is characterized by prominent free-standing civic and architectural monuments in an urban park setting. Just north of the site is the Helsinki Historical Museum and Aalto's Finlandia Hall. Directly opposite the site, across Mannerheimintie, but at a much higher datum is J.S. Siren's Finnish Parliament building. To the north of the Parliament is the National Museum designed by Saarinen, Gesellius and Lindgren.
Helsinki, aerial view of Toolo district.
As a rail yard, there is at present no urban infrastructure in the site, and therefore it is impossible to tackle the problem of designing a building there without making a more comprehensive urban design proposal for the whole area. Given the scope of the thesis, the urban design component of the exercise serves primarily as a context for the design of a particular building. A comprehensive urban design proposal for the district, however, is not unrealistic. In fact, the planning and design of this area has been a subject of continual speculation for many Finnish architects since the early part of this century. In 1985, the State and City re-initiated public interest in this area by organizing a pan Scandinavian design competition for the future development of Kamppi and Toolo district in the anticipation of the imminent removal of the train marshalling yard and reduction of the railway area. The City is planning to develop the area into a civic and cultural center of
mostly public buildings and institutions. In addition to a Museum of Modern Art, there will be a Helsinki City Art Museum; an addition to the Helsinki City Museum; an addition to Finlandia Hall; an addition to the Main Post Office; a hotel; office and commercial space, and some apartment buildings. As of August 1990, the railroad tracks in that area have been cleared. The former train depots are temporarily occupied by an alternative art gallery named MUMM. In any case, it is more than likely that redevelopment will occur in the near future.

It must be acknowledged that many of the ideas employed for the urban design are indebted to the many proposals that I have studied for the area. These include plans by Eliel Saarinen (1911), P.E. Blomstedt (1933), three schemes by Aalto in the 60's and 70's, as well as Arto Sipinen's the winning entry for the same urban design competition held by the city in 1985 that provided the urban program for this thesis.

2.1.2 The Pedagogical Intention for Conducting Two Parallel Design Exercises

The second, or rather parallel, design exercise to the Helsinki project uses the same Museum of Modern Art program for a site in Boston. The intention of this parallel design exercise is twofold.

First, the two design exercises can establish a dialogue between them that focuses on the intrinsic architectural problems embedded in the program. These issues are raised by the different physical constraints of the two sites, such as questions of overall organization, handling of program elements, access, etc..
Second, the knowledge gained through the study of Aalto's buildings can serve as a critical guideline for the design decisions of two separate instances of the same general architectural problem. This is achieved through the systematic application of the same critique to the two separate designs. In turn, the application of the knowledge gained from studying Aalto will hopefully allow us to understand Aalto's own work better.

In order to focus on the general physical and formal issues raised by the building design and to maintain some basis of comparison between the two exercises, an effort was made to choose similar sites in Helsinki and Boston. Both are urban sites which have important axial connections to the city and have strong landscape and water elements.
Boston, site plan of Fenway.
It must be stated that the design exercises omitted any extensive study of the historical and cultural context of Helsinki and Boston. Instead, the exercises emphasizes the particularities of the physical context (e.g. topography, urban edges, etc.) while treating the historical and cultural significance of the site only in general terms. There are two reasons for this. First, the emphasis on physical characteristics of the sites and Aalto's work presumes that physical form can be understood on its own terms, as autonomous of its related non-physical characteristics. Second, the focus on the physical characteristics of the site is in keeping with the bias of this thesis which is an enquiry into the physical manifestations of the design thinking process.
Boston, topographical map of site.
2.1.3 Boston

The site in Boston is located along the eastern edge of the Fens in a narrow strip between the Muddy River and Fenway Drive. The longitudinal extent of the site is marked by Boylston St. in the north and Westland Avenue in the south. The site occupies a prominent position at the mouth of the Muddy River and straddles two important axial extensions from the City to Fenway Park along Boylston and Westland.

The site is fronted by four to six storey residential row houses across Fenway Drive to the east. To the west and across the Muddy River is the Victory Gardens. At present, the Boston Fire Department Alarm Headquarters occupies the area that terminates the Westland axis. The building effectively blocks the view to the park along Westland Avenue. For the sake of the exercise it is assumed that the Fire Department has found a new home and that the
city has decided to build a Museum of Modern Art at the site because of its relative proximity to other important cultural institutions of the city. (The Institute for Contemporary Art eastward along Boylston; the Boston Symphony Hall and Christain Science Center eastward along Westland; and the Museum of Fine Arts and Gardner Museum southwards along Fenway Drive.)

2.2 An Interpretation of the Program

The program of the Museum is based entirely on the requirements specified in "Silhouettes of Helsinki" competition, (see Appendix E). Given the nature of this investigation, however, the specific program of the building is not of primary importance.

Although it is not the intention of this thesis to make a comprehensive interpretation for the contemporary museum, it is nevertheless important to state the positions that are important in the thinking and forming of the museum environment which is proposed in the design exercises.

1. The scope of Contemporary Art is much more extensive than traditional painting, sculpture, and graphics. It incorporates many new and unconventional media and forms of artistic expression. These include various kinds of environmental art, earth works, performances, installations, kinetic art, videos, and multi-vision productions. The physical implications of this expansion of media is that the traditional room to room display of artwork is no longer viable. These new kinds of production require exhibition spaces that are adaptable in size, lighting, and viewing relationships, (viewing from above, below,
frontally, in the round, etc.). This translates to variability and adaptability in plan and section. In addition, the separation between access and viewing rooms is to be eliminated, since this would allow for a more variable and informal relationship between the artwork and the viewer.

2. This expansion of media in Contemporary Art also forces us to reconsider the nature of the art object. The art object can no longer be seen simply as a testimony of personal artistic expression or a demonstration of artistic competence and virtuosity of the artist, but as a product of an artistic process which demands speculation and dialogue between the artist and the viewer and among viewers. Consequently, the museum can no longer be seen as a repository of art artifacts only, but must also be a place of cultural exchange and learning. The objects displayed are of no greater importance than the people who come to visit. Thus the physical environment of the museum should engender exchange between the artifacts and people as well as between people and people.
3.0 HELSINKI PROJECT

Site plan.
Ground floor plan.
Upper Gallery plan of earlier scheme.
Section A, through auditoria and bridge level from Parliament.
Section B, through main lobby and entry area.
Section C, through galleries.
Section D, through library and offices.
4.0 GENERAL OBSERVATIONS ON AALTO'S WORK

These observations of the buildings of Aalto arose out of and were conducted through the process of the design exercises. The verbal articulation of these issues about physical form were fundamental in informing the visual process of design. The topics are not comprehensive, nor are they definitive, they are simply a collection of observations about Aalto's work which have helped me define the boundaries and direction of my own concurrent design exercises. In their final form here, some of the conclusions have been invariably over generalized. This process of generalizing partial observations into some coherent form was useful in trying to understand some of Aalto's decisions as consistent design strategies or generative principles as well as helping me to develop some normative attitudes in my own designs. In any case, I hope these observations can be useful to others, although they perhaps reveal much more of my own biases about architectural design than Aalto's.

4.1 Themes and Historical Types

This section on themes is the result of trying to understand the forms of Aalto's buildings. In addition to studying the forms themselves, invariably I was lead to the question of what were some of the sources of these forms.

There are obvious recurring themes through Aalto's work. This is not simply the consistent use of formal and building vocabulary, but also by the continual exploration of certain organizational and formal strategies. The identification and the respective
development of Aalto's themes can be traced fairly straightforwardly through his buildings. Often the organizational themes of Aalto's buildings are developed together with some distinctive shape like the libraries and town halls (cf. 4.3).

Some of these organizational themes which have physical equivalents in conventional architectural types are inherited from the culture in which he worked.¹ These types have associative value gained through time which allows them to communicate certain cultural and architectural values. The organizational type that Aalto alludes to in his building is historically related to the kind of institutional use the building houses. Many of Aalto's town halls are recognizably derived from the court-yard type. The open-court typology for town halls has a well established Renaissance tradition which was continued through to Scandinavia through Neoclassicism. The forecourts which reoccur in many forms in the entry sequence of Aalto's work as in the Paimio Sanatorium, and the Otaniemi Student Dormitory all allude to the long tradition of the cour d'honneur, a conventional entry typology.²

There is no a priori justification for Aalto's use of any particular historical type or organizational theme, except that he was interested in investing his buildings with the same kind of cultural association as the type he alludes to. This in turn gives his buildings greater historical and social legitimacy. These clear references to historical and conventional types suggest that Aalto's architecture is not a simple accommodation of program motivated purely by an ahistorical functional concern.
1. AALTO Saynatsalo Town Hall, an interpretation of the open court type.
2. SAARINEN Lahti Town Hall, example of Finnish neo-classical town hall based on open court typology.
3. FROSTERUS Vanajan Kartano Manor House, Finnish example of cour d'honneur typology.
4. AALTO Paimio Sanatorium, diagram of entry forecourt.
5. AALTO Otaneimi Student Dormitory.
4.1.1 Themes and Personal Research

There are some important formal themes in Aalto's work which have less direct link to any traditional typology. For example the extent to which Aalto used the fan form has no direct historical parallel. Instead, the recurring formal theme of the fan is part of his personal research. His consistent development of the fan form, however, infused the form with its own meaning and significance beyond a personal signature. This is because the use of the fan is not simply formal or visual, but has very real direct implications on the life of the building. In other words, the fan is an intrinsic part of the organization of the building. For example, at the site size, the fan is often used to direct movement through the site and around the building and as a physical extension of the building form into its surrounding landscape. At the building size, the fan-shaped enclosures are consistently used as collective areas in the building such as the reading rooms in the libraries.
Examples of fan form.

6. AALTO Helsinki Opera Project.
7. AALTO Chiraz Museum of Fine Art Project.
8. AALTO Seinajoki Library.
Aalto's Use of Typology

Although Aalto clearly had knowledge of historical types, he did not work within the constraints of the type as a complete model for his own buildings. The recognition of a relationship between a particular Aalto building and a typological model does not imply a deterministic relationship between the two; nor does it suggest that Aalto actually generated the building by directly transforming the type he had in mind. Instead, the resemblance between his buildings and any historical types is based on common elements and shared configurations. That is the relationship is recognizable, but not reproducible. His knowledge and use of historical types, like his classical training, was simply a constant presence in his design process. Except for the very early neoclassical buildings, it is very difficult to find any explicit references and quotations of these sources in his work. He had little interest in imitating appearances, but took from the codified architectural sources an understanding directed towards concrete spatial and human experiences.

Aalto conceived of types as partial spatial and organizing units instead of models for whole buildings. Therefore, Aalto's buildings can seldom be reduced diagrammatically into a single type, they are in fact aggregate hybrid plan forms that have reference to different typologies at different sizes. Furthermore, the same spatial type can be readily adapted and transformed in response to particular programs. For example, the fan type which Aalto developed has
many identities, it is not only used for auditoria, but at a larger size the fan unites different building geometries.³

The transformation of a historical type in Aalto's buildings is not driven by a preconceived "image" or "idea" external to the specific architectural problem at hand. Instead it is an adjustment and adaptation of a pre-existing concept to the specific program and site. The process is guided by a critical attitude about the implications the conventional type has on the way of living, using, and associating in the building. Thus the transformation of the type or the combination of more than a single type not only generates a new physical form for the resultant building, but also a new institution with a concern for contemporary life and human relations. Therefore, the essence of his buildings are more than imagery and a superficial connection to historical typologies.

4.1.3 Codified Knowledge in Types

The allusion to conventional typology is the method through which Aalto introduces codified architectural knowledge into his process of design. For Aalto, the knowledge learned from the types help to define the specific problem setting he was engaged in more clearly. In the cases where he is working with his own formal themes, he is in fact codifying his own knowledge into physical form. Similar to the premise of this thesis, Aalto used design as the context for investigating, critiquing and applying the knowledge embedded in conventional form and typology. The resulting designs are not only legitimate buildings in
their own right, but demonstrate Aalto's literacy and lucidity in existing codified architectural knowledge (cf. 4.1).

4.2 Geometry as Apparatus and Territorial Structure

Aalto's use of geometry is grounded on his training which comes from the classical canon. But his interpretation and use of the geometry is also a partial negation of that same canon. For Aalto, geometry is not an artifice, the geometric order itself cannot describe the overall form of the building nor is it sufficient in sustaining the life of the building. The meaning of the building is not derived from its geometry. Furthermore, the geometric system is not closed and instead, the system of geometry is an apparatus for Aalto, the order it generates is not localized and isolated but open, extensive and superimposed. It is geometry that defines the larger territorial and organizational structure of the building.

The most repetitive geometric pattern in Aalto's buildings is the square and double square. Usually, the entire geometric structure for the building and its larger territory can be derived from either subdividing the largest basic square or using its diagonal or golden section. This technique of subdivision generates proportional and dimensional relationships in the intermediate overlapped zones which in turn allow for the superpositioning or overlapping of geometric elements.
Territory of geometric structure is larger than building.

11. AALTO Castrop-Rauxel Town Centre.
12. AALTO Seinajoki Theatre.
13. AALTO Wolfsburg Theatre.
14. AALTO Essen Opera, geometric order is based on the square.
15. AALTO House of Culture, geometric order is based on the square.
16. AALTO Seinajoki Town Hall, geometric order is based on the Golden Section.
4.2.1 Geometry and Dimensions

The set of dimensions in Aalto's schemes are directly derived from rigorous use of geometry. Although geometric order provides proportional relations between its different parts, it is by itself abstract because it has no scale and real dimensions unless it is site specific. In Aalto's buildings, one of the site dimensions is always the generating dimension in the geometric order. It follows that every other dimension in the geometric order has some proportional relation to the site dimension. Aalto uses this set of site and proportionally generated dimension as the control for each successive order of magnitude of actual building size in the building. Thus, the geometric system provides dimensional structure for the buildings.
Dimensions of building is generated from geometric subdivision.

17. AALTO Malm Cemetery Competition Project.
18. AALTO Seinajoki Library.
19. AALTO Siena Cultural Centre.
4.2.2 Geometry as Control or Regulating Norm

In general, there is never a single geometric ordering system that hierarchically controls every decision in Aalto’s buildings. Instead, there is often more than a single ordering system at work. These different ordering systems are all geometrically generated and are superimposed on each other, but are clearly hierarchically nested.

One of the consistent strategies that Aalto uses is that the geometric control of each physical decision is at the same magnitude as the decision itself. That is, the geometric ordering for the larger form of the building is not the same as the geometric ordering for local decisions. The control of the larger form of the building is derived from an understanding of the hierarchy of the site. In general, the controlling point of the larger form of the building is outside of the building itself. This indicates that the largest control of the building is not the building itself, but the site. In contrast, the form of the smaller decisions depend much more on the internal life of the building. Therefore they are resolved locally and ordered by a much less extensive geometric system. The form of the smaller collective enclosures of the building like the library reading rooms is usually internally controlled with the point of control inside of the building and much more closed since they accommodate internally focused activities, (cf. 4.1.1).
20. AALTO Finlandia Hall, geometric order of larger building form.
Finlandia Hall and Baker House are good examples of this. In both cases, the larger form of the building is related to the hierarchy of the site (cf. 4.5). The long continuous building edge of Finlandia Hall is related to the water's edge and large landscape terraces that Aalto had planned for that district. The opposite diagonal building edge is related to the orientation road in front, and the diagonal ends are parts of a fan generated from a point near the National Museum across the road. On the other hand, the undulating surface of the Congress Wing of Finlandia Hall is generated from the rock outcropping immediately in front of it and controlled by a much less extensive geometric order. All of these formal features suggest that the decisions are hierarchically controlled from the city size first and followed by successively smaller sizes.

Similarly, the direction of the wings of Baker house can be generated directly from subdividing the larger territory of the building, but the orientation of its entry and cafeteria is derived from the direction of the river and an extension of the axis from the main campus of MIT. Again the hierarchy of formal decision is from landscape to institution.

More important, the multiple ordering systems at work for any single building suggest that there is no perceivable single "parti" for the entire building. The building cannot be understood simply as a manifestation of a single idea or single geometric order, (cf. 4.11). However, this does not mean that there is no larger attitude that the building exhibits. The concept in many of Aalto's buildings is not derived from its geometry which is abstract or formal. Instead, the concept is related directly to the life Aalto envisioned for the building.
21. AALTO Finlandia Congress Wing, local geometric order.
Since the life of a building is made up of complex patterns, the larger ordering of the building is not explicit but implicit. This is in contrast to the attitude which reveals the method and process of the building's making explicitly, as exhibited by the Renaissance formally and by the buildings of Louis Kahn generally.
Two different geometric subdivisions of the larger territory of the building which order the direction of the dormitory wings.

22. AALTO Baker House.
23. AALTO Baker House.
4.2.3 Geometry -- Precision and Experience

Although precise geometric ordering can be shown to exist in Aalto’s buildings, there is no evidence to suggest that explicit geometric construction was the first generator of the form. For example, his early sketches of Rovaniemi library simply show the radial form of the overall building organization without a hint of the rigorous geometric ordering that can be found in the final design. The precision of the geometry is likely to have been part of a layered process which operated throughout the design and development stages of the building. Geometry, therefore, serves not only as a formal ordering system, but also a system to facilitate the construction and production of the building.

The exactitude of Aalto’s geometric discipline reveals the rigor of his design process; each gesture is measured and constructed. Geometry provides the framework for constructing spatial and territorial exchange (cf. 4.7) and understanding and experiencing the rhythmical and proportional relationship between different dimensions that build the space or sequence.
of spaces. Experientially, however, the exactness of the geometric system is not important. It does not structure the qualitative elaboration of the space. For example, in painting, linear perspective, like geometry in architecture, is a system of convention that provides the structure for the construction of the space, but the quality of the spatial experience has to come from other systems or conventions of elaboration. Again in the example of painting, the quality of "atmosphere" or illusion of space comes from "atmospheric" perspective, or sfumato, and the technique of chiaroscuro controls light and shadow. In short, a complete elaboration of space requires the use of many systems and conventions. Consequently, there are always many systems of order operating in Aalto's buildings of which geometry is only one. (cf. 4.8 and 4.9)
4.3 Shape and Type

The distinctive shapes in Aalto's work are often related to certain conventional or functional building types. The town halls, churches, and libraries are the most clear examples of these two respective patterns. It would be a mistake, however, to discount shape as merely a personal interpretation of conventional or functional typology. Since this would assume a one-to-one relationship between shape and convention or functional typology.

4.3.1 Shape and Form Families

An examination of Aalto's buildings will show that the exploration of shape takes on its own life independent of convention or function. For example, the fan shape is used not only in the libraries, but also in auditoria, and housing. The shapes of these buildings are all fans, and they belong to the same form or morphological family that share similar basic physical behaviors and attributes. These attributes include the point control of the form and differing dimensions on either side of the fan. These basic physical attributes of the fan are, however, modified and made specific in each case by Aalto to respond to peculiarities derived from the specific site and program. Thus, the specific differences between all the buildings with fans cannot be discounted because they can be lumped into the same morphological or form family. The differences between these similar buildings is intrinsic to the specificness of shapes themselves and the way they are used. In other words, the shapes of buildings are site and institution specific and otherwise not transferable.
Different buildings of the same morphological or form family of the fan.
26. AALTO Mount Angel Library.
27. AALTO Bremen Housing Block.

Undulating wave form has no predetermined program.
28. AALTO Finlandia Congress Wing.
29. AALTO Imatra Church.

It is important to emphasize the distinction between the basic physical attributes and behavior of a form and the manifestations of these physical attributes in a specific shape of a building. It is precisely because Aalto understood the basic physical attributes of the shapes he used that he was able to manipulate them for particular architectural and experiential purposes. For example he would take the same shape and reverse its behavior and therefore the physical experience of it, by manipulating the shape's relationship to the inside and outside or by how he programs the form. Thus Aalto's interest in shape is not only functional or behavioral, but experiential and intrinsic to the specificity of the shape itself.
4.3.2 Shape as Theme

For Aalto, shape can be the thematic element in the generation and overall development of a building, (cf. 4.1). His special interest in the shape of buildings is, however, not exclusive of his concern for relating his building to its specific site. With few exceptions, Aalto generally articulates the hierarchy of the programmatic elements by shape. The most figural and discrete element of the building usually corresponds to the most important programmatic element of the building like the council chamber of the town halls and reading rooms of the libraries. These discrete building elements are collective containments and are usually articulated by continuous undulating walls. The secondary supporting
program elements such as the offices are usually treated in a more straightforward and utilitarian way in orthogonally structured directional masses. The important figural element is deployed within a field established by the support spaces. The difference in the way these programmatic elements are articulated allows the institution of the building to be clearly recognized. However, the relationship between the figural and non-figural elements of the building program is symbiotic. The figural element gives the building character and significance. On the other hand, the support spaces provide directional orientation and build exterior spatial continuity with the site and landscape for the otherwise internally focused and discrete figural element. On the inside, the support spaces organize the direction of access and provide an easy way to enter and exit the figural containments in the building. The programmatic and social implications of this hierarchical shaping of space is discussed in section 4.10.
4.3.3 Non-representational Shapes

Although the shapes are figural, they are not representational. Aalto's shapes do not represent anything but themselves, each having their own inherent logic. The shapes may reveal, however, something about the way they were made, or reveal some aspect of the life or function of the building and site. Often the shape of a space or enclosure has very direct implications on the form of the human activities that go on inside them. The shape of the space may support very specific functions like the theaters, or they may imply a very particular kind of social relation between people and institutions like the council chambers of town hall. In general, Aalto's shapes have an underlying logic and order which is not simplistic or explicitly rational. They cannot be described as organic either since they have their own structure which is not derived from organic structure.

For example, the fan-shape composition of his theaters, auditoria or libraries cannot be read as a direct reference to organic material or nature or to the literalness of a fan. On one level, it is an allusion to the classical theater form and to the accommodating strategy of vernacular architecture. On another level, it is generated from an in depth understanding of human relations and the elegance of architecturally resolving multiple directions and direction changes. In any case, the use of the fan or any specific shape is directly related to the physical and social experience of the building.
4.3.4 Shape as Generator of Building

A distinction must be made between the eventual shape of Aalto's building and the form of the diagram or geometric order (cf. 4.2). The latter has no specific shape and does not determine the eventual form. Unlike other physical attributes which can be abstracted and diagrammed, shape is not diagrammatic or reducible, but is necessarily specific. Thus, the shape of any one building cannot be understood simply as "archetypical," which can be applied over and over again in other situations. Instead, each shape that Aalto uses is particular and unique even though there are similarities with other buildings. A study of some of the sketches reveal that for Aalto shape is an intrinsic part of the initial generation of the building. For Aalto, the generation of the shape of the building is instrumental in defining the nature of the specific architectural problem of use, size, institution and the constraints of the site.

Because the shape is such an important part of the generation of the building, the various building elements that make up the building are relatively dependent in the overall understanding of the shape of the space. Instead of having their own life and defining space by their own intrinsic spatial qualities, the structural elements are used primarily to build the shape that is derived from other programmatic, geometric, or site generated concerns, (cf. 4.8).

Some of the sources of Aalto's shapes.
32. AALTO sketch of Delphi.
33. AALTO Otaneimi Institute of Technology, sketch.
34. House in the island of Kythera, Greece.
Early design studies show the importance of shape in the generation of the building.

35. AALTO Siena Cultural Centre, preliminary sketch.
36. AALTO Chiraz Museum of Fine Art Project, preliminary sketch.
37. AALTO Bremen Housing, sketch.
38. AALTO Imatra Church, sketch.
4.3.5 Hybrid Shapes

Some of Aalto's shapes are compounded as a result of either the resolution between two or more interlocking or superimposed geometric orders or an additive method of designing. Normally, superimposed geometry in Aalto's buildings is not resolved by the dismembering and clashing of the constituent parts—as in the work of Coop Himmelblau—but are instead resolved in hybrid shapes in plan and in section by light and space. The buildings are made up of an aggregation of relatively distinct parts of the program. Usually these different program elements have their own geometric control and are therefore understood as relatively...
Irk-ia independent elements. In general, Aalto's strategy is to distribute and arrange the independent enclosures in an open, but again geometrically controlled, configuration within the larger boundaries of the building. The open arrangement ensures that the space defined by the larger boundaries of the building is not packed or filled so that the spatial experience of the building is not of the discrete enclosures, but of the spatial continuity between the discrete elements. The resultant larger form of the building is complex since the massing of the individual enclosures and volumes are expressed externally. The complete form of the building is not simply picturesque, but can be geometrically constructed.
Diagram showing the shape of the building as a hybrid resolution of the different figural program elements.

42. AALTO Wolfsburg Cultural Centre.
43. AALTO Saynatsalo Town Hall.
4.3.6 Sources of Shapes

The fact that the same shapes occur in Aalto's buildings, pottery, painting and furniture suggests that the interest in certain shapes is inspired by the shapes themselves. The buildings therefore are only part of his personal exploration into these shapes.

It is not important to understand the origins of the shapes, personal taste and experience was certainly an important factor. Unlike his architecture where the shape is not derived from the material of construction -- the Vienna sport center is a notable exception where the roof form is generated from the structure -- his shape experiments with wood and furniture were intimately connected to his understanding of the properties of wood and wood laminate. In these instances, the material properties may have contributed to his formal tastes. The norm of his architectural production was the opposite, it was his interest in certain shapes which lead to the use of the corresponding building vocabulary. Aalto had a particular affinity to using walls over skeletal structure since he was interested in making shapes which are containers or have continuous surfaces (cf. 4.8).
Examples of investigation into shape with different media.

44. AALTO glass vases and bowls.
45. AALTO Kokkola Library.
46. AALTO experiments with wood.
47. AALTO Vienna Sports Hall, shape of roof derived structurally.
4.4 Section

Aalto's sections are characterized by multiple layers of spatial zones. Often the interior and exterior surfaces do not coincide and have very different form. The multiple surfaces are not a result of structural necessity as in wall bearing architecture (which results in solid 'poche'), but are instead derived from the conflicting demands on the two different sides of the wall. For example, the form of the interior section of the Imatra church is motivated by acoustical concerns as well as the formal demand of integrating the three dividable volume. The form of the exterior surface, on the other hand, had to accommodate how several surfaces might meet in addition to satisfying the normal functional and weather considerations. Aalto's solution is not a compromise between these conflicting demands, instead it is a both/and solution. In other words, there is an inherent reason in the way Aalto conceived the architectural dilemma for the interior and exterior walls to take on very different forms. His decision is not simply formalistic or willful. The elegance of his solution is furthered since the space between the interior and exterior section accommodates the moving partitions and the air vents as well.
The key to understanding the resultant physical decisions lies in understanding how Aalto first defined the problem. The program of Imatra church alone does not require the complex solution that Aalto offered. However, by ordering and interpreting the internal constraints specified by the program according to his own architectural terms, Aalto was able to pose the problem which then required a complex solution. In contrast to many of his modern contemporaries, like Gropius for example, who reduced the problem of architecture into quantitative terms only, Aalto's approach to the problem is never reductive, but much more inclusive. The elegance of Aalto's buildings lie not only in the way the architectural problem is conceived, but also in the execution of the solution.

48. Travel sketch showing multiple layers of wall section of Aalto's Imatra Church.
49. AALTO Imatra Church, longitudinal section.
50. AALTO Imatra Church, acoustical model.
4.4.1 Sectional Shape

Many of Aalto's sectional forms are curvalinear or wave forms. The direction of the curvature is usually oriented internally and therefore the section is containing. The specific shape of the section is derived partly from the formal requirements put on the space by the way Aalto formulated the problem. The undulating wave of the ceiling is always shown to be a result of acoustical or light requirements, e.g. the debating hall in the Viipuri Library, Imatra church and library reading room (cf.4.9).

However, these functional or programmatic requirements alone cannot explain or determine the specific shape of the curvalinear containing section. There is never a one-to-one relationship between a functional demand and physical shape, since there are many other shapes that would have fulfilled the acoustical and light requirements of a space. Instead, the choice of the shape of the ceiling is an integral part of a more comprehensive personal exploration into the spatial and habitable qualities of the curvalinear containing form. (cf. 4.3.6) Again Aalto's interest in the particular curvalinear form is not just visual or formal. He is always concerned with making habitable space with the form. In the libraries, where the plan and section are both curvalinear and containing, the sectional containment is only partial because light is allowed to enter and make the space more habitable and functional. For Aalto, a three dimensional containment can still have sectional continuity, i.e. where people are contained, light is not. In any case, the specificness of the shape of the section can only be justified experientially.
For Aalto, sectional shape and volume are treated as single autonomous units or rooms.
Sometimes there are mezzanines and balconies in the space as in the case of Imatra church, but there are very few "interlocking" sections of any significant size. Any interlocking section builds the form of the exchange between different layers in the section and therefore tends to negate or breakdown the containing form. Aalto tends to favor building the containing section over the interlocking section since he favors the spatial experience of the specific curvalinear shape which is in keeping with his own exploration with certain shapes. Consequently, Aalto is generally more inclined to develop his buildings horizontally than vertically. When Aalto needs to build a multistory section, he normally stacks the floors and the large collective space, the sectional space is extruded from plan. The only notable exception to this is the Mount Angel library where Aalto builds an interlocking section. The shape of the section is the form of exchange between two partial containments of stacked spaces, in section, the upper part of the upper section has shape as a result of modulation of the roof plane.

51. AALTO Viipuri Library, diagram of the acoustical scheme.
52. AALTO Seinajoki Library, section through reading room.
53. AALTO Imatra Church, cross-section showing single containing volume of interior.
54. HERTZBERGER sketch of Utrecht Music Centre, example of interlocked section.
55. AALTO Academic Bookstore, section is vertical extrusion of plan.
56. AALTO Pensions Building, section is vertical extrusion of plan.
57. AALTO Mount Angel Library, diagram of interlocked section.
4.5 Site and Hierarchy

For Aalto the site or immediate context of his work is not simply the lot of the building. He always worked at a much larger size and thus his decisions for the buildings are related to the larger physical (dimensions, orientation, etc.) and spatial characteristics of the site. Aalto's buildings are not isolated objects, their geometry, orientation, and organization is always part of a larger whole, (cf. 4.2.2). For example, the form of Finlandia Hall cannot be understood independent of Aalto's urban proposal of the Tooolo area. Finlandia Hall is only one of a string of other public buildings planned to reinforce the edge of Tooolo Bay and the direction of the landscape together with the large pedestrian terraces on the opposite side of the bay.

4.5.1 Site Influences

Aalto's concern for integrating his buildings with the site ranged from the most explicit site orientations to the most subtle treatment of facade details. For example, in Seinajoki, the orientation of the church tower and nave, and the town Hall all defer to the direction of entry to the city of the main regional road. This shift in direction in the buildings to what would otherwise be the normal direction of the ensemble of civic buildings generates the dimension and displacement that allows easy entry to the whole civic complex as well as making some of the partial containment of the civic square itself. The overall massing and
dimensions of the facade facing the harbor of the Enso-Gutzeit building (the facade is a
golden section) takes into consideration the whole dimensional composition of the Helsinki
harbor. The Academic Bookstore, on the other hand, blends subtly into its context by
having differentiated facades on its two street sides.

Diagram showing hierarchy of scheme.

58. AALTO Toolo Bay Urban Design, second proposal
    1959-1964.
59. AALTO Toolo Bay Urban Design, third proposal
60. AALTO Seinajoki Civic Centre, diagram of hierarchical organization of public spaces. Shift is generated by direction of road.
61. AALTO dimensional analysis of Helsinki Harbour with Enzo-Gutzeit Building.
62. AALTO Academic Bookstore, different elevations of a corner building in response to site.
63. AALTO Jyvaskyla University, site plan showing continuity established by figural and non-figural space.
4.5.2 Site Specific Architecture vs. Organic Architecture

Aalto's architecture has often been described as "organic," because most of his buildings are not entirely orthogonal and are quite complex in their structuring. Although the ordering that Aalto employs is generally accepted to be internally coherent, the order is never explicit and therefore hard to understand and explain, (cf. 4.3.3). His buildings are generally considered too specific to allow extension and change, and also anti-urban because the implicit order does not follow conventional urban grids.

The non-orthogonality of Aalto's buildings is not because he appealed to nature or biology as metaphors for his buildings. Instead, the building structure comes from a desire to show how the context, and landscape more generally, affects the form and siting of the building. Aalto's interpretation of landscape and context, however, is based primarily on an understanding of space—both figural and non-figural, the former in the enclosed spaces and the latter in the undefined space of outside territory that he makes. For Aalto, the flow and continuity between his buildings and their respective setting is more important than the urban structure. This continuity is made by linking through and with space, (cf. 4.6).
At first glance, the planometric organization of Finlandia is very much akin to the organization one might find in the landscape. It has no consistent structural organization and pieces of the program are deployed individually like landscape elements. The clearly defined and figural containments are arranged and juxtaposed in a non-figural and less defined access territory which is virtually identical to outside territory. (In this sense Finlandia is similar to the work of Scharoun). A closer examination, however, will show that the deployment of the containments is not at all haphazard or accidental. The order is subtle and not immediately apparent but is in fact tightly controlled by geometry.

Access defined primarily by enclosures.

64. AALTO Finlandia Hall.
65. SCHAROUN Berlin City Library.
There are other Aalto buildings in which the building organization is more explicitly distinct from its setting. The buildings have their own consistent organization and are independent entities to the landscape. Sometimes the building is turned out of the overall field of the landscape to explicitly pronounce its independence. Therefore the building intensifies or adds to the landscape rather than blending into it. This kind of building intensification, however, always takes into consideration the larger continuity of the landscape and urban form.
Buildings are turned in relation to the direction of landscape.

66. AALTO Lynby Cemetery Competition.
67. AALTO Muurutsalo Summer House.
4.5.3 Open-ended Organization for Growth

A more precise description of Aalto's work is "open" rather than "organic," (cf. 4.2). An ensemble of Aalto buildings, is not ordered through a simple, homogeneous, and explicit system like a grid. The buildings are instead related to each other by an implicit and site specific order.

Although his decisions are often non-orthogonal and site specific, Aalto's ordering is "open" because the system of juxtaposition he uses is never singular or complete. For Aalto, the site is always completely defined, but the order is, unlike a grid, not uniform or where every action or growth is predictable and determined (cf. 4.2). It may appear difficult to add to such an ensemble of buildings, since its order is not explicit and the overall arrangement appears to be specific and complete. In fact the buildings can be added to if the larger attitude about the movement and orientation of the site is understood. Therefore, the growth and extension of Aalto's system is open-ended and not completely predetermined, there are always a number of different potential orders that can all be extended coherently. Every physical decision, however, changes the constraints on the next subsequent decisions. Since any addition to the ensemble changes the existing arrangement and forms a new whole.

This kind of addition can occur because Aalto always leaves some "slack" or room in his systems of organization. In other words, the organization is not a complete fit but open and
Proposed site plan and direction of urban growth.

68. AALTO Alajarvi Town Hall.
69. AALTO Saynatsalo Town Hall.
variable in its configuration. This potential for growth is further emphasized by Aalto's use of spatial rather than solid terminations. This partly explains the general lack of symmetry and use of complete forms in his work. In addition, the diagonal branching and fan form are also open-ended forms. The branching and fan forms are different from axial organizations. The former determines the direction of extension, whereas the latter allows a choice of a growth in a number of directions. For example, if the ends of Finlandia Hall and Baker House were orthogonal, it would be clear that an orthogonal order is at work and more important, that the building is the figure and the landscape the ground. Instead, Aalto terminated both buildings with the diagonal. This leaves its relationship to its neighbor open. In addition, the diagonal gives the space between figural qualities. The spatial relationship between building and landscape is now much more reciprocal and figure/figure. In other words, the larger spatial continuities are being made by both the building and the landscape, (cf. 4.7).
Diagram showing indeterminate system of extension because of diagonal ends of building.

70. AALTO Finlandia Hall, site plan showing relationship to city museum.

71. AALTO Baker House.
4.6 Access, Continuity and Place

In Aalto's buildings the access space is the primary generator of spatial continuity in the building and site. The access incorporates zones of movement and circulation as well as most of the collective spaces for interpersonal communication. Unlike Scharoun's buildings, however, where access is generally non-figural and contained in the residual space between and shaped entirely by the surrounding programmatic enclosures; the access in Aalto's buildings are generally figural, and have specific size and form. The access is generally formed by the surrounding enclosures as well as by its own right. For example, in the Saynatsalo Town Hall, the access on one side is defined by the enclosure and on the other is limited by its own dimensional and figural requirements for movement and social gathering. The access therefore has its own life as opposed to being residual and in between. Thus, the figural definition of place in Aalto's buildings is not restricted to discrete enclosures alone, but is also structured in the larger size of the access. Although the access is clearly defined and has figural qualities, Aalto seldom manipulates access as a discrete element. Access is always building the larger continuities of space.
4.6.1 Movement and Direction

In many of Aalto's buildings movement is celebrated. It is one of the primary generator of the form of the building and its site organization, e.g. Baker House and Alajarvi Town Hall. Direction which is a necessary attribute of movement is therefore also an important component to the form of the building. The direction of movement of any particular building, however, is derived not from an a priori ideal associated with direction itself, but from an understanding of the use and institution of the building. For example, the theater and concert halls are collective places and the direction of movement is naturally centrally focused. The form of these buildings in turn exhibit this characteristic of being centrally organized where the movement is from inside out or outside in towards the center.
Many of Aalto's buildings have more than a single direction of access associated with them. This is partly a result of the conflicting demands on the access from the different parts of the program. For example, the direction of movement in the office work areas is different for the main collective areas such as the auditoria as in the Otaniemi Institute of Technology Main Building and Pensions Building. The different demand on the access is resolved hierarchically into major and minor directions which in turn help to define the public and private territories. The major direction of the building, however, generally reinforces the larger direction of flow or continuity in or through the site.
Sometimes the major direction is singular and its repetition in many zones builds a spatial field in that direction. This directional field is responsible for maintaining directional continuity of the access and allows the support and easy access into other more discrete and discontinuous program elements of the building. These more discrete program elements can be of a significantly different size and shape. This kind of strategy of organization allows for the coexistence of the need for containment and discontinuity with openness and continuity.

In Aalto's buildings, the extremes of the most complete and most open forms of spatial definitions are reserved for special uses. Otherwise the norm of Aalto's spatial definitions have a degree of incompletion. The sense of incompletion is often the result of asymmetrical arrangements of form. The notable exceptions to this generalization are the buildings which are singular in their use like the Lahti church.

75. AALTO Otaneimi Institute of Technology Main Building, double directional access system.
76. AALTO Pensions Building, double directional access system.
77. AALTO Alajarvi Town Hall, diagrams showing directional access.
Directional access provides entry to figural containments.

78. AALTO Finlandia Hall.
79. AALTO Rovaneimi Library.

80. AALTO Lahti Church, singular figural building.
4.6.2 Discontinuities and Optional Definitions

Although the access is primarily responsible for providing continuity between more discrete enclosures. Aalto's architecture is not about continuity and flow only. The existence of internally controlled containments allows for discontinuities and privacies within the building. Therefore, space and place in Aalto's buildings is not totally defined or controlled by discrete enclosures or left completely open and continuous. There is always a range of in-between partial definitions that can modify the qualities of the space which allows a greater possibility for different kinds of uses and interpretations.

The collective territory of the access is often open, but can be enclosed. The fact that the access territory can be optionally open and closed gives adaptability to the form of spatial definition. These different spatial configurations allow for variable uses and relationships between the adjoining spaces as opposed to a discrete singular use and experience of the access territory. For example, Town council chamber of Seinajoki with sliding partitions allows the council chamber to become part of the lobby and reception space. Similarly, the operable wall partitions at the Imatra church not only allow the size of the worship area to vary, but in fact permits the sanctuary space to become part of a larger all purpose activity area.
81. AALTO Seinajoki Town Hall council chamber, access territory with different spatial configurations of partition.

82. AALTO Imatra Church, different configurations of nave.
4.7 Territorial Exchange

In Aalto's buildings, space and access is not only the generator of movement but also the generator of exchange between people and adjoining territories.

Exchange occurs in a number of different ways at different sizes in Aalto's buildings. There is the sharing of edges and boundaries between adjoining territories which generate additional intermediate spatial or functional zones of exchange. Furthermore, the shared edges can be of a reciprocal form in which one territory penetrates into the other while being penetrated by it. This results in a figure/figure territorial relationship between the adjoining territories. There is also the physical displacement of parts of one territory into the other and vice versa, which generates exchanges.6

These attributes of physical exchange are a result of Aalto's tendency towards opening up the discrete closed containment and building physical continuities. Furthermore, these formal attributes are generally shared by the whole modern movement and Aalto's contemporaries. For example, the Cubists and De Stijl movements in painting and the architecture of Wright and Corbusier, were all involved in one way or another with the same spatial exploration.
4.7.1 Exchange at the Room Size

The first two kinds of exchange occur at the edges of territories which generate another zone of spatial definition of smaller size in which exchange can occur. These spaces are partially defined in form and use so that it can support a variety of in-between activities. This kind of exchange operates at a variety of sizes. At the room size, it is the threshold of entry from one space to another. Aalto is less concerned with building exchanges at this size compared to Hertzberger. Aalto is generally more interested in building exchanges at the access and collective size of the building. The figural qualities of the access in Aalto's buildings are partly derived from the building of the form of exchange between the access and its
adjoining territories (cf. 4.6). For example, there is often a figure/figure relationship in the form of the boundary between the public access and the large public enclosures like the theaters. This figural form of the access builds the multiple zones of exchange between the two spaces. In Finlandia Hall and the Otaniemi Institute of Technology Main Building, there is more than a single set of stairs in the public access. The repetition of the stairs generates a larger territory for movement and physical exchange.

4.7.2 Exchange at the Building Size

At the building size, the form of the building contributes to the definition of the exchange between the inside or privacies of the building and its immediate outside or collective
Exchange generated through repetition of access zone.

86. AALTO Finlandia Hall.
87. AALTO Otaneimi Institute of Technology Main Building.
88. AALTO Kiruna Town Hall Project, diagram of building size containment.

Aalto in general articulates the form of the building to generate some intermediate exchange territory. This is another way of understanding some of the unusual shapes of his buildings. They are designed to make building size containments and exchanges.

The degree of definition of this territory of exchange depends on the specific form of the building. For example, a series of inflections in the form of the building can make the form of the building a partial containment. The character of this partial containment or territory of exchange varies according to the specific site and programmatic requirements. It can be fairly contained as in the courtyard of the Saynatsalo Town Hall and Seinajoki Church. Or it can be much more continuous with the larger public territory as in open courts of the
Seinajoki Town Hall, and the House of Culture. On the other hand, in the most dense urban sites, the territory of exchange or courtyard is internalized, like the Academic Bookstore and the Rautatalo commercial building. In Baker House, the wave in the building generates territories of exchange on both sides of the building. Furthermore, these territories have directional orientation—the forecourt inflects towards the main building the campus—which connects them to the larger ordering of the site (cf. 4.2.2 and 4.5.3). Once again it is important to point out that these territories of exchange are understandable places in their own right even though they are seldom formally complete or symmetrical. This is because these territories are controlled and ordered by dimensions.
89. AALTO Saynatsalo Town Hall.
90. AALTO Seinajoki Church.
91. AALTO House of Culture, partially contained exchange territory.
92. AALTO Rautatalo Office Building, internalized exchange territory.
4.7.3 Exchange at the Site Size

At the site size, the territory of exchange is defined not only by the building form alone, but by the larger form of aggregation of a number of buildings or the form of the surrounding landscape. The plan for the civic center of Rovaniemi uses the various buildings to form a large court which serves as a center for civic gathering and exchange. The various site plans for the Tooolo area in Helsinki depend on the form of the water as well as the form of the large fanning terraces, (cf. 4.5). Similarly, the external containment in front of Finlandia Hall is built by both the diagonal and bend in the building as well as by the rock outcroppings at the edge of the road.
The site plans of the Seinajoki Town Center, the project for Town Hall at Marl demonstrate how the displacement between different buildings generates an intermediate size territory of exchange between the very large and open landscape and the immediate external territory defined by each of the buildings themselves. In the schemes for the housing projects, the displacements of the building operate in conjunction with larger branching or fanning of the site plan. Thus, the exchange zones between buildings are controlled hierarchically by the fan and are understood as part of a larger sequence of exchange of the whole housing complex and the open landscape.
4.8 Structure

In general, structure in Aalto's work is subsumed under formal considerations. The physical structure is not explicit and is often hidden under the surfaces. For Aalto, the understanding of the space and its form is not directly connected to the understanding of the structure per se. Aalto is much more interested in the physical expression of space and its experience than with the expression of tectonics and materials. Nonetheless, expressive space cannot be understood without talking about specific physical traits such as materials and structure. All the categories of tectonic and material elements such as column, beam, surfaces, and textures as well as the more general categories of describing space like geometry, shape and volume, already discussed are all ways for Aalto to define space in architectural terms.

4.8.1 Multiple Identities of Structural Elements

For Aalto, materials and tectonics are abstracted in the service of expressing space. Thus there is no rigorous distinction between structural and non-structural elements. The column, the bearing wall and the partitions constantly exchange identities. Furthermore, the identity of structural elements are not continuous through the section of the building. For example, in Finlandia Hall, the columns that hold up the chamber music hall are transformed into walls; and the oblong pilasters on the side of the bay are integrated into the curtain wall above. In addition, some of the free standing columns disappear completely on the next
Similarly, in the Wolfsburg cultural center, the structural grid is displaced in section. This discontinuity of structure in the section, and the multiple identities of structural elements is not the result of a lack of rigor in the structuring of the building, but reveals Aalto's bias towards the complex life and spatial experience of the building. Structure is not deployed as an artifice, it has no life and meaning of its own. Unlike Corbusier and Mies, Aalto had no ideology about structure.
4.8.2 Walls and Surfaces

Aalto's interest in walls is not primarily structural, but coincidental with his concern for surfaces. In fact, the walls in Aalto's buildings are generally not bearing, but are surfaces stretched between a skeletal structural frame. Surfaces are generally continuous and are the most important element in the definition of space. Space is therefore conceived as contained and as a volume. The form of the volume of space is derived independent of the structural system. The order that is normally generated from the structure is replaced by a geometric order. Except for the Vienna Sports Hall, Aalto's curvilinear enclosures are not derived empirically from the use of tensile and catenary structure. Instead, the shapes originate in some idea or logic about the life of the space itself as well as his own personal interest in the particular shapes, (cf. 3.4). Sometimes, the construction of these spaces is quite complicated because they are not originally derived structurally. In short, Aalto never thought of the relationship between structure and form as an obligatory or deterministic one.
On the other hand, Aalto did not consider the relationship between structure and the form of the space as arbitrary either. The structure always reinforces the form of the space. When the structure is revealed, it is often figural and anecdotal to the expression of the space, such as the large figural columns that hold up the theaters or the continuous reinforced concrete structures that support the ceilings as in the Riola Parish Church, House of Culture and Otaniemi auditorium. But in general, the structure in Aalto's buildings is not explicit, and therefore it is not always clear how the building is put together.
4.8.3 Structural Logic

When the structural elements are in space, they follow the pattern of the larger geometric order of the building as in Finlandia Hall. What governs the deployment of the structure is therefore not empirical constraints -- that is the span of structural elements -- but a logical and expressive order which is always in service of building space and experience. In his best buildings such as Imatra Church, however, the structure takes on multiple identities, each of these identities help to reinforce the coherence of the overall spatial experience.

4.8.4 Materials

Aalto always uses materials to reinforce the logic of the spatial experience. Materials are not generally used to reveal their empirical qualities. The extensive use of brick during the 50's is essentially the same sensibility that led to the white washed buildings of the 60's and 70's. In both cases, the primary objective is to build the form of the external surface and mass of the building and not to reveal the quality of the brick itself. In the interiors, the white surfaces of the walls and ceilings were used to reinforce the three-dimensional form of the light (cf. 4.9). Similarly, the laminated wood fittings are used to articulate the form of the space and are therefore also painted. However, at his best, Aalto allows the material to take on multiple characters. For example, in the Saynatsalo Town Hall Council Chamber the material reinforces the logic of the spatial experience and as well as revealing its own empirical nature.
4.9 Light

For Aalto, light is the primary device in describing and understanding space. Like space, light reinforces continuities within the building and between inside and outside. Thus, the building of the light in the public collective areas of the building takes precedence over the making of discrete enclosed privacies. Aalto builds the light first as the continuous element and then deploys discrete containments within the territory that is already defined by the light.

99. AALTO Imatra Church, multiple identities of structural elements, air vents are integrated with the beams.
100. AALTO Saynatsalo Town Hall, wooden roof trusses of council chamber.
101. AALTO Saynatsalo Town Hall, exterior view.
The concern for light is the primary reason why Aalto is able to take very containing forms in plan and section and make them habitable. For example, the plan and section of the library reading rooms are both curvalinear and containing, the sectional containment is only partial because light is allowed to enter from the top. For Aalto, a three dimensional containment can still have sectional and light continuity, i.e. where people are contained, light is not. More important, the section and surfaces builds the form of the light directly. Again, in the library reading rooms, Aalto's effort is not just to allow light into the section, but to give three dimensional form to the light. Hence the ceiling and wall surfaces near the skylights are always painted white. Thus the shape of the section is not only the shape of
the space, but also the shape of the light. In effect, the curvilinear form of the reading
rooms is a light container since the containing wall is virtually dematerialized by the light.
The actual containing form provides the psychological and functional need for containments,
but the light makes the form habitable.

4.9.1 Form of the Light

In general, the windows in Aalto's buildings are either part of a larger horizontal zone (cf.
4.9.2) or they have some reciprocal form with the wall which constructs a figure/figure
relationship and a material exchange between the wall surface and the window light.
Aalto's windows and skylights often have more than a single surface of layers. These light
elements have distinctive form and occupy a substantial spatial zone. Because the zone
between the two layers of glass is large, the thermal advantages are minimal since
convection can still occur within this zone. Therefore, the primary reason for this multi-
layered configuration is to build the three dimensional form of the light. For example, the
skylights of the Academic Bookstore have four separate layers. The most interior layer
protrudes into the volume of the space. The light element, therefore, is no longer just in the
surface of the ceiling, but has volume and three dimensional form. They are essentially light
vessels that inhabit the space. In this particular example, the large skylights are discrete
isolated elements which is not normally how Aalto uses the large skylights in other office
buildings. It is, however, more like the way he builds the smaller domed skylights which
are always punched holes in the roof surface.
4.9.2 Virtual Light as Continuity

In many of the office buildings, the public area is adorned with very large skylights. In the Pensions Building, Aalto builds the continuity of light not literally but by substitution. The size and extent of each skylight is limited and act as discrete elements that operate in alternation with surface elements. From the interior, the light still appears as virtually continuous because the surfaces are painted white and act as virtual light elements in substitute for actual light.
This substitution of actual light with white surface as a way of implying continuity of light is a consistent strategy Aalto uses. For example, in the facade of the Seinajoki Town Hall, the horizontal zones of the windows are not covered with the violet porcelain tiles but painted white. These horizontal zones are understood as continuous zones of light in the surface even though the actual windows do not occupy the entire zone. Thus, the windows are not seen as discrete elements, but part of a larger continuity. In the Seinajoki Library, the horizontal window zones are made continuous by painted screens.
4.10 Program

The unconventional form of Aalto's buildings is not just experiential and spatial, but has important social implications. By rearranging conventional physical relationships between different functional elements of an institution, and by giving unconventional shapes to some of the programmatic enclosures, Aalto was able affect the form of the social interaction between the inhabitants. This in turn affected the life and image of the institution associated with the building.

Aalto's buildings challenged the conventional method of building social and interpersonal hierarchies. The town halls are examples in which the hierarchy of the collective body is asserted without literally placing the council chamber in the middle, in fact, what takes precedence is the collective gathering of people in general and not the legislative body alone. The importance of the Council chamber is still evident since it always has the most distinctive massing.
Once Aalto established an understanding for the life of building and the desired programmatic hierarchy of the institution, he was quite relentless and definitive in achieving this objective. The hierarchy of the different programmatic elements is physically achieved by how the different pieces of the program relate to each other physically and how they are individually articulated. The public and collective spaces receive the most attention since for Aalto the collective realm is always more important than the individual. But there is seldom too much public access in Aalto's buildings since he knew this would diffuse the intensity of the public areas and collective life of the building. The more equalitarian offices are on the other hand simply subdivisions of larger spatial units and are minimally articulated. Aalto is always very clear about the articulation of the different pieces of the program because he is aware of their social implications. Again, his decisions about form are never purely formalistic.
4.11 Complexity

Aalto's buildings are the result of a complex and non-reductive approach to architecture. Unlike reductive either-or approaches which simply imposes a particular kind of logic, whether structural or spatial, into an existing context without any modification; Aalto offers a both-and method that can accommodate differences and complexities. Consequently, his buildings are generally a resolution of many partial physical decisions which are made at different times during the design process and based on a complex set of concerns and intentions. The resultant building is shaped and modified by every important concern during the design and construction process. For this reason, it is uncommon to find in Aalto's buildings pure geometric forms which tend by nature to be very singular in both form and meaning. This multiplicity of concerns is directly manifested in and the complex form of the buildings.

The fact that the actual building is made up of many partial decisions does not mean that there is a lack of resolution in the design or that each decision is based on ambivalent concerns or issues. Each physical concern is coherent and important in its own right. But none of these concerns alone is sufficient to generate a complex building with many complicated requirements. The way Aalto controls this complexity is through a intricately nested hierarchical system. Furthermore, each architectural element has more than a single identity or function. The fact that their shapes are not simple allow them to be read in more than a single way.
4.12 Generative Design Principles

This thesis studies each of Aalto's work not as particular, isolated, and idiosyncratic decisions, but as different examples of the same process or method of working. These methods are an integral part of Aalto's practice and can be considered normative, consistent design strategies -- generative principles -- used by Aalto. An understanding of these normative methods of decision making can be adapted to new situations which can be demonstrated through design. In this sense, the lessons of Aalto's process of working is open-ended and can be applied in different contexts.

The interest of this thesis in generative design principles stem from a desire to demystify the design process. It attempts to examine the building through understanding physical (formal, spatial) decisions, and therefore connect the physical artifact to a process of design and fabrication which can be understood and repeated. This is a logical construction of the making of the historical artifact which is an alternative explanation offered by historical research. Instead of interpreting the artifact in its historical context, this explanation does not draw on the original intentions of the architect and historical facts as the most important criteria for understanding the building.

Instead, the generative design principles are derived primarily through a process of observing and studying the physical artifact and recognizing what physical decisions are represented there. This explanation is not necessarily historically correct since it does not draw on
historical sources directly. But this explanation uses actual physical experience as the primary sources for its construction. The usefulness of such generative design principles does not depend on historical authenticity nor do they require extensive documentation to support its findings, assumptions and observations. This kind of explanation cannot be comprehensive or definitive because it stems primarily from the present interest or need of the designer searching for these principles. Its sole objective is to understand the physical information in the artifact for its own sake. To recognize the behavior or effects of the physical decisions so that this knowledge can become useful in the projection of other designs.

1 Types is used here in reference primarily to physical organizational and spatial organization. According to Porphyrios Aalto never used the term 'typology' as such. None-the-less, the idea behind 'typology' which refers to a recurring and recognizable physical form accepted by the architectural convention which is associated with familiar and transmitted cultural values was understood and recognized by Aalto and his contemporaries, (see Porphyrios, Sources of Modern Eclecticism, 25-39).

5 Peter Bucanan, Organic architecture, Architectural Review.
SECTION 5: DESIGN PROCESS

This section presents selected examples from both the Helsinki and Boston design exercises. They are included to illustrate the design setting in which the enquiry into Aalto's buildings were conducted. These examples are organized under the categories of: 1. site studies; 2. plan studies; 3. studies of building elements. The issues raised in these examples correspond to the discussions of related topics in section 4.
5.1 Site Studies

Site issues include:

a. determining the size and extent of the site; what are the site concerns to be included in the design;

b. how the hierarchy of site decisions inform subsequent building decisions.
1. Helsinki, site study. The extension of water into the site from Toolo Bay establishes the direction of the landscape. The extent of the site includes the whole district. The problem is not a building problem but an urban design problem (cf. Aalto's urban schemes for Toolo Bay Area).

2. Helsinki, site study. The territory of the Parliament is extended to the water's edge with a series of interlinked building containments. The axis of the Parliament is terminated by the proposed building. Again the extent of the site is larger than a single building and the scheme proposes much more square footage than required.
3. Helsinki, site study. The form of the water not only reinforces the direction of the landscape, but makes a public open territory in front of the Parliament which clearly defines the extent of the site.

4. Helsinki, site study. Once the extent of the site is defined, the hierarchy of the building decisions is established. The conflict in direction becomes a building problem.
5.2 Plan Studies

Decisions regarding the development of plan include:

a. direction changes and its effect on the overall shape of the building;
b. the hierarchical articulation of the different program elements, such as the auditoria;
c. the use of dimensions and geometry as an ordering device.
5. Helsinki, plan study. The direction shift of the building is generated by the displacement of the auditorium. The secondary direction is controlled axially by the auditorium.
6. Helsinki, plan study. The two directions in the building is superimposed on top of each other. Neither direction dominates.
7. Helsinki, plan study. The directional orientations of the different program elements are organized in a fan. There is however no clear hierarchy between the different directions.
8. Boston, plan study. The diagonal branching of the different program elements at the end of the building is a method of resolving the direction of the building and the axial urban extension.
Helsinki, plan study. The fanning of the building form begins to resolve the direction between the water, the Parliament and the movement across the site. The axis of the Parliament establishes the hierarchy of the directional fanning.
11. Helsinki, plan study. Diagrams of dimensional structure of building across site. The large collective areas in the site are controlled by squares. The squares are distributed relatively independent of each other. Therefore, the form of the building is additive.
12. Boston, plan study. Structure of the dimensions of building. The largest dimension is generated from the site. Again the squares and dimensions are relatively isolated from each other.
13. Helsinki, plan study. Early sketch of final scheme before the control and ordering of geometry.
14. Helsinki, geometric and plan study. The diagonal orientation of the building is generated from the geometry and dimension of the Parliament building. The larger territory defined by the geometric order is based on aggregation of independent geometric solids. There is little overlap between the geometric order of the Parliament building and the geometric order of the building.
15. Helsinki, final scheme. Territory defined by geometric order is much larger than the building. The dimension of the largest square is the dimension of the Parliament building. The building is ordered by a subdivision of the largest geometric solid.
5.3 Building Elements

A set of building vocabulary was studied through modelling. The model is a partial section through the public access area of an preliminary scheme of the Helsinki project.

Considerations in developing a set of building elements include:

a. a study of structural systems; how the form of the structure can contribute to the spatial definition of the space.

b. an investigation of skylights, weather screens and closure, and surface articulation.
16. Model.
17. Helsinki, plan of early scheme from which model developed.
18. Section of early scheme.
19. Model.
20. Section of model.
22. Model.
23. Model.
24. AALTO Mount Angel Library, form of structure in section.
25. Model, skylights.
26. AALTO Pensions Building, skylights.
27. Model, skylights from interior.
28. Section of model through access and skylights.
29. Studies of lighting condition in Galleries.
30. Studies of lighting condition in Galleries.
31. Model, skylight in gallery.
32. AALTO Aalborg Museum exhibition area.
33. AALTO Aaborg Museum exhibition area, section.
34. Model, interior view of gallery.
35. AALTO Maison Carre, section and form of ceiling.
36. Model, closure screens.
37. Model, closure screens.
38. Model, closure screens.
6.0 CONCLUSIONS

Despite the many problems and limitations of this study, it appears that the premise of this investigation is sound. Buildings are sources of knowledge and the design process itself can serve as a viable vehicle to extract the knowledge embedded in the buildings. Although this investigation has lead to a better personal understanding of Aalto's buildings, it has raised more questions than it has answered both about Aalto's buildings and and this method of doing research through design.

In retrospect, this thesis and design exercises may have been over structured from the design viewpoint. The original intention of structuring the design process with some intellectual framework was an effort to help organize the research and to make the design process more explicit and rational. But this overlooked the importance and potential of the implicit logic inherent in the design process itself. Instead of allowing the intrinsic order in the design to guide the investigation, a more explicitly rational order was always operating in this investigation. This may have been a byproduct of the rather evenhanded approach throughout this thesis towards writing and designing. This evenhanded approach, however, may have been the source of some confusion and conflicts in the exploration.

On one level, it is a problem of language and of writing about architecture in general, but it is also a conceptual problem. Design and the writing about design are two different kinds of activities. Designing is necessarily an exploratory and inductive process while writing about design is deductive and invariably organizes and translates the discoveries made in design into some pre-existing intellectual and linguistic categories. In hindsight, some of the observations of Aalto's work made during the course of the designs challenge the validity of
the existing categories or topics they are discussed under. They begin to suggest and demand
their own categories.

Perhaps one or the other approaches should have taken over. Then either one of these
approaches would have provided more order or logic in the thesis. A predominantly written
account would be more deductively organized and therefore more systematic and expository.
On the other hand, a predominantly visual and design focused investigation would be more
inductive and exploratory in nature.

In any case, this kind of design research begins to suggest that the field of thinking of
architecture can be broadened. It raises some issues about design and Aalto that require
continuation. For example, an investigation of this nature can be conducted by more than a
single person. This would require a more systematic means of communicating and sharing
of the knowledge gained through design. Perhaps this kind of joint investigations might
lead to a development of a methodology. As for the work on Aalto, the discussion here is
incomplete, but may serve as a useful platform for more indepth study. For example, the
geometric construction of Aalto’s buildings should be subjected to more rigorous analysis
and study through other design exercises. The continuation of this kind of study may result
in a more comprehensive compilation of the generative design principles exhibited in
Aalto’s buildings.
LIST OF CREDITS

Sources of Illustrations:


- Demetri Porphyrios, *Sources of Modern Eclecticism*, London: Academy Editions,1982: p38 fig. 1 and 2; p39 fig. 3; p63 fig. 34; p76 fig. 53; p81 fig. 61.
Credit for Illustrations and Diagrams

The following diagrams of geometric analysis of Aalto buildings in Section 4.2 were based on studies begun by Professor Imre Halasz: figs. 11-14, 17, 19, 22 and 23. In addition, figs. 15, 18 and 25 were constructed by Amy Lin.

All the geometric diagrams and figs. 21, 28 and 30 in Section 5 were drawn by Amy Lin. Other analytic diagrams of Aalto buildings and design studies, in Section 4 and 5 respectively, were done by: Julie Chang, Susan Dunbar, Daniel Johnson, Amy Lin and Chin Lin.

The format of this thesis was done in collaboration with Don Knerr and is based on the format used in Knowledge in Form by Don Knerr, MIT M. Arch. Thesis, 1989.

The production of this thesis was made possible by the help of Susan Dunbar, Denise Ferris, Don Knerr, Amy Lin, Chin Lin and Daniel Johnson.
Acknowledgement of Ideas

Many of the ideas explored in this thesis originate directly or indirectly from my teachers and friends. I am especially indebted to:

Professor Stanford Anderson and Maurice Smith for the material in Section 1; who in different ways first introduced me to the tradition of thinking about architecture as a form of knowledge.

Professor Thomas Chastain for the ideas in Sections 4.3 and 4.12.

Professor Imre Halasz for the work in Sections 4.2 and 4.5.

Professor Maurice Smith for the intellectual framework implicit in much of the discussion in Section 4, especially Sections 4.6, 4.7 and 4.9.

Don Knerr for ideas in Section 2.2.

The design exercises presented in Section 3 and 5 and in Appendix A received significant contributions from the critique of Professor Stanford Anderson, Professor Thomas Chastain, Professor Imre Halasz, Professor Maurice Smith, and Don Knerr.
Appendix A: Boston Project

Site plan, building steps back from main axial extensions of Boylston Street and Westland Avenue. Allows for spatial termination of axes.
Diagrammatic plan of upper gallery level.
Section C.

Section D.
Section E.

Section F.
Appendix B: Sources of Aalto's work

The enquiry into Aalto's buildings conducted through this thesis is set in the context of design and focuses on the physical evidence in the built artifact. Although they are plausible explanations for some of the design decisions in the building they are not complete. There are many influences on design decisions which are not physical, but socioeconomic and cultural (external to the discipline of architecture). A more complete understanding of the building requires an investigation outside of the artifact itself. There are obviously many influences on Aalto's work, but the three most important sources must be mentioned here.

First, Aalto was deeply embedded in the regional, cultural, and national heritage of Finland. His buildings have strong references to the Finnish folk tradition and their way of living. Second, his method of working was derivative of his classical training in architecture which was in time filtered through his personal experiences as well as through the Neoclassical, National Romantic and Jugendstil architecture movements popular in Finland as well as the other Scandinavian countries during his formative years. Third, Aalto's development and maturation is deeply connected to modernism both formally and ideologically.

Although it is beyond the scope of this thesis to discuss the implications of these socioeconomic and cultural sources of Aalto's work, the purpose of pointing out these historical and contemporary influences on his work is to make clear that Aalto cannot be
understood in isolation of his context. His work is but a small part of a larger continuum of cultural production of his times. From the point of view of a designer, Aalto and his context need to be connected not as history, but as a way of understanding the common basis of his values, and how these values informed his architecture.

The fact that Aalto's work is part of a larger continuum can also shed light on his practice. Although Aalto's practice involved invention, it was a kind of invention that was primarily to do with reformulating and transforming existing physical relationships or arrangements. In other words, he invented new ways of conceiving the same architectural problems which were much more connected to contemporary life and practice. Therefore his work has a kind of integrity and authenticity which is not derived from invention alone, but is rooted in the social, cultural, historical, and national milieu of the time. This is the root of the affinity between Aalto and his contemporary Scandinavian architects such as Asplund and Lewerentz, which ultimately have formal resemblances as well.
Appendix C: Different Spheres of Aalto's Practice (cf. 5.4)

The study of Aalto's practice requires a close investigation of his process of design. This includes his drawings, paintings, sculpture, as well as architecture. His working process contains valuable knowledge, but this knowledge is not identical to the knowledge embedded in the physical artifact.

It is important to distinguish the different spheres of Aalto's practice. First, there is the process of conceiving the design which is recorded by his sketches and painting. This part of the process is most important in understanding Aalto's method of defining the problem setting. Such as his decision concerning the extent of the site and problem and the way he establishes the priorities of the design. Second, there is the course of making decisions after the setting and boundaries of the design problem have been established. This process encompasses the designing and the drawing of construction documents as well as the necessary field work required to erect the actual building. Finally, there is the process of communicating, discussing and teaching of the two above processes.

There is some distance between the process of conceiving a building and the process of making it. The latter process is concerned with the most logical, efficient and economical way of making the building which is often very different from the way it was originally conceived which might have been quite intuitive, circuitous, or even illogical. Furthermore,
This creative process is not the most important for didactic purposes. It is not teachable because it resists analysis by nature.

This thesis concentrates on studying knowledge of the second category, that is knowledge embedded in Aalto's buildings and designs.
Appendix D: Some of the Other Operating Agenda in the Design

1. *Program and Organization*
   - How does the physical organization of the design relate to the institutional requirements of the building? These requirements go beyond functional ones.
   - What is the kind of life envisioned for the building.

2. *Site*
   - Urban continuity--There must be a continuous public walkway along the water's edge.
   - Flow of movement and accessibility.

3. *Access*
   - Access territory is used as exhibition area. Collective spaces act as continuities and discontinuities within the access.

4. *Containments and closure*
   - Containments should be partial in general to allow maximal public continuity.
   - Incomplete spatial definitions can allow greater options in adapting the space for different exhibitions.

5. *Structure*
   - Structure cannot be completely controlled by the form of the spaces as in Aalto's case. The structure must help in the overall spatial definition. The structural elements like columns
and beams cannot be hidden as part of the wall or ceiling surfaces, but can occupy the space and demonstrate its tectonic qualities.

- Structure cannot be uniformly treated. They can occur in variable configurations and take on multiple identities.
- There should be different concentration of structure in different zones of the building. The structure should be more densely articulated in the collective zone and in the zone of exchange between the inside and outside.
Appendix E: Program of Museum of Modern Art
(taken from "Silhouettes of Helsinki," AIAS Spring 1990 International Student Design Competition)

Public areas:

Lobby and lounge areas:
- museum bookstore: 3,800 total sq. ft.
- café for 150 people, kitchen and work spaces: 900 sq. ft. (84 sq. m.)
- public restrooms: 1,500 sq. ft. (139 sq. m.)
- lobby staff room: 1,100 sq. ft. (102 sq. m.)

Exhibition spaces:
- galleries for the permanent collection of paintings, sculpture, graphics, and photographs: 39,000 total sq. ft.
- galleries for temporary exhibition: (with the possibility of dividing the space to smaller units so that several exhibitions can be displayed simultaneously): 23,000 sq. ft. (2138 sq. m.)
- outdoor sculpture garden and performance areas 16,000 sq. ft. (1487 sq. m.)

Special Use:
Three auditoriums: 7,200 total sq. ft. (670 sq. m.)
- projector rooms, AV control booths, rooms for interpreters and the press
Library:
- 15,000 volumes, reading space for 30 people
- staff rooms, research chambers, microfiche, copying

Four Meeting Rooms: 1,200 total sq. ft. (112 sq. m.)

Work and Storage Spaces: 33,800 sq. ft.
(3141 sq. m.)

<table>
<thead>
<tr>
<th>Description</th>
<th>Area</th>
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<tbody>
<tr>
<td>Workshops for exhibition construction equipment:</td>
<td>5,700 sq.ft (530 sq. m.)</td>
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<tr>
<td>Conservation laboratory:</td>
<td>500 sq. ft (46 sq. m.)</td>
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<tr>
<td>Storage for exhibition equipment:</td>
<td>6,500 sq. ft (604 sq. m.)</td>
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<tr>
<td>Loading and unloading exhibition equipment:</td>
<td>9,200 sq. ft (855 sq. m.)</td>
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<tr>
<td>Temporary storage of items:</td>
<td>5,700 sq. ft (530 sq. m.)</td>
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<tr>
<td>Rooms for the photographing and xeroxing of items and exhibition material:</td>
<td>800 sq. ft (74 sq. m.)</td>
</tr>
<tr>
<td>Archives for original drawings, photos, negatives, etc.:</td>
<td>5,200 sq. ft (483 sq. m.)</td>
</tr>
<tr>
<td>Vault for valuables:</td>
<td>200 sq. ft (19 sq. m.)</td>
</tr>
</tbody>
</table>

Administration, Research and Technical Spaces: 5,700 sq. ft. (530 sq. m.)

<table>
<thead>
<tr>
<th>Description</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative offices and associated facilities for 15 people:</td>
<td>2,300 sq.ft (214 sq. m.)</td>
</tr>
<tr>
<td>Research offices for visiting scholars:</td>
<td>400 sq.ft (37 sq. m.)</td>
</tr>
<tr>
<td>Mechanical, cleaning and other facilities:</td>
<td>2,800 sq. ft (260 sq. m.)</td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY


*Silhouettes of Helsinki*, the GE Superabrasives/AIAS, Spring 1990 International Student Design Competition.