6. The Task of Architecture

The theory of architectural autopoiesis identifies architecture's societal function as the innovative framing of social interaction. Interaction is defined as communication between participants who are physically present, as distinct from remote communication via writing, telephone, Internet etc. All communications, and thus all interactions, are embedded within social systems understood as systems of communications. All social interactions take place in designed spaces filled with designed artefacts. Architectural artefacts – as well as other designed artefacts such as furniture, appliances and clothing – thus participate in the reproduction of social systems of communications. Architectural artefacts frame virtually all social communication systems, with the exception of those systems that exclusively reproduce outside the interaction between physically present participants. The designed environment matters: it frames all interactions. Only on the basis of the designed environment as complex system of frames can society be reproduced on the level of complexity it has attained.

All architectural communications, as well as all communications of all the design disciplines, are communications in the medium of space. Architecture frames social interaction. This very general formula characterizes architecture’s societal role, responsibility and raison d'être. At this level of abstraction the formula can say nothing about how architecture might be able to discharge its responsibility, ie, how it might be able to order and frame the manifold social interactions that reproduce society.

---

1 See Volume 1, part 5 The Societal Function of Architecture, in particular, Chapter 5.1.3 Framing as Societal Function of Architecture.
2 To understand the power of architecture's societal function – namely to frame, order and orient social interaction – one might consider the following thought experiment. Imagine that the complex built environment of a city like London is replaced by a flat, undifferentiated surface. Now try to imagine how the 10 million inhabitants of the city stranded on this surface might try to recreate and order social interaction on the level of complexity that is currently sustained by the built environment.
3 All architectural communications are spatial communications. This also applies to drawings and models, including digital models. The drawing/model is architecture's specialized medium developed with the advent of architecture as self-referentially enclosed function system. See Volume 1, part 4 The Medium of Architecture.
Architecture’s raison d’être – its general societal function or responsibility – must be translated into more concrete terms that allow for the formulation of tangible tasks for architecture. The autopoiesis of architecture itself has always – since its very inception – provided for this translation, namely in the terms of its lead-distinction: form (= frame) vs function (= interaction). Architecture’s general societal role is thus continuously reassured, elaborated and made concrete via the continuous application of its lead-distinction on successive scales and levels of abstraction/concretization. The ‘functions’ architects address refer to clusters of social interactions understood as social systems. For instance the function-type ‘residence’ frames families or households, the function-type ‘school’ frames the respective social system. Many such functions can be distinguished, named and listed, at different levels of abstraction/concretization, and then confronted with various spatial forms that might also be distinguished, named and listed.

The historical coevolution of the built environment’s pre-architectural repertoire and society’s pre-Modern manifold of interactions led to the sedimentation of a catalogue of social institutions that correlates with a catalogue of spatio-formal types, ie, the traditional catalogue of building-type solutions. But these traditional ‘solutions’ are not yet conceptualized as solutions to problems. Rather they are naturalized as unquestioned essences. The traditional concepts like villa, church, palace, town hall, town house etc represent the as yet undifferentiated unity of sedimented form-function complexes. The emergence of architecture as autopoietic system – armed with its lead-distinction – implied the possibility to break down these fixed, taken-for-granted form-function unities. The old canon becomes available for dissection and recombination, in both the formal and the functional dimension. Now function and form can be distinguished as aspects of an artefact. The unification of these aspects becomes problematic. The distinction of form vs function poses the question of their effective correlation. The presumed essences are dissolved. Traditional forms can now be criticized with respect to their ability to satisfy functional demands. Functions are now posed as problems. Forms are probed, selected and elaborated as solutions to problems. The distinction of form vs function marks the inauguration of architecture as rational-reflective discipline. It is the precondition of innovation.

Only the distinction of form vs function allows the framing of social interaction – a necessary dimension of all social evolution – to become a subject of critique and innovation. 4

4 Innovation is the raison d’être of the discipline’s reflective rationality.
The task of architecture can thus be cast in terms of architecture’s lead-distinction: to give form to function. This general task formula confronts an increasingly rich world of social institutions with an expanding panoply of forms. Within this abstract conceptual horizon the designer can tackle every concrete design task as the concrete confrontation of a given functional problem with a specific set of forms. As will be elaborated below, this uniform task formulation can be further unfolded by a second, crucial distinction: the distinction between organization and articulation. This distinction is as general and universally applicable as the distinction of form and function. The distinction is equally defining for architecture, and indeed equally venerable in terms of its pedigree in the history of architectural theory. Architectural forms function via organization and articulation. Articulation can be further analyzed into phenomenological articulation and semiological articulation.

Organization and articulation are the constituent dimensions of architecture’s task. However, before elaborating these dimensions, it seems useful to further clarify the general architectural concept of function and to reflect upon how the understanding of functions in architecture might be further developed and upgraded in the light of the current/emergent challenges the autopoiesis of architecture must cope with.

6.1 Functions

THESIS 25
While functional typology remains indispensable as initial orienting framework, functional reasoning in architecture has to upgrade towards a conceptualization of function in terms of action-artefact networks.

The distinction of form and function is architecture’s lead-distinction and as such a permanent communication structure of architecture’s autopoiesis. The concern with function is an inescapable feature of all architectural communications. It concerns all architectural artefacts, from the overall building, to each space, each architectural element, and tectonic detail.

The concept of function is a primary concept within architecture right from its ancient inception and then again from its rebirth in the Renaissance. The classical Vitruvian trinity of firmitas, utilitas and

---

5 See Chapter 6.2.1 Organization and Articulation: Historical and Systematic.
venustas attests to this. The term ‘function’ entered the autopoiesis of architecture only in the 19th century, perhaps most prominently in the writings of Viollet-le-Duc. The term seems to have been borrowed from the biology of Georges Cuvier. Cuvier insisted that the understanding of the structure of organisms had to be grounded in relating structures to their functions. He emphasized the principle of functional organization that allocates specific functions to the various parts of the organism in correlation to all its other parts and its overall conditions of existence. The influence of Cuvier’s idea of functional analysis and his principle of the correlation of parts is evident in Viollet-le-Duc’s writings. ‘In every specimen of mason-work each piece taken separately in the case of dressed stone, or each section in concrete works, should clearly indicate its function. We ought to be able to analyze a building, as we take a puzzle to pieces, so that the place and function of each of the parts cannot be mistaken.’

In the case of Viollet-le-Duc’s notion quoted above, the concept of function refers to the contributions that the different parts of a structure make to the overall performance of a structure. Here these contributions are primarily technical. The different parts have no independent social function. The case is different if we consider the different rooms of a villa. Here each room has an individual social function and as such contributes to the overall functioning of the villa as ordering frame for the family’s life. This second way of applying the concept of function can also be found in Viollet-le-Duc: ‘There is in every building, I may say, one

---

6 Alberti’s corresponding terms are commoda, firmitatem and gratiam.
7 Cuvier argued that an animal should be understood as a functional unit, whose structure is determined by its relationship to its specific environment. Each animal part or organ has its specific function: for example, the lung’s function is respiration etc. All of the organism’s organs relate functionally to one another and operate together. Cuvier believed that no part could alter its form or function without adversely affecting the entire organism. Cuvier emphasized this principle of biological integration – the correlation of parts – as one of the most fundamental laws of comparative anatomy. Cuvier explained his principle with the following example: if an animal’s teeth are such as they must be, in order for it to nourish itself with flesh, we can be sure without further examination that the whole system of its digestive organs is appropriate for that kind of food, and that its whole skeleton and locomotive organs, and even its sense organs, are arranged in such a way as to make it skilful at pursuing and catching its prey. For these relations are the necessary conditions of existence of the animal; if things were not so, it would not be able to subsist. The principle of the correlation of parts – underpinned by the idea of conditions of existence – led Cuvier to the claim that one can infer the structure of the whole animal from any one of its parts. See: Georges Cuvier, The Animal Kingdom – Arranged in Conformity with its Organization, G & C & H Carvill (New York), 1832.
principal organ – one dominant part – and certain secondary orders or members, and the necessary appliances for supplying all these parts, by a system of circulation. Each of these organs has its own function; but it ought to be connected with the whole body in proportion to its requirements. Although the term function was imported into architectural discourse only in the 19th century, and was given a new impetus by the advancing science of biology of the time, both the concept and its underpinning analogy with the animal organism were already fully operative in Alberti’s foundational treatise. Alberti writes: ‘Just as with animals, members relate to members, so too in buildings part ought to relate to part. . . . Each member should therefore be in the correct zone and position; it should be no larger than utility requires, no smaller than dignity demands.’ Alberti parallels functional integration with aesthetic harmony: ‘The parts ought to be so composed that their overall harmony contributes to the honour and grace of the whole work.’ However, the primacy of the functional determination and correlation of the parts is clearly stated: ‘Each part should be appropriate and suit its purpose. For every aspect of building, if you think of it rightly, is born of necessity, nourished by convenience, dignified by use, and only in the end is pleasure provided for.’ Alberti’s implied notion of function (utility, purpose, convenience, necessity) is of equal generality as Viollet-le-Duc’s notion.

More detailed and comprehensive accounts of the emergence and development of the concept of function within architecture can be found in works by Adrian Forty, Christoph Feldtkeller and Philip Steadman, among others. Here the main point is to establish the universal presence of the concept of function since architecture’s inception as well as its generality that encompasses both the architectural artefact’s functioning with respect to social demands and the functioning of the artefact’s parts with respect to their contribution to the artefact’s overall function. Thus the concept of function refers to both the architectural artefact’s ends and its means. Since this generality might lead to confusion, a distinction is called for: the distinction between substantial and subsidiary functions. This distinction will be elaborated below. Before introducing this distinction and elaborating how the substantial functions of architecture are ordered by means of a system of fundamental function-types, another important distinction must be introduced: the

9 Ibid, p 90.
11 Ibid.
distinction between functions and capacities. This distinction will be introduced in the following chapter.

An important aspect of the concept of function as indicated by the historical references quoted above seems to be the idea of the functional integration of parts. The function of an architectural artefact is always defined relative to an encompassing functioning unit to which it is considered to contribute. Therefore, for any particular application of the notion of ‘function’ it is necessary to specify a system-reference, ie, the functioning whole with reference to which the functional element is supposed to contribute by fulfilling its allocated function. An architectural artefact is built up as a cascade of functions serving functions. This cascade is usually ordered hierarchically: encompassing functions are fulfilled via a series of subsidiary functions. One can also find webs of functions that cannot be neatly decomposed into distinct levels. However, the cascade or web of functions always culminates in categorical social functions that are given to architecture as its external reference, its world-reference.

That functions constitute architecture’s world-reference, and that functions are always embedded within cascades and networks of functions, does not tell us what kind of entities the functions of architecture and design are. The fundamental starting point of the theory of architectural autopoiesis is that everything within its domain is communication. This is a consequence of the theory’s self-embedding within Luhmann’s social systems theory. Everything social is communication. Therefore everything architectural is communication.

The theory operates within an ontologically homogeneous domain: everything is communication.

Architecture’s lead-distinction is the distinction of form vs function. According to the theory of architectural autopoiesis, both forms and functions are communications. Forms are framing communications, functions are framed communications. This is the fundamental, necessary axiom of all further theorizing about form and function within the theory of architectural autopoiesis. The built forms of architecture are the final communications of architecture that are released into society to serve as framing communications within the respectively accommodated social systems. The functions of architecture are those communications, communicative interactions and communicative event scenarios that are framed by architecture’s forms. All design is ultimately communication design.

We might demonstrate the pertinence of this axiom by considering some examples. What is, for instance, the function of a bread knife? To cut bread. Or to be more precise: the function of a designed bread knife
is the action or action type of cutting bread. What is the function of a phone? The action (or action type) of having a phone conversation. The function of a designed car is the action type of driving a car, including (perhaps most importantly) when the user of the car is picking up his girlfriend. The function of a dinner table is the action type of sharing a dinner. The function of a lecture theatre is the social event type that we call lecture. What is important to note here is that all these functions are in fact communications. To cut bread at the dinner table is a communication. All actions, as distinct from mere bodily movements, are communications. By cutting the bread at the table the user of the knife might communicate that he wants to guide the event, as a good host, that he wants to express concern, hospitality etc. The knife itself frames this communication. It is itself a framing communication. The design features of the knife participate and give connotation and nuance to the communicative action of cutting the bread. Its weight and size modulate the gesture. Its appearance – modern versus traditional – gives identity to the user etc. It is these communicative aspects of the action that are the concern of the contemporary product designer. The technical feasibility of the knife’s cutting operation is the concern of the product engineer. (The functions engineers are concerned with are physical processes.) In a similar fashion a lecture theatre can be analyzed as a framing communication whose function is the communicative interaction scenario that is the lecture or lecture event. The lecture is a communication that is framed and modulated by the specific design of the lecture theatre. It matters whether the theatre is long or broad, flat or steep, open or closed, with a lot of space between the seats or tightly packed etc. These differences are framing communications that regulate the participants’ expectations and put them in a particular mood and provide a sense of anticipation.

All design is ultimately communication design. The design of social networking software, the design of tableware, the design of an evening dress, as well as the design of a living room, embedded within the design of the encompassing apartment, which is in turn embedded within the design of an apartment building. The functions of architecture and design are communications, communicative interactions, communicative event scenarios and communication systems, all operating within cascades of subordination/superordination, as well as in more loosely structured networks.

6.1.1 FUNCTIONS VERSUS CAPACITIES
The distinction of functions versus capacities is a relatively recent acquisition within the autopoiesis of architecture. This conceptual
augmentation of architectural discourse responds to the increasing fluidity of architecture’s task environment.

Rapidly shifting and differentiating life/communication processes with rather fluid requirements imply that thinking in stereotypical functions is no longer always appropriate. At the same time new design techniques deliver new formal repertoires with as yet unclear utilization potentials.

While a function of a building, space or architectural element is an actual, regular utilization effect of the respective building, space or element, a capacity of a building, space or architectural element is an occasional or only potential utilization effect. (The concept of utilization effect is coextensive with the concept of social communication (action, interaction). All utilization effects of architectural artefacts are social communications.) Functions might be manifest or latent. A function is manifest if it is explicitly acknowledged as the purpose of the building, space or element. Most buildings, spaces or elements have one single manifest function that is referred to in the space/element’s name. For instance, the manifest function of an office building is to be utilized for office work, the manifest function of a lecture theatre is to accommodate lectures, the manifest function of a bedroom is its regular night-time utilization as sleeping place, and the manifest function of an entrance door is to be utilized as point of entry etc. (All these activities can be understood as communicative action: working, sleeping, lecturing, listening to a lecture, entering a building.) In addition to its manifest function, a building, space or architectural element might routinely be utilized in ways that are not explicitly acknowledged. However, these unacknowledged utilizations might still occur regularly, offering advantages that continue to motivate the reproduction of the respective forms of the buildings, spaces or elements in question. For instance, generous entrance steps into a public building might have the implicit or latent function of serving as informal lingering space that gives the respective institution a sense of welcoming animation. Reception desks in lobbies have the latent function of controlling access. Their typical placement within lobbies indicates that this latent function is an aspect of their reproduction. (This distinction of manifest versus latent functions has been borrowed from sociology.)

The routine utilization of a certain form of building, space or architectural element is decisive for defining its functions, both manifest and latent. Further, the ascription of a function requires that this routine utilization feeds back to and motivates the regular reproduction of the respective institution a sense of welcoming animation. Reception desks in lobbies have the latent function of controlling access. Their typical placement within lobbies indicates that this latent function is an aspect of their reproduction. (This distinction of manifest versus latent functions has been borrowed from sociology.)

13 Controlling glances are deterrent communications. Even the mere occupation of a strategic entry position is a communication.
Specific form of building, space or element. Capacities are effects where this aspect of a routine utilization that motivates regular reproduction is absent. Functions are declared or hidden purposes. Capacities are potentials rather than purposes. They are affordances that have neither been asked for by the client, nor are they expected by user groups. Capacities might occasionally be utilized, however, without becoming a factor in the reproduction of the forms that have these capacities. With respect to capacities one might distinguish actual from virtual capacities. Actual capacities are current affordances that are occasionally utilized within the life/communication processes of the accommodated social system. For instance, all the rooms of a residential apartment have the capacity to become students’ studios if the apartment is taken up by a student commune. Virtual capacities are as yet undiscovered, potential affordances that might be actualized only within a transformed life-process. Virtual capacities are involved when architectural design research has its most speculative moments. Virtual capacities are to be transformed into actual capacities. To the extent that these actual capacities become recognized, regularly utilized and then expected, they become functions. If they acquire a name that is used to designate buildings, spaces or elements they become manifest functions.

The distinction of functions versus capacities might be illuminated by reference to a similar distinction that is being made in relation to biology. Biological functions can be defined as selected effects. An effect of a certain organic structure or trait of an organism can only be described as a function of the respective organic structure or trait if this effect presents an advantage for the organism and has contributed to the differential survival of the organism’s ancestors utilizing the effect. The respective structures/traits have been selected in the sense that the population with the structure/trait exhibits a higher rate of reproduction than a comparable population without the structure/trait. The concept also requires that these selected effects are still contributing to the ongoing survival and reproduction success of the population in question. Functions are relative to a given life-process within a given environment. The underlying capacity might lose its function – becoming a mere rudiment – if the life-process changes within a transformed environment. At the same time, capacities that were dormant might become active and relevant for survival/reproduction within the new life-process. At any time,

Concerning the selected effects theory of function see: Karen Neander, ‘Functions as Selected Effects: The Conceptual Analyst’s Defense’, in: Philosophy of Science, Vol 58, No 2 (June 1991), pp 168–84. The paper defends an etiological theory of biological functions according to which the proper function of a trait is the effect for which it was selected by natural selection.
any organism has an inexhaustible excess of virtual capacities. These capacities include the sum total of all traits that emerged as yet unutilized side effects of structures that evolved under certain selection pressures: differences that make no difference yet. The limit for the identification of capacities is located in the observer – biologist, architect, user-group – and his/her/its resources of discrimination. Any feature that can be described at all becomes a virtual capacity if a potentially relevant effect can be imagined that would put the feature to work within an (imagined) future environment or life-process. With a change in selective pressure – induced either by an environmental change or by a change of survival strategy on the part of the organism – these capacities might become relevant contributors to the further survival and proliferation of the organism in question. Side effects become selected effects, capacities transform into functions. This process whereby hitherto redundant features become vital functions is called **exaptation** in contrast to **adaptation** where a given functional feature is gradually optimized relative to a stable selection criterion. Exaptation includes both the first utilization of fallow features and the re-functionalization or ‘détournement’ of functional features, ie, their enlistment for new functions. In retrospect both the redundant features and the functional traits reveal their capacities by becoming evident as so-called **pre-adaptive advances**. Both biological and cultural evolution proceed as much via exaptation as via adaptation. Exaptations are usually followed by further adaptations.

As indicated above, exaptation does not only involve the utilization of hitherto unutilized features but also (and perhaps predominantly so) the re-utilization of features or structures in new capacities that eventually stabilize into functions. The human hand evolved from extremities that were originally (like the feet) organs of locomotion. The evolution of the human speech organs (tongue, voice) involved the détournement of structures that originally evolved as organs with the functions of eating, breathing, and perhaps signalling via screaming. The significant fact with respect to highly evolved, complex organisms is that their body’s organization and its structures are much more fixed and stable than their life-processes. The utilization (functionalization) of these structures and their capacities is much more malleable than these structures themselves. When a new pattern of utilization has been established, optimizing adaptation is set onto a new course and slowly reshapes and refines the structures in question according to the exigencies of the new

life-process and its selection pressures. In the domain of architecture it can also be observed that evolution largely proceeds via the re-utilization of already evolved spatial types for new purposes rather than starting from scratch with each new requirement. In the world of architectural and artefactual evolution, a similar dialectic between exaptation and adaptation can be observed. Revolutionary, creative advances happen when new capacities are discovered and transformed into reproducible functions. Further cumulative advances are possible by means of adaptive refinement in view of the new function and its criteria. A new capacity for both the engine and the carriage was discovered in their combination within the first motor car. Since then a cumulative advancement of this new ‘life form’ has been witnessed, and it is still ongoing on the basis of a fundamental body plan that is now over 100 years old.

Contemporary avant-garde architecture has discovered the category of capacities, and the attendant concept of an always excessive virtuality, as a vehicle for evolutionary acceleration. The proliferation of as yet uninterpreted forms is not only tolerated but promoted as the production of as yet uncharted capacities. The conversion of abstract forms into speculative proto-capacities is proceeding in design processes that employ a form-to-programme heuristics. Sometimes this creative work of functional interpretation is left to audiences that encounter and inhabit experimental projects after their construction. In any case, the architect has no control over which of his/her discovered and promoted capacities are finally selected, recognized and reproduced as designated functions. Architects control form (internal reference), they do not control function (external reference).

If architectural functions are selected effects then the question does indeed arise of how this selection process takes place. The ascription of functions is safe, trivial and even inevitable only in the case of stable, stereotypical social institutions. The standard set of rooms in a modern, residential apartment is an example here: living room, dining room, kitchen, bathrooms and bedrooms have designated functions that the designer can rely on and work with in his design thinking. Strictly speaking even these stereotypical functions are up for détournement. All rooms in an apartment that is taken up by a commune of students are re-utilized as studios, including the living room and the dining room. The détournement sometimes goes even further: the first

---

16 See, for example: John Rajchman (guest editor), ‘The Virtual House’, *Ayn* magazine, September 1997.
17 The lead-distinction of form vs function effects the re-entry of the distinction between system and environment into the system. Form is architecture’s internal reference (self-reference). Function is architecture’s external reference (world-reference). See: Volume 1, chapter 3.4.2
18 Form vs Function as the Lead-distinction within the Design Disciplines.
arbiter of the advancement of social functionality, of the transformation of
capacities into functions, is indeed the appropriation of the designed
territories by the accommodated life-processes of the users. The more
fluid and uncertain those life-processes become, the more must the
discourse of architecture shift its attention from the anticipation of
ascribed/designated functions to speculation about capacities. The
plausibility of such speculations can be enhanced via an upgraded
medium of architecture that is able to build up and visualize various
social scenarios that tease out the virtual capacities of a designed spatial
configuration and morphology.

Although the notion of a territory's capacities is certain to gain more
prominence within architectural discourse, the concept of function
cannot be replaced or eliminated by the promotion of the concept of
capacity. The latter concept requires the former in its definition: a
capacity is defined as a potential function. It is a proto-function in the
sense that it has yet to acquire a determinate and desired effect by being
selected according to the purposes and pursuits of the social
communication processes framed by the territory in question. What must
be refuted decisively here is the idea that all stable functions, and by
implication all stable social institutions and expectations, are about to
dissolve into a maelstrom of ever-changing forms of spontaneous
communicative interaction. There can be no complex, productive social
process that is just built upon fluid spontaneity. Complex social processes
are ordered social processes. The very societal raison d'être of
architecture is to stabilize and order patterns of social communication.
That's the meaning of framing.19 Without the stabilizing force of
architecture no social complexity can be built up. Neither can social
complexity be maintained without architectural stabilization on the high
level of artificiality and thus improbability that has been achieved within
contemporary society. What we must focus on is the innovation of frames
and their functions, not their dissolution. Capacities must ossify into
functions, within ever accelerating cycles of innovation. There can be no
social life without expectations, without institutions, without (manifest
and latent) functions. The functional designation of territories might
become loose, multiple and transient, but it will not disappear. Functions
will mutate from fixed stereotypes into more variable event scenarios. The
functional distinctions will evolve from rigid dichotomies into richer

London studio the author occupied as independent apartment was originally designed as a
kitchen.

19 Framing has been identified as architecture's societal function. See Volume 1, chapter 5.1.3
Framing as Societal Function of Architecture.
manifolds that might be susceptible to architectural ordering via gradients, allowing for smooth transitions and interpenetrations. All this is welcome and necessary, a higher, more complex and variegated order, requiring a more sophisticated repertoire of architectural framing. As will be explored below, the challenge of framing more complex patterns of social communication requires the upgrading of architecture’s framing power along three dimensions that collaborate in the establishment of architectural order: the organizational, phenomenological and semiological dimensions of architectural order. The speculation about new capacities of new architectural forms will play an important part in architecture’s attempt to address the evolving challenges of contemporary life. Their condensation into new function-types must remain the aim of such speculations.

6.1.2 SUBSTANTIAL VERSUS SUBSIDIARY FUNCTIONS

To elaborate a general concept of function, it is crucial to distinguish direct vs indirect contributions to social purposes (social interactions). The functioning of an architectural artefact that contributes to a social use or purpose only indirectly, via its encompassing unit, needs to be distinguished from such architectural artefacts that by themselves directly address a social use or concern. Architectural theory needs to conceptualize the difference between, for example, the function of the posts that make up the balustrade and the social function of the balustrade itself, for example, its latent provision of a comfortable place to lean against, linger and look about. To express this difference, the theory of architectural autopoiesis distinguishes subsidiary functions from substantial functions. The substantial functions of architecture are always self-sufficient communicative actions, interactions, situations, events, scenarios or systems. At this point it is important to identify the architectural units that are capable of carrying substantial functions. The question arises whether architectural elements or components below the level of a room or territory are capable of sustaining a social function. The answer is no. All design disciplines produce artefacts that frame social interaction. Within the domain of architecture – as distinct from product and fashion design – the artefacts that frame social communication are territories that establish a difference between inside and outside. Thus only territories have substantial functions. Therefore, the example of the balustrade is pertinent only to the extent to which the balustrade has

20 Social uses are always communicative actions or interactions: working, conferencing, learning, shopping, dining, hanging out etc.
21 See Volume 1, Chapter 2.5.5 The Specificity of Architecture within the Design Disciplines.
been designed to define a place, and does indeed define a self-sufficient territorial unit that can routinely frame social interactions. This might usually not be the case with balustrades, except perhaps if the balustrade describes a semi-circle to produce a niche and is perhaps further augmented with a wide handrail to lean upon etc. Such a niche or balcony overlooking a lobby is indeed a territorial unit that can sustain a substantial function, i.e., the activity of overlooking the events unfolding in the lobby space. The niche communicates an invitation to reside there in this way. If the niche is occupied, people passing by will understand and respect this. (In this sense the niche communicates a single occupancy rule.) The niche might also invite two or three friends to gather there for a chat. The niche thus has two substantial functions sustaining two distinct types of social interaction: solitary lingering and chatting. Both are latent rather than manifest functions. (A flat, nondescript balustrade might have the capacity to host such events. Since, in this case, such events are not expected or considered in the brief and design of the balustrade they are mere capacities and not functions.) Strictly speaking the balustrade itself does not have its own substantial function. It is subordinate to the niche as frame. It contributes to the framing effect of the niche by means of various subsidiary functions: the function of supporting the weight of the communicating bodies, the space-delimiting function and the provision of an inviting aesthetic or atmospheric identity. Thus we can distinguish three types of subsidiary function: technical, organizational (space-delimiting) and articulatory functions. Each subsidiary effect or function contributes, in its own way, to the creation of the niche and its framing action. The strictly technical aspects, as external constraints, can be taken up by the engineering disciplines. However, even if the responsibility for the technical feasibility of these aspects is renounced, the architect must be able to discuss and integrate the technical requirements.

The distinction introduced here allows explicit differentiation between the merely subsidiary functioning of a staircase as device to reconnect a space that has been severed into levels, and a situation where the staircase is expected to address its own substantial function as a communicative space that has its own social significance. In the first instance the staircase has only a subsidiary function. In the latter instance the staircase has a substantial function. We might also envision a situation where a staircase serves both a subsidiary function, for example, reconnecting a severed programmatic unit, as well as a (latent) substantial function, for example, giving space and occasion to desired communicative encounters. The example of the staircase thus implies that an architectural artefact might, at the same time, but with respect to
different social purposes (situations, audiences), fulfil both subsidiary and substantial functions.

Subsidiary functions always serve substantial functions, either immediately or via a cascade of intermediate subsidiary functions. Substantial functions always address social purposes directly. However, since human purposes are themselves ordered into cascades, hierarchies and networks, so must be the substantial functions that are the external reference and raison d’être of any architectural design. Relations of subordination (or superordination) do not only hold between substantial and subsidiary functions, they also hold among substantial functions as well as among subsidiary functions. The substantial function of the staircase as catalyst and hub for informal communication might be feeding into the encompassing (superordinate) substantial function of a communicative entrance lobby which in turn contributes to the overall function of the corporate headquarters building within which it is located: the overall spatial framing of the social system that is the corporate business organization. The various territorial units within the corporate building have their own (manifest and latent) substantial functions. These functions are meant to collaborate to produce the superordinate, encompassing function of the building. The function of each individual territory is thus conceptually subordinated to the encompassing function. The functions of the parts are meant to be coordinated to add up to an integrated, global function: the designated function of the building as (productive) corporate headquarters for a given business organization. The dimensions of organization and articulation come into play here as follows. The overall constitution and thus ordering/framing communication of the building depends upon the organization (distribution, clustering, nesting) of the elemental territorial units. Also, the internal organization of the territorial units is relevant here. The same integrated concern for both global and local aspects applies to the dimension of articulation. The overall range of atmospheres, their spatial distribution and the contrasts between atmospheres of different units etc, are as important as the individual atmospheres and their connotations and affects. In both dimensions part-to-whole relations (system-subsystem relations) have to be reckoned with and must be orchestrated. Further, dependencies between the three dimensions – technical, organizational and articulatory – need to be considered.

6.1.3 TECTONICS
The relationship between the technical and the articulatory dimensions leads to the concept of tectonics. There are plenty of examples in the history of architecture where architectural elements and features with
technical, subsidiary functions become the object of articulatory
eendeavours. This is the domain of tectonics. For many architectural
theorists, tectonics is the very essence of architecture. However, for these
theorists the point of tectonics is the didactic, visual clarification of the
building’s material and technical constitution. The theory of architectural
autopoiesis rejects this understanding of tectonics as a distraction from
architecture’s societal raison d’être. In what follows, tectonics is given its
appropriate station within the discipline’s rationality.

How can a designer articulate the substantial function of an
architectural space or element? What becomes the material substrate of
his/her effort of articulation? As introduced above, subsidiary functions
might be classified into three categories: technical, organizational and
articulatory functions. This classification of functional dimensions is
important to order the designer’s search for functional equivalents. One
and the same architectural element – for example, a particular wall –
might operate in all three dimensions: it has many technical functions
(load-bearing, thermal insulation), organizational functions (separation of
domains), as well as articulatory functions (giving a characteristic
atmosphere). In each dimension the designer can search for different
possibilities for the wall’s functional substitution. These might or might
not coincide again in a single alternative artefact. The load-bearing
capacity of the wall might be taken up by columns, the separation of
domains might be handled by a light partition wall, and the atmospheric
characterization of the space might be achieved by the ceiling etc. The
design process might proceed in the following sequencing of concerns:
organization, technical materialization, articulation.

The materialized organization, materialized according to the concerns
of technical efficiency, produces a certain morphology with a certain
appearance. Before adding an additional material layer for the purposes
of articulation, it thus makes sense to investigate whether this technically
given phenomenological material is suited to serve the wall’s required
articulatory function.

A technically selected morphology thus assumes articulatory functions.
This initially unconscious, evolutionary, historical process becomes a
conscious design strategy under the banner of tectonics, albeit often with
the tendency to hypostatize the tectonic expression as an end in itself
rather than as a means to articulate the substantial (social) function of
the artefact/space in question. Structural expressionism as primary design
agenda is an example of this hypostatization of tectonic expression.
However, this kind of hypostatization of a valid design strategy does not
invalidate the design strategy as such. If we define tectonics as the
strategic détournement of an element’s technically induced morphology
in order to address substantial functions in the articulatory dimension, then tectonics can be redeemed and integrated within contemporary notions of handling form-function relations. We might call this strategy of opportunizing on technical details **tectonic articulation**. The engineering logic of adapting member sizes in proportion to stresses can be taken up within an architectural strategy of articulation. For instance, the skeleton of a tower might be expressed on the outside as exo-skeleton. It might be differentiated along the vertical axis describing a gradient transformation from massive to filigree. This structural logic might be correlated with an occupational logic and the structure’s articulation might in turn come to signify the occupational distribution.

Historically, the transformation of a technically motivated form into an articulating motif has tended to conventionalize and fix the form. The articulatory function comes to dominate. It often unfolds its own developmental dynamic. Eventually the technical realization of a motif might change, ie, a certain motif loses its original technical *raison d’être*. (At this point, contemporary sensibility would suggest the abandonment of the motif.) This happened to the details of the Classical orders as they moved from wood construction to stone construction. In this case the motif’s articulatory function remains in operation. It is not ’mere decoration’ without function. However, it no longer constitutes tectonic articulation in the sense defined here. It has become *ornamental* articulation.

The theory of architectural autopoiesis recognizes the rationality of tectonic articulation as opportunizing strategy serving articulation. It is no self-serving pursuit and must remain subordinated to the concern of articulating a substantial function. The advantage of tectonic articulation is that what is required anyway, for technical reasons, is utilized as convenient means of articulation. The drawback here is that the articulatory repertoire is thereby constrained, so that this strategy might not succeed if the task of articulation is very complex. For instance, the exposure of the primary structure can be very effective in giving an identifiable character and atmosphere to certain spaces. The internal ordering of large spaces might be facilitated by the lawful differentiation of the structural system: the different (longitudinal versus transversal) directions of the space are indicated by the direction of the primary beams. The centre of a large space is indicated by the greatest depth of the beams etc. These features might serve as orienting clues within a large, otherwise visually partitioned space like a large market space. However, if a rich network of different and differently related spaces needs to be articulated then the enlistment of the (technically homogeneous) structure might not be feasible because it is not versatile
enough. On the other hand, to force the structure into articulatory differences might become too forced and costwise prohibitive. Therefore tectonic articulation cannot be made an absolute priority. Articulation as such, by any means necessary, has precedence.

The articulatory integration of the morphological consequences of technical requirements is always more elegant and satisfying than the attempt to fight and deny them by hiding or obfuscating them. In order for architects to attempt this they need to guide and orchestrate the engineering investigations and then select the engineering options that most suit their primary task to fulfil the posed substantial functions. The adaptive differentiation of structures as well as the adaptive differentiation of volumes and envelopes according to the building’s environmental performance (with respect to its exposure to internal heat loads, as well as sun, wind, rain etc) afford many opportunities for differential tectonic articulation. Although there can be no doubt that architecture remains a discourse that is distinct from engineering, a close collaboration with these disciplines as well as the acquisition of reliable intuitions about their respective logics are increasingly important conditions for the design of contemporary high performance architecture.

6.1.4 THE CATEGORIZATION OF FUNCTION-TYPES
The basis for the overall order of substantial functions in architecture is the functional differentiation of society itself. The panoply of architecture’s substantial functions is the full range of social interaction types, filtered and worked through within the autopoiesis of architecture. This longstanding and ongoing filtration process has produced a relatively stable, categorical system of programmatic distinctions or function-types (programme types) that gives a primary order to the substantial functions of architecture. Function-types are architecture’s registration of types of social interaction.

There is no functionality in the abstract. There’s only functionality with respect to a specified programmatic type or function-type. Therefore, all functional reasoning in architecture starts within the framework of an assumed programme-typology as a given set of distinct social uses (programmatic types, or function-types). However, this does not imply that typological distinctions – like residential vs commercial – are absolute or immutable. Programme types might develop, transitional variants might be derived etc. But the dimension of programme typology cannot be suspended. It remains the starting point for architecture, the inescapable logic of its external reference. The functions that are handled

---

22 The concept of articulation will be elaborated in detail in section 6.5, Articulation.
within architecture are always conceptually subsumed under a certain overarching function-type. This is the structure of architecture’s world-reference. It reflects a key structural property of architecture’s societal environment and is not an arbitrary invention that can be undone by a radical innovation produced within architecture.23

A speculative sociology might go beyond any received institutional typology and speculate radically about possible social formations or societies and thus unravel any given programme types, in order to reconstitute a new way of differentiating the social system, proposing a new set of programmatic types. A certain degree of such sociological imagination, on the level of nuance rather than on the level of revolution, might be admissible and even called for as ingredient of avant-garde architectural work. Otherwise, however, architecture has to accept the given categorical differences between different types of programmes as starting point.

For modern society the distinction between industrial, administrative, residential and recreational functions has been categorical. Further, modernity crystallized a series of stable, specialized, institutional building types like schools, hospitals and museums etc. Even if the attempt is made to subvert those categories, for example, by introducing hybrid typologies like live-work, those categories remain the starting point of this (only partial) subversion. This categorical differentiation of social uses implies that there is, from the start, a multiplicity of substantial functions to be fulfilled rather than a single unified function such as ‘urban life’. A design effort taking on urban life would have to start by breaking this unity into components. This basic principle of functional differentiation is particularly intransigent within modern, functionally differentiated society.

The Middle Ages too knew different building types. The church was not a house. The town hall was distinguished from the houses surrounding it. In principle, however, the mass of the medieval city was segmented rather than differentiated, ie, segmented into multifunctional household units. The house of the burghers carried the whole life of the family and its extended household. It was dwelling, place of work and place of exchange. Within the house the rooms were not specifically differentiated. Segmentation and stratification were the primary modes of differentiation in traditional societies. Functional differentiation is the

23 The slogan of a supposed transition ‘from typology to topology’ that has been put forward in recent avant-garde discourse must be bracketed by this insight. The distinction of fundamental function-types cannot be eradicated from within architecture. It belongs to architecture’s external reference. However, the slogan makes sense in relation to solution-types or archetypes.
primary mode of differentiation in modern society. This is a fundamental external condition for the autopoiesis of architecture, and this condition is recognized by the fact that the identification of the function-type is the fundamental starting point and headline for any architectural project.\footnote{A project that avoids this identification is a proto-architectural study rather than an architectural project. Proto-architectures in this sense are viable vehicles of design research. The AADRL is currently pursuing a three-year design research agenda under the title \textit{Proto-design}.}

6.1.5 PROBLEM-TYPES (FUNCTION-TYPES) VS SOLUTION-TYPES (ARCHETYPES)
The programmatic typology that categorizes substantial functions has been a crucial factor at the root of most of what has been called ‘typology’ within architecture. However, as stable social functions created a stable environment for the development of stable substantial functions for architecture, equally stable spatio-structural solutions emerged to address and fulfil these substantial functions. Those spatio-structural solutions – for example, the hut, the courtyard building, the basilica, the hall, the mall etc – have their own inertia and their own capacity to fulfil new functions. They persist in the history of architecture across a certain diversity of substantial functions, and a concept could therefore be formed that abstracts from the aspect of a specific function. In fact the same respective spatio-structural solutions have been developed over and over again for different social functions at different historical times in different cultures. These abstract, general solutions became the basis of another concept of ‘typology’ in architecture. Bill Hillier talks about ‘solution typologies’, defined as ‘fields of strategic possibility defined by past practice’.\footnote{Bill Hillier, \textit{Space is the Machine – A Configurational Theory of Architecture}, Cambridge University Press (Cambridge), 1996, p 429.}

We might take this cue from Hillier and distinguish problem typologies from solution typologies. Problem types lead to function-types and solution-types lead to what we might call ‘archetypes’. Archetypes, or more general solution-types, belong to the discourse on form. Aldo Rossi explicitly emphasized this abstraction from specific function, referring to such types as \textit{archetypes}, and tried to argue for the virtues of such enduring forms and their potentially open-ended capacities.\footnote{This double meaning of the notion of typology that is here unfolded reflects the fundamental double-orientation of architecture: the orientation towards function (problems) and forms (solutions).}

Function-types – as problem types – remain relatively stable across styles, while the conceptualization of archetypes, conceptualized in the context of solution typologies, shifts as the discipline moves from one style to the next.
traditional city was seen as a reservoir of such archetypes with multivalent capacities with respect to (new) functions. Although there are insights to be captured here, it has to be said that such collections of ‘archetypes’ can never be expected to form a stable system of categories that could give long-term order to the discipline of architecture. Such archetypes stabilized primarily on the basis of longstanding technical limitations of the craft of construction in unison with the long-term stability of social institutions. The enumeration of historical archetypes – courtyard house, basilica etc – produces a rather haphazard collection of items that can hardly form the basis of a systematic theory. Instead solution typologies might be constructed on the basis of an abstract principle that delivers a systematically constituted, exhaustive solution space. One might formulate solution typologies based on abstract classificatory principles, for example, a typology of basic building shapes based upon the relative expansiveness of their respective spatial dimensions. On this basis we might thus distinguish six basic solution-types for buildings (or for components of larger building complexes):

- point-shape (pavilion)
- horizontal line-shape (bar)
- vertical line-shape (tower)
- horizontal plane-shape (shed)
- vertical plane-shape (slab)
- and cubic-shape (block)

With respect to the basic aspect of the building’s outward dimensional ratios, this is an exhaustive universe: pavilions, bars, towers, sheds, slabs and blocks. The six building forms represent all there is, in terms of the basic modules of our cities. There are typical combinations like vertical line-shapes on top of horizontal plane-shapes (tower over podium), or vertical plane-shapes over horizontal plane-shapes (slab over podium). Complexes, with volume shapes that do not immediately fit into this system, can nevertheless be analyzed: for instance, dumb-bell shopping malls can be analyzed as two parallel bars running between two sheds or two blocks.

These basic, generic types are in principle open with respect to their substantial function. This typology of basic building forms might then enter into a typology of urban morphologies, distinguishing ways of multiplying, arraying and combining these types of volume-shape into types of urban massing. We might also proceed inwards and distinguish different patterns of internal voiding and patterns of internal partitioning. On all three levels – on the level of the internal subdivision, on the level...
of the basic building shape and on the urban level – such solution typologies might be related to problem typologies.

At Zaha Hadid Architects we analyzed all our prior oeuvre with respect to this categorization. We did this in connection with a theoretical design project that was presented under the general headline of ‘Form Informing Urbanism’,28 conceived within the paradigm of ‘Parametric Urbanism’.29 In this project we took this basic building-shape typology – after enhancing each basic type with a scale-dependent void – as a starting point for a systematic field-differentiation whereby we subjected the six types to a multi-dimensional morphing process. The results are still analyzable in terms of the six categories, albeit on a more sophisticated level: each building is now indexed with respect to a series of percentiles that indicate the morphing mix of the building in question. This was a purely formal exercise (resulting in interesting formal field qualities as the morphing mix and scale were correlated with river-proximity and topography).

However, the purpose of setting up such a typology is not only to have a systematic, exhaustive register of building forms for the sake of setting up formal operations. Indeed, with respect to formal proliferation this catalogue is rather too reductive. The primary purpose of such a categorization is to have a starting point for thinking through systematic form-function relations. The ‘colloquial’ type-names like tower, slab, block, shed etc indicate that this basic form-categorization might systematically correlate with certain functional capacities that tend to attract preferred substantial function-types.

Alejandro Zaera-Polo is probing precisely this intuition with his ambitious ‘unitary theory of the building envelope’.30 His typology takes nearly the same approach of distinguishing according to volumetric proportions. He distinguishes four types and starts to characterize them in terms of their functional capacity and probable social (and ‘political’) import:

- **X = Y > Z** Flat-horizontal envelopes: loose fit
  This category comprises functions such as train stations, airports, trade fairs, markets, stadiums etc. According to Zaera-Polo: ‘Their ability to host crowds, enclose public space, and control flow in an artificially controlled environment, as well as their conflictual relationship with the

---

28 ‘Form Informing Urbanism – Parametric Urbanism’, is a display and animated film created by Zaha Hadid & Patrik Schumacher for the Global Cities exhibition at Tate Modern, June 2007.
local, qualifies flat-horizontal envelopes as highly politically charged. The material and geometrical configuration of the edge is crucial to the articulation of inside and outside: insets of the footprint or corrugation of the vertical surface and the use of permeable materials may contribute to enhancing osmosis between the contained programme and its surroundings. The problem of inserting a large shed into an urban fabric is...large scale obstacles to urban flows, sterilizing their surroundings... resulting in a struggle between... developers who want to swallow as much space as possible within their complexes, and urban planners who want to keep as much permeability as possible.'

- $X = Y = Z$ Spherical envelopes: relaxed fit
  ‘The specificity of this type is precisely the relative independence that the skin acquires in relation to its programmatic determinations as function is not usually determined by proximity to the outside... The spherical type often contains gradients of publicness within. Spherical envelopes often correspond to public buildings, buildings that gather a multiplicity of spaces rather than a repetitive type of space... Political expression and identity are particularly important... The spherical envelope features the lowest level of environmental constraints and the highest levels of representational demands.’

- $X = Z > Y$ Flat-vertical envelopes: tight fit
  ‘Flat-vertical envelopes are generated by the horizontal displacement of a section of space, which in order to support a specific function, optimizes density, daylight, ventilation, structural constraints and the building’s relationship with public space and infrastructure. Land uses and orientation are also important drivers for this type of envelope. We can probably include within this category most mid-rise residential and many office buildings as they respond to the need to host a large volume of homogeneous programme... Modern fabrics tend to be predominantly matrices of Flat-vertical envelopes.’

- $Z > X = Y$ Vertical envelope: slim fit
  ‘The collusion between extreme technical performance and high visual impact produces a maximum tension between efficiency and expression... As the envelope increases in visibility and iconographic

---

31 Ibid, p. 82.
32 Ibid, p. 87.
33 See chapter 2.39 Retroactive Manifestos.
potential, so do the environmental and structural demands. As a result of this intensification of the environmental parameters the vertical envelope is becoming increasingly complex and anisotropic. It is reacting very specifically to the surrounding urban context with specific inflexions that provide views, solar exposure, natural ventilation and profile. The current urban core densification is reviving the drive for monumental high-rise construction. Tall buildings are paradigmatic of the representation of power in the city. The manipulation of the envelope’s crowning, where the technical determinations are weaker, is the technique to distinguish buildings otherwise designed as mere extrusions of an optimized footprint. Tall buildings are no longer an expensive extravagance but a crucial development vehicle engaging the middle classes. In this process of democratization the high-rise has exceeded its natural milieu as workspace and pervaded all aspects of urban life. Because of its engagement with domestic protocols and specific climatic conditions, the vertical envelope is now producing culturally-specific, vernacular varieties.

These excerpts might not do justice to the intentions of Zaera-Polo’s attempt to reconstruct the ‘politics of the envelope’. Here they should act as an example of the kinds of generalizing statements about form-function relations we find in contemporary architecture. The excerpts also serve as an initial pointer towards a type of research that would aim to establish systematic correlations between forms (solutions) and functions (problems). This is the core business of substantive architectural theory. Both solution typologies and problem typologies – whether based on inductive retrieval or deductive construction – are an essential first step in the attempt to develop a substantive architectural theory. The next step is to try to map solution typologies onto problem typologies, on the basis of both empirical observation and rational reconstruction, in order to establish theoretical premises for a creative expansion of new, viable form-function complexes. Zaera-Polo’s solution typology, and his (so far rather unsystematic) attempt to gather and reconstruct evidence concerning the functional capacities and performative effects of these types, is a first step that deserves to be noted.

Obviously the outer shape (ratios of primary dimensions) is only one among many dimensions of formal classification. Although we can presume that articulated building complexes might be analyzed as composites of those types, we should not over-emphasize this thinking in terms of convex containers. We cannot afford to forget the significance of the switch from edifice to space. Also, types like the flat-horizontal
envelope sometimes extend to dimensions where the external shape opens up so many possibilities of internal organization that the identification of the type leaves everything yet to be determined. The notion of an ‘interior urbanism’ has been coined for this condition (airports, malls etc). Working with the (inevitably reductive) method of solution types always runs counter to the radical openness that was gained by the switch from edifice to space. However, an analytic architectural theory has to find ways of ordering this universe of possibility, and the indicated shape-types have the advantage of possessing close empirical correlates. Thus they are a good starting point even if the intention is to move ‘from typology to topology’.

The ‘parametric’ approach to design, which is sometimes supposed to supersede typology, might rather be theorized as a refinement within the typological discourse. While parametric design indeed dissolves formal types understood as rigid archetypal forms, it cannot replace functional typology as a necessary framework for the elaboration of the functional/performative dimension of architecture. Meaningful parameters can only be defined within a classification that allows for the specification of performance criteria relative to corresponding types of activities. Ideas of gradual transition or hybridization obviously depend upon prior categories to be hybridized or morphed. Even assuming a totally smooth series of continuous transformation, gradual quantitative change will lead to qualitative differences that must be conceptualized by some form of classification: typology.

Traditional schemes of classification are thus augmented by the possibility of hybridization, and the ordering of a spectrum of smooth transitions between types via ordinate or quantitative (parametricized) concepts. Function-types are thus placed within a continuous order and redefined as variable, parametricized constructs. The result is more complex than a traditional typology. This increased complexity does not only result from the addition of the in-between variants, but is also due to the much stronger sense of integration achieved within such a topo-typological system.

35 Interior Urbanism was one of the key slogans that guided the generative design research at the AADRL, Design Research Lab founded in 1996 as Master of Architecture Programme at the Architectural Association School of Architecture.

36 Obviously, such ideas of typological hybridization and smooth transitions require corresponding tendencies within the societal environment, for example, the tendency of knowledge based self-employment and home-work leading to the new hybrid typology of live-work, which in fact has already been institutionalized within the planning guidelines, for instance in London.
6.1.6 PATTERNS OF DECOMPOSITION/COMPOSITION

The notion of function refers to the role a territorial unit or architectural subsystem plays with respect to the ordering/framing operation of an encompassing territory. The function of the part/subsystem is its contribution to the function of the superordinate system which in turn is itself a part or subsystem of a yet larger territorial system. The function of the staircase for instance is the integration of the stack of floors into a functional unit, a certain (wing of a) building. This building might in turn be a component that makes a specific functional contribution to the functioning of an encompassing building complex. In this way a nested chain of system-subsystem relations might be constructed. Certain spatial items or artefacts might be parts of several systems. This multiple system-reference should be distinguished from multifunctionality which implies that a unit might have several functions within a single system. In each case, functionality is defined with respect to the most immediate level of system integration, within an overall (hierarchical) order of system levels.

According to which organizational pattern should a network of territorial/architectural system-subsystem relations be constructed? The answer must depend upon the structure of the life-process of the accommodated social system. How should a given institutional totality, for example, the life of a family or household that is to be framed by a residential architecture, be decomposed into interaction/activity subsystems? The point here is to note that there are many possible patterns of decomposition/composition that might be proposed to resolve a global function, like the function of a residence, into its contributing parts. A residential unit might be decomposed into the standard room-types like living room, and dining room, kitchen, bedroom, bathroom, ie, the unit breaks into five parts. Or one might proceed more abstractly via several levels of decomposition and first distinguish those areas to which visitors have access versus those areas to which there is no such access by visitors. Then one might take each of these subsystems, the public versus the private subsystem, and decompose further, either by trying to maintain a general principle of differentiation that applies to successive levels of subsystem formation, for instance the differentiation of (more) public versus (more) private activities/spaces, or alternatively by introducing a new principle like distinguishing servicing vs served activities/spaces, or finally proceeding independently in each branch of the initial bifurcation, distinguishing, for example, the public subsystem into lounging versus dining, while distinguishing the private part into sleeping, dressing and bathing. The decision or preference might depend upon the criterion of parsimony. In this case the single principle approach
should be chosen. A further abstract-formal a priori would be to proceed by dichotomous bifurcation only. If this seems too forced or artificial, and instead close adherence to common sense is the criterion, then one might utilize familiar concepts and change the principle of differentiation on each level, without regulating the span of differentiation. The different ways of architectural ordering considered here are at the same time different ways of ordering the social life-processes that are expected to unfold within the designed architecture. The architectural order is assumed to coincide with and sustain the social order. The main point to establish here is that whatever pattern of decomposition or systems-integration is assumed, the notion of function can only be specified in such a context of decomposition or integration.

The decomposition is supposed to produce functional subsystems. These subsystems are integrated via a unifying function that is performed for the encompassing system. These subsystems might be decomposed further into elements that ideally all cooperate via relations that are internal to the subsystem, ie, without getting entangled in interdependencies that stretch across the subsystem boundaries. For instance, a bathroom is an autonomous functional unit that requires no contribution from facilities that are located outside the bathroom. The towel should be ready to hand and not be placed in the dressing room. On the next level of system integration, the bathroom and the dressing room function together as private backstage unit that allows the inhabitants to prepare themselves to face the public. Together they form an autonomous subsystem separated off from the rest of the residential unit. This avoidance of boundary-crossing dependencies – full (or near) decomposability – has the advantage of allowing for a controlled build up of complexity. However, this principle limits the ability to articulate the increased levels of connection intensity that marks many contemporary social institutions. Therefore the principle of full (or near) decomposability cannot be set up as a universal rule or preference. This principle gives up on the potential efficiencies of overlapping utilization. Another way to proceed might be via the opposition of several systems of differentiation that each operate across the overall domain, intersecting like a matrix rather than building up a hierarchy of nesting distinctions. Public versus private might be intersected by servicing versus served. Christopher Alexander proposed this possibility with respect to urban differentiation in his seminal text ‘A City is not a Tree’.  

The arrangement of a network of criss-crossing functional contributions of territorial units or architectural subsystems is conceivable, whereby each unit/subsystem might contribute to multiple further units/subsystems in a way that does not allow for the analysis into a hierarchical tree-like decomposition of functions. To track such complex patterns of functional collaboration the use of ‘network analysis’ or ‘graph theory’\(^\text{38}\) can be recommended.

### 6.1.7 FUNCTIONAL REASONING VIA ACTION-ARTEFACT NETWORKS

Within a societal environment where social communication processes become increasingly diverse, multifaceted and nuanced, architecture must think of upgrading its understanding and handling of functions. The disposition over a mere handful of standard function-types that trigger routine design responses can no longer satisfy sophisticated clients. A more detailed and nuanced understanding of architecture’s audiences and user groups – in terms of their actual and potential patterns of communicative interaction – seems to be called for.

Does this imply that architects should try to design the life-processes that are to unfold within the spaces of their buildings? Such a pretension is evidently preposterous. (Architects have indeed been accused of such pretensions.) How should architectural theory conceive the relation of the designed architectural artefacts to its users within its design projects?

The user or, to be more precise, the user’s communicative activities\(^\text{39}\) that utilize architectural spaces, are located in architecture’s most immediate and most relevant societal environment. The user’s communications and communicative interactions are not architectural communications. They belong to the social systems of communications that are serviced/framed by architecture. The communications unfolding within a lecture theatre during a lecture belong to the temporary system of communications that we can identify with the lecture as autopoietic system of communications.\(^\text{40}\) At the same time the lecture is embedded

---

\(^{38}\) See section 6.4 Supplementing Architecture with a Science of Configuration.

\(^{39}\) There is a general theoretical predisposition to be observed here. This predisposition resides in one of Luhmann’s fundamental theoretical decisions: the decision to locate human beings (as psychic and living/organic systems) within the environment of society. Society, according to Luhmann, consists of nothing but communications connecting to communications. To follow this theoretical decision here implies that not the users but their communications and communicative interactions constitute the immediate and most relevant societal environment of architecture.

\(^{40}\) A lecture is an autopoietic system of communications because during its course it develops a unique mood, understanding and rapport among the participants, i.e., it self-referentially closes and builds up temporary communication structures. A latecomer will find it difficult to catch up with what is going on.
within a lecture series, which in turn is embedded in the larger communication system that is the university department within which the lecture has an allocated role to play. It is within these social systems that the communications unfolding within the lecture theatre belong. The same applies to the designed lecture theatre itself as framing communication. The main lecture theatre of the university department is a communication within the social system of this department. Its location, size and atmosphere communicate about the department, on behalf of the department. This communication is attributed to the department as much as the lecture series unfolding within it is attributed to it. Both belong to the same system of communications. Both are located in the environment of architecture. However, the designed lecture theatre might also be circulating as communication within the autopoiesis of architecture. Perhaps it is recognized as avant-garde contribution to a certain emerging style and as such might be attracting appraisals within the architectural discourse. Architectural students might come to visit and debate its design features. In this way all built works of architecture lead a communicative double life, as framing communications within the social systems they accommodate, and as communications within the autopoietic system of architecture. (The framing role of specific architectural works within their framed social systems might become the topic of communication within architectural discourse. This, however, would not overcome the sharp distinction that exists between these two domains of communication.)

To reiterate: the users and their patterns of utilization and communication cannot be made an immediate object of design within an architectural project. They constitute architecture’s external reference, outside the architect’s control. Architects control the construction of forms, architecture’s internal reference. However, both the final built architectural forms and the functions they sustain are communications that together reside in architecture’s environment. It is this environment that is modelled within architecture’s design medium. Traditionally, the architectural drawing only depicts the forms that are under architecture’s control. Functions are not depicted beyond simple designations that appear as room labels within the drawing. Sometimes furniture configurations are drawn to indicate the utilization of a particular spatial layout. The thesis here is that the autopoiesis of architecture should aim to go beyond this and deepen its engagement with the potential utilization of its designs. Occupation and communication patterns should become the key reference point of architectural design speculation and discussion. In order for this to happen, these patterns of communicative interaction (that are to be ordered, framed and thereby sustained by the
architectural design effort) must be represented within architecture’s
design medium. Each ambitious design project that is confronted with
the task of designing for advanced contemporary social institutions (like
universities or sophisticated corporations) must find ways to explore and
discuss in detail the framing role specific architectural forms should take
up within the social systems they engage with. The architectural design
process and discourse must develop the tools and intelligence to
anticipate and evaluate the framing efficacy of their design proposals. It
is a key thesis of the theory of architectural autopoiesis that complex,
sophisticated communication systems like advanced corporations can no
longer be adequately framed via a given standard set of stereotypical
solutions.

The development of more versatile and nuanced solutions requires not
only the expansion of the formal repertoire on the basis of a new formal
design heuristics, but equally a new functional heuristics, ie, a new way of
understanding and handling functions that is able analytically to break up
stereotypical monolithic functions to get into their underlying constitution
from multiple, communicative interaction scenarios. What is required
here is, first of all, the interpretation of functions as communicative
interaction scenarios and, secondly, a close reading and speculation
about how the various aspects of a framing architectural setting intervene
in such scenarios, ie, how architectural spaces and their furnishings
become ‘actors’ or ‘agents’ within the unfolding event scenarios. The task
is to understand and simulate how architectural agents might gather,
order, prompt, cajole and inspire desired patterns of social
communication. The phrase or formula that the theory of architectural
autopoiesis proposes for this reads: architecture must conceive of its
function in terms of action-artefact networks.41 The architectural design
process should be able credibly to speculate about probable social
scenarios. This implies that the design medium represents and animates
such scenarios. This requires that artefacts (forms) and communicative
actions (functions) are modelled together. The artefacts/forms are the
independent variable under the manipulative control of the designer. The
actions/functions are the dependent variable that serves as feedback and
selection criterion for the manipulation of forms.

The substantial functions of architecture have to be addressed in
terms of action-artefact networks. The inclusion of communicating actors

41 The concept is loosely inspired by actor-network theory. Although the context and purpose of
the concept of actor-networks are rather different, the perspective shares the aspect of
theorizing communicative complexes that involves actors and material objects (as well as the
routines that bind them). See Bruno Latour, Reassembling the Social: An Introduction to
within action-artefact networks is the only viable way forward with respect to a contemporary, upgraded functional reasoning that would be able to cope with the level of sophistication and innovation demanded by contemporary society. For instance, with respect to the design of a high performance private residence, we might consider the example of hosting a dinner party, understood as a complex and ambitious communicative institution. The success of the party hinges upon its ability to engender stimulating conversations, its ability to facilitate individual efforts in making new acquaintances etc. One crucial parameter of the design might be the density and arrangement of props capable of creating situations that facilitate the deepening of networks of friendship and allow a measured increase in the level of intimacy with selected guests. Such a dinner party is in effect a complex and layered configuration of communication and community building. Ideally an extended scenario might be orchestrated, unfolding in choreographed stages. The party begins as people are moving in, gathering in the entrance hall and taking a stand-up cocktail. A cluster of stand-up tables, in conjunction with a window affording a stimulating view of the city, facilitates the necessary physical proximity of human bodies and the shared attentional focus that is required to stimulate communication. Here opportunities for informal acquaintance are afforded. At the next stage, the host starts to call everybody to the big, unified dining table. Everybody has extended time to converse with their respective neighbours at the table. After dinner this stable configuration is transformed into the fluid play of small groups gathering and dispersing at the various lounging points. Shifting conversational clusters can be formed. Diverse spatial settings with various types of furnishings might be called for to catalyze and orchestrate this scenario. The subsystems and elements of this social institution of the dinner party are the communicative actions of the users. However, those communicative actions, all along, involve architectural settings and artefacts as integral parts of the communicative events. We might refer to those artefacts as architectural agents. Armchairs are shifted and turned, cushions are adjusted, legs crossed over, wine glasses are refilled, light levels are adjusted. The intimate conversation at the small side-table is a subsystem contributing to the overall event of the party by remaining in view and by contributing to the background noise. This way of functional reasoning and analysis leads to the shift of attention from the form and spatial arrangement of the artefacts to the description of action patterns with emphasis on the contribution of the respective architectural agents within these social situations.

Each level of the architectural analysis involves action-artefact complexes, never the mere artefacts. Obviously, this conception of...
architectural design discourse is rather ambitious. A kind of scenario thinking, on the level of anecdote, has long since been woven into the design considerations of sensitive architects. The point here is to raise the stakes by radicalizing this aspect towards a vigorous demarcation of architecture. Lack of concern for architecture’s communicative engagement either by focusing on simple physical functions like shelter, durable construction etc or by focusing solely on the form of the artefact, spells the ejection from the discourse of architecture. These escapes from the central concern of architecture lead to the domain of engineering in the first case and to the domain of art in the second case. The threshold of the presupposed intelligence and sophistication with respect to the participation within the discourse of architecture is significantly raised by this move towards the explicit emphasis upon communicative interaction patterns. An ability to talk about and model such patterns (in relation to architectural form) becomes an entrance threshold for competent participation within the autopoiesis of architecture.

This upgraded design speculation is only possible on the back of an upgraded medium of design. Current animation software affords the tools to elaborate 4D scenarios involving the modelling of agent-systems and character animation to speculate about use-patterns in varying settings. The completed design would then no longer rest with a full set of drawings plus photorealistic renderings. A new layer of representation would have to be added: a series of animated scenarios that demonstrate the anticipated action-artefact networks that have been guiding the design process. This move from mere spatial figures to space-time figures would accompany the design process all the way from the initial animated diagrams to the final life-like simulations in the form of movie-clips.\(^{42}\)

The conventional mode of design speculates only about spatial form as a response to fixed, presupposed use-patterns. This limits innovation to formal variations. In this way a dining chair remains forever a dining chair (gathering participants facing each other around a dining table), in all sorts of formal variations that leave intact the basic social diagram and the expectations it encodes. The institution of the dinner is always fixed and presupposed and remains outside the domain of architectural speculation. The same goes for higher levels of system-integration: domestic life at home, corporate life at the office, educational life on the university campus. Radical innovation only broke ground in the late

---

\(^{42}\) At the AADRL, the Design Research Laboratory at the Architectural Association School of Architecture, this type of elaborate scenario modelling was a key component of each thesis design during a three-year research agenda ‘Responsive Environments’ in 2001–4.
1960s, pushed on by the social revolutions of the time. While modern furniture design was typologically rigid all the way to the mid 1960s, radical mutations and an expansion of the given furniture typology have been achieved since the late 1960s. Superstudio’s ‘Superwave’ might act as example here. Similar mutations happened in other institutions and their respective building types. For instance, schools, universities, museums and many workplaces changed both their patterns of communication and their spatial physiognomy. The example of the radical transformations that were achieved in the late 1960s indicates that architectural innovations require a conducive societal environment. In fact the societal environment pushes without knowing where it wants to go architecturally. This question can only be answered within the autopoiesis of architecture. The underlying premise of this chapter is thus that societal mutations are currently under way in various domains of social life that create an environment conducive to the promoted concept of action-artefact networks. Functional reasoning in terms of action-artefact networks increases architecture’s capacity to analyze, dissolve, vary and reconstitute its elements in relation to a more versatile and nuanced understanding of its substantial functions. It is in the context of modelling and discussing action-artefact networks that the concept of capacity will flourish.

The attempt to transcend functional reasoning in stereotype solutions and to leave the familiar solutions behind dramatically increases the inherent risk that is bound up with all design activity projecting into an unknown future. Communication on this enhanced level of uncertainty would be highly improbable and indeed impossible without a dramatic increase in the power of architecture’s medium. The key is the incorporation of credible ways of representing the occupation and interaction scenarios that are to guide and test the formal manipulations during the design process. On the organizational level of general layouts and plan configurations, user groups and their patterns of occupation can be simulated via agent modelling. The computational representation of human actors as rule-governed automatons does not contradict the emphasis on communication. Patterns of pedestrian movement, crowd behaviour, queues etc are communication scenarios. Pacing down the pavement is as much a communicative action (‘out of my way!’) as is the relaxed, hand-in-hand strolling (window shopping).

Patterns of observed crowd behaviour can be simulated via scripted agents. For instance, the spontaneous ordering of pedestrian flows into a right and left stream moving in opposite directions within a busy corridor or underground passage can be recreated with agents. The introduction of
a narrow point (door-frame) within such a computational model spontaneously produces a new pattern of ordering the flows. In this case, time rather than space is used and the flow breaks into an oscillating pattern where one direction flows for a while until pressure builds up at the other side and the flow direction is reversed. A junction of four inflowing lines of movement spontaneously produces a circular flow pattern. Such patterns can be reproduced with very simple agent profiles. The probable impact of manipulating spatial forms can be observed in real time. However, the possibility of modelling occupational patterns with agents is not restricted to such basic phenomena. Lingering in the foyer, stopping at a notice board, sitting down on the staircase outside the entrance etc are communicative actions that can still be simulated with a high degree of veracity by automatons. More sophisticated agents can be programmed. For example, in the context of a corporate space-planning project, University College London’s Space Syntax Lab conducted a study of space occupation and communication patterns via camera recordings of patterns of movement, resting, gathering etc within the existing spaces of the corporation. An extensive analysis tried to abstract the rules that governed these observed patterns in their dependence on the architectural environment. Where were the attractors that made short gatherings more likely? What are the properties of settings that correlate with longer gatherings? How many agents were likely to gather where and for how long? How about the differential speed of moving relative to the spatial conditions? These were the kinds of questions that were asked and answered. The rules that answered these questions were embodied in the agent definitions. The success of this exercise could be demonstrated by the verisimilitude of the reproduction of the observed patterns. On this basis the spatial configuration of the environment (independent variable) could be manipulated and tested with respect to its effect in terms of probable communication patterns (dependent variable).

The next step in the design, beyond the abstract plan configuration, can still be supported by a further expansion of architecture’s design medium. A fully modelled 3D scene might be turned into a 4D animated scene including character animation and scenario development in the form of small movies depicting patterns of communication within the designed environments. The intuitive plausibility of such animations would be the guiding evaluation criterion here. The important fact is that the designer has a medium within which slowly to work on and elaborate both forms and their probable functions together, with a nearly infinite level of detail resolution in both respects. A thus enhanced medium can – to a certain extent – overcome the inherent improbability of
successful communications about strange environments and their claim to be innovative facilitators of desired communication patterns. The exact content of the hosted communications can obviously not be steered in this way. However, the density and distribution of encounters and the general social or atmospheric character of the various gatherings and interactions can be influenced. On the basis of these discursive and medial enhancements of working in terms of action-artefact networks, the risk of venturing into unfamiliar territory can be contained and managed. A narrative scenario with animated visualizations might convince not only the designers themselves but also their clients and user groups that unfamiliar spaces could sustain and encourage desired interaction patterns that are more productive (albeit equally plausible) than what is to be expected within current form-function stereotypes.

6.1.8 LIMITATIONS OF FUNCTIONAL EXPERTISE

The architectural discourse on (substantial) function constitutes architecture’s world-reference. The upgrading of the discipline’s environmental adaptivity involves the upgrading of its analytic-predictive resources. This raises the question: how far must the discipline of architecture penetrate the various societal domains in order to fulfil the promise of an upgraded action-artefact reasoning? At this stage in the argument the question of the demarcation and autonomy of the discipline of architecture is once more posed. Obviously, architectural design cannot dissolve into the education system and incorporate the theory of pedagogy when it comes to the design of a school. In the case of workplace design, architecture does not dissolve into corporate management or management consulting, even if it has to engage in a close collaboration with these domains.

There seems to be an occasion for an interdisciplinary project (and discourse) here that equally engages architects and management consultants in a single concerted effort. We can observe the beginnings of a new type of service for corporations whereby corporate space-planning and interior design are integrated and offered in conjunction with management consultancy and organization design. One of the world’s leading corporate space-planning firms – London-based DEGW – was bought and integrated within management consultancy firm Twynstra Gudde. DEGW has been developing space-planning expertise for corporations that goes far beyond the usual architectural service of arranging spaces according to a given schedule of accommodation. Instead DEGW is offering to develop the client’s brief on the basis of a detailed analysis of how the client’s current pattern of space occupation
correlates with its current profile of activities. Social science research tools like interviews and questionnaires are deployed to relate the ongoing communication patterns to both organizational and spatial relations. The Space Syntax Lab is a direct competitor of DEGW that works in much the same way, but in addition deploys agent-based simulations of space occupancy in terms of circulation and informal communication patterns. The initial empirical research involves the placement of inconspicuous cameras in lobbies and corridors of the client’s current premises. The recordings are then analyzed in terms of movement patterns with particular attention to the way people might initiate short communications upon the occasion of random encounters. Attention is paid to the relationship between spatial conditions and the probability and duration of the communicative encounters. The results of this analysis are then used to programme a population of agents in such a way that they spontaneously approximate the observed patterns at the respective locations within the model of the corporate space. On the basis of the successful replication of the observed patterns, the agent’s behaviour within a modified spatial configuration can be regarded as a simulation of the communication patterns that might be expected within the newly configured space. The simulation is effectively a parametric model of an action-artefact network and can be operated as a predictive design tool.

These examples do not imply that all ambitious architects must now aspire to become social scientist and agent programmers. Such an integration of expert knowledge and specialized skills is highly unlikely to become generalized. What is more likely is that the professional design team – led by the architect – is augmented by new specialized contributors. This in turn also implies the expansion of the architect’s typical horizon of expertise and knowledge together with the overall retooling of the discourse of the discipline that is required to adequately address the new societal challenges and technological opportunities. New forms of knowledge need to be integrated into the discourse and new techniques need to be integrated into the design process – together leading to an invigorated architectural autopoiesis. This indirect utilization of scientific expert knowledge and specialized skills is based upon a partial assimilation of key concepts that inspire the adaptation of architecture’s own communicative structures. A full integration of social science into architecture is unrealistic.

The Space Syntax Lab is a research lab at UCL (University College London) that also operates as a professional consultancy.
The case is comparable to the challenge placed upon architecture by the general ascendance of ecological concerns and demands for sustainability. Here too we witness both the enlisting of new experts into the architecture-led design team and the partial assimilation of key concepts and general principles into the discursive constitution and system of values of the discipline. Architects start to talk about ecological principles and integrate such talk into the formation of their design concepts, but they are not becoming sustainability experts, nor do, by this token, scientific principles dominate the design process and its attendant communications. Architects call upon external experts to upgrade their game but keep their own design prerogatives under the spell of utility, beauty and originality.

The cases of DEGW and the Space Syntax Lab are also instructive on this question of the maintenance of the disciplinary boundaries. Although the background of the partners and key staff, in both cases, is architecture, we can observe two developmental paths that seem open here to architectural firms. DEGW – although temporarily acquired by a management consultancy group – stayed within the domain of architecture. They soon separated from Twynstra Gudde and continued as architects (space planners and interior designers), albeit with a special client base and with an especially innovative, augmented design intelligence and process. How influential their innovations prove to be within the larger field has yet to be seen. The Space Syntax Lab started out from an architectural academic base about 20 years ago, setting out to augment the architectural and urban discourse with new concepts, methods and techniques, especially focusing on rigorous configurational analysis. Both as an academic research project and as a professional practice, the success of the Space Syntax Lab has been very impressive. However, its theoretical and practical achievements have not penetrated the heart of the discipline. Their concepts, techniques and specific mode of reasoning have not made an impact within the wider architectural discourse. Their call for scientific rigour in the design discourse and for a design process informed by scientifically rigorous analysis has not been heeded. Instead of impacting the core of the discipline through its discourse, the Space Syntax Lab has been successfully operating like a specialist consultancy service advising and supporting architects, albeit – despite its success – without yet finding any followers. Only on the basis of an expanding utilization as specialist consultancy, so it seems, can the insights of space syntax research be expected to exert a certain influence and indirectly augment the discourse of architecture and urbanism. Although it might be hoped for, a full-blown inclusion of space syntax thinking into general architectural thinking should perhaps not be
expected. Despite these caveats, below the attempt is made to assimilate key insights of space syntax theory within a broader theory of architectural order.

Space syntax operates as an engineering discipline or applied science. Its discourse is regulated by the code of truth and by the code of utility but does not concern itself with either beauty or design originality. The theory of architectural autopoiesis can thus explain the failure of space syntax to impact architectural discourse, despite its otherwise compelling theoretical and practical achievements. The discursive structure of architecture is too different to incorporate segments of science-based engineering wholesale. Architecture can be perturbed and stirred by science/engineering, but how, and to what extent, scientific knowledge is filtered and absorbed into architecture, and perhaps transmuted and codified into design principles or routine processes, is a matter of its own evolving autopoiesis. Scientists will never rule architecture and design.

This obstinacy of architecture should not in itself be a cause for concern. In fact, the author is rather optimistic that many of the preoccupations, concepts and insights of space syntax research will filter into the avant-garde discourse and finally into the generalized design intelligence of architecture – albeit in a mutated form that allows these insights to be fitted into the distinct communication structures of architecture. Hillier's *Space is the Machine*[^44] is not only promoted here; it is widely read within architectural academia. Key terms like configuration and integration and a general sense that what Hillier calls configurational properties matter for functionality and orientation with respect to complex buildings or urban fields are spreading. However, the detailed, analytical science that can concretely operationalize these insights will always require a specialist expert service.

### 6.2 Order via Organization and Articulation

**THESIS 26**

Architectural order is symbiotic with social order and its effective realization requires organization and articulation as crucial registers of the design effort.

The distinction of form and function poses the question of their effective correlation. The question is how functional requirements can be addressed by architectural forms. This is the ultimate question of architectural theory and the most general formulation of the task posed to

[^44]: Bill Hillier, *Space is the Machine*. 42
architecture. The autopoiesis of architecture, ie, architecture as a discipline and discourse, is dedicated to innovating the resources and processes that can be brought to bear on this task.

The theory of architectural autopoiesis analyzes the task of giving form to functions via a crucial distinction: the distinction between organization and articulation. Organization and articulation are the two irreducible, constituent components of architecture’s task. Organization is concerned with the physical distancing, separation and connection of domains and is thus framing communication physically, by physically channelling movement and interaction. Articulation is concerned with orientation and is framing communication cognitively. Articulation is guiding movement and interaction via atmospheres, and perceptual as well as semiotic clues. Organization recognizes and operates via social communication’s dependence on human beings as mobile bodies in space, while articulation recognizes and operates via social communication’s dependence on human beings as perceiving/comprehending systems.

Organization and articulation are worked out in architecture’s design medium of the drawing/model. The built results – the organized and articulated buildings and spaces – operate in the medium of space. All framing communications are spatial communications. In Volume 1, architecture’s design medium was theorized as symbolically generalized medium of communication that is able to make otherwise improbable communications probable. The medium was compared to money as the medium of the economic system and to power as the medium of the political system. The theory of architectural autopoiesis now poses space as the medium of architecture. The idea of a symbolically generalized medium for architectural communications might thus be applied once more, namely to the completed buildings and spaces that are architecture’s final communications. We thus need to distinguish between architecture’s design medium – the medium of the drawing/model – and architecture’s success medium, ie, space as the medium within which architecture delivers its service to society: the buildings and spaces that are architecture’s final communications that function as spatial frames and premises for all further communicative

---

45 The concept of framing is central within the theory of architectural autopoiesis. It pinpoints architecture’s unique societal function. See Volume 1, chapter 5.1.5 Framing Double Contingency.

46 The switch from edifice to space and the further switch from space to field should not be seen to contradict this statement. The theoretical concept of space as medium proposed here should be distinguished from the concept of space as historically specific regulating idea used by Modernist architects to characterize the scope of their work.
interactions. Space has thus been appropriated to be the success medium of the autopoietic function system of architecture.\footnote{47 However, the space referred to here is not the space that results as a haphazard, uncontrolled side product of human intervention, but only the carefully designed, organized and articulated space. As we shall see below, this architectural, framing space is always a phenomenologically and semiotically charged space. Only selected aspects of what we might otherwise include in the general idea of space become available as medium of a framing communication. These aspects are mostly limited to those that can be controlled via architecture’s design medium. Design medium and success medium must thus be closely related.}

To give form to functions in architecture translates into the task of (spatially) organizing and (morphologically) articulating the substantial functions that represent the demands of the social life-process within architecture. Although at first sight it may seem as if organization is concerned with function, judged according to its utility, and as if articulation is concerned with form, judged according to its beauty, the theory of architectural autopoiesis resists this latent alignment, and insists instead that the distinction organization vs articulation cuts orthogonally across architecture’s lead-distinction of form vs function. Both the organization and the articulation of a space/building involve both form and function, and thus call forth both sides of the double code of beauty and utility. During the design process or when judging completed buildings, the parti or organization of a scheme might not just be judged in terms of its utility – functional or dysfunctional – it might also be judged to be either formally resolved (beautiful) or formally unresolved (ugly). The same goes for the aspect of articulation. Here it seems as if formal judgement is more pertinent: the atmosphere pleases or displeases. However, articulation can, is, and should be judged according to utility as well. A certain scheme of articulation might ease orientation and wayfinding or not. It might define the various required/expected atmospheres and moods of the destination spaces appropriately or inappropriately, and thus either serve to enhance the ease of communicative interaction, or irritate, confuse and distract.

Organization involves the functional allocation of spaces, ie, the distinction, designation and spatial distribution of uses. Articulation is concerned with making the distinction and designation of uses, as well as their spatial relations, conspicuous and legible. To illustrate this conceptual pair one might point to the architectural order of the typical Renaissance Palazzo as inaugurated by Alberti’s Palazzo Rucellai completed in 1451 in Florence, and perhaps more vigorously expressed in Michelozzo di Bartolomeo’s Palazzo Medici-Riccardi completed in 1459. The organizational and articulatory schema of the Renaissance Palazzo became a ubiquitous trope of architecture for the following
450 years. A stratified, tripartite organization of uses is articulated by the
different architectural treatment of each of the three levels. On the
ground floor are allocated the storage, production and business quarters,
expressed as a solid, rusticated base with small windows. The second
level – the ‘piano nobile’ – is allocated to public receptions. Here the
walls are usually smoother and the windows much larger. The third floor
contains the private living quarters and bedrooms of the noble family.
Here the height might be somewhat reduced and the windows are once
more smaller and the wall is smoother still. The servants’ bedrooms on
top are made virtually invisible by the large cornice that terminates the
facade. While the differentiation of the three strata is overall more
conspicuous in the Palazzo Medici-Riccardi, Alberti’s Palazzo Rucellai
offers a further, more subtle, semiological rather than phenomenological
differentiation: the differentiation by means of pilasters expressing the
three Classical column orders.

The typical schema of the Renaissance Palazzo illustrates the dialectic
of organization and articulation. It shows how the functional designation
motivates certain morphological adaptations, for example, in terms of
differential heights, wall thicknesses and window sizes, that follow both
functional requirements of use as well as a structural rationality. The
spatial distribution of the designated uses follows the logic of the social
life and communication process. The example also makes clear that
architecture involves the expressive heightening of the functional
distinctions and the attempt to characterize them via tectonic or
ornamental features. The rustication of the base expresses its
protective solidity. The Doric order, as the expressly sturdiest order,
further symbolizes this aspect. Neither rustication nor pilasters serve any
necessary physical function. They are clearly articulatory devices that
communicate. The progression of successive smoothening and
ornamental refinement is expressive of a definite, deliberate order. It
communicates order. The same is true for the Classical sequence Doric,
Ionic, Corinthian. A definite order is applied resulting in an overall
architectural order that is understood to be meaningful.

Other typical examples are: Palazzo Pitti by Brunelleschi, Florence 1464; Palazzo Strozzi by
Benedetto da Maiano, Florence 1485; Palazzo Vidoni-Caffarelli by Raffaello Sanzio, Rome
1515; Palazzo Farnese by Antonio da Sangallo il Giovane and Michelangelo Buonarroti, Rome
1536. The same tripartite organization/articulation is also evident, in an even more expressive
fashion, in Michelangelo’s Palazzo Senatorio in Rome, designed in 1536 as part of the Piazza
del Campidoglio, as well as in Palladio’s Villa Foscari designed in 1549.

These ornamental features are usually of tectonic origin, i.e., they originate in features that are
due to technical function and material fabrication.
The two key concepts that act here to define the task of architecture – organization and articulation – are well established within current architectural discourse. However, these concepts are here promoted to a new level of significance: as a conceptual pair they are designated to encompass the totality of architecture’s task. These concepts, and the agendas they sponsor, are elaborated here to an extent that goes beyond a mere analysis of current practice and discourse. The attempt is made to contribute to the *retooling* of the discipline by giving indications about how the organizational and articulatory capacity of contemporary architecture can be enhanced. This enhancement proceeds along the two primary dimensions of architecture’s task: the dimension of organization and the dimension of articulation. As will be elaborated below, the dimension of articulation includes two distinct sub-tasks: phenomenological articulation and semiological articulation. Thus we can distinguish three agendas – the *organizational*, the *phenomenological* and the *semiological* agenda – for the retooling of architecture’s expertise. Each of these agendas is given a separate treatment. The semiological dimension receives the most extensive treatment here, not only because it is currently the least developed and the least prominent of the three dimensions, but also because the theory of architectural autopoiesis argues that it is this dimension which should represent the core competency of the discipline. The theory speculates that it is in this dimension that contemporary avant-garde architecture can and must demonstrate its superiority. However, all three dimensions are indispensable aspects of architecture’s task. Accordingly, each ambitious contemporary avant-garde design project should contain and synthesize an organizational, a phenomenological and a semiological project. The three dimensions together procure what we call here architectural order. Thus we can summarize the conceptual set up of this section as follows:

\[
\begin{array}{c}
\text{architectural order} \\
\hspace{1cm} \text{organization} \\
\hspace{1.5cm} \text{articulation} \\
\hspace{2cm} \text{phenomenology} \\
\hspace{2.5cm} \text{semiology}
\end{array}
\]

This diagram relates the key terms of this section. At the same time it gives a summary map of what the theory of architectural autopoiesis suspects are the most promising avenues for architecture’s theory-led self-enhancement. First ventures in this direction are offered in what follows. However, only when these dimensions are placed on architecture’s collective design research agenda, and only when these aspects begin to be mastered, should we be satisfied that the autopoiesis
of architecture is on the way to fulfil its societal function on the new level of sophistication that would be conducive to the advances made in the other great function systems of contemporary world society.

6.2.1 ORGANIZATION AND ARTICULATION: HISTORICAL AND SYSTEMATIC

Architecture facilitates interaction by providing spatio-morphological frames that firstly structure patterns of encounter, and secondly help to define the encounters to be expected. The first aspect – the aspect of organization – operates primarily via spatial separation and connection. The second aspect – the aspect of articulation – operates primarily via the priming of the participant’s perceptions, inducing pertinent expectations, and thus preparing the appropriate mood and readiness to interact.

Both key concepts – the concept of organization and the concept of articulation – have noteworthy precursors in the history of architectural theory. To recognize this is important. The distinction of organization vs articulation – denoting two fundamental dimensions of architecture’s task – is a permanent communication structure of architecture. As such it must have had a conceptual registration within the history of architectural theory. This is indeed the case.

The first precursor of the concept of organization was Alberti’s concept of *partitio* (compartition). Compartition is one of six topics that together structure the whole subject matter of architectural design. The six topics are sequenced in accordance with the design process: locality, area, compartition, wall, roof, openings. The compartition of the building, essentially the internal division into rooms, is determined by means of the floorplan, after the site and the footprint of the building have been determined, and before the walls, roof and openings are raised in elevation over the plan. Alberti defines: ‘Compartition (*partitio*) is the process of dividing up the site (footprint of the building) into yet smaller units, so that the building may be considered as being made up of close-fitting smaller buildings, joined together like members of the whole body.’

This analogy of the organization of the building with the organization of the body, and with organisms and organic systems in general, has been inspiring architecture from its beginning (with Alberti) all the way to the most current agenda of avant-garde architecture (Parametricism). The importance of compartition is duly emphasized by Alberti: ‘All the power of invention, all the skill and experience of the art of building are called upon in compartition; compartition alone divides up

---

the whole building into the parts by which it is articulated, and integrates its every part by composing all the lines and angles into a single, harmonious work that respects utility, dignity, and delight. Just as with animals, members relate to members, so too in buildings part ought to relate to part. Each member should therefore be in the correct zone and position. It is important to note here that according to Alberti, organization – and not just decoration – is subject to both codes, the code of utility and the code of beauty (dignity and delight). This relationship between compartition and beauty is further emphasized: ‘If the compartition satisfies these conditions completely, the cheerfulness and elegance of the ornament will find the appropriate place and will shine out; but if not, the work will undoubtedly fail to retain any dignity. The entire composition of the members, therefore, must be so well considered, conform so perfectly with the requirements of necessity and convenience, that this or that part should not give as much pleasure separately as their appropriate placing, here or there, in a particular order, situation, conjunction, arrangement, and configuration. This final proliferation of terms – order, situation, conjunction, arrangement, configuration – does indeed testify to the importance of the thus denoted concern: the concern of organization.

Although much of subsequent architectural theory focused on the Classical orders and their proportions, the much more fundamental notion of organization continued to be registered under various titles, most notably under the title of distribution. Distribution was considered within an overall tripartite division of architecture’s teachings: distribution, construction and decoration. This tripartite division of architectural knowledge was established in French architectural theory by Augustin-Charles d’Aviler in his Cours d’architecture (1691). This work was a standard reference during the whole of the 18th century. The triad of distribution, construction and decoration is also found in Jacques-François Blondel’s celebrated Cours d’architecture (1771–7). Karl Friedrich Schinkel (1802) refers to this tripartite division in his (unfinished) architectural treatise. According to Schinkel ‘the purposefulness of any building can be considered from three principal perspectives: purposefulness of spatial distribution (Raumverteilung) or of the plan, purposefulness of construction or the joining of materials appropriate to the plan, purposefulness of ornament or decoration.’

51 Ibid, p 23.
52 Ibid, p 163.
53 Karl Friedrich Schinkel, Das Architektonische Lehrbuch, Deutscher Kunstverlag (Munich/Berlin), 2001, p 22, the text from 1805 remained an unpublished fragment during Schinkel’s time.
Schinkel goes on to elaborate as follows: ‘The purposefulness of spatial distribution or of the plan contains the following three principal attributes: greatest economy of space, greatest order in the distribution, greatest comfort in the space.’ Sir John Soane’s second series of six Royal Academy Lectures in 1815 was also structured by this tripartite division: ‘The great points or objects now to be considered might be classed and separately treated of, under the heads of Distribution, Construction, and Decoration.’ Soane defines distribution as follows: ‘Distribution comprehends the divisions and arrangements of the various parts of buildings of every kind as to solidity, convenience, elegance and beauty. Distribution must therefore be viewed as one of those essential and important objects of architectural study that must claim the most serious consideration of the architect, and require the fullest exertion of his talents and genius.’ The emphasis on the importance of distribution is reminiscent of Alberti’s emphasis of the importance of partitio. The core of the definition – division and arrangement – also matches Alberti’s core definition that compartition divides and integrates.

We should also note that in the quote above, Soane – again in line with Alberti’s theory – assumes that distribution is contributing to both the functionality (convenience, solidity) and the beauty (elegance) of the building. However, Soane remains ambiguous in this respect. Later in the same lecture he maps the tripartite division of the discipline into distribution, construction and decoration onto the Vitruvian triad of solidity, convenience and beauty: ‘In buildings of every description...three things are indispensably necessary, viz., solidity in construction, convenience in distribution, and beauty in its characteristic decoration.’

Although this alignment seems to be compelling, the theory of architectural autopoiesis proposes a different arrangement of concepts. First of all we recognize that the concern of construction and solidity has drifted out of the central domain of architecture into the domain of engineering. (This also suits our preference for conceptual pairs over conceptual triads.) We are thus left with two conceptual pairs or distinctions: organization vs articulation on the one hand, and utility vs beauty on the other hand, respectively indicating the task of architecture and the code of architecture. The conceptual scheme proposed here sets these two distinctions orthogonal rather than parallel to each other. Both

54 Ibid.
56 Ibid, p 158.
57 Ibid, p 165.
tasks have to respond to both codes. Organization has to answer both the demand of functionality and the demand of formal resolution, and articulation equally has to answer both the demand of functionality and the demand of formal resolution. If we define architectural order as the result of the conjoined effort of organization and articulation, we can summarize the essential concern of architecture as the elaboration of a functional and formally resolved architectural order.

<table>
<thead>
<tr>
<th>code</th>
<th>task</th>
<th>organization</th>
<th>articulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>utility</td>
<td>organization</td>
<td>functional organization</td>
<td>functional articulation</td>
</tr>
<tr>
<td></td>
<td>vs</td>
<td>vs dysfunctional organization</td>
<td>vs dysfunctional articulation</td>
</tr>
<tr>
<td>beauty</td>
<td>formal organization</td>
<td>formally resolved organization</td>
<td>formally resolved articulation</td>
</tr>
<tr>
<td></td>
<td>vs</td>
<td>vs formally unresolved organization</td>
<td>vs formally unresolved articulation</td>
</tr>
</tbody>
</table>

The formal judgement of organizational patterns seems odd at first sight. Also, the utility/function of articulation has not always been recognized. The rationality and advantages of this arrangement will transpire in the following chapters where this conceptual schema is going to be further explicated and put to work. At the current juncture of the argument it suffices to point out that the proposed arrangement can make claims to count as a reconstruction and clarification of the theoretical heritage rather than an arbitrary conceptual invention or imposition. As documented above, the aesthetic import of organization has been stated by both Alberti and Soane, among others. This point will be further reinforced if we recognize that much of what we encompass under the heading of organization has traditionally been treated under the heading of composition. Thus we can note that the traditional notions of compartition, distribution and composition are now to be absorbed within the concept of organization, although the traditional treatment of composition also covers aspects of what we now encompass under the concept of articulation.

Aspects of what we today understand (and shall further elaborate here) under the heading of articulation had been alluded to within the history of architectural theory under the titles of character and expression. The notion of character has indeed been related to the building’s function, as its expression, and as such it fulfils a function, ie, the function of communicating the purpose of the building. The ideas of ‘character’ and ‘expression’, taken from the theatre, were together first introduced into
architectural theory by Germain Boffrand, a student of Mansart, and an important French architect of the early 18th century. He introduced the discussion of character in his *Livre d’architecture* of 1745:

‘Architecture... its component parts are so to speak brought to life by the different characters that it conveys to us. Through its composition a building expresses, as if in the theatre, that the scene is pastoral or tragic; that this is a temple or a palace, a public building destined for a particular purpose or a private house. By their planning, their structure and their decoration, all such buildings must proclaim their purpose to the beholder. If they fail to do so, they offend against expression and are not what they ought to be.’

It is noteworthy here that all three terms of the Classical tripartite division – planning (distribution), structure (construction), decoration – are together involved in expressing the character of the building. The positive function of character expression is to proclaim the purpose of the building to the beholder. The notions of expression and character imply a particular way in which this proclamation is effected: ‘If you are setting out to build a music room, or a salon in which to receive company, it must be cheerful in its planning, in its lighting, and in its manner of decoration. If you want a mausoleum, the building must be suited to its use, and the architecture and decoration must be serious and sad; for Nature makes us susceptible to all these impressions, and a unified impulse never fails to touch our feelings.’

The unified impulse that touches our feelings might best be translated into our contemporary language in terms of the atmosphere of a space we might be immersed within. Jacques-François Blondel referred to ‘imperceptible nuances’ in connection with the concepts of character and expression: ‘It is by the assistance of these imperceptible nuances that we are able to make a real distinction in the design of two buildings of the same genre but which nevertheless should announce themselves differently: preferring in one a style sublime, noble and elevated; in the other a character naïve, simple and true. Distinct particular expressions... that need to be felt... contribute more than one ordinarily imagines in assigning to each building the character that is proper to it.’

This type of architectural effectiveness, via atmospheric values that

---


59 Ibid.

60 Jacques-François Blondel, *Course of Architecture*, 1771, excerpt in: Harry Francis Mallgrave (Ed), *Architectural Theory*, p 198. Blondel goes on to utilize the distinction of male versus female as an analogical character distinction applicable to buildings. The male character...
are taken in semi-consciously, is to be considered when we theorize the
task of articulation. Articulation operates largely via the modulation of
morphological features that are perceived in passing, in a mode of
which is relevant for the quick, intuitive orientation of users and for their
behavioural priming appropriate for the respective social setting, is
largely unconscious. This intuitive, even ‘feeling’-based processing of
articulated spaces must find recognition within a design research
programme of articulation that suggests the calculated build up of
phenomenological and semiotic effects.

6.2.2 ARCHITECTURAL ORDER
How can functional requirements be effectively addressed by
architectural forms? To narrow the scope of this very general question it is
pertinent to concentrate on the most fundamental, primary part of the
question, ie, the question of how a given social order can be facilitated by
a corresponding architectural order. The term social order should denote
the overall system of substantial\footnote{See section 6.1 Functions, in particular chapter 6.1.2 Substantial vs Subsidiary Functions.} functional requirements posed by the
specific social institution or life-process to be accommodated. We are
speaking of a social or institutional order to the extent to which we
assume that the communications and interactions that constitute the
social practice or institution in question are subject to non-arbitrary
relationships and interdependencies.

We might assume that an important architectural pendant of this
notion of social order is the parti of the project. The parti addresses
functional requirements on the level of global organization. At this level –
mostly in the initial stages of the design process – we are more concerned
with the basic distinctions and organizing principles employed. The
overall organizational diagram serves as premise for further design
decisions.\footnote{For instance, in the case of designing a residence, the parti is concerned with the location of the private quarters in relation to the public reception spaces, rather than being concerned about the natural light in the corridor or addressing the pros and cons of different kitchen layouts. A specific architectural order is always about the facilitation and manifestation of a particular life-process implying a particular social order with its respective substantial functions that need to be addressed. For instance, the pertinence of a sharp separation of the private domain from the reception areas in a family where the different family members maintain quite separate social circles might suggest a bipolar parti with both front and back garden rather than...}
With respect to architectural organization, the globally defined parti is only one possible starting point. It is equally possible to proceed in a bottom-up process of agglomerating local micro organizations, for example, via local rules in the fashion of cellular automata, or via agent-based models. The resultant *emergent* global pattern is no less organized than an organization that is elaborated in a top-down process starting with the overall parti. The main difference is that the parti starts with a global concept while the organization emerging from a bottom-up generative process starts with constitutive local relationships and ends up with an emergent organization that requires an additional effort to be described with respect to its global outcome. However, neither globally imposed parti, nor emergent global patterns, are automatically recognized as *architectural order*. The theory of architectural autopoiesis reserves the concept of order for organizations that become apparent – visible and legible – via the effort of articulation.

The *concept of order* proposed here thus denotes the result of the combined effort of organization and articulation. Architectural order – symbiotic with social order – requires *both* spatial organization *and* spatio-morphological articulation. Spatial organization and morphological articulation together produce architectural order. With respect to the question of how to design an architectural order we might thus pose two related sub-questions:

1. How can a workable organization (parti or emergent pattern) be found and ascertained?
2. How can this organization (parti or emergent pattern) be made intelligible and effectively brought to life with respect to the perceiving/conceiving/navigating social actors?

The first task is *the task of organization*. The second, dependent task is *the task of articulation*. These two tasks deserve to be distinguished. Each demands its own distinct design effort.

The reference to intelligibility/navigability is necessary to tie the concept of order to performance. This, however, complicates matters. It transforms the concept of order from a category that merely describes and compares an objective property of an architectural than the unified diagram of the courtyard villa. Subsidiary concerns like the handling of natural light within the house or the kitchen typology should in the final analysis also be guided by their contribution to the architectural order that facilitates and manifests the social order, ie, the order of the life-process that is supposed to unfold within the house. Order understood as the integration of all substantial functions is thus the alpha and omega of the design effort. Obviously this abstract statement gives no hint as to how such effective order can be achieved or ascertained.
artefact/configuration to a category that describes and compares a relation that holds between an architectural artefact and a (socialized) user/audience that perceives and (hopefully) comprehends this artefact/configuration. The concept of order proposed thus has an objective as well as subjective aspect. The objective aspect is the (degree of) organization within a configuration. The subjective aspect is the (degree of) articulation within an organized configuration, ie, the extent to which the organization is retrievable by a navigating/perceiving subject.

Organization is based upon the constitution and distribution of positions for elements and their pattern of linkages. Articulation is based upon the constitution and the distribution of morphological identities, similitudes and differences across the elements to be organized. Organization is instituted via the physical means of distancing, barring, as well as connecting via vistas and/or circulatory channelling. These mechanisms can operate independently of all nuanced perception and comprehension, and can thus in principle succeed without the efforts of articulation. However, the restriction to a mere organization without articulation, and thus without facilitating the participants’ active navigation, would severely constrain the level of complexity that would be possible in the social communication thus framed. Articulation, the distinction and distribution of morphological characteristics, presupposes cognition. It enlists the participant’s perception and comprehension and thus facilitates the participant’s active orientation. The two registers relate as follows. Articulation builds upon and reveals organization. Articulation makes the organization of functions apparent. In doing so it elevates organization into order. Articulation might also, to a certain extent, compensate for organizational patterns that deviate from the intended relations. For instance, if a given physical configuration separates what belongs together or pushes together what should be separated (for example, because of tight packing constraints), articulation can counteract these shortcomings by morphologically assimilating what is spatially distant and by morphologically distinguishing what is spatially continuous.

The concept of organization is updating and systematizing the concerns traditionally addressed in the concepts of compartition, distribution and composition. The concept of articulation is updating and systematizing the concerns traditionally addressed in the concepts of decoration (ornamentation), character and expression. The notions of character and expression hinted at the goal of articulation, and the notion of ornament was seen as the primary means of articulation. Contemporary architecture operates with a vastly expanded formal repertoire if
compared with Classical architecture – with respect to both its organizational and articulatory registers. Morphological articulation is a much more fundamental register than traditional ornamentation – it encompasses the global shape, tectonic constitution and surface treatment of the architectural elements in question.

The crucial conceptual difference between those traditional notions and the contemporary concepts of organization and articulation is that the latter are ultimately seen as instrumental with respect to the social life-process and its functional requirements, while composition and ornamentation were often considered to be serving beauty as a value in its own right.

However, the ultimate functional instrumentalization of organization and articulation does not imply that the theoretical elaboration of those concepts must be directly tied to the discussion of functional concerns. Just like composition and ornamentation were discussed and taught in their own right, the theory of organization and the theory of articulation must be able to develop their respective concepts, criteria and repertoires with a degree of abstract generality and versatility that prevents instant performative evaluation, even if its effective instrumentalization remains its destiny. Instead of operating with fixed form-function unities like (Gothic) ‘church’, (Renaissance) ‘villa’, (Baroque) ‘palace’ etc, contemporary architecture must develop three initially independent conceptual registers, each with a rich apparatus of distinctions. There must be an organizational register, an articulatory register and a functional-programmatic register. These registers must first be unfolded independently. Only on this basis can the architect inquire into how these three registers might best be brought together to establish viable designs. On the basis of a rich, threefold repertoire, and threefold intelligence, the architect can experiment with pertinent correlations and inquire which functions select which organizations, and which organizations select which articulatory morphologies. The clear differentiation and independent elaboration of these three registers are a precondition for finding ever more effective possibilities (solutions) for their effective collaboration. This enhancement of architecture’s ability to analyze and recombine its concepts is a precondition of architectural innovation.

The concepts of order, organization and articulation all make sense for both domains that are to be correlated – for the domain of the social process and for the domain of architectural space. Thus we can speak of

64 The first two registers together prepare the formal side in the build up of form-function correlations.
both social and architectural order, of both social and spatial organization, and also of both social and spatio-morphological articulation. However, there can be no direct translation from a social, language-based articulation to the required architectural articulation. The path of translation is routed via organization. Social organization translates into spatial organization by way of translating the patterns of social distinction, social grouping and social communication into spatial partitions, enclosures and connections. The sequence of design then moves from organization to articulation.

Articulation cannot be dispensed with. This is due to the fact that cities, urban spaces and buildings function only via their utilization by perceiving and comprehending subjects who need to recognize and understand the built environment in order to navigate and utilize it effectively. The effective social order requires an articulated spatial organization: architectural order. Even without articulation as consciously guided design effort, the inevitable spatio-morphological (‘compositional’ and ‘decorative’) features of the resultant design will be (more or less successfully) utilized as orienting clues within the social life-process accommodated within the designed territory. Every designing architect articulates intuitively. Both phenomenological and semiological aspects are taken into account even without an explicitly theorized expertise.\(^65\) This is also the case with vernacular building. The city confronts society with its image. This was perhaps clearer in the old days when most social relations were literally enclosed within the bounds of the city wall. Anthropologists are able to detect the structure of primitive societies in their settlement structures. This is certainly more difficult with respect to modern urban environments. An ordered built environment remains, however, an indispensable aspect in the ordering of social interaction. The sociologist Dirk Baecker sees urban space as a ‘symbiotic mechanism of society that makes the complex relations of life...phenomenologically palpable’.\(^66\) The important point here is that this spatial representation of society and its various social systems does itself become a productive (and indeed indispensable) factor in the functioning of society. The more complex the social order becomes, the more it pays to upgrade architecture’s ability to construct visual order and legibility in the face of this increasing social complexity.

\(^{65}\) The theory of architectural autopoiesis proposes that it is time to move beyond this intuitive handling of the environment’s legibility. The task of articulation must become the explicit subject of a principled and self-critical intelligence.

6.2.3 A DEFINITION OF ORGANIZATION FOR CONTEMPORARY ARCHITECTURE

In very general terms organization (and therefore by extension order) is understood as the opposite of arbitrary randomness. This very basic definition must be our uncontested point of departure. The task of spatial organization is working against utter randomness or chaos by establishing a pattern, a spatial organization. The encompassing concept that comprises both spatial organizations and spatial chaos is the concept of configuration: comprising both organized and arbitrary (unorganized) configurations.

While traditional notions of organization and order sought to constrain arbitrariness via the adherence of a configuration to a preconceived, ideal pattern or scheme, for instance via grids, preconceived proportional schemes and symmetries, contemporary notions of organization are much more open with respect to the mechanisms that might restrict randomness. Contemporary mechanisms might hinge on the establishment of local interdependencies between elements rather than on the dependency of elements on prior, global schemata.

Both Classical and Modernist architecture display compositions that arrange a handful of preconceived, identifiable parts – geometric figures like rectangles/cubes, circles/cylinders/semi-spheres and triangles/prisms/pyramids – according to simple relations/operations as follows: Classical architecture uses repetition, symmetry and proportion. Modernism uses fewer constraints, allowing for asymmetry as well as for stretched proportions without proportional coordination. Modernism allows for an increased heterogeneity within large architectural configurations like institutional buildings or ensembles. However, usually orthogonality is presupposed throughout in both the global configuration and its parts and details. Modernist design operates by means of separating parts and allowing each part to develop an independent morphology according to functional requirements. Within each separated part of the composition repetition is used extensively. To give a certain sense of global unity to these compositions, Modernism uses the loose concept of dynamic equilibrium.

Modernist compositions are more open/incomplete than Classical compositions, and are overall less constrained. In this sense we can say that Modernist compositions are less organized in comparison to Classical compositions. This trajectory of decreasing organization by removing constraints continues with Postmodernism and Deconstructivism. Deconstructivism removes the presupposition of orthogonality, and it allows new moves – like the overlap of geometric figures and the interpenetration of different grids – that both expand the repertoire and
decrease the degree of organization and thus predictability of the design. By predictability we mean here two related things: first, the predictability of a particular design move/decision within the design process (design progress predictability) and, second, the ability to make predictions or successful guesses – while moving through the building – about how the building continues (configuration predictability), i.e., local to local inferences as well as local to global inferences that facilitate successful navigation. We can thus observe a historical trajectory in the development of 20th-century architecture that paid for successive repertoire expansions (that in turn afforded increases in architecture’s response versatility) with a successive decrease in organization and thus navigability.

The question thus arises here whether this trade off is inevitable or whether it is possible to combine further, necessary increases in architecture’s response versatility with a simultaneous increase in organization. The thesis proposed here is that the contemporary style of Parametricism is – in principle – geared up to accomplish this combined advance of versatility and organization. The style is further set up to augment complex organizations via pertinent techniques of articulation that make the elaborated organization legible, thus potentially establishing an architectural order capable of addressing the complexities of contemporary society. The demonstration of the thesis demands first of all a more precise concept of organization that allows at least the comparison (if not measurement) of degrees of organization. As a priori criterion for such a definition of degrees of organization we stipulate that higher degrees of a thus defined organization must, if appropriately articulated, lead to a higher intelligibility and navigability.

The theory of architectural autopoiesis values organization and order in the sense defined here. Organization implies organized complexity as distinct from both configurations that lack determination (organization) and configurations that lack complexity (diversity). Both types of spatial configurations are equally disorienting and incapable of effectively ordering/framing the processes of contemporary society. From the perspective of the spatial needs of contemporary network society, the Modernist regime of serial repetition lacks complexity. The Modernist urban and architectural repertoire – well-adapted to the era of Fordist mass society – can no longer accommodate the complexity of Post-Fordist network society. However, the unregulated expression of diversity that has followed in the wake of the crisis and abandonment of Modernism is equally disorienting: it lacks organization.

6.2 ORDER VIA ORGANIZATION AND ARTICULATION

Figure 1  Fordist urbanism: determination without diversity, Ludwig Hilberseimer, *Groszstadtarchitektur*, 1927

Figure 2  Moscow City, 21st century: diversity without determination

The relentless seriality of Modernism made way for the Postmodern principle of collage where no regulation constrains the agglomeration of difference. In urban agglomerations like the one depicted in Figure 2, all elements and their properties are chosen without regard to each other. There are no relations or interdependencies set up between buildings. Everything is equally possible and equally unexpected. Neither the repetition of the same nor the collage of the different is appropriate for
the spatial organization and architectural articulation of contemporary society. The key to a much more appropriate urban and architectural response might be found in the kind of organized complexity one can observe in natural systems. Here lies the profound motivation for the recent interest in natural systems.
Natural systems display the coincidence of rich differentiation and rigorous determination that we recognize as the key characteristics of organized complexity. Complexity theory – with the aid of digital computation – has been able to analyze and simulate the rule-based formation of this kind of organized complexity. These systems have been referred to as ‘self-organizing systems’ because the build up of the organization has been revealed to proceed bottom-up, often via the build up of hierarchical levels, but always without the need to presume that an a priori mould or telos is being imposed from outside.

6.2.4 COMPLICATED, COMPLEX, ORGANIZED, ORDERED

Architectural order facilitates social order and its effective realization requires organization and articulation as crucial registers of the design effort. The first task is the task of spatial organization. The second, dependent task is the task of spatio-morphological articulation. The combined effort results in architectural order.

The theory of architectural autopoiesis distinguishes organizations from mere configurations. To be more precise: the class of all configurations encompasses organizations as a special subclass. Organizations are then to be understood as configurations that satisfy some additional criterion, namely the criterion to be organized. In what follows here this tautology will be unpacked, and an operational definition of relative degrees of organization will be offered.

An organized spatial configuration is defined in opposition to an arbitrary or random configuration. A configuration is random when no position/property of any element within the configuration in any way constrains the positioning or property of any other element within the configuration. No rules exist that regulate the configuration, no correlations are prescribed. The result is a zero degree of organization. A random configuration is the outer limit of a spectrum that stretches

---

68 The concept of complexity will be elaborated and formalized below.
69 For social order we might stipulate the same aspects of organization and articulation. Social organization is more effective if it is articulated, ie, perceived and comprehended by the participants of social interactions. A police officer is more effective if his/her position and status is readily recognizable. In general language, the availability of single terms for social positions is a primary mechanism for articulating social organization. However, design and architecture participate as well in this articulatory effort.
70 The concept of organization is updating and systematizing the concerns traditionally addressed in the concepts of compartition, distribution and composition.
71 The concept of articulation is updating and systematizing the concerns traditionally addressed in the concepts of ornamentation, character and expression. The notion of character hinted at the goal of articulation (expression) and ornament was seen as the primary means of articulation.
between mere configurations and highly organized spatial systems. Random configurations in this sense define a limit case that we should not expect to exist in the built environment. The apparently ‘random’ patterns one finds in unplanned settlements do not constitute pure randomness. Bill Hillier has demonstrated that such irregular developments follow patterns that emerge from the observation of locally applied rules. Those rules might best be characterized as constraints on an otherwise random agglomeration. What might appear as chaotic or arbitrary might reveal a hidden organization through an upgraded analysis that has a more advanced, richer repertoire of organizational notions at its disposal. It therefore makes sense to open the concept of spatial organization as much as possible and let the boundary of the concept be marked by the utterly arbitrary and formless, ie, configurations that resist any attempt to be predicted, summarized and reproduced.

From this definition of the limit case of a totally random configuration several ways open up to build up degrees of organization by working away from this radical arbitrariness. If we describe the configuration by describing its constitution via its sequential build up we can distinguish various ways of working away from randomness.

The first approach is the idea that a spatial organization is a configuration the description of which can be condensed into a formula. This implies that a spatial organization can be constructed or reconstructed via some production rule. Such rules might give exact determinations that leave nothing to chance. The result will be totally organized, a total organization – the other limit case in the spectrum from configuration to system. Again, we should not expect a total organization in the reality of the built environment. Unique contextual conditions and other unexpected circumstances are likely to produce singularities that intervene with the unfolding of the deterministic rule.

The first way to build up an organized spatial organization is to define a formula, ie, a recursive rule that successively produces the overall pattern. The process starts with a single element and uses its position and properties as starting input for the stepwise proliferation of similar elements according to a recursively applied function. The resultant configuration is fully determined with respect to the positions and

72 Hillier analyzed and simulated the typical settlement patterns of the villages of the South of France. The typical pattern is the ‘beady ring’ pattern. Hillier’s simulation involves rules that operate via specific local restrictions of an otherwise random process. Bill Hillier & Julienne Hanson, The Social Logic of Space, Cambridge University Press (Cambridge), 1984.

73 The string length of such a formula in a given formalized language can be taken as a measure of the organization’s descriptive complexity, also referred to as Kolmogorov complexity. This measure is obviously relative to the language used.
properties of all its elements. Branching L-systems are a classic example of systems that are defined via such recursive rules. Grids can also be constructed by means of such recursive rules. The same goes for radial city systems with radials and concentric rings. These three types of systems are obvious and easy to recognize. However, the definition of the concept of organization does not imply that its systematic constitution is readily apparent. The retrieval of the generative rule is a matter of analytical reconstruction. The recognition of organization/systematicity is a matter of Gestalt perception. Neither can be taken for granted. It is the design task of articulation to enhance the chance of an organization’s successful recognition.

The three typical urban systems mentioned above display regularity. Regular organizations have a greater chance of being detected and understood. A regular spatial organization is not only determined with respect to the positions and properties of all its elements, it is also self-similar throughout its expanse. Not all recursive rules produce regularity. There are further constraints to be observed to achieve regularity. For instance, there must be a provision against the spatial interpenetration of elements. Also, the element parameters must be constrained within a certain range in order to preserve sufficient self-similarity.

Instead of working with fully deterministic rules, one might also script rules that integrate partial randomization. Such rules define conditions that allow for arbitrary choices, constrained within certain parametric boundaries. If we compare two similar configurations based on two similar branching algorithms – one fully deterministic, the other partially deterministic – the fully deterministic configuration is stipulated to be more systematic, more organized. However, determination is not the ultimate endgame of the pursuit of high levels of organization. There is another key dimension of organization: complexity.

Since there is an unlimited number of generative or recursive rules that can fully determine a spatial system, the degree of determination does not serve us well in distinguishing degrees of organization. There must be at least one other dimension that deserves to be taken into account. If we compare two branching systems – one where the branch length and the angle of branching stay constant from generation to

---

74 Regularity is a broader concept with weaker requirements than the concept of repetitiveness. Both repetition and iteration are compatible with the requirement of regularity.
75 These boundaries must either vary systematically across the expanse of the territory or vary according to local conditions that emerge and therefore lead to a self-induced concatenation of constraints.
76 The concept of complexity will be elaborated and formalized below.
generation versus another one where the branch length shortens (or
elongates) and where the angle progressively opens (or closes) with each
generation – which of the two systems should we consider to be more
organized? The decision should not be too difficult: intuitively the latter
system would be considered to be of a higher degree of organization
(irrespective of the fact that without such a progressive rule the system
would soon terminate due to self-intersection). The latter system displays
a higher degree of complexity – it contains more variation – without losing
its determinateness or systematicity. A system that only varies branch
length but keeps the angle of branching constant would be less
organized, displaying a lesser degree or lower level of organization. A
spatial configuration that subjects the length and/or angle of branching to
a more elaborate rule (rather than a mere linear progression) would be of
higher organization. In general we stipulate that the degree of
organization increases with the complexity of the rule system. The
increase of complexity must be determined complexity. The degree of
determined complexity is reflected in the complexity (length,
elaborateness) of the formula or script that generates/determines the
system. Thus we arrive at a second dimension of organization: the degree
of determined complexity.77 On this count the Manhattan grid is of
(slightly) higher organization than a fully isotropic grid. The degree of
organization – due to the build up of determined complexity – shows up
determined differentiation of the system. Taking up the example of the
variously defined branching systems above, we can observe that the more
organized branching systems that vary branch-lengths and angles
according to a rule produce a spatial field that is lawfully differentiated.
This lawful, rule-based differentiation affords an important property: it
allows us to infer additional information from the given parameters.

The comparison between the two most typical urban systems – simple
grid system and simple radial system – allows an assessment of their
relative degree of organization. The radial system is more organized than

77 Determined complexity is thus the descriptive complexity of the condensed production
formula that generates the determined complexity. Mirco Becker gives the following example:
a set of 100 points with random distribution has to be determined by XYZ coordinates thus
leading to 300 entries in a table in order to be fully described. 100 points with equal distance
along an axis of a Cartesian coordinate system can be expressed in a compact formula stating
the XYZ coordinates of the first point, the modulus – equal distance, and the total number,
thus only requiring five entries in a table. (Becker talks about algorithmic rather than
determined complexity and uses the term ‘structure in a data-set’ rather than organization in a
configuration.) The random distribution has complexity of 300 but no organization, the
equidistant set along an axis has a fully determined complexity but a relatively low level of
organization because of its low level of complexity. See: Mirco Becker, ‘The Generative and
the grid system because it is more complex and differentiated. The grid is undifferentiated and affords no local to local or local to global inferences. There is no local spatial difference between the interior (geometric centre) of the overall grid and its peripheral regions. In contrast, the radial system has a marked singularity – its centre – and the system is continuously differentiated: moving outwards the concentric rings increase in radius and the ring segments between the radials increase in length. The system establishes a correlation between a road’s radius and its distance from the centre. This systematic, correlated variation in turn affords local information about the position within the overall system. The convex side of the road points towards the centre and the concave side points outward. The proximity to the centre can be read off the radius of the ring. This particular information is redundantly underlined by the length of the ring segments. These local properties are inherent in the geometry of the system. They are available – as potential orienting information – even without articulatory intent or effort. They become actualized to the extent to which the global system is understood and thus available as guiding mental map, and to the extent to which the local properties become perceptually available. (The aspect of perceptual availability might require further articulatory efforts.) However, the embedded information is relatively weak due to the large degree of symmetry within the system, i.e., there are many positions with the same local parameters. Further systematic differentiation (symmetry-breaking) would lead to further potential orienting information. In this sense a radial system built upon ellipses rather than circles would be of higher organization.

The first way to build up organization – in contradistinction to random configurations – is to determine the build up of the configuration from scratch, step by step, via a (partially) deterministic, generative formula or recursive rule. A second way can be described as follows: to build up organization one might start with a random disposition of more or less self-similar elements as a base configuration. Then – with respect to this initially arbitrary configuration – rules might be defined that place additional layers of elements according to parameters read off the initial random layer. The initial configuration might be generated by a random process. Often the given site and its context, or rather a specific analytical reading of a given site/context, might serve as a quasi-random starting point. Functions might then be defined that constrain all further moves on the basis of the initial layer. The parametric disposition of the

Potential orienting information becomes actual orienting information when the objective correlations within the system are further articulated to trigger subjective associations within the users of the system.
additional layers is then driven by the parameter distribution of the initial, random configuration. Systematic correlations are thus formed, and the degree of organization increases with each new layer. With each new rigorously scripted layer determined complexity, and thus the degree of organization, increases. Complexity increases with each new layer in relation to the number and variability of the new elements placed and with respect to the elaborateness of the rule that is applied. The increase of complexity without rule-based determination/correlation does not increase organization. We might say that this indeterminate increase of complexity results in extensive complexity. Consequently we might use the term intensive complexity for the result of the determined increase of complexity.

This elaborated concept of complexity is the key to give the concept of organization an ordinal-comparative meaning and measure. (However, the degree of complexity of a configuration is not the same as its degree or level of organization.) With respect to the relative measure of complexity within a configuration we might distinguish two dimensions of comparison: extensive complexity and intensive complexity, each comprising two sub-dimensions. These dimensions allow us to speak of a relative increase or decrease of organization within a given design process, ie, whether a certain design move increases or decreases organization, or which of two design moves engenders a larger increase in organization. An increase in intensive complexity always increases the degree of organization. An increase in extensive complexity might reduce the degree of organization unless it is accompanied and captured by a simultaneous increase in intensive complexity. Complexity is thus Janus-faced. It only increases organization to the extent to which its introduction is determined by rules of correlation. An increase of merely extensive complexity lowers the overall level of organization within a configuration.

extensive complexity: this measure depends both on the number of distinguishable items and on the diversity of those items within the configuration

---

79 There are various attempts to measure complexity within different contexts. The one proposed here is not based on any specific source.

80 However, this definition neither allows us to measure across disparate, unrelated designs, nor do its dimensional values ever add up to deliver a single value that could rank different versions of a design that differ in several dimensions at the same time. The application of the concept is thus subject to severe ceteris paribus restrictions, ie, comparisons can only be made one dimension at a time, while assuming everything else to be equal.

intensive complexity: this measure depends both on the density of interdependencies between the distinguishable items and on the diversity of those interdependencies within the configuration.

Extensive complexity provides only the necessary basis upon which intensive complexity can be built up via the establishment of interdependencies. To the extent to which the number/diversity of items (extensive complexity) in the configuration is not becoming the basis of establishing interdependencies (producing intensive complexity), it is producing mere complication. The degree of complication – measured by those items that remain unrelated/independent and by those types of items (diversity) that do not make a difference in terms of the establishment of interdependencies – detracts from the relative degree of organization, and thus finally from the degree of order the respective configuration achieves.

Intensive complexity builds upon extensive complexity by grouping items into sets and then defining (scripting) correlations (functions, mappings) between those sets. Extensive and intensive complexity relate differently to organization. While intensive complexity increases organization, merely extensive complexity reduces organization. But the relationship is not one of simple reversal. The increase of extensive complexity – while initially reducing organization – increases the opportunity/potential for intensive complexity and thus for an enhanced degree of organization, if further interdependencies are established.

The process of organization is a process of establishing interdependencies. As the design progresses, the density of these interdependencies should increase. This means that organized complexity is built up rather than mere complication. Any parameter (property or relation) of any item might be associated with any parameter (property or relation) of any other item (or sets of items). The perfect technique/vehicle for this is scripted functions.

The two dimensions of complexity are incommensurable. Degrees of complexity cannot be measured on a unitary scale. It is a multi-dimensional ‘measure’ that cannot be reduced to a single scale. This does not invalidate the concept. The concept defined here is conceived to allow comparisons within an ongoing design process. The concept/measure is operational as long as it allows the designer to assess whether a certain proposed design move increases or decreases the organization of the design. With sufficiently small (or sufficiently decomposed) design steps there should be no problem in applying the criteria proposed here. The introduction of additional elements or layers
within a configuration increases complexity. However, they increase rather than decrease organization only if their introduction is rule-based so that the positions and properties of the new elements are not only internally correlated but correlated with (and thus at least partially determined by) what had been built up already. Any random interference, deletion or distortion of what has already been determined/correlated decreases the level of organization. For instance, the injection of a random scatter of buildings into an urban grid or onto a radial urban system decreases the degree of organization. Even the imposition of a further internally systematic layer increases the overall level of organization only if there is a systematic correlation with what was there already. Bernard Tschumi’s design strategy for his Parc de la Villette serves as an example. The project builds up complexity by layering multiple urban geometries: point grid system, system of primary geometric zones (circle, triangle, square), system of winding paths. Each configuration is internally systematic, but they are wholly indifferent (uncorrelated) with respect to each other. According to our stipulation there is a decrease of organization with each new superimposed layer. The project becomes ever more chaotic. However, this build up of extensive complexity prepares the ground for the build up of intensive complexity via correlations. Huge increases in organization would be possible if these layers were now to adapt to each other via rules of inflection and modulation.

A highly organized configuration is marked by a rich, systematic differentiation. For the design process this recommends the following two-step strategy. If the system lacks initial differentiation (grid, simple radial system) then first increase complexity by an initially random injection of elements or layers. The resultant differentiation could then be overdetermined by systematic rules of adaptation that take up and correlate at least some of the new material with what else is there. The first step establishes a complicated configuration via extensive complexity. The second step transforms this extensive complexity into intensive complexity, and thus increases the organization of the configuration.82

An example of this is the utilization of ‘forces’ to distort/differentiate a grid. The imposition of attractors is random, but their dynamic correlation leads to a coherently differentiated field and thus to an increase in the overall degree of organization. Once a sufficiently complex differentiation (with sufficient asymmetries and gradients) has been achieved, further injections of complexity might be determined by scripts without any

82 Due to the random component in the generation of the configuration it can never reach the total organisation or full determination of a pure system.
further injection of randomness. The determination via scripts ensures organization. The process increases both complexity and organization resulting in **organized complexity**.

Within the prevailing trend of contemporary avant-garde architecture, organized complexity rather than total organization is the primary aim. Guided by the ambition to increase organized complexity, the design creativity moves from individual manipulations of elements to the conception of collective manipulations that handle many instances simultaneously, each individually formed according to the intersection of global rules with local parameters. The build up of organized complexity according to the Parametricist rule-imposing heuristic is cumulative and implies that an initially arbitrary beginning leads to a more and more self-constraining organization where each additional element or design intervention must be ever more carefully elaborated to satisfy and continue the complex web of rules and interdependencies already established. The overall organization remains open – it never achieves completion or perfection like, for example, a Palladian villa – but the probability that a design move disrupts rather than enhances the design increases with every further move. The further elaboration of the design becomes increasingly difficult the more the design advances. (A sense of necessity is therefore the subjective corollary of this situation from the designer's perspective.) Successful Parametricist designs share this feature with highly evolved organisms. Modernist, Postmodernist and Deconstructivist designs do not experience this increasing tightening of the remaining space of possibilities and the attendant increase in the difficulty of elaborating satisfying solutions for further design requirements or details. For Modernist, Postmodernist and Deconstructivist designs, a late design move is nearly as easy and unconstrained as an early move. Nearly anything goes. These compositions are far less organized.

The Parametricist build up of organized complexity often proceeds hierarchically, whereby correlated/interdependent sets of items (systems) are set into correlations (functions, mappings) with other such integrated sets of items or systems. Such systems are often functional units or subsystems. One might think of the subsystems of a tower, such as envelope, structural skeleton, system of spatial divisions, circulation system etc. Each of these systems is itself comprised of interrelated parts. According to the design research programme of Parametricism, one would expect each of these systems to be internally differentiated rather than repetitive (as one could assume in Modernism), ie, the skeleton's

---

83 Parametricism aims for organized complexity while Minimalism aims for total organization.
elements and their pattern of connections should be differentiated along
the vertical axis of the tower in accordance with load and moment/stability
parameters. The skeleton’s particular pattern of differentiation can now
become the input data-set for driving (aspects of) the facade’s internal
differentiation while other aspects/properties might be differentiated in
accordance with environmental parameters. The structural system might
in turn adapt to this envelope differentiation by producing a secondary
differentiation, albeit without undermining its primary differentiation.

To the extent to which such differentiations are articulated and
become legible, their organization contributes to the establishment of
architectural order. For instance, the visible differentiation of the skeleton
offers clues (facilitating positional local to global inferences) as to
whether one is relatively high or low within the building, or the visible
differentiation of the facade’s shading devices along the tower’s
circumference might offer clues (facilitating positional local to global
inferences) as to one’s orientation. Again, to the extent to which the
correlation between these two subsystems of the tower is legible, ie, to the
extent to which the skeleton’s differentiation shines through the facade or
is even further accentuated and revealed by the facade, organization is
elevated to become order. In this case the subsystems involved in the
scripted correlations become indeed representations[^84] of each other.

Above we emphasized that a Parametricist design transforms an
arbitrary beginning into a highly elaborate, complex order that assumes
the semblance of necessity for the designer. To the extent to which this
ever more tightened network of organizing correlations is articulated
(made visible/legible), an awe-inspiring elegance[^85] results.

6.3 Organization

THESIS 27
Proficiency in establishing compelling new form-function relationships
requires a system of abstract mediating concepts that can guide the
correlation of spatial with social patterns.

Although the importance of organization (compartition, distribution,
composition) has often been emphasized, traditional architectural theory

[^84]: The German word for mathematical function ‘Abbildung’ literally translates as
’representation’.
gives more space to the discussion of construction and decoration. The relative sparsity of detailed thoughts on distribution might be due to the relatively simple layouts of most historical buildings. Recommendations are concerned with the orientation of various rooms – bedchambers to the east, dining rooms to the west etc – with the appropriate shape and proportions of the various rooms, and with symmetry in the overall arrangement. The absence of an elaborated theory of distribution continued throughout the 19th century and throughout most of the 20th century. Only since the 1960s have theoretical resources been developed that are able to facilitate the principled build up and tractability of much higher levels of organizational complexity. However, those resources have remained marginal within the autopoiesis of architecture. It is one of the ambitions of the theory of architectural autopoiesis to shift these resources further into the centre of attention, at least (initially) within the avant-garde segment of architecture. Since these theoretical resources are capable of being handled computationally (parametrically) there is a justified hope that the current intensification of Parametricist design research will take note of this demand and opportunity.

The task of architectural design, project by project, is the elaboration of an architectural order that catalyzes, facilitates and maintains the specific social order to be accommodated. The first component of this task pertains to organization, i.e., the translation of social organization into spatial organization. One might call this first subtask the projection of social structure into space. The accomplishment of this task can then form the basis for the task of articulation. Organization and articulation together establish a legible architectural order as the precondition to speculate about and simulate effective action-artefact networks understood as architecturally framed scenarios of social interaction.

It is the global spatial organization of the design that constitutes the first problem that any architectural design has to solve. The global spatial organization might be conceived in top-down fashion or might result from a bottom-up process. In the first case we might speak of a parti. In the second case we are dealing with an emergent pattern. The initial parti or pattern has to be further manipulated and adapted if the project is to accommodate a complex social institution or life-process beyond the threshold of the trivial. How can this parti or pattern be found and ascertained? The problem is how to guide the search of promising correlations between social institutions and spatial arrangements. The ability to address this task hinges on the repertoire of possible organizational patterns as well as on the methods of evaluating the options available within the given repertoire.
Architectural design is first of all concerned with organization. Few architects would disagree with this. But when faced with the request to elaborate this general dictum by describing specific patterns of organization most architects remain mute, or are at best able to hint at vague distinctions like hierarchical versus non-hierarchical organization. The truth is that the discipline does not have any sophisticated descriptive terminology at its regular disposal. It seems high time that architecture overcomes this muteness and acquires a much richer and more precise conceptual apparatus to cope with contemporary demands to organize increasingly complex institutions.

The continued autopoiesis of architecture must allow for the replenishment of the universe of possibilities that is the source domain or solution space within which the organizational forms are searched for in this crucial initial design stage. How can this universe of possibilities be systematically expanded? And where can we find the appropriate search heuristics and evaluation criteria that must complement the expanded repertoire?

The aim of this section on organization is to give initial indications towards the elaboration of a detailed and systematic ‘art of organization’ that builds its principles upon a rich descriptive terminology and systematic apparatus of concepts, measures and theorems. Only on this basis can the discipline develop an effective organizational design intelligence that is adequate to the task of framing the increasing complexity of contemporary communication patterns.

6.3.1 RELATING SPATIAL TO SOCIAL ORGANIZATION

The original, most general question, ‘How can functional requirements be effectively addressed by architectural forms?’, has been broken down to arrive at the formulation of a first crucial subtask: architectural design is first of all the translation of social organizations into spatial organizations. What has been gained by this re-formulation?

What has been gained or acquired here is the concept of organization as central mediating concept between social function and spatial form. The concept of organization is a crucial lever to retool the discipline. If contemporary designers locate their efforts on the level of abstraction that is afforded by the concept of organization – the central concept that is shared between the domains of social organization and spatial organization – then they can adequately address the task of correlating complex social processes with complex architectural arrangements – provided that architectural theory can sufficiently unfold this concept of organization. This implies the systematic distinction of different types of organizational patterns – the construction of an organizational
6.3 ORGANIZATION

taxonomy – and the definition of pertinent qualities and measures of organization that apply to both the social and the spatial dimension. Such a system of organizational concepts provides a viable set of mediating terms, ie, terms that can mediate the domain of social functions with the domain of spatial forms and thus facilitate the effective correlation of social and spatial organization.86

The correlation between social and spatial patterns of organization is well prepared by the fact that the language for the conceptualization of the social world has been derived primarily from the language of space. Spatial relations form the primary source domain for metaphors and concepts of social order. Fundamental spatial concepts like position, distance, domain, boundary and symmetry have all been borrowed to describe social order. The very concept of order itself has its roots in spatial order and architecture.

Architectural organization is the spatial organization of a given social organization. Spatial organization primarily proceeds by means of boundaries. Boundaries both enclose and divide space. Originally this was very much an act of claiming and defining a bounded domain or territory against an undifferentiated, virgin background. However, such virgin ground has long since disappeared and architectural organization takes the form of a re-division or further subdivision of a given system of boundaries/territories. The initial task of architectural design might indeed be concisely defined as the distribution of (permeable) boundaries that both separate and selectively connect social domains and activities.87

Enclosure produces unities that might be further divided. Further enclosures might be established within enclosures thus producing a system of nesting enclosures within enclosures. Thus a hierarchical (but not necessarily stratified) organization is established. Division produces parallel spatial segments (segments next to segments) that might represent a segmented, stratified or functionally differentiated social organization.88

86 The theoretical paradigm of ‘space syntax’ is an interesting example where the formal elaboration of computational measures of spatial organisation has spurned an interdisciplinary discourse – with enlisting contributors from the social sciences – around the diverse application of the basic concepts and computational tools of space syntax. See Bill Hillier, Space is the Machine.

87 Compare: Christoph Feldtkeller, Der architektonische Raum: eine Fiktion. Annäherung an eine funktionale Betrachtung, Bauwelt Fundamente 83, Vieweg (Braunschweig/Wiesbaden), 1989.

88 A hierarchy of access might then be used to support a stratified social organization, for example, with the deepest, most remote space being of the highest social importance. A parallel access via corridor might support a segmented or functionally differentiated organization without ranking.
The theory of architectural autopoiesis adopts/adapts Deleuze and Guattari’s concept of **territorialization** as a general concept of organization by means of boundaries whereby a spatial continuum is broken down into discrete spatial units: **territorial units**. Territorialization thus encompasses both enclosure and division. This primary operation of territorialization – the drawing of a line (or outline) representing a boundary – produces the distinction of inside vs outside. The operations of enclosure and/or division might be repeated on the inside of the domain thus established. This way a complex system of nested inside/outside relations might be built up. This distinction of inside and outside – although relative to an assumed position – is (nearly) always applicable as the primary means of orientation within architectural organizations. Key terms in architecture that refer to organizational patterns like ‘plan’, ‘diagram’, ‘layout’ or ‘parti’ are mostly concerned with the pattern of spatial territorialization.

All the more significant is the radical break and expansion of organizational possibilities that architecture enacted when it set itself the aim of undermining the clear distinction between inside and outside, introducing concepts like overlap and phased transitions. These concepts, which in their Modernist guise still rely on the underlying operation of spatial division and the setting of boundaries, were further radicalized during the 1980s and 1990s, to the point where a whole new organizational paradigm beyond boundary formation becomes possible: the notion of space as a **continuously differentiated field** or medium in which gradients, vectors of transformation, directionalities and the distribution of densities etc replace the system of domains next to/within domains. Deleuze and Guattari distinguished smooth space from striated space.\(^89\) This distinction became influential within the architectural avant-garde discourse of the 1990s. The theory of architectural autopoiesis reaffirms and incorporates this distinction as denoting an important and powerful innovation in the theory and practice of contemporary architectural organization. In the terminological apparatus forged here, both smooth and striated regimes of spatial organization are territorializing regimes that produce ‘territorial units’. Even fuzzy sets are sets, and transitional zones operate like expanded boundaries. Territories might be defined by intensive field qualities rather than extensive enclosures. The theory of architectural autopoiesis requires a general, abstract category for the elemental units of spatial organization that can

be applied across all regimes or modes of organization. The concept of territory fulfils this requirement.

Although the discovery and promotion of smooth organization marks an extremely important innovation, the bulk of architectural production – both mainstream and avant-garde – and most of social life continue to operate under the regime of striation by means of boundaries. The result of striation, a territorialized space, might be obtained by two rather different design operations: the operation of enclosure/division on the one hand, and the operation of aggregating cells on the other hand. The successive (hierarchical) enclosure/division might be substituted by a (functionally equivalent) operation of successive (hierarchical) aggregation of territorial units into larger, encompassing territorial units. The result is the same: a striated world made up of discrete units of space. The organizational regime of striation thus encompasses the operations of enclosure, division as well as aggregation. The overarching concept of territorialization encompasses all processes of striation as well as the processes of smooth and intensive differentiation.

Territorialization must be complemented by defining connections between the delineated territories. The established boundaries must be opened up by means of apertures as points of access or visual connection. This way the established domains are linked and related. The concatenation and three-dimensional integration of these linkages might be abstracted and investigated as integrated path-systems each with their own respective configuration. The pattern of these path-systems is as important as the pattern of territorialization. Together they produce the effective system of spatial relations which can be considered as a spatial mapping or projection of social relations, reinforcing the relevant social distinctions, positions, linkages etc, and organizing the required social activities.

A spatial organization is thus only fully specified and established once a given pattern of territorialization is complemented by a pattern of connection. However, a comprehensive theory of architectural organization has to take account of both striated spaces and smooth fields. A smooth field pattern needs to be complemented by a pattern

---

90 Even most avant-garde work still operates via patterns of enclosure and division – although these patterns are more intricate than traditional and modern patterns. Contemporary patterns involve broken boundaries and interpenetrating domains.

91 In order to remain terminologically consistent, the theory of architectural autopoiesis must transmute Deleuze & Guattari’s concept of smooth space into the concept of smooth field. This is in line with the proposal to reserve the concept of space (as much as possible) for the Modernist conception of architecture as space. Against this concept of space the contemporary
of penetration. The penetration of fields does not necessarily involve fixed lines of movement. The actual patterns of movement observed might describe path networks. However, the field itself produces only a differentiated movement potential. The field might thus be described in terms of differential permeability maps, with different (gradually transforming) biases or resistances in various directions. If we utilize the general term territorialization to comprise the differentiating operations of both striation and smooth distribution, and take the general term integration to denote both the operations of connection and penetration, we can formulate as follows: there are two general dimensions of spatial organization that have to be addressed in every spatial organization – territorialization and integration.

The patterns depicted in Figure 5 might equally apply to the connection of striated space and the penetration of smooth fields. Each diagram connects the same 25 territories. The direct-lines pattern serves here as theoretical limit case against which all other types can be understood and measured. Each organizational type selects from the all-lines diagram according to a rule. The types can be evaluated via the double measure of total network length on the one hand, and average point-to-point path length (or imposed detour factor) on the other hand.

avant-garde – here theorized under the title of Parametricism – has been pushing the field concept. See Volume 1, chapter 5.4.4, From Space to Field.
These are important efficiency measures\textsuperscript{92} that urban planners/designers should take into account. These measures might also factor in the network formation of unplanned urban development processes. Besides these quantitative concerns, urban planners/designers should be cognizant of the fact that the different organizational types make a difference in terms of the systems of positions they establish. These respectively established spatial positions might take account of social significance, and thus the choice of spatial organization can be presumed to impact (if not impose) the social order of the accommodated population. The grid produces an array of (nearly) equivalent positions. In contrast, the star type creates a very strong centre that ‘controls’ all movements, or is able to take advantage of all movements. The branching system also establishes a centre but in addition sets up a series of subcentres. Both star and branching system establish a hierarchy of positions that will irresistibly produce a social or functional hierarchy. These organizational patterns operate like sorting machines. They are bound to structure the organization of the social communication processes that are unfolding in the respective territories. We might speak here about the demiurge-like power of architecture.

6.3.2 TERRITORIALIZATION AND INTEGRATION
The distinction of territorialization and integration\textsuperscript{93} is the most general and universally applicable distinction that might be placed at the starting point of a theory of spatial organization. Territorialization comprises striation (enclosure, division, cell aggregation) as well as smooth differentiation. It differentiates otherwise continuous, undifferentiated space\textsuperscript{94} into more or less distinct (fuzzy) territorial units (domains, 

\textsuperscript{92} The smaller the overall path network and the smaller the average detour factor, the more efficient is the network. However, the simultaneous application of both criteria pulls the network in different directions.

\textsuperscript{93} The distinction of territorialization and integration generalizes Frei Otto’s distinction of occupying and connecting. Frei Otto introduced this conceptual pair to identify the two complementary, constituent operations of all urban settlement processes. The conceptual pair of territorialization and integration generalizes this notion across all scales to include architecture and its interior divisions and connections. The notion of territorialization is substituted for Frei Otto’s notion of occupying in order to keep the conceptual pair strictly within the realm of spatial operations. Frei Otto’s notion of occupying conflates spatial and social operations. The conceptual apparatus developed here initially separates spatial and social organization to problematize their relationship. Compare: Frei Otto, Occupying and Connecting – Thoughts on Territories and Spheres of Influence with Particular Reference to Human Settlement, Edition Axel Menges (Stuttgart/London), 2009.

\textsuperscript{94} Obviously the natural landscape is always differentiated to a certain extent. Natural features and discontinuities are therefore often utilized and incorporated into the architectural pattern of territorialization.
regions, zones, sites, parcels, spaces, rooms). Spatial territorialization recurs on many scales. The process of territorializing differentiation thus becomes a continuous chain of sub-differentiations within differentiations. Urban design divides the urban territory into districts, urban blocks and individual parcels/sites. Architecture continues the process of division by segmenting the site or building complex into separate buildings, tracts or wings, floors and spaces/rooms. Territorializing differentiation might be effected by many means, ie, by means of boundaries (walls, fences etc) and sharp thresholds (curbs etc) or by means of continuous field differentiation (density gradients, light modulations etc) and morphological differentiation (morphing) as means of smooth field differentiations.

Integration integrates the differentiated territories. It connects the distinct domains within the subdivided space and penetrates the smoothly differentiated field. Integration might proceed by means of openings within boundaries and by delineating path-networks, or by means of distributing differential degrees of porosity that bias and thus pattern field penetration. Integration comprises both circulatory and visual integration.

The connection lines that channel the necessary movements between the domains either run along and between the boundary lines that set up the domains at each scale, or they run across the boundaries to cut across the various spatial domains and subdomains. Thus the connection lines are either parallel or orthogonal to the dividing lines. Beijing’s Forbidden City is an extensive urban complex where orthogonal circulation dominates, both within the urban spaces and within the buildings. Modern society has all but eliminated the orthogonal variant of the relation between connection and division. In former times – before the advent of modern society – roads were often interrupted by barriers at the boundary of domains, for example, by customs barriers and by the city gates. Within most pre-Modern buildings circulation went right through the middle of the spaces, from adjoining space to adjoining space, en suite (enfilade). The invention of corridors has all but terminated this condition.95

Typically, territorialization is subject to the organizing principle of nesting, ie, domains are embedded within encompassing larger domains which are in turn embedded within even larger domains etc. This works as much with fuzzy, gradient domains as it does with strictly delimited zones. Although the principle of hierarchical nesting has been prevalent

throughout the history of human civilization, striations (enclosures, divisions) can cut across each other, so that domains might overlap or intersect. The organizing principle of intersection also operates with both crisp and fuzzy domains. Just like fuzzy set calculus builds upon ordinary set calculus, so we might look upon smooth field organization as an enhanced form of striated space organization.

The principle of nesting has its complement in the dimension of integration: paths typically branch off larger and longer paths, which in turn branch off even larger/longer paths etc. Thus the principle of nesting enclosures is mirrored in the principle of successive connective branches and sub-branches.

Territorialization and integration complement each other and are tightly correlated. Neither of the two dimensions can claim any logical priority over the other. The same is true with respect to the design sequence in which these dimensions are addressed: the design of either dimension can (temporarily) take the lead. The same applies to (unplanned) developmental processes. Pathways through the open landscape set up lines along which subdivisions can proceed to segment the adjoining land, or the lines dividing the (for example, agricultural) domains acquire the function of circulation lines. Both with respect to design and with respect to developmental processes, the build up of an effective spatial organization involves the oscillation between territorialization and integration.

The contemporary built environment is fully territorialized and integrated. Spatial subdivision is directly linked with social appropriation across all scales: administrative domains, property in land and buildings, socially appropriated/dedicated spaces within buildings. Modern circulatory irrigation of space reaches nearly every domain independently. Every territorial unit is linked up with every other territorial unit. (There are no longer any ‘caught’ territories.) We can therefore equate circulatory connection with the public domain while spatial enclosure and subdivision can be – with very few exceptions – equated with the private domain. This rigorous distinction between the category of the private vs the public domain is a characteristic hallmark of modern society. Spatially this is reflected in the combination of total connection and total territorialization, ie, the spatial organization of modern society uniquely combines total territorialization (spatializing the private domain as inviolate social category, mostly via relentless striation) with total connection (spatializing the public as inviolate social category). It might seem that this condition represents a deep structural feature of modern society and that we should expect the attendant fundamental feature of the organization of space to remain dominant for a long time to come.
However, the new concept and repertoire of smooth field organization dissolves the strict dichotomy of public circulation versus private destination spaces and thus between public and private zones. The avant-garde interest in smooth and interpenetrating differentiations is not an unfounded enthusiasm. It is based on the identification of societal tendencies that at least point in the direction of more complex and dynamic forms of social organization that would find a better, more conducive registration and support in the regime of smooth differentiation that allows for conditions of smooth interpenetration and transitioning rather than relying on strict and determinate zoning. In any event, the distinction of the regime of striated space versus the regime of smooth fields is no either/or dichotomy. The two regimes can coexist.

While the partition of space into private parcels within separate buildings dominates the building scale, on the urban scale the boundless urban sprawl and the continuous modulation of the urban fabric tend to produce smooth field conditions. Also, within large private parcels, for example, within malls or within large corporate headquarters, an interior urbanism becomes possible that is based on the smooth differentiation of field qualities rather than relying on enclosure and subdivision with their attendant strict distinction of circulation and destination spaces.

6.3.3 SYSTEMS, CONFIGURATIONS, ORGANIZATIONS

A configuration is defined as a set of spatial elements that can be considered as a unit of interaction. Such a set of spatial elements might be either ontologically **homogeneous** or **heterogeneous**. If the spatial elements within the configuration are of the same type we speak of an ontologically **homogeneous** configuration, for example, nothing but lines of circulation (channels), or nothing but territorial cells (with or without overlap), or nothing but a scatter of destination points etc. An analysis that would be able to describe an architectural or urban artefact by simultaneously referencing different types of spatial elements, for example, channels, cells, destination points, would be analyzing the architectural or urban artefact as an ontologically **heterogeneous** configuration.\(^{96}\)

While all but the most simple design projects must inevitably become heterogeneous, during the design process the designer might be temporarily concerned with a particular subsystem of the project. Such a subsystem, if studied at a sufficiently high level of abstraction, might be considered and handled as a homogeneous configuration. The same

---

\(^{96}\) Space syntax seems to restrict its scope to the analysis of homogeneous configurations – a rather severe and artificial restriction.
might occur for the purposes of the theoretical analysis of a given built project, for example, the high level analysis of a project’s structural system (skeleton) as a homogeneous configuration of linear structural members, or the high level analysis of a project’s circulation system as a homogeneous configuration of linear paths. Notions like ‘structural system’ and ‘circulation system’ are commonplace. Not much thought is given to their designation as systems. The theory of architectural autopoiesis proposes to sharpen and regulate the use of this term: it is a fact that all members of a structure or all the paths of a path-network hang and act together and thus form a functional unit that warrants their qualification as system. Another example is a building’s outer envelope. It is a system because it is a continuous, functional unit. A breach at any point compromises the performance of the whole envelope. Thus we can define: architectural and urban systems are collaborative unities. The minimum requirement here is that their parts (elements or subsystems) are functionally interdependent. This relation of functional dependence must be reciprocal or mutual, i.e., each part impacts all other parts and is impacted by all other parts, directly or indirectly.

This definition alters some of the common uses of the term. For instance, a building envelope is a single, unitary system even if it is a collage or patchwork of disparate facade types, or a city’s circulation system is a single system even if it comprises zones with grids, zones with radial organization, ‘irregular’ areas, as well as zones where these three types of configuration interpenetrate. Usually one might distinguish the gridded from the radial part as two different systems. In contrast the system concept proposed here does not require adherence to a unitary scheme. Indeed, no regularity is implied at all. The same applies to structural systems. Usually one might distinguish a post-beam system, from a portal-frame system, from a vaulting system etc. This usage of the term system – its indication of a certain internal coherence, generative principle, or rule – is taken up by the notion of organization. Instead of talking about different structural systems or different circulation systems in this way the theory of architectural autopoiesis proposes to talk about different principles of structural organization or different principles of circulatory organization etc.

On the other hand, certain classes of elements in the city are usually talked about as systems even if there is little or no evidence of them being functionally collaborative. That all the parks or green areas in a city form a system – the city’s system of parks – cannot be taken for granted. Rather it is an empirical question that depends upon the citizens’

This definition encompasses subsystems. Subsystems are systems in this sense.
patterns of usage, ie, it depends, for instance, on whether and to what extent most citizens consider the different items within the named class – ‘parks’ – as functional substitutes for each other, so that, for example, a local park expansion is an effective expansion of the overall provision.

Even the question of whether a city’s street network in its totality does indeed form a system is not absolutely settled. Some of its parts might be so isolated and cut off from the actual flows moving through the city that their modification would have virtually no impact on the overall network. Such an isolated zone would therefore not belong to the city’s circulation system, even if it were vitally to depend upon the rest of the city’s network. According to our definition dependency has to be mutual. One-sided chains of dependency do not constitute systems.

The old way of thinking in distinct systems understood as different types – grid, spine or ring etc – is typical of the Modernist paradigm, and leads to questions such as: ‘Which system should we employ here?’ Contemporary sensibility – as well as contemporary reality – suggests a different approach. The different structural or circulatory typologies are hybridized or morphed into each other. What matters is that there emerges a collaborative unity. This collaborative unity might be internally differentiated in terms of different patterns of configuration. Different principles of organization might be distributed across the system. For instance, the different types of organization shown in Figure 5 might coexist in an overall patchwork configuration. Or they might coexist in the sense of an interpenetration, for example, an urban zone might be a spine in terms of vehicular circulation and a grid in terms of pedestrian circulation.

The system concept defined here admits both homogeneous and heterogeneous configurations. All that matters is that the components act together or at least mutually depend upon each other with respect to their respective performance. The term configuration is more general. Any co-present collection of spatial items can be taken and investigated as configuration. Christopher Alexander employed nearly the same concept of system defined here: ‘When the elements of a set belong together because they co-operate or work together somehow, we call the set of elements a system.’98 Alexander gives an example of a system that is interesting because of its extremely heterogeneous make up: ‘For example, in Berkeley at the corner of Hearst and Euclid, there is a drugstore, and outside the drugstore a traffic light. In the entrance to the

drugstore there is a newsrack where the day's papers are displayed. When the light is red, people who are waiting to cross the street stand idly by the light; and since they have nothing to do, they look at the papers displayed on the newsrack which they can see from where they stand. Some of them just read the headlines, others actually buy a paper while they wait. This effect makes the newsrack and the traffic light interactive; the newsrack, the newspapers on it, the money going from people's pockets to the dime slot, the people who stop at the light and read papers, the traffic light, the electric impulses which make the lights change, and the sidewalk which the people stand on form a system – they all work together.\(^99\) Alexander's notion of a collaboratively functioning system anticipates the concept of an integrated action-artefact network\(^100\) as the basis for analyzing and distilling the functional requirements that are to be fulfilled by the architectural system in question: 'From the designer's point of view, the physically unchanging part of this system is of special interest. The newsrack, the traffic light and the sidewalk between them, related as they are, form the fixed part of the system. It is the unchanging receptacle in which the changing parts of the system – people, newspapers, money and electrical impulses – can work together. I define this fixed part as a unit of the city. It derives its coherence as a unit both from the forces which hold its own elements together and from the dynamic coherence of the larger living system which includes it as a fixed invariant part.'\(^101\) The only difference in the conceptualization proposed within the theory of architectural autopoiesis is the attempt to interpret the operations of both actors and artefacts as communications. A designed pavement communicates an invitation to pedestrians to stroll here. The actions of its pedestrian users communicate, in their manner of walking and overall demeanour, that they have understood and accepted the framing communication of the pavement.

The question whether a specifically defined or identified configuration is a system is a question that involves the concept of function. A system must function as a system. In contrast, the concept of configuration, as well as the concept of organization, is located in the domain of form. The forms, features and measures of configurations and organizations are initially analyzed without functional prejudice or reference to functional capacities. Only in a second step are the identified and described forms, features and measures of configurations and organizations investigated in

---

99 Ibid.
100 See chapter 6.1.7 Functional Reasoning via Action-artefact Networks.
terms of their functional capacities and possible functional application. The question whether a given configuration or organization works as a system, how it functions and whether it functions well, are questions that are best approached on the basis of a prior configurational/organizational analysis. Both the forms (configurations, organizations), understood as repertoire of potential solutions, and functions (activity networks), understood as problems, need to be theoretically prepared in order to be intelligently related to each other in the search for new, viable (high-performance) form-function complexes.\footnote{This theoretical project of enhancing the conceptual repertoire of formal (configurational, organizational) description and design is tentatively sketched out and started in section 6.4.}

A city’s road-network hangs together. Any local blockage might have effects that ripple through the network and impact many distant (if not all) points. Therefore we must speak of a unified system of circulation, even if there are no systematic principles or general features that pervade the circulation network in all its parts. A system is given whenever many parts operate together, independent of the degree of organization and coherence of the system. There might be only one, several, or no principles of organization at work. In the latter case the circulation system is a mere configuration.

To mark the difference between a chaotic, random, unprincipled configuration and a configuration that is based on rules that pervasively structure the configuration, we employ the concept of organization defined above. Thus in terms of, for example, urban circulation networks, the notion of circulation organization should be reserved for the latter case where the whole circulation network is indeed patterned according to a certain systematically applied principle and therefore possesses a coherent global organization as well as general properties that pervade the respective system all the way through. Otherwise, in the absence of a systematically applied principle, we should restrict ourselves to speak of a given circulation configuration. Circulation configurations are therefore either organized or unorganized. However, the mere positing of this distinction does not imply that it is easy to operationalize and apply this distinction.

Above, organization was defined as the opposite of randomness. However, at this preliminary stage of setting out the basic concepts of a theory of organization, there is no strict a priori operational criterion of organization available that would allow us to dismiss an apparently
random configuration as unorganized only because we can neither reproduce its rule nor recognize its organization. Rather, the theory of architectural autopoiesis is reckoning with an ever expanding repertoire of organizational processes/patterns. This does not mean that the unorganized is merely a receding limit case. No. Given the fragmented and haphazard way in which large urban agglomerations have been built up over long periods of time according to shifting and inconsistent influences, we should assume the absence of organization until we have decoded the underlying principles that have constrained randomness and thus imposed a certain degree of organization. The idea that organization in the case of urban settlement patterns should not only be thought of in terms of deterministic rules but rather in terms of certain rule-based constraints upon an otherwise random growth process is a fruitful starting point. Often these rules are rather local and take on only a few key parameters as factors that constrain the next move. The more aspects of an already given configuration are taken into account to constrain (if not determine) the next move, the more organized does the resultant configuration become.

Traditional notions of organization sought to avoid arbitrariness via adherence to a preconceived, ideal pattern or scheme. Contemporary notions of organization are much more open with respect to the mechanisms that might restrict randomness. Contemporary mechanisms hinge on the establishment of internal interdependencies between elements rather than on the dependency of elements on prior global schemata. (Accordingly, a notion of relative degrees of organization was defined on the basis of the relative density and diversity of interdependencies between the elements within a configuration.) However, here in the context of setting out the basic concepts for a comprehensive theory of architectural organization, simple schemata like grids or concentric-radial patterns cannot be excluded from the concept of organization versus mere configuration.

All circulation systems have a certain configuration. Circulation organizations are a subset of circulation configurations. The extent to which any given configuration can be specified by means of an explicit ordering principle might be referred to as circulation organization. Typical examples are the rigorous American street grids, or radial city plans with converging radials and concentric ring-roads. Karlsruhe and Moscow might serve as examples here. London might act as a typical example of a configuration without any evident, pervasive organizing principle. Different local patches might adhere to different local organizing principles. There are, however, certain general structural features that
seem to be nearly ubiquitous throughout London. A good heuristic criterion for this is the fact that Londoners can navigate areas with which they have no familiarity. There seems to be a certain intuitive predictability at play here. Most probably this predictability relies not only on the organization of the street system itself, but could instead involve correlations with the lawful distribution of the built fabric. This indicates that an initially random or nearly random pattern can climb the gradient of relative organization by adding further elements according to mapping rules that create interdependencies and thus predictability (and, in our terms, more organization) without relying on prior schemata.

The same distinction and relationship between the concept of organization and the more general, encompassing concept of configuration can be defined with respect to the dimension of territorialization. Enclosure-and-division organizations are then set against mere enclosure-and-division configurations. We might also apply this distinction to conjunctions of differentiation- and integration-configurations. Some are organized – to a certain relative degree – and some seem unorganized.

Organizations are to be preferred over mere configurations. However, it should be clear by now that the distinction between organizations and mere configurations is not a simple, absolute and objective distinction. The distinction is relative to what is understood and accepted as an explicit principle of organization. There are degrees of organization that can be assessed only comparatively, when comparing configurations that are somehow versions of each other. The distinction of organizations in relation to mere configurations thus depends upon what can be analyzed with a given theoretical apparatus.

What might appear as unorganized or arbitrary might reveal a hidden organization through an upgraded analysis that has a more advanced, richer repertoire of organizational notions at its disposal. Recently the available canon of organizational principles has been expanded to include formation processes that allow for a certain degree of unpredictability, freedom or randomization while still affording the ascertainment of certain global statistical properties. Modernists like Le Corbusier were operating with a rather restrictive notion of organization. He admired the urban regularity of Roman cities and rejected the irregularity of medieval cities as ‘the pack-donkey’s way’.\(^{103}\) Le Corbusier’s limitation is not his insistence upon regularity but his limited concept of regularity in terms of

Classical geometry. Complexity theory (chaos theory) in general, and the research of Frei Otto in particular, have since taught us to recognize, measure and simulate the complex patterns of organization that emerge from processes of self-organization. Phenomena like the ‘donkey’s path’ of least resistance and the urban patterns resulting from unplanned settlement processes can now be analyzed and appreciated in terms of their hidden organizational principles, and thus (at least approximate or stochastic) predictability.

The question whether an agglomeration of multiple organizations can be construed as an organization is also open to debate. This relative vagueness and openness of the distinction is rather an advantage at this stage of building a theory of architectural organization. It leaves scope for evolving the concepts together with the development of the theory. At this stage of the theory it makes sense to open up the concept of spatial organization as much as possible and let the boundary of the concept be marked by the utterly arbitrary and formless, ie, configurations that resist any attempts to be predicted, summarized and reproduced.

In contrast, the concept of order imposes a rather strict selection criterion with respect to pertinent organizations. Order requires that articulation is able to make the underlying organization perceptually palpable and legible. The theory of architectural autopoiesis insists that any claim concerning the accomplishment of urban or architectural order must simultaneously reflect the conditions that impact the cognition of the proposed organization. We can only claim that a complex order has been achieved, if the constructed/conceived organization has a reasonable chance to be perceived/understood, not by organizational scientists but by the (well-socialized) users of architecture.

---

104 Are Voronoi patterns systems of spatial organization? All or only some? How about L-systems? This depends upon how these patterns are explicitly set up, analyzed, understood and handled. There is an open-ended number of networking algorithms that might be defined and applied to any given point cloud. As scripting becomes ever more widespread as design technique we might raise the question: should we classify any configuration that results from recursive, rule-based pattern-formation as spatial organisation? The theory of architectural autopoiesis answers this question in the affirmative.

105 The theory of architectural autopoiesis concurs with Bill Hillier’s assessment that the difficulty of talking about spatial configuration in architecture is a central problem of architectural theory. Bill Hillier, *Space is the Machine*, p 38.
6.4 Supplementing Architecture with a Science of Configuration

THESIS 28
The task of organization today requires a more explicit and more elaborate repertoire of organizational patterns and more explicit, precise criteria for their evaluation than what can be reasonably expected from the tacit knowledge and accumulated wisdom of an experienced architect.

To give traction to the distinction of organized versus unorganized configurations requires a repertoire of concepts and principles of organization. What follows is an attempt to contribute to the build up of such a repertoire.

So far we have only established some basic definitions in preparation for a theory of architectural organization.

Above, the need for a systematic ‘art of organization’ was stipulated, ie, a theory and technique of organization that build their heuristic principles upon a rich descriptive terminology and a systematic apparatus of concepts, measures and theorems. How can such an ‘art of organization’ be developed? Are there intellectual resources to draw on? Is there a science that can be consulted and exploited for the task of architectural organization?

There are indeed well-elaborated resources that architecture can draw upon to enhance its organizational intelligence: the resources of discrete mathematics (or finite mathematics), most generally set theory, and more specifically combinatorics with its subdisciplines of network theory (graph theory) and order theory.

6.4.1 SET THEORY
The concepts of set theory have become the most fundamental and ubiquitous concepts of all logic and mathematics. Two of the most basic concepts within set theory – the concept of membership and the concept of containment – can be perfectly well illustrated by the fundamental architectural relation of enclosure. That this fundamental concept of logic should find its most illustrative exemplification in architecture should encourage architects to explore this domain further.

Set theory commences with a very simple ontology. There are two primitive entities: elements and sets, and the basic relation of membership – being an element of – relating elements with sets. A set is an unordered collection of elements. A given element either does or does
not belong to a given set. The are some basic relationships that can hold between a given number of sets:

1. containment, whereby one set is fully contained within another. A contains B implies that B is a subset of A, ie, all of B’s elements are also elements of the containing set A.
2. intersection, whereby two (or more) sets intersect and share some elements common to both (all).
3. disjointedness, whereby sets are disjoint, ie, they do not have any elements in common.
4. complementarity, whereby two sets are disjoint and together fully dissect the domain within which they are defined.

There are some basic operations performed on sets: set union, set intersection, set subtraction and set complement. These are operations that produce a new set from any one, two, or more given sets. The union of two sets A and B is the set C which features all of the elements that are in A or B or in both. The resultant set C contains both A and B. The intersection of two sets A and B is the set C which features only those elements which are in both A and B. The complement of set A is the set B that features all of the objects in the universal set except those in A.

To visualize relationships between elements and sets, as well as relationships between different sets, a graphic notation called Venn diagrams might be used. Venn diagrams represent sets by convex bounding lines that encircle all the elements the set contains. The ‘paper space’ represents ‘the universe’. The complement set is thus the area that surrounds a closed outline. The containment or subset relation is depicted by means of one outline fully encircling another, and the relation of intersection is depicted by the overlapping or interpenetration of the respective bounded areas. The area of overlap then represents the set generated by the intersection of the intersecting sets and might be denoted in its own right.

The representational device of the Venn diagrams allows us to ascertain some key logical relations by visual inspection. For instance, the transitivity of the containment relation can be immediately read from the graphic representation as relation of spatial inclusion: the nesting of bounded domains. This law of the transitivity of the containment relation is in fact the fundamental figure of logical inference since Aristotle. His first syllogism reads: if all A are B and all B are C then all A are C. The graphic representation of its set-theoretic equivalent is the simple diagram of three concentric circles, with A in the centre and C on the
outside. Set B is in the middle, representing the so-called middle or mediating term in Aristotle’s first syllogism.106

We might interpret bubble diagrams, the architect’s primary tool for setting out the primary spatial organization or parti of his/her design, as a variant of Venn diagrams that operates with relations of spatial containment. The difference is that bubble diagrams are usually processing further information like the adjacencies of the domains to be organized, and perhaps the rough relative sizes of the domains. While bubble diagrams give meaning to the relative position of the bubbles that are collected within an enclosing bubble, Venn diagrams do not interpret this (graphically unavoidable) feature of relative spatial position. It is noteworthy that until relatively recently bubble intersection in bubble diagrams was taboo. Relations of disjointedness and relations of containment were the only relations considered.

In Venn diagrams spatialization is only utilized to represent the abstract relations of containment, intersection and disjointedness while the relative sizes and adjacency positions are irrelevant and might be chosen arbitrarily, or according to the exigencies of illustrative clarity. The Venn diagram proper, if applied to architecture, would spatialize neither more nor less than the logical relations of subsumption that are usually presented in the schedule of accommodation with its chapter and subchapter titles, each heading a list of spaces to be accommodated under the various chapters.

106 The philosophical significance of this parallelism between primary logical relations and tropes of spatial organization will be reflected below, in the chapter 8.6.2 From Spatial Order to Conceptual Order.
If we thus juxtapose the conceptual apparatus of set theory with the usual structure of architectural briefs given in the form of schedules of accommodation, one blindspot is again salient: the total absence of intersection or overlap within the normal form of the architectural brief. Intersection, one of the key relations of interest within set theory, seems to be excluded from architectural organization from the very start. Only relations of full containment and relations of full disjointedness are recognized. As already mentioned, until relatively recently the overlap of domains was not only absent from architectural briefs but was also absent from the design repertoire of architecture and urbanism. The interpenetration of domains – a key pursuit of Deconstructivist and
Parametricist architecture – was not considered as a meaningful spatial operation.

This rejection of overlap had for a long time also been a hallmark of modern social organizations such as government bureaucracies and business corporations. The overruling idea of organization theory during the first half of the 20th century was clarity of the lines of command. Departmental affiliation should be unambiguous, i.e., the domains of competency were supposed to be clearly and singularly allocated. Overlap implied confusion. However, this has since changed drastically, and the idea of overlapping domains of competency has become a part of standard organizational strategies establishing so-called matrix organizations where functional and divisional segmentations cross.

In terms of a mathematics of organization inspired by set theory, one might point here to the exponential increase in differentiation and complexity that can be achieved if one works with intersecting sets rather than being restricted to disjoinedness and containment. Both in the case of the juxtaposition of disjoined sets and with respect to the concentric nesting of sets within sets, the further placement of each set increases the complexity of the overall organization by one additional position only. With the admission of intersection the complexity of the overall organization increases by multiplication rather than addition. With each single new set that intersects the given cluster of sets, the overall number of positions increases by the number of sets intersected by the new set. Each set that is intersected by the new set allows for the establishment of a new position in the respective area of overlap generated. The result is a rapid increase in organizational complexity that has the advantage of being reducible to a very small number of key determinants.

The absence of architectural and urban overlap was famously criticized by Christopher Alexander in relation to modern urban planning. Commencing with Alexander’s influential polemic ‘A City is not a Tree’ published in 1965 and with Colin Rowe’s and Robert Slutzky’s nearly simultaneous landmark article ‘Transparency: Literal and Phenomenal’, first published in 1963, the idea of spatial intersection and ‘super-position’ gathered pace during the 1970s, in the work of Michael Graves, Peter Eisenman, and others, to become one of the key preoccupations of the architectural avant-garde during the 1980s, perhaps best exemplified by Bernard Tschumi’s 1985 winning entry for the grand competition for Paris’ Parc de la Villette. The idea of spatial super-position was followed by further concepts that instantiate the logic of intersecting sets within architecture: cross-programming, hybridity and multiple affiliation.
6.4.2 HARNESSING NETWORK THEORY

That the resources offered within discrete mathematics might be pertinent with respect to the task of spatial organization in architecture and urbanism is most immediately obvious with respect to network theory (graph theory). The mathematics of networks seems to be most pertinent to the field of urbanism. However, both the logic and the graphic representations that illustrate the basic concepts of network theory are also instantiated in the familiar connection diagrams that often accompany the schedule of accommodation in design briefs, whereby each required connection between programme components is indicated by a line linking the labelled boxes representing the respective programme components. The architect’s first task is to translate this abstract connection diagram into a spatial configuration that takes the relative sizes of the required spaces into account and interprets connection as adjacency.107

The most basic entities (primitives) that constitute networks or graphs – the elements and the relations between those elements – are referred to as nodes (or vertices) and links (or edges). In its most simple, default mode the links are binary, symmetric and irreflexive relations.108 However this basic ontology might be expanded to include directional links (directed vs undirected graphs), and a further expansion allows for links to be weighted or signed (plus vs minus). Street networks might be presented by undirected, but weighted networks, whereby the capacities, or the metric distances between junctions might be translated into weights.

The network theoretical representation of, for example, a circulation configuration (street pattern) – given or to be designed – allows for a series of rigorous definitions and computational solutions, for instance for the shortest path between any two nodes measured by the number of intervening nodes, or various measures for node positions like the relative centrality of a node within a given network, definable in a variety of ways. Graph theory provides the solution for various problems that are relevant in certain architectural or urban problem-contexts. For instance, the famous Königsberg Bridges problem: is it possible to cross the seven bridges of Königsberg (connecting two islands in the river with each other and with the opposite riverbanks) in a continuous walk without recrossing

---

107 In complex briefs the desired connections mostly overreach the possibility of being solved via immediate adjacency relations.

108 The characterization of the basic relation as binary, symmetric and irreflexive relation implies that each relation links only two elements, and if vertex $a$ is linked to vertex $b$, then $b$ is eo ipso linked to $a$. Links are only defined between different vertices, ie, a vertex cannot be linked to itself.
Figure 9  Euler’s solution to the famous problem of the seven bridges of Königsberg. From March & Steadman, *The Geometry of Environment*, 1971

them? Graph theory can prove that the multi-graph representing the situation has no trail containing all links. The graph-theoretic formalism facilitates the implementation of various graph algorithms such as the depth-first-search, shortest path search, single-source shortest path problem, the route inspection problem (also called the ‘Chinese Postman Problem’) and optimal routing problems such as the famous travelling salesman problem.\(^{109}\)

There are numerous problems that can be formalized with graphs, especially problems that have to do with flows in networks. A network flow is an assignment of flow to the edges of a directed graph (called a flow network in this case) where each edge has a capacity, such that the amount of flow along an edge does not exceed its capacity. In addition you have the restriction that the amount of flow into a node equals the amount of flow out of it (unless it is a source, which only has outgoing flow, or sink, which has only incoming flow). A flow network can be used to simulate fluids in pipes, currents in an electrical circuit, or anything where something travels through a network, including, for example, the traffic that might flow within a given road system.

Networks/graphs are represented graphically by plotting a dot for every node (vertex), and by drawing a line between two nodes if they are connected by a link (edge), and by drawing arrows in the case of directed graphs. A network/graph drawing should not be confused with the network/graph itself (the abstract organizational structure). There are always multiple ways to draw the network/graph. All that matters is the

\(^{109}\) A salesman starts at a certain point and has to reach all of a given set of points. If the distances between every pair of points are known, what is the shortest route which visits all points and returns to the point of origin?
logic of the connection pattern, not the spatial layout. In practice it is often difficult to decide whether two drawings represent the same network/graph. Depending on the problem domain, some layouts may be better suited and easier to understand than others. In fact this multitude of possible drawings (spatializations) of the abstract organizational pattern is the first part of the problem of architectural design understood as projection of abstract (social) organization into space.

We can therefore introduce the following distinction for our specific architectural purposes: the distinction between *logical configuration* and *spatial configuration* and the related distinction between *spatio-configurational* equivalence and *logico-configurational* equivalence. This distinction makes sense with respect to the graphic (spatial) representation and architectural/urban instantiation of networks, and goes beyond network theory proper. We define two spatial network patterns to be *logico-configurationally* equivalent if they represent the same network/graph as defined by network/graph theory. We define two spatial network patterns to be *spatio-configurationally* equivalent if they are *logico-configurationally* equivalent and also conserve the same adjacency relations – left of, right of, above, below, or: north of, south of, west of, east of – between the plotted node positions. Two spatial networks that are *spatio-configurationally* equivalent will exhibit the same pattern of link-intersection, while *logico-configurationally* equivalence is consistent with rather different patterns of link-intersection. While link-intersections in plotted network/graphs carry no meaning in network/graph theory, they might be significant with respect to certain architectural/urban applications. A specific task might for instance
suggest that a given logical configuration should be spatialized with a minimum (or conversely with a maximum) of link intersections.

We surmise here that the abstract structure of a homogeneous spatial configuration – be it a differentiation (parcellation) pattern or an integration (circulation) pattern – can be fully described and analyzed within the formalization offered by set theory and/or network theory. So far we have introduced two formalisms with their attendant graphic languages: a set-calculus spatialized in Venn diagrams and a network-calculus spatialized in node-link diagrams. Venn diagrams seem to be able to abstract (or construct) the logic of parcellation or zoning configurations in as much as relations of spatial disjointedness (segmentation), containment (nesting) and intersection (interpenetration) between domains are involved or intended. Node-link diagrams seem predestined to represent, explore and measure the configurational characteristics of circulation configurations on both urban and architectural scales. However, node-link diagrams are also well suited to represent, explore and measure any given parcellation configuration by representing parcels as nodes and shared boundaries as links. The node-link diagram can even be used to represent the set-theoretical relation of containment. In this case, since containment is asymmetrical, we need to employ directed graphs. The directed link from A to B can thus represent that A contains/encloses B. (Figures 11 & 12 encode the containment relation – A contains B – as a downward link from A to B.) The concentric nesting sequence becomes a monodirectional chain of directed links. The typical nesting pattern, whereby each set in the order of subsumption contains multiple subsets, can be represented by a branching pattern of directed links. This pattern is referred to as a tree. In the tree pattern each node receives one incoming link from the node representing the containing set (or enclosing parcel) and generates multiple outgoing links representing the various contained subsets (or fully enclosed parcels).110 Those subsets are disjoint and the node from which they spring is their union. This graphic notation can also represent set-configurations with intersecting sets. In this case the directed graph is no longer a tree, but instead allows nodes to have multiple incoming links implying that the respective element or set (parcel) is the intersection set of the various sets represented by the incoming links. This possibility of establishing an isomorphism between network diagrams and Venn diagrams is a rather interesting opportunity for organizational analysis and synthesis in architecture.

110 Trees have the interesting property that any two nodes are connected by exactly one path.
Venn diagrams and network diagrams might also be combined in a single graphic notation. So-called hypergraphs constitute such a combination. Hypergraphs might be used to depict partitioned networks. Partitioned networks are networks that are partitioned into zones by enclosing bounding lines that segment off and collect a certain number of nodes. Within an architectural design process one might use and interpret a hypergraph as follows: the nodes might represent programme components (activities). Links between nodes might represent adjacencies, perhaps categorized or even weighted to represent the quality or degree of direct accessibility (wall with opening vs wall with door vs low partition wall etc). The enclosing lines can operate very much like the encircling lines in Venn diagrams, expressing the basic relationships of inclusion, exclusion and intersection between sets. The nodes within the enclosures are now the elements within the sets or parcels. The operation of encirclement or segmentation within a partitioned network implies that some of the links within the network are now crossing a partition boundary with one node of the binary link being inside the bounded domain while the other node is outside. This new
expanded ontology comprising nodes and links plus enclosures is still fully encompassed within network/graph theory. In fact the enclosing lines might be considered to be so-called hyperlinks. Hyperlinks are a variation of the network-theoretical link whereby one basic constraint of the link is lifted: the hyperlink is no longer constrained to represent a binary relation, but can instead link up an arbitrary number of nodes. Networks or graphs that use hyperlinks are called hyper-networks or hyper-graphs. A possible graphical representation for hyper-graphs is an enclosing outline capturing all and only those nodes to be linked by the hyperlink. The captured nodes can be interpreted as sets of related activities/programmes that are to be enclosed within a domain. In the absence of any rule that a node can only be captured by one hyperlink, the formalism allows for overlap or intersecting sets/domains.

With the hyper-network formalism both spatial differentiation and integration patterns can be built up and analyzed within a single representation: layout diagrams showing the partitioning of space together with the accessibility network of connections. Thus we have identified some pertinent diagramming formalisms for constructing and analyzing complex spatial organizations. There are various mathematical measures/calculations that tie in with these formalisms and thus allow for the utilization of mathematical techniques that might help architecture to cope with the increasing complexity of its task. These formalisms provide a basic conceptual, computational and notational set up on the basis of which concepts, measures and organizational principles can now be developed.

The mathematics of network theory does indeed hold the promise of an enhanced descriptive, analytical and constructive power for the organizational intelligence of architecture. Obviously, the primitives, various compound definitions, and especially the mathematical questions and theorems have not been crafted in response to the particular problems of architectural organization. Thus we will encounter a lot of material that is not readily applicable or useful. Pure mathematics is in permanent exchange with a wide range of applications. It also has its own immanent dynamic. The overabundance of conceptual material compensates for its lack of specific focus. In fact, it is the very promiscuity of mathematics – coupled with its radical abstractness – that makes mathematics so fertile as an exchange hub and transmission system for conceptual structures.¹¹¹

¹¹¹ This function as conceptual exchange hub makes mathematics comparable to philosophy. Both mathematics and philosophy fulfil parallel functions and are equally abstract. The difference is in the kind of conceptual structures that are being traded and the type of user manuals that are
The application domains of network theory (graph theory) include the basic fields of physics (force vectors), chemistry (analysis of molecular structures) and biology (metabolic networks). A lot of the recent work in network theory evolved in exchanges with computer science and related domains of application like chip design, neural networks, analysis of Internet link-structures, search engines etc. But network theory is also heavily utilized with respect to many spatial problem domains that more or less directly interface with urban and architectural questions, like geographic mapping and traffic analysis/simulation. Network theory has also been productive in linguistics, and most importantly in the social sciences under the name of social network analysis.

Of course, nothing stops architecture from constructing its own specifically crafted mathematics of spatial configuration, and this might indeed happen. There is in fact a rather successful example of a specifically crafted utilization of the basic concepts and techniques of network theory in the context of architecture and urbanism: Bill Hillier’s theory and practice of ‘space syntax’. Hillier also demonstrates how the mathematical reconstruction of a question paves the way for its computer-aided solution.

Before taking a closer look at Hillier’s achievements we will briefly scan through some mathematical raw material, roughly filtered according to what seems to hold a potential for architectural application. The purpose here can only be to inspire curiosity and motivation for future work.

6.4.3 EXCURSION: NETWORK THEORY
This excursion offers a short exposition of network theory, presented via the successive build up of definitions, at times augmented by brief notes indicating typical applications in various fields. This short exposition avoids all mathematical notation. Hunches concerning the potential for fruitful applicability within architecture will emanate between the lines. What will become evident is a general sense of the productivity of a systematic build up of well-defined, complex concepts resulting in an overall system of concepts that combines expressive and heuristic power with precision.

Basic definitions:

Graph: An (undirected) graph (or network) is a finite set – the so-called vertex set with each element being referred to as vertex (or node) – together with an irreflexive, symmetric relation that defines ordered
pairs of vertices called edges (or links), together forming the edge-set that completely determines the respective relation. The order of a graph is the number of vertices within the graph. The size of the graph is the number of edges within the graph.

Adjacent: Two vertices (nodes) are adjacent if and only if they are joined by an edge (link).

There are a number of cross-cutting qualifications that define various modifications of the basic definition of a graph:

Directed graph: A directed graph (or digraph) is a graph whereby the defining relation is non-symmetric, for example, as might be used to indicate the direction of traffic in a traffic analysis graph.

Mixed graph: A mixed graph may contain both directional and non-directional (symmetric) links.

Signed graph: A signed graph is a graph whereby each edge receives either a plus sign or a minus sign. (Often used in social network analysis where a relationship might be positive or negative.)

Weighted graph: A weighted graph is a graph where the links are numerically weighted.

Multi-graph: A multi-graph is a graph where the restriction that the defining relation should be binary is lifted, ie, there might be more than one direct link between two nodes.

Further definitions:

Degree: The degree of a node is the number of nodes it is adjacent to; or, equivalently, it is the number of edges that are incident upon it. A node with degree 0 is an isolate, with degree 1 a pendant. In a directed graph, we can distinguish indegrees and outdegrees. A node with a positive outdegree but no indegree is called a source. A node with a positive indegree but no outdegree is called a sink.

Subgraph: A subgraph of a graph G is a graph whose vertices and edges are also in G. If we select a set of nodes from a graph, and then select all the edges that connect those nodes within this graph, the resulting subgraph is called an induced subgraph.

Walk: A walk is a sequence of adjacent vertices (nodes) together with the edges (links) that connect them. A walk might traverse nodes/links more than once, ie, a walk is a path in which segments may be repeated.

Path: A path is a walk in which no node is visited more than once. A path is a subgraph that is a linear sequence of connected vertices through a given graph. A path is itself a connected graph with degree 2 at every vertex.
Cycle: A cycle or circuit is a closed path without self-intersections. It is a connected graph with degree 2 at every vertex.

Disjointedness: A set of walks that share no vertices is called vertex-disjoint. A set of walks that share no edges is called edge-disjoint. Obviously, vertex-disjoint paths are also edge-disjoint. If a pair of nodes are connected by three vertex-disjoint paths, this means that there are three completely independent ways of getting from one point to the other.

Geodesics: A geodesic path is a shortest path between two nodes. There can be more than one geodesic path joining a given pair of nodes. The graph-theoretic distance or geodesic distance between two nodes is the length of the shortest path between them.

Complete graph: In a complete graph each pair of vertices is joined by an edge, i.e., the graph contains all possible edges.

Bipartite graph: In a bipartite graph the vertices can be divided into two sets, so that every edge has one vertex in each of the two sets.

Complete bipartite graph: In a complete bipartite graph the vertex set is the union of two disjoint subsets, so that every vertex in one is adjacent to every vertex in the other but there are no edges within either.

Planar graph: A planar graph can be drawn in a plane with no crossing edges. The graph is ‘embedded’ in a plane.

Fáry’s theorem: The theorem states that any simple planar graph can be drawn without crossings so that its edges are straight line segments. That is, the ability to draw graph edges as curves instead of as straight line segments does not allow a larger class of graphs to be drawn.

Clique: A clique within an undirected graph is a subgraph or set of vertices such that for every two vertices in the subgraph there exists an edge connecting the two, i.e., every vertex in the clique is joined with every other vertex in the clique. This is equivalent to saying that the subgraph is a complete graph. The clique number of a graph is the order (number of vertices) of the largest clique within this graph.

Connected graphs: A graph is connected if there exists a path from every node to every other node. A digraph that satisfies the connectedness definition is called strongly connected, i.e., for any pair of nodes a and b, there exists both a path from a to b and from b to a. A digraph is unilaterally connected if between every unordered pair of nodes there is at least one path that connects them. A digraph whose underlying graph is connected is called weakly connected.

Maximal subgraph: A maximal subgraph is a subgraph that satisfies some specified property (such as being connected) and to which no node can be added without violating the property.

Component: A maximal connected subgraph is called a component.
**Cutpoint:** A cutpoint is a node whose removal would disconnect the graph. Alternatively, we could define a cutpoint as a node whose removal would increase the number of components of the graph. For instance, a social network that contains a cutpoint will break apart if the person who occupies the cutpoint leaves.

**Bridge:** A bridge is a link or edge whose removal disconnects the graph.

**Block:** A block is a subgraph which contains no cutpoints.

**Cutset:** A cutset is a set of points whose removal would disconnect a graph. A *minimal cutset* is a cutset that contains the minimum possible number of nodes that disconnect the graph. An *edge cutset* is a set of lines whose removal disconnects the graph.

**Vertex connectivity:** The size of a minimal cutset is called the *vertex connectivity* of the graph. The smaller the value, the greater the vulnerability of the network to disconnection. We can also define a pairwise version of vertex connectivity, which gives the minimum number of (intermediary) nodes that must be removed in order to disconnect two nodes.

**Menger's theorem:** Menger's theorem states that the minimum number of nodes that must be removed to disconnect two nodes is equal to the maximum number of vertex-disjoint paths that join those two nodes. This also works for lines.

**Edge-connectivity:** The edge-connectivity between two edges is equal to the maximum number of edge-disjoint paths that join the two edges.

**Tree:** A tree is a graph in which any two nodes are connected by *exactly one* path. A tree is a connected graph with no cycles, i.e., trees are *acyclical*. A tree is called a *rooted tree* if one vertex has been designated the *root*, in which case the edges have a natural orientation, *towards* or *away* from the root. Rooted trees are well suited to analyze social hierarchies, for example, in business organizations where every member of the organization has one and only one superior. The single path translates into the single line of command and reporting. All parts of the hierarchy which are not vertically linked to one another can nevertheless be linked by travelling up the hierarchy to find a common direct or indirect superior, and then down again. Every finite tree structure has a single member that has no superior. This member is the root or root node. A node without outgoing link is called *end-node* or *leaf*. In a tree a directed edge refers to the link from the superior node (*parent*) to the inferior node (*child*).

**Depth:** The depth of a node n is the length of the path from the root to the node. The set of all nodes at a given depth is called a *level* of the tree (like a level within a hierarchy).
**Height**: The height of a tree is the length of the path from the root node to its furthest leaf.

**Ancestors/descendants**: If a path exists from node p to node q, then p is an ancestor of q and q is a descendant of p.

**Size**: In a tree the size of a node is the number of descendants it has including itself.

**Binary tree**: A rooted binary tree is a rooted tree in which every node has at most two children.

**Full binary tree**: A full binary tree, or proper binary tree, is a tree in which every node has zero or two children.

**Perfect binary tree**: A perfect binary tree (sometimes complete binary tree) is a full binary tree in which all leaves are at the same depth.

**Spanning tree**: A spanning tree of a graph is a selection of edges from this graph that form a tree spanning every vertex. That is, every vertex is connected to the tree, but no cycles (or loops) are formed.

**Forest**: A forest is a graph in which any two vertices are connected by at most one path. An equivalent definition is that a forest is a union of disjoint trees.

Network measures and node measures:

**Centrality**: There are different centrality measures for nodes within networks, describing the relative position or importance of the nodes and links in a network. The *degree* is the simplest measure distinguishing relative importance. More pertinent is the measure of centrality that considers both direct and indirect links and measures centrality by shortest number of total steps by which all other nodes within the network can be reached from the node in question.

**Chromatic number**: The chromatic number is the least number of colours needed to colour the graph whereby no joint vertices can have the same colour. For instance, six colours suit a complete graph with six vertices, but fewer colours would result in adjacent vertices of the same colour.

**Perfect graph**: A perfect graph is a graph in which the chromatic number of every induced subgraph equals the clique number of that subgraph. In any graph, the clique number provides a lower bound for the chromatic number, as all vertices in a clique must be assigned distinct colours. The perfect graphs are those for which this lower bound is tight, not just in the graph itself but in all of its induced subgraphs. For more general graphs, the chromatic number and clique number can differ; for example, a cycle of length five requires three colours in any proper colouring but its largest clique has size two.

**Related theorem**: The complement of a bipartite graph is perfect.
**Arboricity**: The arboricity of a graph is the minimum number of spanning trees needed to cover all the edges of the graph.

**Thickness**: The thickness of a graph is the minimum number of planar subgraphs into which its edges can be partitioned. As any planar graph has arboricity three, the thickness of any graph is at least equal to a third of the arboricity, and at most equal to the arboricity.

There are a number of standard operations that operate on graphs to produce new graphs:

- **Line graph**: The operation line graph converts nodes into links and vice versa.
- **Dual graph**: A dual graph of a given planar graph \( G \) has a vertex for each plane region of \( G \), and an edge for each edge joining two neighbouring regions. This property is symmetric, i.e., these graphs come in pairs.
- **Complement graph**: The complement or inverse of a graph \( G \) is a graph \( H \) on the same vertices such that two vertices of \( H \) are adjacent if and only if they are not adjacent in \( G \).

Concerning complex networks:

- **Complex network**: The term complex network refers to a network/graph that has certain non-trivial topological features that do not occur in simple networks. Such non-trivial features include: a heavy-tail in the degree distribution, a high clustering coefficient, assortativity or disassortativity among vertices; community structure at many scales; and evidence of a hierarchical structure. In contrast, simple networks have none of these properties and are typically represented by graphs such as a lattice or a random graph, which exhibit a high similarity no matter what part is examined.
- **Heavy-tailed**: A heavy-tailed probability distribution is one that assigns relatively high probabilities to regions far from the mean or median.
- **Clustering coefficient**: The clustering coefficient for a vertex is the proportion of links between the vertices within its neighbourhood divided by the number of links that could possibly exist between them. This measures 1 if every neighbour connected to the vertex is also connected to every other vertex within the neighbourhood, and 0 if none of vertices that are connected to the vertex in question connects to any of the other vertices connected to the vertex in question. The clustering coefficient is a graph measure that can be used to determine whether or not a graph is a small-world network.
- **Assortativity**: Assortativity refers to a preference for a network’s nodes to attach to others that are similar or different in some way. Though the specific measure of similarity may vary, network theorists often examine
assortativity in terms of a node’s degrees. Correlations between nodes of similar degree are found in many social networks: highly connected nodes tend to be connected with other high degree nodes.

**Dissortativity:** Conversely dissortativity implies that high degree nodes tend to attach to low degree nodes.

**Community structures:** A community structure within a network is a group of nodes which are more densely interconnected with each other than with the rest of the network. A network might contain multiple communities. This inhomogeneity suggests that the network has certain natural divisions within it. Communities might overlap. Social networks often include community groups based on common location, interests, occupation, etc. Metabolic networks have communities based on functional groupings. Citation networks form communities by research topic.

**Small-world networks:** A small-world network is a graph in which the average number of edges between any two vertices is very small (mathematically, it should grow as the logarithm of the size of the network), while the clustering coefficient stays large. A network is called a small-world network by analogy with the small-world phenomenon known as *six degrees of separation*: the small world hypothesis is the idea that two arbitrary people are connected by only six intermediaries. With the addition of only a small number of long-range links, a regular graph, in which the *diameter* is proportional to the size of the network, can be transformed into a ‘small world’. A wide variety of abstract graphs exhibits the small-world property, for example, scale-free networks and random graphs.

**Scale-free networks:** Scale-free networks are complex networks. A network is named scale-free if its degree distribution, ie, the probability that a node selected uniformly at random has a certain number of links (degrees), follows a particular mathematical function called a *power law*. The power law implies that the degree distribution of these networks has no characteristic scale. In contrast, a network with a single, well-defined scale is somewhat similar to a lattice in that every node has (roughly) the same degree. In a network with a scale-free degree distribution, some vertices have a degree that is orders of magnitude larger than the average – these vertices are often called ‘hubs’. (There is no inherent threshold above which a node can be viewed as a hub. If there were, then it wouldn’t be a scale-free distribution!) Power-law degree distribution is found in many real world networks such as the World Wide Web, the network of Internet routers, email networks etc, but also, for example, in protein interaction networks. Networks with a power-law degree distribution can be highly
resistant to the random deletion of vertices, ie, the vast majority of vertices remain connected in a giant component.

**Giant component:** A giant component is a connected subgraph that contains a majority of the entire graph’s nodes. Such networks can also be quite sensitive to targeted attacks.

**Random graphs:** The theory of random graphs studies typical properties of random graphs, those that hold with high probability for graphs drawn from a particular distribution. For example, that it has a path between any two nodes. Ramsey theory states that any sufficiently large random configuration will contain some sort of order. This theorem gives an interesting subtext to my earlier assertion that the difference between a system implying an explicit order and a mere configuration depends upon the repertoire of notions of order that is available in the analysis of the respective configuration.

### 6.4.4 A CITY IS NOT A TREE

‘A City is not a Tree’\(^{112}\) is the title of Christopher Alexander’s 1965 seminal contribution to the theory of architectural and urban design, where he effectively deployed (a very small number of) concepts from set theory and graph theory to expose the organizational narrow-mindedness within the urban planning and design thinking of his day. The ‘tree’ in the title of Alexander’s paper is the abstract structure as defined within graph theory: a directed graph constrained by the rule that every node has only one incoming link but may have multiple outgoing links, ie, the graph ramifies outwards from a root-node without ever reconnecting the branches.

In ‘A City is not a Tree’, Alexander contrasts this tree organization with patterns that do admit nodes with more that one incoming link and therefore allow multiple paths between nodes. He calls such a less constrained pattern a ‘semi-lattice’ and interprets both as patterns of decomposition for urban and architectural systems, ie, as patterns of how a system might be decomposed into various subsystems. The link of the directed graph thus stands for the inverse relation of being a subsystem or a subset. ‘Both the tree and the semi-lattice are ways of thinking about how a large collection of many small systems goes to make up a large and complex system. More generally, they are both names for structures of

This interpretation of the nodes of the graph as sets together with the interpretation of the links as relation of set-containment – as discussed above – affords the conversion of any given Venn diagram of disjoint and nesting circles into a corresponding tree diagram and vice versa. If the tree is drawn from top (root-node) to bottom (end-nodes), nodes that are laterally positioned imply disjoint sets that fall into the encompassing domain corresponding to the node at which their respective upward path/branches meet. The defining restriction of the tree translates into the exclusion of overlap or intersection between the domains. In the semi-lattice pattern two incoming links would imply that the respective set belongs to two containing sets as their intersection set. Alexander therefore gives the following definition: 'The tree axiom states: A collection of sets forms a tree if and only if, for any two sets that belong to the collection either one is wholly contained in the other, or else they are wholly disjoint.' And he cites the axiom of the semi-lattice thus: 'A collection of sets forms a semilattice if and only if, when two overlapping sets belong to the collection, the set of elements common to both also belongs to the collection.'

Alexander distinguishes artificial city plans that are designed as trees from natural cities that are usually semi-lattices, and emphasizes their difference in complexity: 'We are concerned with the difference between structures in which no overlap occurs, and those structures in which overlap does occur. It is not merely the overlap which makes the distinction between the two important. Still more important is the fact that the semilattice is potentially a much more complex and subtle structure than a tree. We may see just how much more complex a semilattice can be than a tree in the following fact: a tree based on 20 elements can contain at most 19 further subsets of the 20, while a semilattice based on the same 20 elements can contain more than 1,000,000 different subsets. This enormously greater variety is an index of the great structural complexity a semilattice can have when compared with the structural simplicity of a tree. It is this lack of structural

113 Christopher Alexander, 'A City is not a Tree', in: Architectural Forum, Vol 122, No 1, April 1965, part I, p 58.
114 This means: all tree diagrams can be converted into Venn diagrams, but with respect to semi-lattice configurations this translation into Venn diagrams is practical only for rather simple configurations.
115 Alexander, 'A City is not a Tree', Part I, p 60.
116 Ibid.
Figure 13  Analysis: Kenzo Tange's Tokyo Bay Project. From 'A City is not a Tree' by Christopher Alexander, 1987
complexity, characteristic of trees, which is crippling our conceptions of
the city.'

As Alexander analyzes a series of planned, ‘artificial’ cities it becomes
clear that the set-structure implied in the plans can be read off the map
in terms of the depicted parcellation and circulation patterns, ie, in terms
of the zoning and road configurations. Alexander gives a series of
examples, including Chandigarh which is based on a nested zoning
diagram, and Brasilia which is based on an obvious tree-shaped
circulation system. The most perfect example is Kenzo Tange’s famous
plan for Tokyo Bay, because here there is a direct coincidence between
the pattern of roads and the pattern of the major parcels. The plan
consists of a series of loops stretched across Tokyo Bay. There are four
major loops, each of which contains three medium loops. Each medium
loop contains three minor loops which are the residential
neighbourhoods. Alexander comments: ‘Each of these structures, then, is
a tree. Each unit in each tree that I have described, moreover, is the
fixed, unchanging residue of some system in the living city…. However,
in every city there are thousands, even millions, of times as many more
systems at work whose physical residue does not appear as a unit in these
tree structures. In the worst cases, the units which do appear fail to
correspond to any living reality; and the real systems, whose existence
actually makes the city live, have been provided with no physical
receptacle.’

Alexander continues to explicate: ‘The units of which an
artificial city is made up are always organized to form a tree…. Whenever
we have a tree structure, it means that within this structure no piece of
any unit is ever connected to other units, except through the medium of
that unit as a whole. The enormity of this restriction is difficult to grasp.
It is a little as though the members of a family were not free to make
friends outside the family, except when the family as a whole made a
friendship…. When we describe the city in terms of neighbourhoods, we
implicitly assume that the smaller elements within any one of these
neighbourhoods belong together so tightly that they only interact with
elements in other neighbourhoods through the medium of the
neighbourhoods to which they themselves belong.’

This comparison of city patterns with the pattern of social connections
implied by the tree model is of particular pertinence: while traditional
society might indeed have been organized in the form of disjunct and

117 Alexander, ‘A City is not a Tree’, Part 1, p 60.
119 Ibid.
nesting groups, the patterns of social communication in modern society have exploded these restrictions. After having analyzed a series of ‘artificial’ city plans, Alexander proceeds to use Ruth Glass’ discourse about her redevelopment plan for Middlesbrough to demonstrate how the actual patterns of using space in a given modern city exceed the restrictive logic of the tree organization. Ruth Glass was trying to establish neighbourhoods but her efforts to establish a single pattern of decomposition were (bound to be) frustrated. The various real social systems she tried to capture each focused on a specific spatial node, like, for example, the primary schools, secondary schools, youth clubs, grocery shops etc. However, the catchment-areas of these nodes did not coincide, nor did they allow for arrangements of concentric nesting domains. The diagram that plotted these effective social groups – each defined by the node they utilized – was in fact a diagram of overlapping domains, whereby domains were neither disjunct, nor fully contained one within the other. Alexander summarized: ‘There is nothing in the nature of the various centres which says that their catchment-areas should be the same. Their natures are different. Therefore the units they define are different.’\textsuperscript{120} Conversely, however, the plotted catchment-areas find no architectural expression in the city fabric of Middlesbrough other than the node itself. The organizing capacity of

\textsuperscript{120} Alexander, ‘A City is not a Tree’, Part 1, p.62.
6.4 SUPPLEMENTING ARCHITECTURE WITH A SCIENCE OF CONFIGURATION

Figure 15 Diagram of painting with multiple readings/decompositions (after Simon Nicholson). From 'A City is not a Tree' by Christopher Alexander

this node is not supported by any particular urban spatial pattern. This lack provides an interesting urban design task.

Alexander cannot show us a design for a city plan that could provide a paradigm for urban semi-lattice organization. Instead he presents a remarkable painting by Simon Nicholson. The fascination of this painting lies in the fact that, although constructed of rather few simple triangular elements, these elements unite in many different ways to form the large units of the painting – in such a way that, if we make a complete inventory of the perceived units in the painting, we find that each triangle enters into four or five completely different units or figures, none contained in any of the others, yet all overlapping in that triangle. The proposal to use such an image as an analogy for the spatial organization of a city coincides with Colin Rowe and Robert Slutzky’s notion of *phenomenal transparency* as expounded in 'Transparency: Literal and Phenomenal' published one year in advance of Christopher Alexander’s article. Alexander’s proposal might be taken as the urban application of the concept of phenomenal transparency, with emphasis on organization rather than perception. Both Christopher Alexander’s indication and Colin Rowe’s treatise established an early, powerful anticipation of the ambitions that were to follow and occupy a whole generation of avant-garde architects, and still remains on the agenda of the avant-garde today.122

122 This ambition to construct configurations within which multiple readings overlap lives on within the contemporary style of Parametricism under the heading of parametric figuration. See below, part 11 *Parametricism – The Parametric Paradigm and the Formation of a New Style.*
However, before turning to the organizational innovations that are fermenting within the current architectural avant-garde, it makes sense to introduce another strand of architectural research that was inspired by Christopher Alexander’s introduction of new mathematics into the field of architecture and that remained closely tied to the instrumentalization of mathematical reasoning in relation to the problems of architectural and urban design. This research, which was pushed forward by Lionel March and Philip Steadman during the 1970s, found its current point of culmination in the work of Bill Hillier and his Space Syntax Lab, based at London University. This mathematical research into the problematic of urban and architectural configuration was one of the first loci for the deployment of computational processes within the design disciplines.

6.4.5 SPACE SYNTAX: CONCEPTS AND TOOLS OF ANALYSIS
The work gathered under the heading of space syntax is perhaps the most impressive effort to date towards the enhancement of architectural intelligence in the problem-area of spatial configuration. Space syntax has been pioneered by Bill Hillier as an organizationally focused approach to problems of architectural and urban design. This approach comprises a powerful set of techniques for the analysis of the spatial configurations of buildings, urban quarters and cities. In 1995 Bill Hillier established the Space Syntax Laboratory at The Bartlett Faculty of the Built Environment at University College London. The Space Syntax Laboratory operates both as academic institute and as consultancy firm.

Space syntax succeeded in elaborating a specific conceptual apparatus for architecture and urbanism, on the basis of the general conceptual tools of network theory, and it utilized this apparatus to build up an extensive body of analytical case studies, to formulate a series of noteworthy theoretical claims about the social functioning of the built environment, and finally to apply the tools and theorems of space syntax

---

124 In his first book, The Social Logic of Space (1984), Hillier introduced the key configurational concepts and a first decade of research involving computational tools to analyze spatial configurations. Twelve years later, in his second book and magnum opus Space is the Machine (1996), Hillier presented the results of a further decade of research guided by the research programme outlined in The Social Logic of Space. Together the two works constitute one of the most original and profound contributions to architectural theory, a contribution which has as yet to be fully recognized and integrated into the ongoing autopoiesis of architecture. See Bill Hillier & Julienne Hanson, The Social Logic of Space, Cambridge University Press (Cambridge), 1984, and Bill Hillier, Space is the Machine, Cambridge University Press (Cambridge), 1996.
within an ongoing design support service for architects and urbanists. The foundational concept of space syntax theory and practice is the concept of configuration. The concept aims at the whole of a complex to denote a set of relationships among things that are all interdependent. A relation between two elements is configurational 'insofar as it is affected by the simultaneous co-presence of at least a third element, and possibly all other elements, in a complex'. A configuration is then defined as follows: 'Configuration is a set of interdependent relations in which each is determined by its relation to all the others.' Thus Hillier’s concept of configuration differs from the (weaker) concept of configuration defined within the theory of architectural autopoiesis. However, the difference is slight. The only additional criterion that Hillier’s concept assumes is the criterion of continuity of access. All of Hillier’s investigations ultimately focus on relations of access. When he investigates relations of visual connection they come in as supplementary to relations of access. The theory of architectural autopoiesis, as comprehensive theory of architecture, did not find it expedient to restrict the scope of relation-types that might be relevant for a general concept of configuration. The interdependency that enters into Hillier’s definition is only relative to certain network measures, for example, the relative centrality or ‘integration’ of nodes or links within the network. Interdependency here means just that if you change the network locally, ie, by cutting a connection, the values of certain node measures that measure the node’s direct and indirect connection with all other nodes change for every node. This formal interdependency might or might not impact on a corresponding functional interdependency. (This is a further question of substantial theory which Hillier tends to answer positively.) Hillier's concept of ‘interdependent’ spatial elements is, at least at its outset or definition, not to be confused with Alexander’s concept of spatial system which demands the effective functional interdependence of spatial elements within action-artefact networks. Above, the theory of architectural autopoiesis placed the term configuration as the overarching term encompassing organizations as non-arbitrary, rule-constrained configurations. This implies that there are mere configurations that exhibit a zero degree of organization. Hillier is not working with this distinction arbitrary/random versus rule-based/organized, nor does he thus employ the concept of degrees of organization. Typology, ie, the distinction of (rule-based) types of configuration/organization (tree vs

125 Hillier, *Space is the Machine*, p 96.
126 Ibid, p 35.
semi-lattice, or grid vs ring vs star etc), is also missing from Hillier’s discourse. These ‘omissions’ are not in any way criticized here, they are part of a very productive theoretical economy.

Space syntax is concerned with spatial configurations. However, Hillier’s concern is not with the shape of the spaces, but only with their relative accessibility. All spaces must be accessible, but it matters how these relations of accessibility between spaces are patterned. Space syntax focuses exclusively on the density and distribution of the connections between spatial elements. The space syntax techniques measure connectivity. This base notion of spatial connection can be applied with respect to variously defined spatial elements: to rooms within a building, zones within larger spaces, or streets within street networks.  

Two elements in a configuration are either directly connected or not. This relation is symmetrical. Those elements that are not directly connected are indirectly connected.

The most fundamental relational measure between any two elements within a configuration is their depth with respect to each other. The depth – or configurational distance – between two spatial elements is defined as the minimum number of intervening elements plus one, i.e., the minimum number of boundary crossings or street corners that need to be passed on the way from one of the elements to the other. From this binary relation Hillier moves on to an element’s total depth as the sum of all binary depth measures of this element, i.e., measuring the accessibility of this element from all the other elements in the configuration. The element with the lowest total depth is the most accessible or most integrated element within the configuration. From these measures a series of global measures that serve to characterize the overall configuration can be derived: the configuration’s total depth or universal distance sums all the individual elements’ total depth values and thus gives the total number of links that must be traversed to move from each element to every other elemental space within the configuration. The average integration value of the configuration’s elements allows us to distinguish deep from shallow configurations. The standard deviation (the average deviation from the average), and the ratio of the number of different integration values relative to the number of elements, both give a measure of the degree of the configuration’s differentiation. The more symmetry a configuration

127 While rooms as closed cells are easy to identify, with respect to zones and streets space syntax requires operational definitions that unambiguously decompose a spatial configuration into elements, thus establishing where one element stops and another starts. With respect to given urban street patterns, space syntax analysis often chooses to consider straight street segments as elements. Thus a long street with multiple changes of direction breaks into as many elements as there are bends or changes of direction.
Figure 16  Space syntax – plan diagrams and their different justified adjacency/permeability graphs. The graphs read all full face adjacencies between spatial elements (cells) as connections. The numbers represent the total depth values (universal distances) of the cells. From Hillier, *Space is the Machine*, 1996

...exhibits, the more equivalent parts does it contain and thus the smaller will be the ratio of different integration values. Within a perfect ring of cells, all cells have the same integration value. In a totally asymmetric configuration all cells might have different integration values. A high differentiation of integration values – high ratio of differently integrated elements and high standard deviation – means that the configuration offers a high variety of positions. What we might call the element’s position within a configuration is not fully described by a mere numerical value. The position of an element within a configuration – in terms of the configurational key aspect of relative accessibility – can best be brought out by the utilization of certain graphic representations.
It is the combination of quantitative and graphic analysis that is the hallmark of Hillier’s method. The so-called justified graph (short: j-graph) presents the permeability map or network of accessibility of a configuration from the point of view of a chosen spatial element. The j-graph of an element lays out all the other elements of the configuration in the order of their accessibility from the chosen element. The element chosen to be analyzed is placed at the root of the graph. From the root upwards the graph first plots all the elements that are immediately accessible, ie, that are accessible with one step from the root element. Then the second layer is plotted above with all the elements at depth two, then all those elements that can be reached with three steps, and so forth until all elements in the configuration are reached. The j-graph thus depicts all the elements of the configuration ordered by way of their depth from the chosen root element. The j-graph also shows all the links that exist between all the elements within the configuration.

Each element has its own j-graph. However, the global properties of the configuration that can be read off the different j-graphs must obviously remain invariant across the different graphs, for example, whether the configuration is a tree or a semi-lattice, and in the case of the latter, its degree of ringiness, ie, the number of rings within the configuration etc.128 Despite the invariance of these global properties, different elements within the configuration might have rather differently patterned j-graphs with a different number of layers and different total depth. J-graphs thus characterize the different positions within a spatial configuration. There might also be elements with equivalent j-graphs. This depends on the degree of internal symmetry within the configuration.

The four plan diagrams depicted above show different arrangements of eight cells each. Each configuration has a different number of different j-graphs. The more symmetrical the figure is, the smaller is the number of different j-graphs and thus the less positional difference is available.

J-graph isomorphism indicates equivalence of positional information and offers a more pertinent definition of symmetry than the usual definition as ‘invariance under motion’. Along these lines more nuanced definitions of symmetry are also possible. For instance, one might distinguish local symmetry from global symmetry, ie, considering local rather than global j-graph isomorphism by taking only the first few layers of the graph into account. Weak symmetry might be defined by specifying various types of similarities (rather than identity) with respect to the positional information of the respective spatial elements. Hillier also suggests that

128 In the j-graphs depicted above only the j-graphs of the second shape contain rings: here each j-graph contains two rings. The j-graphs of the other two shapes are trees.
he can give a formalization of balanced asymmetry where the total depth in each of the two sides is equal but the pattern of connectivity is different. The fourth plan diagram in Figure 16 displays balanced asymmetry in this sense.\textsuperscript{129}

\textit{J} -graphs give a \textit{topological} rather than geometric image of a spatial layout. Above, the assumption was made that cells connect at all full face adjacencies. If we interpret the cells as rooms within a building we would not expect doors at all points of adjacency. The graphs above therefore present connection potential rather than implemented connections.

\textsuperscript{129} Hillier did not depict all the different \textit{j}-graphs. For instance, with respect to the third shape, the two cells which both have a total depth value of 13 have \textit{different} \textit{j}-graphs. Hillier only depicts one of them. Between the two elements holds the relationship of balanced asymmetry.
Figure 18 Four different justified permeability maps. From Hillier & Hanson, *The Social Logic of Space*, 1984

118
The four plan diagrams below (Figure 17) all show the same spatial arrangement of nine rooms, however, in each case with a different arrangement of doors. The depicted j-graphs are taking the surrounding exterior space as root to look at the syntax of each variant. Despite the geometric identity of the four plans they are syntactically distinct: their respective j-graphs are strikingly different.

It should be clear that the j-graph is a more pertinent map of the respective plan’s spatial logic – and of the social logic of its occupation – than the geometric plan itself. The visual order of the respective plan’s bird’s-eye view is rather deceiving. Only from the syntactic point of view is it possible to identify what Hillier calls genotypes, ie, recurrent spatial configurations that sustain and stabilize recurrent patterns of social life. As example of such a genotype, Hillier has been analyzing French farm houses, discovering a stable syntactic pattern that distinguishes two similarly sized spaces: the salle commune and the grande salle. Hillier uses the example of French farm houses to explain the significance of genotypes: ‘We can ask how the different functions in the house are “spatialized”, that is how they are embedded in the overall spatial configuration. . . . We find that it is very common that different functions are spatialized in different ways, and that this can often be expressed clearly through “integration” analysis. . . . To the extent that there are commonalities in the sequence of inequalities, then we can say that there is a common pattern to the way in which different functions are spatialized in the house. We call such common patterns “inequality genotypes”’.

The French farm houses analyzed by Hillier displayed the reverse condition from the four layouts shown above in Figure 17: their topological/syntactic patterns are more similar than their geometric shape. The figure below represents the genotype as an abstracted plan diagram. The two following diagrams utilize a graphic technique that allows combination of the spatial shape information with syntactic information. Here the total depth-values (integration values) are used to drive a colour coding that reveals how the key property of integration is distributed across the plan. Hillier works with two variants of this technique. The first takes each convex space – the rooms as well as the corridor – as a single spatial element. The second variant tessellates the plan and then takes each square module as a separate spatial element. Walls feature here as interruptions in the grid of cells. The second variant

130 Hillier, Space is the Machine, p 56.
Figure 19  Space syntax: abstracted plan diagram of typical French farm house. From Hillier, *Space is the Machine*, 1996

Figure 20  Space syntax: graphic integration analysis decomposing the plan into convex spaces. From Hillier, *Space is the Machine*, 1996

Figure 21  Space syntax: graphic integration analysis decomposing the plan into a tessellation of same sized cells. From Hillier, *Space is the Machine*, 1996

Figure 22  Space syntax: graphic integration analysis superimposing convex space analysis with strips of visual connection. From Hillier, *Space is the Machine*, 1996
captures two factors over and above the pure logic of space-to-space accessibility: the metric distances and the size of the spaces. The first factor is relevant in terms of the physiological effort required to move through the plan. The second factor recognizes that larger rooms are more important and can be expected to attract more people independent of relative position. While the first variant ignores these factors, the second variant allows them to influence the distribution of integration within the plan. In the specific case of the genotype of the French farm house, both analyses show both the salle commune and the corridor as the spaces with the highest level of integration. Hillier suggests that these two ways of decomposing a plan as a basis for integration analysis can be operated simultaneously by superimposing the calculations. He is also suggesting a third form of decomposition in terms of axial strips representing visual connectivity. All three variants of analysis might be superimposed within a single multi-layered analysis, or might be placed next to each other, each displaying its specific emphasis.

The possibility of superimposing the calculations of multiple decompositions suggests that integration analysis can be applied to decompositions that within themselves recognize overlapping or interpenetrating spaces. This is important because the most interesting architectural designs since the advent of Modernism no longer work with cellular rooms. Instead space is often conceived as open and continuous, and in recent years spatial overlap and the interpenetration of domains have been pushed onto the design agenda. Areas of overlap are areas of intensity that will also be highlighted by the attendant integration analysis.

Within Hillier’s space syntax, conditions of spatial overlap are primarily found in the analysis of urban space. Within urban environments, space is rarely unambiguously contained. Instead space flows continuously. With the exception of American cities that display relentlessly regular grid layouts, most urban layouts present the urban space structure Hillier calls deformed grid. Here the street pattern deviates from strict orthogonality. Most cities in Europe fall into this category. In these deformed grids lines of sight do not continue all the way through but streets keep changing direction and lines of sight keep striking the facades of buildings. As we move through the city, the shape of our field of vision continuously changes.

A typical urban space defined by urban blocks might be decomposed into spatial elements in a number of ways. One plausible way to define spatial segments within the continuity of urban space is to use the faces of the blocks as references. Each face or facade sponsors a determinate field of visibility: the union of the isovists of all points on the respective
facade defines a spatial zone that can be seen from the facade. This zone collects all points from where the facade can be seen. Such a field of visibility can be constructed for each face of each urban block. These fields of vision overlap. The zones of overlap can themselves be taken as spatial elements. There are zones of overlap that are convex. In such zones all points are mutually visible to each other. Such zones are of special interest in so far as they might serve as unified event spaces or spaces of congregation. The high visibility spaces where many fields of vision overlap are also central to the orientation within an urban field. The convex overlap areas might be taken as spatial elements of an integration analysis. This is one way space syntax analysis can be applied to the continuous and ambiguous shape of urban space.

Another, more straightforward way to analyze urban patterns is in terms of straight lines striking through the urban space. These lines depict the street spaces in terms of the relevant aspect of straight lines of sight directing movement. These lines extend further through the deformed grid and thus generate higher values of total integration. The space syntax toolbox distinguishes ‘all line maps’ and ‘axial line maps’. The latter just take the street axes of the deformed urban grid as long as they are straight. Any bend in the street generates a new segment for the axial analysis. The urban space is thus decomposed into a network of connected straight line segments. The most salient property space syntax focuses on is once more the depth of those street segments from each
other. On this basis the total depth (or degree of integration)\textsuperscript{131} of each segment and the total depth/integration of the whole configuration are measured. There are two rules of thumb: segments in the centre tend to have a higher degree of integration than segments on the periphery, and the longer the segment the higher is its potential level of integration. However, this rule can be subverted by the way the elements are networked. The attendant graphic technique reveals each element’s relative integration by colour-coding the elements according to their integration ranking. The colour-coded axial maps are thus depicting the differentiation and distribution of integration across the configuration.

The integration value of an element qualifies the element in its relation to the global configuration. Space syntax analysis also works with more local measures, for example, different measures of \textit{local integration} can be defined by measuring how many elements can be reached by one or two steps. In large global systems, a three-step analysis might also serve as a measure of local integration. The axial map analysis is the most widely used tool in the practical applications of space syntax analysis.

The configurational properties of streets, as visualized in the axial map below (Figure 25), and the configurational properties of rooms, as visualized in Figure 22, are invisible, hidden (‘non-discursive’) properties.

\textsuperscript{131}While total depth values are simple summations of individual depth counts, so that larger configurations generate larger total depths, the inverse measure of integration is corrected for the overall size of the configuration. Therefore integration values can be compared across configurations of different size.
These properties are, supposedly, operationally effective. They certainly have the capacity or potential for operational effectiveness. The correlations that Hillier detects between these invisible configurational properties and social patterns of utilization imply that these properties, or rather the advantages these properties entail, have somehow been detected by social actors, even if only in a collective process of trial and error, symmetry-breaking and self-amplification. Small, initial, visible, functional concentrations along invisibly advantageous lines lead to further concentrations along the same lines etc. Can this haphazard process of discovering these functional potentials (hidden in the configurational maze) be facilitated by architectural design? The possibility of tracking and revealing important configurational properties creates the possibility of making them visible, not only in an analytical diagram but within the medium of built architecture via dedicated means of articulation. It seems Hillier never considered this possibility but his tools open up the possibility to turn the objective configurational properties into subjectively available information by making the space syntax of buildings and urban fields transparent to its users, for instance by using variable intensity of ornamentation to track degrees of integration. This idea leads us to the more general recognition that articulation in architecture does not have to be restricted to the articulation of local functional features. It includes the local morphological registration of positional properties, and indeed of relational properties in general, that exceed the immediate contiguous
present. The information that might be encoded might allow local to local as well as local to global inferences of all kinds. Articulations that should transport these kinds of non-present information can only function through systematically coded systems-of-signification. They belong to architecture’s semiological rather than organizational dimension.132

6.4.6 SPACE SYNTAX: THEORETICAL CLAIMS

The central idea of space syntax is that the crucial aspect of the built environment that needs to be analyzed in order to understand how buildings function within society is the spatial configuration that exists within and between them. Hillier denounces the preoccupation of a lot of architectural theory with style and visual appearance as missing the essential point about the social efficacy of architecture. Space syntax also implies that buildings respond to functional requirements not primarily by giving shape to individual spaces but by the patterns of connections it affords. The neutral, rectilinear shape of most spaces attests to this. This relative shape neutrality makes buildings inherently multifunctional. Although the fact that buildings are usually erected for (more or less) specific purposes cannot be denied, it seems pertinent to focus theoretical attention on more generic patterns of social organization in terms of access, encounter and avoidance that are shared across many different function-types.

The built environment and the buildings within it provide a spatial patterning of activities and relationships. The simple act of creating a spatial boundary separates an inside from an outside and thus creates (or reflects) a socially significant distinction or relation. Hillier’s theoretical interest focuses on relations and on the more complex relational schemes he calls configurations.133

He insists that architectural space should be analyzed in terms of configuration because ‘it is as configuration that it has its most powerful and independent effects on the way buildings and built environments are formed and how they function for their purposes’.134 This is so because ‘individual spaces place little limit on human activity, except for those of size and perhaps shape. . . . The relation between space and social existence lies in the relations between configurations of people and configurations of space.’135 The emphasis on systems of spatial relations

---

132 This dimension, and the potential for upgrading architecture’s capacity within it, will be explored below, in sections 6.8 to 6.10.
133 Hillier prefers the term configuration over the term pattern because he feels that the word pattern suggests an expectation of a recognizable regularity.
134 Hillier, Space is the Machine, p 27.
(configurations) in architecture is an important pendant to the importance of systems of relations in the societal environment that architecture is to serve. It is not isolated individual users who are important but the organization of social relations. Hiller clearly realizes this: ‘Encountering, congregating, avoiding, interacting, dwelling, conferring are not attributes of individuals, but patterns, or configurations formed by groups or collections of people. They depend on an engineered pattern of co-presence, and indeed co-absence.’ Systems of relations are crucial. This creates an inherent difficulty for architects, because it is much more difficult to grasp relations and systems of relations than to grasp objects and their properties. ‘Related spaces, almost by definition, cannot be seen all at once, but require movement from one to other to experience the whole. This is to say that relationality in space is rarely accessible to us as a single experience.’ According to Hillier the difficulty of thinking about relations has led architectural theory astray. Systems of relations – like languages, symbolic systems and also the complex spatial systems that architecture should be concerned with – are ‘much easier to use and to take for granted than to talk about analytically’. As a result, Hillier suggests that ‘the discourse about architecture that is a necessary concomitant of the practice of architecture is afflicted with a kind of permanent disability’. It is this disability that space syntax as an analytically rigorous theory of spatial configuration sets out to address and overcome. This task is crucial for architectural theory, Hillier claims, because it is only on the basis of syntactic analysis – focusing on space-to-space permeability – that the social logic of space can be detected.

More specifically, space syntax theory claims that the space syntax techniques of analysis are able to predict the likely occupation effects of architectural and urban designs on the basis of a purely configurational analysis that can proceed on the basis of maps or geometric surveys without requiring additional information about traffic or the distribution of functions. In fact, the claim is that traffic patterns and functional distributions can be inferred from the results of a space syntax analysis of the spatial configuration. The most effective and thus most likely occurrence of certain urban functions – like shops and restaurants – that feed on movement and high visibility can also be read off the space.
syntax map of the urban geometry. These claims have been corroborated in extensive empirical studies involving functional mappings, measurements of traffic flows as well as pedestrian movement densities.

However, Hillier’s space syntax paradigm is not only confined to quantitative analyses and measurements. Hillier argues that his techniques can serve to explain, formalize and thus demystify otherwise elusive qualitative concepts like urbanity and intelligibility.

According to Hillier, the noticeable lack of urbanity of many new cities in comparison with old cities, and the respective lack of urbanity of the modern parts in comparison with the historical parts of cities, has more to do with spatial syntax than with the aesthetic feel of the respective places. Modern cities and parts of cities are often characterized by both an overall shortfall of integration and by a lack of differentiation of integration values across the configuration of streets. This is especially the case with the much maligned modern housing estates. The estate type of development is characterized both by its segregation from the rest of the city – giving it an overall low integration score – and by an evenness in the distribution of integration values across the estate. The integration analysis of three London housing estates confirms this general pattern: ‘The estate is substantially more segregated than the rest of the urban surface and, what is more problematic, segregated as a lump. Good urban space has segregated lines, but they are close to integrated lines, so that there is a good mix of integrated and segregated lines locally.’ \(^{140}\)

Urbanity – a vibrant street life – thrives on the local concentration of movement that is generated both locally and globally.

Hillier makes another pertinent point about modern housing estates that is revealed when global integration analysis is related to a three step local integration analysis. The analyzed housing estates evidence a ‘poor relation between local and global integration’ \(^{141}\) and thus an ‘unclear relation between local and global structure’. \(^{142}\) This implies a disalignment of localized and less localized movement and thus between inhabitant and stranger. This observed lack of coincidence between local and global integration has another, more general significance. According to Hillier this mismatch between local and global integration implies a lack of ‘intelligibility’.

\(^{140}\) Hillier, *Space is the Machine*, p 175.
\(^{141}\) Ibid.
\(^{142}\) Ibid.
This notion of ‘intelligibility’ is rather interesting because it expands the type of performance criteria that a spatial configuration might be subjected to. So far Hillier has considered concepts/criteria that describe/measure characteristics that pertain to the configuration itself. A configuration has a certain degree of symmetry, a certain degree of ringiness or a certain degree of overall depth/integration etc. It seems that the import of the criterion of ‘intelligibility’ cannot be understood merely by reference to the objective characteristics of the configuration itself. The concept makes claims about the relationship between certain measurable properties of the configuration itself and a human occupant’s capacity to successfully navigate the system. The pair of diagrams in Figure 27 are presented by Hillier to give the reader an intuitively accessible illustration of intelligibility: the first configuration seems to be a proper urban space while the second looks rather labyrinthian. It seems like a reasonable intuition to presume that those moving through these spaces find the first configuration more ‘intelligible’ and thus easier to orient within than the second configuration.

The term intelligibility is placed in quotation marks throughout the discussion of Hillier’s account of the concept. This should not imply any disrespect for Hillier’s original, insightful contribution around this concept. However, the theory of architectural autopoiesis prefers to withdraw this term – with its connotations implying reference to the cognition of users/observers – from the concept Hillier operationalizes with space syntax theory. What Hillier defines is not degrees of intelligibility but degrees of internal correlation, specifically the correlation of local with global integration.
6.4 SUPPLEMENTING ARCHITECTURE WITH A SCIENCE OF CONFIGURATION

Figure 27  Space syntax: two urban configurations, urban vs labyrinthian configuration. From Hillier, *Space is the Machine*, 1996

Figure 28  Space syntax: two configurations, orderly vs disorderly distribution of integration values. From Hillier, *Space is the Machine*, 1996

Figure 29  Space syntax: two urban configurations, high intelligibility vs low intelligibility. From Hillier, *Space is the Machine*, 1996
Hillier claims that this intuitively available quality of ‘intelligibility’ has an underlying syntactic cause. His initial heuristic definition of ‘intelligibility’ is noteworthy: ‘The property of “intelligibility” in a deformed grid means the degree to which what we can see... is a good guide to what we cannot see.’ Hillier then moves on to operationalize this definition by means of relating two measures: the visible measure of immediate connection (local integration) and the invisible measure of global integration. Hillier’s thesis then reads: ‘An intelligible system is one in which well-connected spaces also tend to be well-integrated spaces. An unintelligible system is one where well-connected spaces are not well integrated, so that what we can see of their connections misleads us about the status of that space in the system as a whole.’ The two scattergrams plot all convex spatial elements with respect to the two coordinates of visible connectivity and invisible integration. The superior degree of ‘intelligibility’ of the first configuration is indicated by its relative tightness of correlation between connectivity and integration in comparison with the loose, uncorrelated scatter of the second configuration.

144 Hillier, *Space is the Machine*, p. 127.
The analytical techniques of space syntax can also be integrated in the creative design process, especially as the invisible numerical properties of the configuration can be handled graphically. It is the computational implementation and graphical representation of the various organizational measures that allow designers to utilize space syntax analysis within the design process. As the urban designer builds up his/her urban configuration he/she receives instant feedback about the distribution and redistribution of integration within the evolving configuration. In parallel, the ‘intelligibility’ of the configuration can be monitored, and thus pursued as a strategic goal, as the design progresses.

6.4.7 FROM ORGANIZATION TO ARTICULATION: TAKING ACCOUNT OF COGNITION

Above, the term intelligibility is placed in quotation marks in the discussion of Hillier’s account of the concept. This should not imply any disrespect for the insights that Hillier gathers around this term. However, the theory of architectural autopoiesis prefers to withdraw this term – with its connotations implying reference to the cognition of users/observers – from the concept Hillier operationalizes within space syntax theory. What Hillier defines is not degrees of intelligibility but degrees of *internal correlation* within a configuration, specifically the correlation of local with global integration.

Above it was suggested that the import of the criterion of ‘intelligibility’ cannot be understood merely by reference to the objective characteristics of the configuration itself. Indeed, it seems that the intuitive concept makes a claim about the relationship between certain measurable properties of the configuration itself and a human occupant’s capacity to perceive and comprehend, and thus successfully navigate the configuration. However, Hillier’s operationalization of the concept does not capture the intuitive intent of the concept: Hillier’s operational definition of ‘intelligibility’ does *not* include any reference to specific cognitive capacities. Hillier’s notion of ‘intelligibility’ remains fully within the realm of objective configurational properties irrespective of what one presumes about the cognitive capacities of users/observers. All that Hillier’s concept asserts is that the configuration is structured in a way that *allows* for an inference from local properties to global positional properties. This is in itself an important notion. One might talk about local-to-global coherence or local-to-global correlation as an objective precondition for anybody’s local-to-global orientation. This kind of objective local-to-global correlation – here specifically of local and global integration values – can indeed be considered to be a precondition of local-to-global intelligibility, but cannot in itself already constitute or
The dispute revolves around the appropriate use of a term, but it is motivated by the attempt to build a theory with a further enhanced level of analytical resolution.

What the theory of architectural autopoiesis can take up and preserve from Hillier’s discussion of ‘intelligibility’ is the fundamental notion of correlation in general, and of correlations that allow for local to global inferences in particular. These are important notions that lead the theory to move from the realm of organization to the concern with articulation.

Hillier’s insight is that the correlation of local and global integration is a desirable property of urban configurations, a property that might – under certain further conditions – serve to facilitate orientation. These further conditions must be as much a concern for a comprehensive theory as the configurational precondition that Hillier has aptly identified. To the extent that local connectivity can indeed be perceived and if such a correlation is being assumed or expected, this correlation can indeed become a powerful orienting mechanism for urban navigation. Architecture’s ability to facilitate orientation via perception and pattern recognition will be elaborated and theorized under the auspices of a general concept of articulation.

It is important to note that the notion of local-to-global correlation can be generalized beyond the rather narrow focus on the correlation of local with global integration. There can be many more potentially significant forms of local-to-global correlation as so many objective preconditions of so many orienting local-to-global inferences. The concept of correlation can and must be generalized further, beyond local-to-global correlations, to local-to-local correlations, and indeed to correlations in general. For instance, given the fact that the inside and outside of a building can rarely be simultaneously perceived, the correlation between the properties of the outside of a building and the inside of the building should be an

145 In a sense, implicit in Hillier’s choice of terminology is the rather strong theoretical claim that objective ‘intelligibility’ as detected and measured in real urban environments produces or facilitates real, subjective intelligibility with the effect that environments that have this property function better. The claim has the status of a prima facie worthwhile hypothesis but its validation would require empirical or experimental corroboration. It should perhaps not be written into the very terminology of the theory.

146 It seems as if Hillier takes both assumptions for granted: first, that connectivity can be easily perceived, and further that users habitually expect local hubs to lead to global hubs. Perhaps this is not an unreasonable assumption with respect to habitual life in traditional city layouts, and perhaps this justifies Hillier’s deployment of the term ‘intelligibility’. That might very well be so, but this cannot deter the theory of architectural autopoiesis from proposing a different terminology in the attempt to construct a richer and more comprehensive theory that takes less for granted and focuses more on future design potentials than on the explanation of well established urban patterns.
important type of correlation as precondition for vital outside-to-inside inferences. Finally, in general, and most importantly, there is the correlation of forms with functions, on all scales, creating the objective preconditions for form-to-function inferences. (The construction of form-to-function correlations, like the construction of any correlation, cannot be achieved via isolated instances, but only by mapping one range of differences (the dependent variable) onto another range of differences (the independent variable). An ordered range of different forms might be correlated with a corresponding ordered range of different functions.)

With these formulations we are indeed arriving at the point where a definition of the concept of articulation can be refined. The facilitation of form-to-function inferences is the task and agenda of articulation, with specific attention to the cognitive conditions of the design’s prospective users. Because the form-to-function inferences must operate intuitively, in a state of ‘distraction’ rather than via an effortless step by step analysis, it is more appropriate to talk about associations than about inferences. We can thus formulate the following general thesis: articulation presupposes correlation. From systematic correlation as an objective condition we must progress to association as its (potential) subjective consequence. Articulation is then that design effort that facilitates the transformation of objective correlations into subjective associations.

For the sake of ‘intelligibility’, ie, in order to establish the objective, organizational preconditions for intelligibility, a spatial configuration – urban or architectural – should be designed in such a way that it is saturated with such correlations. The resultant configuration might be called information rich. We might also talk about a high degree of organization. Above we defined architectural order as an articulated organization. A high degree of organization is the organizational basis for a high level of architectural order. To realize this order an additional design effort is necessary, an effort that takes the cognitive capacities/constraints of the users/observers into account. This design effort is what the theory of architectural autopoiesis emphasizes under the title of articulation. Architectural order is the result of organization and articulation, whereby objective correlations are transformed into subjective associations. It is this more elaborate concept of architectural/urban order that is the theoretically appropriate place where the concept of intelligibility might be applied. A mere spatial organization cannot be qualified in terms of its degree of intelligibility. Intelligibility is a property of architectural or urban orders. It signifies the perceptual/cognitive transparency or lucidity of the order in question, and constitutes one of the most important qualities that architectural and urban design, and indeed design in general, aspire to. The intelligibility
of a particular architectural or urban order depends upon two factors: its organization and its articulation. Accordingly, the degree of intelligibility of the respective order must be assessed along two dimensions: the degree of organization on the one hand, and its degree of articulateness on the other hand. The latter dimension is elaborated below.

6.5 Articulation

THESIS 29
The degree to which the effective functioning of architecture must (and can) rely upon articulation rather than mere physical organization is a barometer of societal progress.

Articulation reckons with the fact that buildings function only via the user’s active ‘reading’ of the building’s spatial and functional organization. At a certain level of social complexity a building’s order, designed to structure an intended life-process, can only realize its intended role if it reckons with and enlists the user’s capacity actively to ‘read’ and comprehend the order of the building. Only on the basis of articulate organizations will users be enabled to navigate, appropriate and collectively utilize the built environment to its fullest potential. The ability thus to enlist the perceiving/comprehending users depends upon a design effort that systematically reflects the legibility of a spatial arrangement. As organizational complexity is being built up during the design process, ‘aesthetic’ control is required to prevent visual chaos and to preserve legibility. Legibility has a phenomenological and a semiological dimension. The phenomenological aspect requires reflection upon the conditions of effective perception, and the semiological aspect requires reflection upon the conditions that allow the interplay of spatial, morphological and material differentiations to produce a semiological code that can inform and direct the socialized users. The task of imbuing the organized environment with a heightened legibility is the architectural design task of articulation.

6.5.1 ARTICULATION VS ORGANIZATION
The distinction of articulation versus organization cannot be aligned with the distinction of form versus function. The two distinctions intersect.

---

147 According to the definitions of the theory of architectural autopoeisis only those spatial/functional organizations that are designed so as to enlist the user’s capacity actively to ‘read’ and comprehend them are elevated to the title of orders.
each other. Both organization and articulation have functional as well as formal aspects. Both organizational diagrams and strategies of articulation are subject to the formal a priori, and both need to be selected on the basis of their social functionality.

The task of architecture as a functional subsystem of modern society is to organize and articulate new social functions by means of new spatial forms. Articulation is not adornment, but the continuation of the organizing effort by other means. Articulation augments the effectiveness of organization. Adornment can become a means of articulation if it is employed as a phenomenologically effective accentuation, or if it is integrated into a semiologically effective code, or both at the same time.

Beyond organization by means of establishing appropriate adjacencies, distances, barriers and connections etc emerges the task of ordering by means of articulation. Thus we may distinguish physical organization from articulated organization. The abstract organizational diagrams discussed in the previous section are open with respect to whether they will be concretized as merely physical organizations channelling bodies or as articulated organizations guiding subjects.

In ambitious architectural designs, physical organization is usually augmented by means of articulation, resulting in an articulated organization. Articulated organizations presuppose physical organization as their basis. However, we cannot assume that articulation merely emphasizes an organization that is already functioning as such. There are many social organizations that can only function if their spatial organization is articulated, because their efficient functioning relies upon the quick comprehension of the users, and this cannot be achieved by focusing on physical operations (distancing, physical separation, physical connection) only. One of the main arguments developed here is that advanced social institutions and life-processes can no longer be ordered by physical means only, but increasingly rely on spatial organizations that are highly articulated. Articulation is always selective. It involves both the accentuation and the suppression of features, revealing and concealing, making conspicuous as well as inconspicuous. It is often necessary to conceal, avoiding the conspicuity of certain features that might otherwise impress themselves and distract/disorient the users.

The distinction between organization and articulation recognizes the difference between the organizing operations of the building that work via professional standards and the work of the architect which is driven by personal and social impulses. The architect is not a mere technical expert, but a creative individual who designs and builds in an artistic manner.

---

148 'Articulation' comprises both phenomenological articulation and semiological articulation (signification).

149 A lot of ingenuity and effort are invested in Minimalist detailing which essentially consists in the suppression of construction details.
physical imposition and those ordering effects that work via the user’s perception, conception and comprehension of their environment. The effective structuring of the social process via channelling, separating and aggregating human bodies serves as the criterion of successful physical organization. Objective measures like the absolute/relative size, proximity/distance and the relative position of spaces, as well as the capacity/speed of circulation possible between these spaces are relevant here. In contrast articulation is ‘measured’ subjectively, on the basis of the degree of navigation, orientation and immersion or atmospheric priming it affords the respective users. These three aspects constitute the three main functions of all articulatory efforts within architecture. Navigation refers to wayfinding within a territorial matrix. Orientation refers to the grasping of the social situation and the anticipation of the social interaction-scenarios that might be expected within a particular environment. Immersion or atmospheric priming instills mental and emotional disposition that initiates and sustains successful social interaction. All three functions of articulation contribute to architecture’s capacity to address its societal function: the framing of social communication.

The three aspects of legibility thus furnish the criteria for what is to be considered well articulated. In order to anticipate and predict these subject-dependent affordances we need to work with quasi-objective ‘phenomenological qualities’ and the presumed ‘semiological charge’ of a projected spatial configuration and architectural morphology. Articulation over-determines organization. Articulation can even substitute for organization where demarcation no longer equals physical separation and instead relies on the ‘reading’ of space. Orientation within a sufficiently complex social space indeed requires active conceptualization rather than mere passive perception. As stated above, any simple concept of a built organization that is construed as functioning by means of the physical channelling of bodies only, and that receives articulation only as a secondary add-on that is merely improving this prior functionality by making it transparent, is insufficient. Today we witness many complex spheres of social life – for example, the open

---

150 Bill Hillier’s measure of ‘integration’ of a spatial unit within a network of such units belongs in this category of objective measures the geometric (physical) organization of space. Hillier goes on to suggest that a further objective measure – the degree of coincidence between global and local integration – can be used as an indication of the intelligibility of the system. However, Hillier’s concept does not reflect the user’s cognition and thus remains in the realm of organisation rather than articulation.

151 The design process relies on the designer’s own continuous, critical assessment of the legibility of the design – trying to see the design through the eyes of its future audience and users.
office landscapes of contemporary corporations – where physical separation is far too crude and restrictive a measure to order and frame the process. The environment is obviously always physical, but the contemporary means of ordering – lightweight screens, soffits, steps, morphological distinctions, light levels etc – are too nuanced and subtle to function via their (far reduced) physical presence. Physically the thresholds would simply be overrun, if they were not perceived, conceived and understood as communications. The meaning of these articulations is not always explicit, and may be navigated subliminally. They order the ongoing communication as framing context. Although primarily operating via subliminal cognition, the implicit meaning of spatial settings can – at any time – be made the subject of a clarifying, explicit communication.

6.5.2 THE PROBLEM OF ORIENTATION AND THE PROBLEMATIC OF LEGIBILITY
The reference problem for the task of articulation is orientation. Articulation should facilitate orientation by making the spatial organization and the social order within it legible. Orientation includes wayfinding within a spatial configuration, but it encompasses much more than that. Orientation includes the steering of expectations about the social scenarios that might unfold within a space and about the conduct that is appropriate within the space. The built environment is always more or less legible, whether there was an articulatory effort at work or not. Articulation therefore does not establish legibility as such. Rather articulation is the competent, purposeful effort to increase the legibility of a proposed spatial/functional organization.

Again: the built environment is always more or less legible. Organizations that are designed by paying attention to their physical effect only, nevertheless end up with an outward form that can be taken as an orienting clue (or so-called ‘index’). Users can indeed always learn to read their physical environments, extracting clues from the observation of regularities. In theory this is always possible, just as we can learn to read and navigate a landscape on the basis of observed regularities. The problem is that the contemporary diversity and complexity of social institutions and the contemporary proliferation of construction technologies/materials give far too much scope for random variety. The

152 For the sake of brevity the term orientation is used as pars pro toto, referring to the three functions of navigation, orientation and priming/immersion.
153 This may not only be a form of graphic post-production – like a post-fitted signage system – but also a concern that is folded into the very conception of the design.
same materials/forms are used for diverse social institutions and the same social institutions might be constructed with very diverse forms/materials. This condition requires a strategic approach to the selection of spatial forms and materials, with the view to visual clarification and systematic codification. The aim should be to establish systematic correlations that map the social differentiation onto spatial, morphological and material differentiations. The more complex the social system, the more resourceful must be the articulatory repertoire of any architectural style to cope with the sharpened problematic of legibility. 

6.5.3 ARTICULATE VS INARTICULATE ORGANIZATION

We have distinguished physical organization from articulated organization. Then we had to admit that merely physically ordered organizations can nevertheless be (more or less) legible. We defined articulation as the conscious design effort towards increasing legibility. As conscious effort directed towards a (more or less) generic audience, the articulatory effort constitutes a communication, to the extent to which it is recognized, understood and attributed as communication. The fact that the articulated organization is being recognized as deliberate communication is itself a factor enhancing its potential effectiveness. The audience’s attention level and perspective can be expected to shift favourably once an intention to communicate is detected in the built environment. However, even under this favourable disposition, there is no guarantee that the articulatory effort succeeds in increasing legibility. The opposite might hold and confusion might be introduced into a complex that might otherwise have been reasonably legible. Therefore we need to distinguish articulate organizations from (potentially badly) articulated organizations. The achievement of a truly articulate organization is the name of the game in architecture. The opposite term inarticulate organization thus comprises everything that is in one way or another deficient with respect to articulation: the merely physically ordered organization – legible or illegible – as well as the articulated organization that remains or turns out to be illegible to all or most users. It is important to note that the concept of articulate organization includes the designer’s deliberate effort as a necessary moment of its definition. What the concept requires is not only successful legibility but a

154 It has to be noted here that the solution cannot be the mere simplification of the visual field. This would imply the obliteration rather than the articulation of complexity.
155 Communications via built architectural works are attributed to the client, host, occupying organization rather than to the architect.
156 We are referring here only to the relevant audience that is trying to read and navigate the space and is thus motivated to look for clues.
successful legibility that has been achieved through a conscious design effort deploying deliberate strategies of articulation. Articulate organization is posited here as the prized endgame of architecture as conscious design discourse, in contradistinction to the vernacular tradition.

The section on architectural style stated that styles differ with respect to the way they handle form-function relations. We can further state that they represent specific ways of translating social into spatial order. We can observe that the requirements of articulation historically advance in prominence over and above the requirements of mere physical ordering. Now we can further specify that styles may differ in their ability to cater for this increasing demand of the advancing social order. The Baroque style, for instance, seems more articulate than the Renaissance. In general, we might surmise that the progression of styles, that is the history of architecture, might be written from the vantage point of a hypothesized increase in the capacity to cope with the advancing social demand to generate articulate spatial organizations. The degree of articulateness is then a primary criterion for the competitive evaluation of styles.

6.5.4 ARTICULATION AS THE CORE COMPETENCY OF ARCHITECTURE

Contemporary efforts at architectural articulation address the need for an increasingly rapid orientation in an increasingly complex built environment/social arena. This quest for orientation demands legibility in the face of mounting complexity.

The problematic of legibility provides the decisive differentia specifica that distinguishes architecture from engineering. While engineering is concerned with the provision of physical support systems (stability, climatic control etc), architecture is concerned with the spatial framing of social processes. This is a task that needs to go beyond physical organization to include articulate organization, addressed to perceptive, comprehending subjects. Thus the overall architectural design task, the spatialization of social processes, has two aspects: physical organization and articulation. Both aspects are currently handled by the discipline of architecture.

However, a potential future differentiation of the discipline into independent subsystems (rather than dependent subdivisions within a single system) can be detected here. Should the evolution proceed in this direction, the time-honoured title of architecture could only be given to one of the two social systems. Given the social cachet that comes with this title, the representative of the other of the two contending
subdisciplines is likely to be demoted to become either a ‘mere engineer’ or a ‘mere decorator’ respectively. It is my thesis here that, should this differentiation occur, it will be the task of articulation that most probably can seize the prized title of ‘architecture’.

The recent emphasis on ‘operativity’ and ‘performance’ fails to take account of this crucial moment of articulation that distinguishes architecture from engineering. The opposition of performance versus representation that has dominated the polemic against both Postmodernism and Deconstructivism is a false opposition. This one-sided emphasis on operativity and the related ambition to ‘determine’ rather than intuitively ‘invent’ form induces avant-garde design research to gravitate towards those problems that tend to be operation focused, such as transport interchanges where physical organization seems to be primary, involving objective processes only. Attention to such physical operations is always involved in solving architectural problems, but the more specific task of architecture involves the articulation of space with reference to perceiving and comprehending subjects and their communicative interactions. This, in turn, involves the question of phenomenology, ie, how are pertinent percepts solicited?, as well as the question of semiology, ie, how are pertinent systems of significations constructed and activated? Answers to the semiological question do not necessarily imply the utilization of well-established references. ‘Signification’ might involve the negation, decoding or subversion of known references and, within sufficiently large structures, new semiological systems can be forged (as will be elaborated below). That the semiological dimension of architecture has been denigrated in recent avant-garde discourses is due to the dialectical overreaction against the undue over-emphasis of issues of meaning during the previous periods of Postmodernism and Deconstructivism. The suppression of semiotic concerns is therefore a reactive rather than inherent trait of the recent avant-garde. It is a key contention of the theory of architectural autopoiesis that it is necessary to reintegrate both phenomenology and semiology into the design research programme of the current avant-garde.

6.5.5 GENERALIZING THE CONCEPT OF FUNCTION
All the above implies that phenomenology and semiology in architecture should not be opposed to function. Rather, phenomenological and semiological concerns should be subsumed within an updated, more general and more demanding notion of function, in line with the reconceptualization of functionality in terms of action-artefact networks.

157 For instance in Winy Maas’ programme of architecture as datascape.
Both the phenomenological and the semiological dimension of architecture, together, have to be theorized as catering for the articulatory demands placed upon architecture, over and above the basic demand for hard, physical organization. We might accordingly distinguish **hard functioning** and **soft functioning**. A physical distance functions as an undeniable, physical imposition. A solid wall constitutes a hard territorial boundary by physical force. In contrast, a step, balustrade or ceiling design might articulate a territorial distinction without barring movement and communication from territory to territory. These devices function softly, via suggestion rather than via imposition. The territorial boundary no longer imposes a physical barrier. This coincidence of territorial distinction and uninterrupted communication across territorial boundaries lies beyond the capacity of mere physical organisation. But it is this coincidence that affords much enhanced efficiencies in the spatial ordering of complex social systems. Even where physical organization is operating already, an articulatory overlay further enhances the social functionality of the space. The soft function of the wall is to create a perceptually palpable identity and atmosphere over and above the hard physical separation. The articulation of the space might also be involved in semiological coding operations that indicate the space’s relative position in the overall spatial organization as well as its particular, designated function within an overall system of distinguished functions.

The utility of a spatial organization might be considerably enhanced by means of an effective articulation that makes the underlying physical organization and the functional distribution of the territory legible to its users. The more complex and intricate the accommodated social institution, the more important, and indeed indispensable, becomes the articulatory enhancement of the spatial organization. Full functionality can no longer be sustained without a well-articulated design that satisfies both phenomenological and semiological criteria. This implies that the effective spatial ordering of the accommodated social institution can only be achieved by the coincidence of both physical organization and articulation. The solid wall operates as overpowering physical device separating domains in terms of access and visual/acoustic isolation. Thus it produces an organizational effect by means of physical power. In contrast to this **physical organization** the **phenomenological/semiological ordering** uses the necessary physical substrate in its articulatory (rather than in its physical) capacity. Obviously both operations rely on a physical substrate that can be specified in a set of construction documents. However, the conditions of effective phenomenological/semiological ordering stretch far beyond what can be delineated and specified within a traditional architectural drawing. Virtuoso articulation cannot be designed
via abstract diagrams or 2D line-drawings. Thus the task of articulation, especially under the condition of complexity and radical innovation, calls for a significant expansion of the design media of the discipline. The designer needs the enhanced visual simulation capacities of 3D rendering and animation to calibrate the perceptual efficacy of the design.

The visual appearance of buildings and spaces matters enormously within architecture. Both architects and clients demonstrate their investment in appearances and aesthetic matters. The theory of architectural autopoiesis shows why this investment is not a fetish or indulgence. The rationality of this investment lies in the fact that architecture functions as much via its appearance as it functions via its physical sorting of bodies. This has always been the case. However, architectural theory has tended to set appearance against function. In contrast, the theory of architectural autopoiesis incorporates the concern for the visual appearance of architectural works within an expanded or generalized concept of architectural functioning. This generalized concept of function in turn demands that appearances are consciously functionalized within the design process. What is new in recent times is that the physical sorting of bodies recedes in relative importance. What is also new is that societal development has accelerated and social complexity has increased to a point where the conscious functionalization of appearances within a strategic, theory-led design effort becomes more and more urgent. This fact is recognized by positing articulation as fundamental dimension of architecture's task.

6.6 The Phenomenological vs the Semiological Dimension of Architecture

THESIS 30
Phenomenology and semiology address different dimensions of the task of architectural articulation that are equally indispensable for the built environment's functionality: the perception of spatial order and the comprehension of social order.

Both the phenomenological and the semiological dimension of architecture are dimensions of architecture's functionality. Thus far we have coupled the phenomenological and semiological dimensions, to distinguish them, as subject-dependent dimensions, from the objective organizational dimension. Now it is necessary to distinguish phenomenology from semiology leading to the following tripartite distinction:
The organizational dimension of architecture is the part of the architectural discourse/design-effort that is concerned with the physical conditions of the built environment’s social functionality. The organizational dimension is based on the fact that the effective use of the built environment depends upon the physical ordering of the user’s activities and relative movements.\textsuperscript{158}

The phenomenological dimension of architecture is the part of the architectural discourse/design-effort that is concerned with the perceptual conditions of the built environment’s social functionality. The phenomenological dimension is based on the fact that the effective use of the built environment depends upon the user’s fast and comprehensive perception of its spatial organization.

The semiological (semantic) dimension of architecture is the part of the architectural discourse/design-effort that is concerned with the semantic conditions of the built environment’s social functionality. The semiological dimension is based on the fact that the effective use of the built environment depends upon the user’s fast and comprehensive understanding of the built environment as system of signification that reveals its social meaning, i.e., the types of social interactions that are to be expected within the encountered environment.

Between these three dimensions obtains a relation of successive presupposition such that the successful activation of the semantic dimension presupposes a prior accomplishment within the phenomenological dimension which in turn presupposes at least a certain minimum of physical organization. The final result of these staggered achievements is the accomplishment of a designated and articulated spatial organization, i.e., an architectural order that frames and thus facilitates the participating actor’s orderly communication processes.

Architecture functions only if it is understood by its users. This understanding presupposes the recognition of figures and configurations as well as the observation of regular correlations of spatial forms with social functions within the built environment. These regular correlations might be a side effect of physical organization or the result of a conscious articulatory effort of the designer. Independently of their origin as side effects or intended effects, in each instance, regular correlations consolidate to more or less fixed signs. In the first case, where the sign emerges on the basis of unintended regularities, the observed

\textsuperscript{158} The physical dimension of architecture is the dimension where functionality is established by means which do not depend upon specifically sharpened perceptual and semantic capacities of the occupants to achieve its organizational objectives.
spatio-physical feature operates as a so-called *indexical sign*. In the second case, where the relationship is consciously crafted it operates as a so-called *symbolic sign*. Irrespectively, the emerging sign system belongs to the semiological dimension of architecture. This semiological dimension of architecture thus emerges partly by default semiosis and partly on the basis of intended signification.

It is important to note that effective meanings cannot be established by fiat. Deliberate strategies of signification are no more than suggestive steering efforts that rely on the user’s acceptance and routine utilization to become effective. This user-dependency limits the degree of novelty/strangeness that can be introduced at any one time. For radical novelty to succeed, a certain critical mass of construction – as a critical quantum of material for semiosis – is required. Within mainstream architecture, deliberate strategies of signification are often just imitating the results of unconscious vernacular building, following on from the indexical signs as conventional condensation of the originally unintended correlations. For instance, there might be the deliberate intention to make sure that a villa looks like a villa, a hotel looks like a hotel etc. Thus emerges a *conventional symbolic canon* of (all too) familiar architectural signs. It is one of the primary agendas of the theory of architectural autopoiesis to contribute to the development of a semiological expertise that can be confident enough to break through this barrier of conventionality.

The *phenomenological dimension* refers to pre-semantic cognitive processes where less familiar figurations and configurations are perceived and percepts are constructed rather than simply retrieved via indexical, iconic or symbolic triggers. The construction of percepts might be both bottom-up – as in the famous Gestalt-grouping principles (proximity, similarity, continuity, symmetry, closure) – as well as top-down on the basis of prior schemata and mental maps. These schemata, like axes, grids, concentric organizations etc, are abstract and thus open to novel interpretation. Here, in the pre-semantic domain, articulation facilitates perception by means of visual clarification in terms of general criteria of perceptibility and conspicuity, as have been elaborated by the Gestalt psychologists in the early 20th century. It is important to recognize the phenomenological dimension as independent, pre-semantic domain of articulation that operates in advance of any iconography or conventional symbolic canon. Over-reliance on the semiological dimension of architecture tends towards iconography, which is often rather inimical to radical innovation. It is possible to articulate abstract configurations that can be navigated without yet being coded with fixed social meanings, thus giving scope to creative appropriation.
Avant-garde architects should be fully aware of the complex semiological codings that always operate within the social utilization of the built environment. But this understanding of the prevailing semiological codes should enable the architect to break up and subvert the prevailing meanings rather than only use and perpetuate them. This practice of ‘making strange’ is indeed a hallmark of all avant-garde design practice – although this is not always reflected and instrumentalized in relation to a programme of articulation.\textsuperscript{159} In order to facilitate the build up of a new legible order, eventually engendering a new semiosis, the architect must reflect upon the cognitive capacities of its users, and perhaps tap into the relevant psychological research. In fact, there has been an interesting historical lineage whereby the insights of Gestalt psychology have been channelled into the discourse of architecture. Le Corbusier, László Moholy-Nagy, Sigfried Giedion, György Kepes, Colin Rowe, Christian Norberg-Schulz, Michael Graves and Peter Eisenman are among those who concerned themselves with questions of perception and took note of Gestalt psychology.

The study of the psychological science of perception might be helpful, but is no \textit{conditio sine qua non}. The architect can work quite intuitively and use his own perceptual capacity as ongoing control mechanism. However, reliance on the average architect’s intuitions is insufficient to address society’s increasingly rich and complex life-processes. The task of articulation requires the explicit recognition of architecture’s phenomenological dimension as a field of design research. It is one of the agendas of the theory of architectural autopoiesis to instigate a collective, investigative discourse as well as theoretically informed design experiments in this dimension.

6.7 The Phenomenological Dimension of Architectural Articulation

THESIS 31

Within the avant-garde stage of a style, articulation strategies must emphasize the phenomenological dimension as independent, pre-semantic arena of articulation that gives scope to creative appropriation beyond fixed meanings.

While architecture shares the semiological dimension with other design disciplines like product and fashion design, the phenomenological dimension, although perhaps not exclusive to architecture, is of unique

\textsuperscript{159} This practice of ‘making strange’ was first formulated in the art system (Surrealism) and within the context of modern theatre (Brecht).
importance to architecture and urban design. The perception of architectural and urban territories presents some unique cognitive challenges in comparison with the perception of objects of the kind product designers deal with. The perceptual identification and isolation of objects like mobile phones, handbags, chairs and bicycles is unproblematic because they move against their background. The integrity and demarcation of architectural entities is, in comparison, always more problematic. The distinction of buildings within a contiguous urban fabric is often difficult. Strictly speaking, the built environment is a single, continuous entity. Its decomposition into units lacks the hard criterion of independent mobility. The perceptual identification of architectural unities is further made difficult by the fact that most relevant architectural unities (buildings, territories) elude the scope of individual vistas. While the totality of a mobile phone is in view all the time (or can be brought to view and easily grasped by swivelling it in one’s hand), the totality of a building always eludes the scope of what can be seen at any one time. Cognition has actively to synthesize architectural unities from perceptual fragments. Thus phenomenological articulation is required to support the perceptual decomposition of a global scene into relevant units, both via the perceptual severing of an otherwise continuous contiguity, and via the synthesis of asynchronous parts into unities.

Thus in the case of architecture, the synthesis of parts into relevant unities is burdened by the fact that movement and time are required to synthesize the perceptual totality of the building. The front and back of the building can never be experienced at the same time. The same separation in time exists with respect to inside and outside. They can never be experienced simultaneously. The same applies to interior spaces. Human vision is not 360 degree vision. The perception of an enveloping space requires time and synthesis, even in the case of simple convex spaces. Also, the different, collaborating parts of the building’s interior – although intended to form a functional unity – can never be apprehended together. Instead a mental map needs to be constructed to make orientation possible. But in order to construct such a map the spatial organization of those parts relative to each other has to be grasped. The subject/user has to understand what belongs together and where a different zone or territory begins. What is required here is that the phenomenological articulation furnishes conspicuous visual contrasts

160 The distinction of inside versus outside is the differents specifiques that demarcates architecture from the other design disciplines. See Volume 1, chapter 2.5.5 The Specificity of Architecture within the Design Disciplines.
and continuities that support the individuation of different territories. These visual differentiations should be ordered into a system of visual similitudes and contrasts that corresponds to the system of social distinctions. Thus, especially in view of articulating larger complexes, the establishment of these contrasts and continuities should be rule based. What is further required is the grasp of the spatial relations and access opportunities between the distinguished units.

The subject’s mastery of all these perceptual challenges can be facilitated by the design effort of phenomenological articulation. Phenomenology thus facilitates orientation and navigation. It should do so, as much as possible, on the basis of the subject’s cognitive background processing rather than requiring the subject’s concentrated observation.

6.7.1 THE PERCEPTUAL CONSTITUTION OF OBJECTS AND SPACES

Fast orientation in complex scenes is based on the capacity to perceive configurations as whole figures. This instant (re)cognition of the whole figure without prior (re)cognition of the parts might be referred to as the psychological primacy of wholes. The recognition of individual parts is not implied, and requires a further, separate focus and cognitive effort. The recognition of wholes, i.e., simple or complex objects that form a functional unit or unit of interaction, is a vital capacity of all higher organisms that have to identify prey and avoid predators. Perception, involving object- and pattern-recognition, is not a matter of passive reception. The identification of stable objects within the ongoing stream of impressions is an act of cognitive synthesis. Perception is proactively involved in the very construction or constitution of objects and patterns. The achievement of synthesizing the multitude of impressions from the tactile, auditory and visual sense, each delivering ever-changing sensory inputs (sense-data), relies on a capacity that is species-dependent and to a certain extent subject to cultural overdetermination. The acquisition of such an interpretative capacity is an evolutionary achievement of the species and a developmental achievement within each individual. According to the pioneer of developmental psychology, Jean Piaget, the full achievement of this competency – which Piaget terms the achievement of object permanence (OP) – is realized at the age of two and marks a definite stage in the cognitive development of the child.

161 The German word for figure is ‘Gestalt’. Accordingly, Gestalt psychology is the psychology of figure recognition. (Gestalt-psychologie is the name Max Werheimer and his followers gave their original, groundbreaking research into and theory of the psychology of perception.)
The evolved human mind constructs or calculates the world of stable objects from the ever-changing stream of sensory inputs. The input for this calculation comprises the coincidence and concatenation of ever-changing, fragmented, tactile encounters and visual sensations. The visual sensations are subject to perspective distortions as well as to continuously shifting conditions of visual overlap and reflections due to modulated conditions of light/shadow. The perspective distortions are regularly concatenated and correlated with the sense of bodily movements. Reflections and overlap are also correlated with the sense of bodily movement indicating the subject's shifting spatial position. The fluidity and subjectivity of sensory impressions have led philosophers to ruminate upon the reality of the ‘external world’.

The empiricist philosopher Bertrand Russell considers physical objects to be nothing but ‘logical constructions from sense-data’ whereby the criterion that distinguishes stable objects from hallucinations is the regular, predictable concatenation of the sequence of sense-data. Bertrand Russell defined sense-data as follows: ‘Let us give the name of “sense-data” to the things that are immediately known in sensation: such things as colours, sounds, smells, hardnesses, roughnesses, and so on.’

Russell’s analysis of the perception of a simple everyday object is instructive:

... let us concentrate attention on the table. To the eye it is oblong, brown and shiny, to the touch it is smooth and cool and hard; when I tap it, it gives out a wooden sound.... Although I believe that the table is ‘really’ of the same colour all over, the parts that reflect the light look much brighter than the other parts, and some parts look white because of reflected light. I know that, if I move, the parts that reflect the light will be different, so that the apparent distribution of colours on the table will change.... This colour is not something which is inherent in the table, but something depending upon the table and the spectator and the way the light falls on the table.... The shape of the table is no better. We are all in the habit of judging as to the ‘real’ shapes of things, and we do this so unreflectingly that we come to think we actually see the real shapes. But, in fact, as we all have to learn if we try to draw, a given thing looks different in shape from every different point of view. If our table is ‘really’ rectangular, it will look, from almost all points of view, as if it had two acute angles and two obtuse angles. If opposite sides are parallel, they will look as if they converged to a point away from the spectator; if they are of equal length, they will look as if the nearer side were longer. All these things are not commonly noticed in looking at a table, because experience has taught us to construct the ‘real’

shape from the apparent shape, and the ‘real’ shape is what interests us as practical men. But the ‘real’ shape is not what we see; it is something inferred from what we see. And what we see is constantly changing in shape as we move about the room. . . .

The underlying philosophical quest of Russell to explicate the ontological status of physical objects of experience and to give a critical foundation to science is of no concern to us here. (Russell’s philosophical efforts in these respects have long since been superseded.) What is of interest here is the illustration of the difference between immediate appearances and the ‘inferred’ reality. In everyday life our experience of this ‘inferred’ reality is immediate, although we have the ability to reflect upon the underlying appearances. Painters need to be able to concentrate on appearances to simulate the visual impression of reality. The theory of architectural autopoiesis argues that architects too should pay close attention to how spatial reality is ‘inferred’ or ‘constructed’ from appearances. This process of construction or inference is a cognitive process that happens preconsciously. In a cognitive science of perception something like sense-data (retinal images) are taken as the primary input to perceptual processes. Within consciousness the complete object is the primary given. The process of constructing stable mental images is an automatic process that renders that which is immediately given to our senses virtually invisible. It takes a rather artificial mode of attention to abstract from the automatic recognition of objects and to focus instead on what is given to the senses. This artificial mode of concentrated attention and reflection is at the root of the philosophical methodology of phenomenology, the so-called phenomenological reduction. A similar, artificial focus on unprocessed sense-data is required for the task of realistic painting. When a child tries to depict a familiar object it lacks realism. It seems as if the child goes by what it knows rather than what it really sees. This shows that the realism we expect from a skilful rendition – supposedly depicting the thing or scene just as we see it – is a rather effortful, artificial achievement that in no way comes naturally. Seeing cannot easily be separated from knowing and recognizing. But that is what is required in order to produce the kind of realistic simulation of visual reality that we admire in virtuoso painting. This kind of simulation requires us to invert our natural perceptual attitude. It requires

us to realize what is projected onto our retina when we experience objects within an environment. It took thousands of years of development before the art of drawing/painting was able effectively to simulate the visual sense-data that our senses receive and upon which the acts of perceptual synthesis are performed to deliver our experience of the tangible world. The simulation of perspective distortion was a first major step – understood and promoted by Alberti. Perspective did not only advance painting, it also inaugurated architecture’s skilful engagement with the phenomenological dimension of the built environment by establishing its capacity to simulate the visual impressions that a building or space would make. Leonardo da Vinci’s simulation of air-perspective indicating far distances was another step. The advanced simulation of light and shadow effects followed, most notably by Caravaggio and Rembrandt. The architecture of the Baroque reflects this new sensibility towards light and shadow effects with its emphasis of deep relief and plasticity.

The history of painting can thus be written as a long march back to the sensory base of perception. The last stage and final moment of arrival – Impressionism – both delivers compelling simulations and, at this very moment of delivery, shows its own artifice and thereby finally reveals the creative act of perceptual synthesis. The Impressionist canvas, if viewed from a distance, displays a convincing simulation of a real-life scene. Upon close inspection the image dissolves into an amorphous flux of elementary colour patches.

Impressionist painting might very well be interpreted as either an anticipation or an illustration of the radically empiricist philosophy of sense-data that emerged at about the same time.164 The next step was Cubism. Like Impressionism, Cubism was concerned with the investigation of perception. Both Impressionism and Cubism were working with quasi-scientific series. Analytical Cubism goes further and, as it were, moves from the Impressionist’s real-life experiments in perception to abstract ‘laboratory’ experiments that allow for the systematic manipulation of critical variables in order to home in on some profound and compelling effects.165 The key dichotomy of all perception and all prior representation – the distinction of figure and ground – was probed. The figures are broken into fragments and assimilated to the

164 Although Russell’s text dates from 1912, similar ideas had been discussed earlier, most notably Ernst Mach’s *The Analysis of Sensations and the Relation of the Physical to the Psychical*, Open Court Publishing Company (Chicago/London), 1914. The German original – *Die Analyse der Empfindungen und das Verhältnis des Physischen zum Psychischen*, Verlag Gustav Fischer (Jena), 1886.

165 This interpretation of Cubism does not make any claims with respect to Picasso and Braque’s self-conscious intentions.
background in the attempt to find the threshold where a figure crystallizes from the amorphous background and dissolves back into it. The paintings try to capture this tipping point. If one looks successively at a whole series of such works, one can realize that this threshold or tipping point depends on what one has been looking at before. Thus the sequencing of images – or vistas in a spatial sequence – can determine how each individual image or vista is perceived. Within the psychology of perception this effect is called ‘priming’. The Gestalt psychologist Kurt Koffka, following Edgar Rubin, talks about ‘figural after-effects’.\(^{166}\)

The early Cubist paintings worked with the fragmentation of the human figure. The Cubists also worked with still lifes: simple scenes of everyday life with the most mundane and taken-for-granted objects like bottles or vases on a table. Their pictorial problematization of these most simple and clear objects mirrors the philosophers’ preferred examples – chairs, tables and the book on the table in front of them – as vehicles for the problematization of reality and knowledge.

Le Corbusier experimented with the ambiguity and volatility of perceptual object synthesis in his paintings from the 1920s. His *Still Life* from 1920, at first glance, seems to depict a guitar as the most prominent, central figure in the painting. Further exposure to the painting

---

slowly reveals other objects. However, these other objects cannot coexist with the guitar. They dissolve the guitar by reinterpreting its supposed parts within other object formations. The circle in the centre of the body of the guitar (supposedly depicting the guitar’s rosette) becomes the top plate of a pile of plates. What seemed to be the tuning keys of the guitar turn out to be the mouths of various bottles, glasses and pipes placed upon the table. Even the body of the guitar disappears and re-appears as the back of a chair that is pushed against the table. The painting thus calibrates a multiplicity of equally plausible decompositions. What is a whole and what is a part, and to which wholes the parts assemble remains unresolved.

The synthesis of a multitude of impressions into a set of stable objects is the fundamental task of perception. Ephemeral appearances have to be
distinguished from recurrent properties. Another, related task – or perhaps another way to pose the same problem – is the task of decomposing a complex scene or perceptual totality into relevant units of interaction. Effective units of interaction, like people, animals, flocks of animals, plants etc, have to be distinguished from each other, from their background, and from coincidental clusters of features that do not form an integrated, functioning whole. The surest criterion for what should be considered an effective unit of interaction is what moves together: the various body parts of an animal, the flock of birds, the stone that rolls down the hill. Within the built environment, architecture’s domain of intervention, this ultimate criterion of object individuation is not available. In architecture, object identities are always problematic. What should be considered as an integral whole, as effective unit of interaction, must remain a precarious inference. There is no ultimate test of wholeness. Yet, within the built environment it remains as vital as it is within nature to understand what belongs together to form an effective unit of interaction. What works together should be perceived as integral entity. The perceived visual decomposition of a scene should match the functional decomposition of the territory.

Where does a space, a territory, or a building begin and where does it end? What works together? What functions as a unit? Which sequence or cluster of spaces belongs together as spatial system sustaining a social system and its integral life-process? Functional units must be recognized as such in order to function. Therefore spatial elements must be allocated and understood as parts of larger, effective wholes. The potential for ambiguity is enormous here. But this ambiguity is not only a problem. This ambiguity entails an exciting potential that can be exploited in respectively astute design strategies. Architectural and urban design are creative fields where the reflection upon the principles that govern perceptual synthesis and decomposition is most pertinent.

6.7.2 COGNITIVE PRINCIPLES OF GESTALT-PERCEPTION
At the exact same time when Picasso and Braque developed Cubism, and Russell analyzed the constitution of objects in terms of sense-data, Max Wertheimer (1880–1943) – together with his collaborators Kurt Koffka (1886–1941) and Wolfgang Köhler (1887–1967) – started to develop a new approach to the psychology of perception that was soon termed Gestalt psychology. The key concept of Gestalt – the German word for figure or pattern – indicates the keen interest in the fact that perception involves the organization of integral figures or patterns. The problematic of the previous chapter – the perceptual constitution of objects and the
related decomposition of a complex scene – is the key problematic of Gestalt psychology.

The key tenet of Gestalt psychology is the insistence on the experiential primacy of wholes and the rejection of the notion of atomistically conceived sensations, insisting that ‘percepts have characteristics which cannot be derived from the characteristics of their ultimate components, the so-called sensations’. The Gestalt psychologists discovered and documented through extensive experiments that the identity and properties of the various elements within a perceptual field are relational rather than autonomous. The properties of parts are determined by the wholes they are perceived to be a part of. And, as Koffka insists, ‘these properties need not be like those of traditional psychology, “dead” attributes, possessing a “so-being” only, but that many of them are alive and active, possessing a “so-functioning”.’ Experiments can be constructed in which the elements that constitute an experience change their perceived character and properties when shifted into a new constellation despite the fact that the underlying elemental stimulus remains the same. Conversely, a perceived whole, for example, a chord, melody or characteristic spatial shape/configuration, is perceived as being the same even if all its elemental stimuli are being changed, for instance, when a melody is transposed into a different key or a shape is perspectively distorted. These experiments suggested that it is to the Gestalt, the relational organization or figural whole, rather than to individual sensory elements, that the organism responds. Especially when a scene or figure is exposed only for a very short moment, essential Gestalt qualities are grasped and recognized without any ability to recall or identify components. Before Gestalt psychology, the psychology of perception was focusing on elemental sensations and the habitual association between such sensations. According to Wolfgang Köhler, psychology has been ‘ignoring all processes, all functional interrelations, which may have operated before there is a perceptual scene and which thus influence the characteristics of this scene’. The recognition of a Gestalt is a ‘whole undivided experience’. But, as Koffka points out, ‘undivided does not mean uniform, for an undivided experience may be articulated and it may involve an immense richness of detail, yet this detail does not make of it

a sum of many experiences’. Koffka writes: ‘What we find is an undivided, articulated whole. Let us call these wholes “structures”, and we can then assert that an unprejudiced description finds such structures in the cases underlying all psycho-physical experiments, but never any separate sensations.’ The importance of structures is that they determine the qualities of all subsidiary parts. ‘Structures, then, are very elementary reactions, which phenomenally are not composed of constituent elements, their members being what they are by virtue of their “member-character”, their place in the whole; their essential nature being derived from the whole whose members they are.’ Max Wertheimer summarized the essential insight of his approach as follows: ‘The fundamental “formula” of Gestalt theory might be expressed in this way: There are wholes, the behaviour of which is not determined by that of their individual elements, but where the part-processes are themselves determined by the intrinsic nature of the whole.’

According to the Gestalt psychologists there are certain universal principles that order human visual perception, most importantly the separation of ‘figure’ and ‘ground’ as precondition for further discriminations within the figure or for comparisons from figure to figure. Confronted by a rich visual scene, we need to separate a dominant shape (a ‘figure’ with a definite contour) from what our current concerns then relegate to the ‘background’ (or ‘ground’). An illustration of figure-ground separation as perceptual act is the famous ambiguous figure devised by the Danish psychologist Edgar Rubin which appears alternately as vase or as two human profiles facing each other. Kurt Koffka considers the ‘figure-ground structure’ to be ‘one of the most primitive of all structures’. He describes the essential features of this structure as follows: ‘As a rule the figure is the outstanding kernel of the whole experience. Whenever I give attention to a particular part of a field, this part appears in the figure-character. . . . Whatever I am looking at, watching, acting upon, stands forth, grows fixed, becomes an object, while the rest recedes, grows empty, and becomes the ground. . . . The ground is always less “formed”, less outlined, than the figure. . . . Phenomenally, the figure is always a stronger and more resistant structure than the ground, and in extreme cases the ground may be almost formless, a mere background.’

171 Ibid.
172 Ibid.
Figure 33  Figure-ground ambiguity, Edgar Rubin 1915

Figure 34  Giambattista Nolli, Plan of Rome, 1748, small segment
Koffka is once more emphasizing the act of perceptual synthesis: 'Phenomenal figures have boundary lines even when the corresponding objective figures have none. A good figure is always a “closed” figure, which the boundary line has the function of closing.'

The classic architectural application of the figure-ground structure is manifest in the so-called figure-ground plan that distinguishes urban mass from urban void. Giambattista Nolli’s famous 1748 Plan of Rome depicts the non-public urban mass as black solids while letting the urban voids and important public interiors show up in white. Here it is the voids rather than the built forms that are perceived as figures against the background of a nearly amorphous fabric. What inclines us to focus on the voids here? It is the sense of convex closure of the white areas – although this feature is objectively always interrupted by the incoming and outgoing streets. Furthermore it is the greater regularity and symmetry of the white areas. (These factors will be thematized below under the heading of ‘Gestalt-grouping principles’.) With respect to urban scenes there is always this double-sidedness, this twofold possibility of reading the structure as a structure of voids or as a structure of solids. Colin Rowe has noted that traditional and modern city stand opposed, with the latter focusing on solids with a continuous void as background and the former focusing on voids with a continuous background of solids: ‘the traditional city . . . is so much the inverse of the city of modern architecture that the two of them together might, sometimes, almost present themselves as the alternative reading of some Gestalt diagram illustrating the fluctuations of the figure-ground phenomenon.’ However, even if one reading is privileged, either as solid or as void, depending upon the type of urban formation, there remains an inherent ambiguity. The potential for a Gestalt-switch remains. An urban design strategy might involve strategic shifts between the two tendencies and set up conditions that induce subjective figure-ground reversals. One might set up zones that clearly privilege the reading of solid figures and then move on to zones that privilege the reading of the figural voids. There might be a zone of transition where the matter becomes ambiguous and thus prone to the experience of Gestalt-switches. While Rubin’s abstract ambiguous figure-ground structure leads to an unpredictable oscillation between two possible perceptions, in a concrete ecological condition one of the two readings might be contextually primed. The reading of the transition zone might depend on the direction from which an observer enters the transitional scene. It is in such a situation that figural after-effects come into play. Koffka elaborated on this phenomenon as follows:

The figure-ground distinction cannot be identified with a mere difference of the attention-level. The organism’s structural reaction to a pair of stimuli depends upon its attitude. Before the subject is confronted with the stimulus, the structure that eventually will ensue must be prepared for by a mental attitude, and this attitude consists mainly in a readiness to carry out a certain structural process. ‘Attitude’ has now become a well-defined term as distinguished from ‘attention’. It means that in entering a given situation the organism has in readiness certain modes of response, these modes being themselves what we have called ‘structures’. If a structural process is thus adequately prepared for, it may come to its full effect under conditions which of themselves would have provoked a different structural process.175

However, before or rather alongside all after-effects and attitudinal preparedness there might be hard-wired structuring processes that are part of an invariant make up of our perceptual/cognitive apparatus. The question must be raised which aspects of an objective spatial configuration become decisive factors for the emergence of patterns and figures within human perception/apprehension. Gestalt psychology talks about Gestalt-grouping principles which regulate how one (rather than another) whole figure is perceived in the face of a certain arrangement of ‘stuff’. (We say ‘stuff’ because to speak of parts, elements or even fragments already implies a certain whole as reference.) Although habituation plays an important role in perception, Wertheimer insists and demonstrates that the operation of the Gestalt-grouping principles cannot be explained on the basis of a subject’s prior experience, as a mere tendency to recognize the familiar.176

The major Gestalt-grouping principles are: the law of proximity, the law of similarity, the law of continuation, the law of closure and the law of symmetry.

These principles designate conditions that promote the perceptual synthesis of the ‘given’ visual ‘stuff’ into the wholes which imprint themselves so irresistibly in our minds. For instance, within a scatter of dots we tend to perceive groups/figures where dots are more proximate to each other. With respect to interpreting lines as outlines that define an object or figure, a smooth/curvilinear/convex line dominates over concave lines, or lines which are broken by kinks. Symmetry also inclines

perception to draw complementing elements into a whole. The Gestalt-grouping principles thus compose/decompose the visual scene into a particular configuration. Usually this entails the so-called *figure-ground segregations* as basic result.

1. The law of proximity:
   Grouping proceeds on the basis of contiguity, or in the absence of contiguity, grouping is guided by the closest proximity. The left image suggests vertical lines while the right image suggests horizontal lines. However, it should be observed that an inverse reading is still possible.

   ![Figure 35 Gestalt grouping principle: the law of proximity](image)

2. The law of similarity:
   Grouping proceeds on the basis of similarity. Despite the fact that the proximity principle would privilege the perception of vertical lines, the principle of similarity suggests horizontal lines. This example thus shows that the different principles might be in conflict with each other. Here similarity dominates.

   ![Figure 36 Gestalt-grouping principle: the law of similarity](image)
3. The law of continuation:
Grouping proceeds on the basis of smooth continuation. The first option of decomposition is most likely, it is privileged by the law of continuation. Again, the other two ways of decomposing the scene remain latent possibilities. Such latent possibility might be triggered by the introduction of minute geometric manipulations, for example, the introduction of a small gap at the junction, or by prior lead in experiences.

![Figure 37 Gestalt-grouping principle: the law of continuity](image)

4. The law of closure:
The synthesis of the given elements (here line segments) – or rather the decomposition of the scene into figures – privileges closed forms. The first decomposition of the scene into a closed, convex figure that is framed by two lines is the most natural one. This effect holds despite the fact that the other two possibilities of synthesis/decomposition reveal the latent presence of equally familiar figures, namely the letters K, W and M. Closure as a primary Gestalt-grouping principle trumps familiarity.

![Figure 38 Gestalt-grouping principle: the law of closure](image)

This can be confirmed with the image Wertheimer himself uses. Here the familiar figure of the square is avoided. The first part of Figure 39 does not privilege the decomposition into the letters W and M but rather suggests a (strange) shape squeezed between two lines.

Wertheimer uses the configuration in Figure 40 to show a conflict between closure and continuation. Here the continuation of the curve dominates over the option to see three separate closed figures.
5. The law of symmetry:
Figure identification privileges symmetrical figures. This explains why we tend to focus on the white in the top row and on the black in the bottom row. However, the effect seems rather unstable here.
The power of symmetry with respect to catching our attention can also be demonstrated with the images utilized in the so-called Rorschach test. These images emerge from random ink splashes that are then folded into symmetrical figures that trigger the test participant’s imaginative figure reading. Our predisposition towards reading such shapes as creatures implies that we seek out credible units of interaction in whatever visual material we are confronted with.

One can observe here that the attention-grabbing impact of the symmetry increases with the degree of complex irregularity/asymmetry of the half-image that is then mirrored to produce the final image. The figure is so strongly integrated because its parts lack independent figural qualities. Thus there is little chance that this whole falls apart into autonomous segments. The hidden rationality of this effect lies in the improbability that such a complex configuration could be accidental. It therefore makes sense that such a configuration commands attention. In fact, this dialectic whereby incompleteness, asymmetry and complexity in the parts is sublated into an all the more powerful impression of unity in

---

177 The Rorschach inkblot test is a psychological assessment to examine and evaluate the personality characteristics, in particular with respect to the detection of psychotic thinking. The test was created by Hermann Rorschach in 1921. There are 10 official inkblots. Five inkblots are black ink on white paper. Two are black and red ink on white paper. Three are multicoloured. The image depicted above is the first of the official black inkblots. Rorschach’s test was first published in his 1921 publication Psychodiagnostik (Berlin/Leipzig), 1921.
the whole was effectively utilized by the Baroque. Here lies the primary advance of the Baroque over the Renaissance: the Baroque’s far superior capacity to forge large, complex unities.

Architectural composition can utilize these principles to aggregate building components into strong and coherent, highly legible objects and configurations of objects. But it is equally possible, and this has been the ambition of Colin Rowe’s concept of *phenomenal transparency*,\(^\text{178}\) to take the cue from the ambiguous figures and multivalent patterns\(^\text{179}\) that serve as research material in the psychology of perception, and allow the various Gestalt-grouping principles to compete against each other, setting up arrangements that oscillate between several latent ‘readings’\(^\text{180}\). Phenomenal transparency implies the formal multi-tasking of the parts of a formal arrangement. Even what is a nameable part (or distinct sub-whole) is a function of the overall reading of the arrangement as figure. Two-dimensional ambiguous figures are the perfect example. But we can also observe this phenomenon in three-dimensional space. This strategy allows for the simultaneous articulation of different social orders, catering for different events or audiences sharing a complex social space.

For each audience, with its particular expectations, a latent reading is presented. In this way visual ambiguity or multiple readings give phenomenological support to multifunctionality within a single territory that is simultaneously utilized according to two different event patterns. However, in the history of architectural thinking the idea of phenomenal transparency was, so far, only a concept concerned with formal/experiential effects.

Le Corbusier’s 1920 still life described above can serve as a paradigmatic example of phenomenal transparency. Colin Rowe used Le Corbusier’s 1927 competition design for the League of Nations as one of several examples of how the phenomenal transparency effect can operate

\(^{178}\) Colin Rowe & Robert Slutzky, ‘Transparency: Literal and Phenomenal’, *Perspecta* 8 (Yale Architectural Journal), Yale University, 1963. Jeff Kipnis proposed an interesting expansion of Rowe’s concept, ie, he proposed the term ‘phenomenal transparency’ to describe conditions where an indeterminate number of latent readings seems to be embedded within a rich pattern.

\(^{179}\) A fascinating, in-depth exploration of ambiguous figures and multivalent patterns can be found in George Stiny’s brilliant *Shape*. According to Stiny, shape ambiguity and the continuous re-reading of figures/shapes is an essential aspect of the design process. See George Stiny, *Shape: Talking about Seeing and Doing*, MIT Press (Cambridge, MA), 2006.

\(^{180}\) In architectural design (as distinct from product design), this notion of latency is of particular relevance, because in architecture part to whole relationships are always somewhat precarious. In architecture everything is immobile. There are no objects in architecture if one assumes that the paradigm of the integral object is the mobile object that moves with all its parts and thus severs itself unambiguously from its background. In architecture this final, absolute criterion of distinct objecthood – its independent, integral mobility – is lacking. Therefore in architecture objecthood remains precarious. There are – *stricto sensu* – no architectural objects.
in space. The different readings of the overall spatial composition are triggered by a shifting subject position when the subject moves through the complex and thus gains and loses aspects of the composition. The two main readings between which Le Corbusier’s design oscillates are its reading as monumental, symmetrical composition (perceived when approached on axis), and its reading as asymmetrical, dynamic composition of planes sliding against each other.

One of the author’s own attempts to utilize the phenomenal transparency effect within a spatial composition was realized in the context of an exhibition design, the design for ‘Wishmachine – World Invention’ curated by Brigitte Felderer and Herbert Lachmayer. The two primary readings (decompositions) of the spatial composition were functionalized in terms of two ways of ordering the exhibits into storylines. The first decomposition of the scene presented four different walls that traversed the space: a zigzag wall, an S-curved wall, a boomerang-shaped wall and a wall in the shape of a giant ramp. Each wall traversed the given bounding box, intersecting with all (or some of) the other walls. Each wall carried a chronological, monothematic sequence of objects. The intersection of the walls produced a series of enclosures between them and the bounding box. This series of enclosed territories presented the second decomposition of the scene. Here clusters of the objects, from different themes, came together in particular, synoptic, multi-theme time-slices. Thus the concept of phenomenal transparency is
utilized to support the perceptual presence of two different spatial ordering principles, allowing for the double association of exhibits, and thus installing a richer field of content relations than would have been possible with a traditional, unitary ordering principle.

6.7.3 PARAMETRIC FIGURATION
As the example of the design for ‘Wishmachine – World Invention’ demonstrates, the inherent volatility of the perceptual interpretation of complex scenes offers the opportunity to be functionalized for the programmatic coexistence of multiple social agendas in a single territory. The articulatory ambition here is to give all simultaneously operating life-processes a strong phenomenological registration. The different life-processes might also utilize the territory at different times, for example, weekend life versus weekday life. The switch between the two (or more) possible phenomenological interpretations does not have to be left to chance. It is possible to trigger latent readings by means of parametric levers that overturn a reading by a small, strategic intervention.

The author has seized upon this possibility within a design research project that has been conducted at various undergraduate and postgraduate design studios.\textsuperscript{181} The projects were conducted under various titles – Parametric Urbanism and the Perception of Complexity, Simultaneity & Latency, Figure-field Symbiosis & Parametric Figuration – but they shared the same original ambition that is perhaps best referred to as parametric figuration. The underlying thesis suggests that multi-stable urban/architectural configurations can be devised that are

\textsuperscript{181} Institute of Experimental Architecture, Innsbruck University; Design Research Laboratory, Architectural Association School of Architecture, London; University of Applied Arts, Vienna; Yale University, New Haven.
pregnant with a multiplicity of variously conspicuous readings. This latency can be set up as a parametric model whereby the variables are extremely Gestalt-sensitive, ie, the quantitative modification of these parameters triggers qualitative shifts – Gestalt-catastrophes – in the perceived order of the urban/architectural configuration. The key parameters of the model are chosen with respect to the Gestalt-potentials that are embedded in the configuration. This parametricization is initially a design tool. However, it then can also be treated literally as a mechanism to trigger Gestalt-switches in the real building. For the parametric set up we distinguish object parameters (geometry, material textures), ambient parameters (lighting conditions, contexts) and observer parameters (camera position, movement, priming) as registers for the parametric calibration of the latent figuration.

The build up of such multivalent arrangements is a fragile balancing act, and very context sensitive. The aim of the set up is to achieve a maximal perceptual reconfiguration of a scene with a minimal intervention. Potential interventions (triggers) include the shifting of observer position and perspective (observer parameter), the change of lighting conditions (ambient parameter) and the manipulation of kinetic elements (object parameter). An object parameter, for instance, could be the opening or closing of a gap that creates or breaks a spatial figure, or creates/breaks visual connections.

The figural reading of a scene and its parts is subject to various context effects. All perception and pattern recognition is context dependent – both with respect to the spatial context, as well as with respect to the context of time (before and after). In both respects – time contexts and space contexts – we have to distinguish so-called low level context effects (like light/dark contrast, or colour contrast, relative direction, relative size etc) from high level context effects which work on the basis of the context implicating our prior knowledge, concepts, schemata and expectations. The final achievement of a reading/percept involves both bottom-up processes like the Gestalt-grouping principles, and top-down processes of recognition on the basis of memory, expectations and higher level concepts. High level context effects (top-down perceptual processes) are strongly influenced by the prevailing semiological conventions, but – as perceptual processes – belong to the phenomenological dimension and must be distinguished from semiology proper. Top-down processing implies that figures and patterns are recognized as looking like something familiar, nameable, thus terminating the game of discovery and interpretation.

Architecture’s societal function is the innovation of the spatial means that can be deployed to order social processes. Beyond the basic physical
Articulation operates through the related registers of phenomenology and semiology. These three staggered dimensions of spatial organization – the organizational, the phenomenological and the semiological dimension – can be effected either by separate sets of building elements, or by superimposing the physical, phenomenological and semiological effect within one set of architectural elements. For instance, a step that cuts across a space and imposes a certain (but not impenetrable) physical barrier, can in addition assume phenomenological prominence, for example, via symmetry, and finally a semantic significance, for example, via a semiological system that distinguishes socially significant levels within the space. Each successive register/dimension reinforces the function of the step as ordering device, enhancing its capacity to facilitate social order and orientation.

The given/evolving built environment is a more or less integrated universe of organizational, phenomenological and semiological orderings. It is a product of the coevolution of specific social communication processes in specifically shaped architectural environments. Not all of this is consciously and strategically available to the designing architect, because a lot of the nuances are not explicitly reflected within the architectural expert discourse. The designer’s active intervention within this universe goes on irrespectively. Design decisions need to be made. It is the academic branch of the discipline that we must look to if we wish to gain more explicit, intelligent control over the intuitive efforts of designers to produce sophisticated architectural orders that operate along all three dimensions of architecture’s task.

6.8 The Semiological Dimension of Architectural Articulation

THESIS 32

The semiological dimension makes a significant contribution to the architecturally inspired process of social structuration that occurs all the time, at all scales.

The premise and challenge of this section can be conveyed in the following words by Roland Barthes: ‘The city is a discourse, and this discourse is actually a language: the city speaks to its inhabitants, we speak to our city, the city where we are, simply by inhabiting it, by traversing it, by looking at it. Yet, the problem is to extract an expression like “the language of the city” from the purely metaphorical stage.... We must confront this problem: how to shift from metaphor to analysis when
we speak of the language of the city?" This problem has been posed many times. A convincing solution to this question is bound to empower architecture. However, the analytical task is only the first stepping stone: the required semiological intelligence has to sponsor an effective semiological design project.

To meet the posed challenge, the theory of architectural autopoiesis filters, assimilates and reconstructs the field of **semiology or semiotics**. The two competing names in the field are due to its two independent, modern originators: the linguist Ferdinand de Saussure (sémiologie) and the philosopher and logician Charles S Peirce (semiotics). The double origin of the field led to two traditions and two broad conceptual lineages. The two traditions differ already with respect to their conceptual analyses of the base concept of the **sign**. Saussure defines the sign as the unity of a signifier (sign-vehicle) with a signified (meaning). Peirce analyzes the sign into three components: the sign itself (equivalent to Saussure’s signifier), the interpretant (equivalent to Saussure’s signified), and the object. The subsequent cross-fertilization of the two lineages only complicated matters. While linguistics became a highly evolved, technical discipline, the rest of the field of semiology/semiotics remained as rugged and confusing on the side of theory as it is broad and unwieldy on the side of empirical content. Like many human sciences it lacks a singular and clear paradigmatic framework. Therefore, each effort in the field needs to sort, select and restructure the basic categories and axioms of the field before moving on to specific studies. That’s why, on the one hand, the all too familiar terms of the field – code, sign, signifier, signified, referent, icon, index, symbol, syntagmatic, paradigmatic, metaphor, metonym, denotation, connotation, semiosis etc – are defined and networked differently in each account or study, while on the other hand, equivalent or very similar conceptual distinctions are often given different terms.

The field came to general intellectual prominence during the 1960s. This also led to its reception and influence within the autopoiesis of

---


architecture and became a factor in the crisis of Modernism and in the attempts to work through this crisis. One of the first milestone publications that recognized and enhanced the reflection of the semiological dimension within architecture was the anthology *Meaning in Architecture*, edited by Charles Jencks and George Baird, in 1970.\(^{184}\)

The book comprises 15 articles by leading architectural theorists (and theoretically minded architects) of the time including, besides the editors, contributions from Geoffrey Broadbent, Reyner Banham, Kenneth Frampton, Aldo van Eyck, Christian Norberg-Schulz and Alan Colquhoun, among others. Charles Jencks’ own lead-in article was entitled ‘Semiology & Architecture’. The various attempts to make the concepts and insights of semiology/semiotics fruitful within architecture each tapped into different sources. Although, in general, the influence of the semiological lineage dominates over the semiotic one, concepts have been mixed and matched as seemed appropriate. Even where roughly the same sources come into play, their respective application within the domain of architecture has been rather varied. The appropriation of semiology/semiotics within architecture roughly spans two decades, the 1970s and the 1980s. The first decade mostly relied on the theoretical resources of Structuralism, going back to Saussure. Besides Saussure, the main source was Claude Lévi-Strauss, with occasional references also to Roland Barthes, Roman Jakobson and Umberto Eco. In the 1980s architectural discourse was shifting by catching up with Post-Structuralism. The main author referred to now was Jacques Derrida, with references as well to Michel Foucault, Julia Kristeva, Jean Baudrillard, Jean-François Lyotard etc. The discourse became more sophisticated but also more critical rather than constructive and systematizing. In any case, within architecture the discourse had never reached a stage of cumulative design research on the basis of a shared theoretical paradigm. Furthermore, the discourse on signification in architecture has been more or less dormant for 20 years now.\(^{185}\)

This situation leaves us no other choice than, once more, to try to filter, assimilate and reconstruct insights, concepts and terminology in a new way, fit for our specific purposes. Moreover, this creative


\(^{185}\) In the early 1990s the concern with ‘representation’ had been repudiated in favour of a concern with ‘performance’ within the discourse of the architectural avant-garde. The problem with this confrontation is that architecture, to a large extent, performs through representation.
reconstruction is, in any case, unavoidable because we approach the field of semiology/semiotics (as well as its tentative prior applications to the domain of architecture) with a fully formed, coherent, overarching conceptual framework, namely the adopted framework of Luhmann’s social systems theory – adopted, adapted and extensively elaborated within the two volumes of *The Autopoiesis of Architecture*. Whatever we appropriate from the field of semiology/semiotics must be fitted into the evolving edifice of the theory of architectural autopoiesis.

From which sources should the theory of architectural autopoiesis start its assimilation of the required semiological intelligence? Given the impressive development of linguistics in comparison with the relatively primitive and inconclusive status of the field of semiology/semiotics as a whole, it seems to make sense to look primarily to linguistics for inspiration and guidance. But is the medium and function of verbal languages not too different from the medium and function of what might be called (initially only metaphorically) architectural languages? The risk here is that the analogy that is to be elaborated is too forced to become productive. However, to take this risk is worthwhile, especially as the task here is not merely an analytical one. The ambition is also the creative advancement of the discipline’s design capacity. To this end a mere analytical penetration of how the built environment currently operates as a system-of-signification does not suffice. Ideas on how these operations might be systematized and intensified need to be generated. Linguistics might become a source of inspiration in this sense. However, with the project of an architectural semiology being effectively still in its infancy, it would make little sense to confront it with the latest, most advanced and technically detailed researches.\(^{186}\) The decision has thus been taken to start once more with the founding document of modern structural linguistics, Ferdinand de Saussure’s *Cours de linguistique générale*, first published posthumously in 1916, and to use Saussure’s original insights, concepts and suggestions, that proved to be so seminal for the inauguration of linguistics and semiology, as the primary guide to explore the basic categories upon which to construct a theoretical framework for a prospective architectural semiology that must ultimately be design oriented and generative rather than merely analytical in ambition. Before returning to Saussure, with this ambition in mind, it is necessary to prepare the conceptual ground of this engagement within the already elaborate conceptual framework of the theory of architectural autopoiesis.

\(^{186}\) In any case, the acquisition of expertise in advanced linguistics lies beyond the capacity of the author, as well as beyond the capacity of architectural discourse in general.
6.8.1 THE BUILT WORKS OF ARCHITECTURE AS FRAMING COMMUNICATIONS

The theoretical decision to include spaces and buildings among the communications that constitute the ongoing autopoiesis of architecture predisposes the theory of architectural autopoiesis towards a semiological understanding of architectural works. Perhaps the most sustained and convincing analytical attempt to apply semiology/semiotics to the built environment can be found in the writings of the art historian Donald Preziosi. In 1979 Preziosi published two substantial works in the subdiscipline of architectural semiotics: *The Semiotics of the Built Environment*, 187 and *Architecture, Language, and Meaning*. 188 Preziosi’s works display a number of insights and conceptual stipulations that coincide with the theoretical premises and decisions promoted within the theory of architectural autopoiesis. The first shared premise is entailed in the following excerpt: ‘Like verbal language... the architectonic code is a panhuman phenomenon. No human society exists without artificially reordering its environment – without employing environmental formations (whether made or appropriated) as sign-tokens in a system of visual communication... Every human society communicates architectonically... in media addressed to visual perception.’ 189 The second shared premise is that the pertinent theoretical scope here encompasses the totality of the built environment and the world of artefacts (as well as appropriated natural spaces/objects). The theoretical task of the semiotics of the built environment is to explain: ‘how it is that we come to scaffold our individual and collaborative lives through the appropriation of and interaction with this omnipresent world of objects’. 190 The third shared premise is that any ‘architectonic code’ can only function within a matrix of multiple, simultaneously operating systems-of-signification: ‘As a system of signs, a built environment does not exist in a vacuum but is co-occurrent with ensembles of other sign systems in different media... The architectonic code is one of several fundamental panhuman sign systems which in concert provide individuals and groups with a multi-modal and multi-stereoscopic template for the creation of humanly-meaningful realities.’ 191

---

190 Ibid.
In the conceptual framework adopted by the theory of architectural autopoiesis, the multiplicity of simultaneously operating sign systems is thought to be orchestrated by the unity of a social system – conceptualized as **autopoietic system of communications** – that underlies all human communication processes. This most fundamental concept of the theory of architectural autopoiesis was not available to Preziosi. Preziosi’s work, however, shares the functional outlook of the theory of architectural autopoiesis and looks out for functional equivalences: ‘Each sign system offers certain advantages over others. . . . A built environment does certain things which verbal language does not do, or only does by weak approximation and circumlocution – and vice versa. Sign systems often provide partially redundant ways of doing functionally equivalent things. I can maintain my privacy, for example, by building a wall around myself, putting up a “no trespassing” sign, wearing a loincloth, or gesturing dramatically whenever a stranger comes within six meters of my person.’

Another coincidence between Preziosi’s work and the attempt made here to develop a theoretical framework for the effective handling of architecture’s semiological dimension lies in the important theoretical problem of identifying the specific, pertinent, elemental units within the built environment that are capable of carrying social meaning in the specific mode of architecture. According to Preziosi, the organizing units of any architectonic code are what he calls ‘space-cells’ characterized by the ‘topological property of boundedness’. Being built up from this type of elemental unit is seen as architecturally universal, as the common denominator of all ‘architectonic systems’ and human built environments. The theory of architectural autopoiesis, as will be elaborated below, on its own account, has come to the same conclusion. Whether understood as empirical generalization or theoretical stipulation, what Preziosi calls ‘space-cell’, and what the theory of architectural autopoiesis prefers to call **frame or territory**, is the fundamental unit of all communications that are operating via built architectural works. This proposition is fully consistent with the identification of architecture’s societal function as **framing**.

As stated above at the outset of this chapter, the basic premise to include built works among the communications of architecture’s autopoiesis predisposes the theory towards a semiological approach. We have now reached a point in the build up of the theory where this initial decision compels us to corroborate, through a more detailed theoretical elaboration, that buildings and the spaces within them do indeed

---

192 Ibid, p 3.
The theory of architectural autopoiesis postulates that architectural spaces are *framing* communications that communicate through predefining and ordering the social situations and attendant expectations that structure all communicative interactions.\textsuperscript{194} In this sense all built works of architecture have a semiological dimension, i.e., all architectural works operate as signs and can be analyzed as such, independently of whether the architect/designer has paid explicit expert attention to this fact or not.\textsuperscript{195}

According to Luhmann’s theoretical premises – which have been adopted here – communications are events that acquire and process meaning via their recursive concatenation within autopoietic systems of communication.\textsuperscript{196} The insistence that communications are events produces a prima facie difficulty for the inclusion of architectural/design artefacts. Luhmann often emphasizes the ephemerality of communication events. They perish quickly as they succeed each other in often rapid succession. But this does not hold for all communications Luhmann recognizes. A written inscription is a communication that persists through time. The same is the case with buildings and designed artefacts. Their physical permanence implies that their respective message is broadcast ceaselessly. Luhmann has never explicitly counted, nor has he ever explicitly excluded, buildings, spaces or any other designed artefacts among the communications his theory is concerned with. Luhmann’s theory is claiming comprehensiveness, and he was wise enough never to attempt a comprehensive list of types of communication. Concerning the supposed event character and ephemerality of communications, this cannot be construed as a necessary, definitive condition of communications within Luhmann’s theoretical system. As hinted above, a powerful example that stands against such an interpretation is the example of written communications, including books, which Luhmann (like Derrida and Marshall McLuhan) recognizes as a crucial form of communication. Our civilization is, in a very profound sense, a literary

\textsuperscript{194} See Volume 1, chapter 5.1.3 *Framing as Societal Function of Architecture.*

\textsuperscript{195} It can safely be assumed that architects, as socialized members of society, are intuitively paying tribute to the dimension of social meaning in their design work. And should they lack the respective sensibility, or violate such concerns due to an avant-gardist radicality, their clients will surely steer them in ways that recognize the potential social meanings that the designed works are likely to acquire.

\textsuperscript{196} The circularity of this statement is inevitable and does not interfere with the statement’s function as criterion. Circularity is an inevitable mark of the definition of base concepts. What can be provided here is a criterion of coherency of concept deployment, but not an indisputable foundation.
and print based civilization, it is ‘Gutenberg’s galaxy’. Books can thus serve as example to argue that architectural- and design-artefacts cannot be excluded from the realm of communications just on account of their persistence and their lacking event character.

The notion that architectural spaces and buildings are communications implies that they participate within recursive networks of communications. To secure our starting premise – architectural works communicate – we merely have to establish that spaces and buildings can function within networks of communications, not that they, between themselves alone, form a complete system of communications. In fact, in the strict sense of the concept *system of communications* employed here, this possibility must be excluded. An ‘architectural system of communications’ can only exist in a looser, more general sense of ‘system’, in the sense that, for instance, structuralist linguists refer to language as a system, namely as a system of signification. This employment of the term system refers to an abstractum rather than a social reality that can be observed. To avoid the proliferation of the term system, the theory of architectural autopoiesis thus proposes to restrict its use – as much as possible – to the designation of autopoietic systems. Instead of ‘architectural system of communications’, phrases like ‘architectural system-of-signification’, or better still ‘architectural language’ should be used here. In Luhmann’s theoretical edifice (presupposed here), general societal languages like English, French etc are categorized as a medium of communication, a medium using articulated speech. The more specific languages of autopoietic subsystems with their more narrowly defined systems-of-signification fall under the general category of communication structures. This terminology will also be adopted here in order to avoid ambiguity with respect to the term ‘system’. In this sense the terminological apparatus of the theory of architectural autopoiesis will refer to building in general as medium of communication. It categorizes specific architectural languages or systems-of-signification as specific communication structures. These specific languages or communication structures, in terms of their formal formation, are tied to specific architectural styles, oeuvres or individual projects, depending on the specificity of the rules of signification implied. However, in terms of their meanings, these specific structures/languages are tied to the specific social systems that communicate through and within these structures. The built works of architecture function as

197 Below, in section 8.6 on *The Built Environment as Primordial Condition of Society*, the theory of architectural autopoiesis will explicate how our civilization is in an even deeper sense also an architectural civilization.
framing communications within the social system that utilizes these works. Therefore the architectural language employed is a medium or communication structure within the framed social system. The designing architecture can only provide the forms but never control the meanings of the respective architectural language.

Another defining criterion of communications is their tripartite constitution allowing for the distinction of information, impartation\(^{198}\) and understanding. Some kind of information must be conveyed. Luhmann’s favourite shorthand definition of information is Gregory Bateson’s dictum: *a difference that makes a difference*. One can safely grant that (some if not all) design differences do make a difference with respect to the ongoing communicative interaction within a space. The second point requires that it must be possible to distinguish the impartation, conveyance or broadcasting of this information from the information or differential import. To grant this might be considered more problematic. It implies that architectural spaces are recognized as communications within social systems. In this sense, the third moment of understanding entails the distinction of information and impartation.

Understanding does not only involve the reception of the information but also the recognition that this information was imparted within a particular, situated communication ‘event’. This usually involves the attribution of the communication to a sender. This point of attribution, however, does not have to be a person. It might be a certain social organization (legal person) or the state, as in a statute. In the case of an architectural space such an attribution is indeed possible and even likely. The user of a building who recognizes a certain, specific arrangement of the spaces within the building, a certain style in the articulation of its interior, a certain atmosphere, is not only likely to be impacted by taking in the information about the social situations to be expected, he/she is also likely to attribute this message to the intentions of those who provided those arrangements and atmospheric steerings. The point of attribution is usually not the architect or designer, who will most probably be unknown to the user. It is much more likely and appropriate for the user to attribute the communication to the occupying institution or hosting owner of the building who is receiving the users and who originally acted as the architect’s client. Thus we can establish that architectural spaces are usually understood as impartations that convey information. Architectural buildings and spaces can thus be construed to

---

\(^{198}\) Luhmann uses the German word *Mitteilung*, mostly translated as *utterance*. I believe the rendering as impartation captures Luhmann’s concept much better. Another term that captures the meaning of impartation is *conveyance*. 
fulfil Luhmann’s defining criteria for the concept of communication. Therefore, our fundamental theoretical premise holds (so far), namely that built architectural works can (and must) be counted among the communications that constitute society.

The theory of architectural autopoiesis proposes that built architectural works constitute the ‘final’ communications of architecture. Whether these final communications of the discipline form their own subsystem-of-signification, and whether this subsystem-of-signification exhibits systematicity, or whether it can be enhanced to become more systematic and language-like, is the (compound) question that will concern us within this section.

6.8.2 ANALOGY: LANGUAGE AND BUILT ENVIRONMENT AS MEDIA OF COMMUNICATION

In principle, the totality of the built environment, its spaces, furnishings, appliances, vehicles, as well as our outfits, is under the purview of architecture and the design disciplines. The totality of the man-made, phenomenological world is shaped by design. Everything has to go through the controlling gate or needle’s eye of the design discourse.

The premise here is that the built environment, together with the world of artefacts that populate it, is involved in processes of social communication. Spaces and artefacts are not only objects of communication but they function as specific means, media or modes of communication within all (multi-modal) systems of communication that together constitute society. This presumption implies that architecture and the design disciplines should be keenly interested to understand this involvement. Architecture and design – whether this is always consciously reflected or not – intervene in an ongoing semiosis that continuously evolves the semiological aspect of the built environment and the world of artefacts. This semiosis has been going on since the dawn of culture, long before architectural design was differentiated as a specialized discipline. This ongoing process of semiosis cannot be fully controlled by design, not even by a design discipline that is becoming more and more self-conscious about its role within this process. However, this process can be investigated and theorized in order to guide the strategic design engagement with it.

199 See Volume 1, Introduction. This system comprises built architectural works as well as drawings, models, talks, books, exhibitions etc. Built architectural works feature in two ways as points of discursive reference and as spatial frames, namely the territories in which architects work, talk and exhibit etc.

200 This design discourse is the topic and site of intervention of this book. Theory plays a crucial role in shaping this gate.
Where might the theoretical resources be drawn from to undertake such an investigation? The discipline of semiotics or semiology had been postulated 100 years ago, by Peirce and Saussure respectively, as a general science of systems-of-signification (media). Linguistics remains by far the most advanced subdiscipline, and thus remains the crucial source domain for conceptual and analogical transferences into an analysis of the built environment as semiotic or semiological system-of-signification that operates, like a language, within and across various social systems (autopoietic systems of communication).

Although there are obvious, significant differences between spoken languages and the presumed ‘language’ that operates via the built environment – the one unfolds in time, the other unfolds in space; one communicates via ephemeral utterances, the other via persistent and often massive constructions – there is no viable alternative to the language analogy and linguistics as source of theoretical guidance. Language is the most potent medium of communication. No other medium has received an equivalent level of detailed and sustained attention. Linguistics is a highly evolved science that offers a panoply of conceptual schemes that might be put to the test with respect to the domain of architectural theory.

It has been established here that the built environment can be used as a medium of communication. This implies that – to the extent that aspects of the built environment indeed operate as communications – it should be possible to analyze such built environments as systems-of-signification that encode social meanings. But to what extent are such systems-of-signification language-like?

The idea that architecture constitutes a ‘language’ has been formulated many times. For instance, Gottfried Semper starts the introduction of his Style in the Technical and Tectonic Arts with this idea: ‘Art has a special language of its own, consisting of formal types and symbols that have changed in a great variety of ways over the course of cultural history. They offer as many ways of making oneself understood as language itself.’

Semper’s interest focused on emulating the efforts of historical linguistics with respect to tracing the most basic forms and symbols of architecture just as historical linguistics have been able to trace the various languages and words to their common primeval forms. However, without really being able to substantiate and elaborate the language analogy, Semper claims: ‘If an architect recognizes the primeval

---

201 Gottfried Semper, Style in the Technical and Tectonic Arts: or, Practical Aesthetics, Getty Publications (Los Angeles), 2004, original German: Der Stil in den Technischen und Tektonischen Künsten; oder Praktische Aesthetik. Ein Handbuch für Techniker, Künstler und Kunstfreunde, Verlag für Kunst & Wissenschaft (Frankfurt am Main), 1860, vol 1, p 103.
value of the oldest symbols of his language and takes account of the way in which they, along with art itself, have changed their form and meaning historically, then he will have the same advantage as a modern orator who studies comparative linguistics and the most ancient relationships among languages. Semper moves on to offer the following outlook on future research opportunities: ‘It will not be long before research into linguistics will start to interact with research into art-forms; such a link is bound to lead to the most remarkable revelations in both fields.’ This seems like a rather prescient anticipation, except that it took a rather long time before efforts in this direction took off, and excepting that we are still in the infancy of exploiting this link.

Then there is John Summerson’s *The Classical Language of Architecture*. Summerson refers to Classical architecture as ‘the Latin of architecture’, and the chapter headings read, among others, ‘The Grammar of Antiquity’, ‘Sixteenth-Century Linguistics’ and ‘The Rhetoric of Baroque’. But again, the analogy remains on the level of simple metaphors rather than being instrumentalized for systematic analogical transferences. The same goes for Bruno Zevi’s *The Modern Language of Architecture*. Here the analogy is evoked in the introduction entitled ‘Speaking Architecture’, but it is not followed through in any detail. Zevi is introducing his book as a sequel to Summerson’s book and suggests that: ‘in the course of centuries only one architectural language has been codified, that of classicism. None other has been processed and put into the systematic form required of an acknowledged language.’ To do this for modern architecture is presented as the most urgent task facing architectural history and criticism. Zevi purports to ‘formulate the modern idiom’ and is referring to ‘the vocabulary, the grammar, and the syntax of the contemporary language’. But once more, these terms remain instant metaphors without any further elaboration. The same goes for Charles Jencks’ *The Language of Post-Modern Architecture*.

In a reverse move linguists have sometimes used architectural analogies to explicate their concepts and insights. Saussure, for instance, uses the analogy of the Classical architectural orders to explicate the

203 Ibid.
207 Ibid, p 3.
crucial distinction of the two basic types of relationship between linguistic elements that must be mastered by any speaker to achieve linguistic competence: syntagmatic and paradigmatic relations. Syntagmatic relations involve the coordination – in praesentia – of elements into syntagms or sequences, and paradigmatic relations – Saussure calls them associative – involve the association of present elements with absent ones that might have been chosen as alternative options instead of the chosen elements. Saussure constructs his analogy as follows:

Neither order of relations is reducible to the other: both are operative. If we compare them to the parts of a building: columns will stand in a certain relation to a frieze they support. These two components are related in a way which is comparable to the syntagmatic relation. It is an arrangement of two co-present units. If I see a Doric column, I might link it by association with a series of objects that are not present, associative relations (Ionic column, Corinthian column). The sum total of word relations that the mind associates with any word that is present gives a virtual series, a series formed by the memory (a mnemonic series), as opposed to a chain, a syntagma formed by two units present together. This is an actual series, as opposed to a virtual series, and gives rise to other relations.

This analogy is as instructive for architecture as it is for linguistics. Here seems to be a point of departure to make the analogy between language and architecture work with some detail, perhaps allowing us to appropriate an important theoretical distinction for architecture.

The language analogy and the comparison of architectural semiosis with linguistic semiosis might indeed afford clues and inspiration for the potential expansion of the semiotic power of architecture. That is the motivation for rehearsing the basic concepts and insights of linguistics. The most appropriate place to start should indeed be Ferdinand de Saussure’s Course in General Linguistics, the foundational text of modern linguistics and semiology. It seems, before engaging with any particular linguistic approach, the fundamental plausibility of the language analogy has to be assessed. However, the real test of productivity of the analogy can only be the success of its detailed elaboration.

Before diving into this elaboration, two critical questions might be raised in advance, as probing devices. The first question was already raised above: does the built environment display sufficient systematicity or correlative regularity in relation to the social life and communication processes taking place within it? The second question is whether there is

an architectural analogue of linguistic well-formedness? A linguistic utterance is either well-formed or not, grammatically correct or incorrect. With respect to the built environment, or within the practice and discourse of architecture, the question is whether we can find or construct an equivalent for this fundamental distinction? This distinction between correctly vs incorrectly formed expressions arises due to the fact that a language is not just a set of simple signs – each doing its job independently. Language builds up its meaningful signs as composites from elements according to rules. Is there something like architectural well-formedness vs architectural disfigurement? And does the signifying power of architecture depend upon this ability to construct well-formed, compound signs? Thus we have posed two fundamental preconditions for the plausibility of the language analogy within architecture.

These questions cannot be answered ad hoc, in advance of a more elaborate analysis. However, they might be addressed here with some initial considerations. The first question – the question of architecture’s systematicity and consistency of correlation with social processes – seems to afford a clearly positive answer only with respect to pre-Modern societies. For instance, Claude Lévi-Strauss’ structural analysis of South American villages suggests rather strict and tight correlations between the structure of the village and the observed social structure and communication patterns. In the village of the Bororo, the position of an individual’s abode correlated strictly with the individual’s moiety, clan, economic activity, role in religious ceremony and possible choice of mate. The same seems to apply to archaic Greek cities, and still to the early medieval towns of Europe. Later, in particular with the onset of modernity, this tight correlation of settlement structure and social communication processes seems to loosen. Or is this impression merely a matter of complication resulting in the difficulty of analytical penetration? And further, assuming that systematicity has indeed been eroded, is it possible to reverse this process, at least locally, by a conscious design effort? And further still, might we ask if it could be possible to steer the global autopoiesis of architecture into a mode of operation that can start to reverse this process of hyposignification\(^{210}\) on a global level, to enhance the overall semiotic prowess of architecture and urbanism?

Concerning the second question about the applicability of the distinction well-formed vs disfigured: the case is not as straightforward as it is in the case of language. Architectural designs are composed of

elements. The distinction between well-formedness and disfigurement depends upon rules of composition. With respect to Classical architecture the presence of such rules is rather evident. Well-formedness according to rules can be asserted most rigorously within a style, less so across styles. But whether the compositional rules of an architectural style are – like a grammar – being mobilized for signification is less clear. However, again, the agenda here is not merely descriptive or analytical. Even if the grammars of architectural styles have so far been rather rudimentary, or are currently going through a process of disintegration, it might be worthwhile to explore the language analogy within the context of a theory that has placed its agenda of analysis and reflection within an agenda of adaptive enhancement. Perhaps the two agendas must be combined: shared criteria of well-formedness of multi-component architectural constructs might be a means to enhance the degree of systematicity in architecture's semiological operations and on this basis enhance architecture's chance to maintain/upgrade its semiotic prowess in a world of increasing social complexity.

6.8.3 SIGNS AS COMMUNICATIONS
The concept of the sign is the central, undisputed founding concept of semiology (semiotics). In order to engage with and appropriate the insights of semiology/semiotics within the theory of architectural autopoiesis it is necessary to clarify and redefine the sign concept in relation to Luhmann’s concept of communication. The proposal here is to define signs as communications. The two concepts are taken here as coextensive, ie, they are taken to denote the same class of entities in the world. Every sign is a communication and every communication is a sign. This means, first of all, that signs are not abstracta that exist in Platonic heaven. They exist as communicative events in space and time, within a specific social system or societal context. Isolated words, slumbering in dictionaries, are therefore not signs in the sense defined here. Also, individual words within speech cannot be abstracted from their context and considered as self-sufficient signs in their own right. The minimal unit of language that can be considered a sign is the individual speech act.\footnote{Communication is not only conveying information. Communication is social action. Speech act theory also emphasizes this fact. See John L. Austin, \textit{How to Do Things with Words}, Clarendon Press (Oxford), 1962; also: John Searle, \textit{Speech Acts}, Cambridge University Press (Cambridge), 1969.} Speech acts usually take the form of sentences, as minimal units conveying a determinate meaning. Occasionally, a single word might constitute a complete, self-sufficient speech act. In such cases, words
serve as compressed or abbreviated sentences, ie, it is always possible to unfold them to proper sentences, and thus explicate their meaning. For example, the appellation ‘Come!’ can be explicated as: ‘You should come here!’

This identification of signs with communications does not contradict the standard definition of the sign found in expositions of semiology, namely its definition as the unity (coincidence, bond, relation) of a signifier and a signified. The signifier is initially introduced as the material aspect or physical body of the sign with all its empirically observable properties. This seems, prima facie, clear enough to work with. (However, if one probes deeper into how the signer’s identity is constituted and reproduced, one realizes that it is a pattern or class of phenomenal entities the identification of which depends dialectically on its use or correlation with the signified.) The other conceptual component of the sign concept – the signified – seems more problematic (obscure, mysterious) right from the start. The term refers to the ‘meaning’ of the sign, or better, to that which the sign signifies. Saussure, who first introduced this triad of sign (signe), signifier (signifiant) and signified (signifié), presumed the signified to be a mental entity. Here the philosophical quicksand abounds all around. As Umberto Eco alludes, ‘the entire history of philosophy could be re-read in a semiotic perspective’.212 That is why Luhmann understands meaning as network connectivity rather than mental entity.

The signifier is formed in a medium. In the case of verbal language the primary medium is the medium of articulated oral sounds, and its (by now at least equally important) secondary medium (or set of media) of writing/typing/printing with graphic alphabets. The medium of architectural design is the medium (set of media) of drawing and digital modelling. The relevant communication medium for built architectures is the medium of spatial construction utilizing the full panoply of materials as well as fabrication and construction processes offered by the construction industry. (This large and ever-extending palette, however liberating it might seem, also constitutes a problem, at least for the vital, spontaneous semiosis of the built environment.) This identification of the various media of various systems-of-signification is consistent with Luhmann’s general concept of medium as a universe of loosely coupled elements that serves as reservoir for the formation of forms understood as strict couplings of elements selected from within the medium.

6.8.4 TERRITORY AS FUNDAMENTAL SEMIOLOGICAL UNIT

The elaboration of the language analogy within architecture must start with the identification of the basic units within built architectures that function as communications. Any semiological interpretation and analysis of built architectures must answer this question: which minimal, self-sufficient units within the built environment function as full communications or communicating signs? What, in the domain of communication via built architectures, generates a self-sufficient social meaning? Or, in other words, what is the equivalent of the speech act or sentence in the language of architecture? The answer proposed here is that territories are the fundamental, minimal units of communication within built environments. This proposition stipulating the territory as the fundamental unit that underlies all processes of signification is a fundamental axiom of the architectural semiology sketched out here. Territories are communications. As such they constitute a form of social action. The establishment and provision of a territory is indeed a social act and communication, a territorializing act and communication.

Every territory – just like every speech act – is embedded within a context. It is to be expected that the meaning of the territory depends upon its context. There are two types of context that need to be distinguished. The spatial context, ie, the other surrounding territories on the one hand, and the social context, ie, the social events that are or have been unfolding within the territory.213

The concept of territory proposed here comprises all kinds of places, spaces, zones etc, interior, or urban. Anything that produces a sense of enclosure, separation, demarcation or distinction, in any way whatsoever, and that can be somehow recognized as frame for social interaction. The concept of territory, together with its derivatives of territorialization and territorial unit, has already been introduced above, in the context of discussing the organizational dimension of architecture.214 Thus the fundamental unit of all spatial organization is at the same time the fundamental unit of all processes of semiosis within the built environment.

A territory functions – permanently, at certain times, or momentarily – as designated locus for specific forms of interaction. (Even if they are used for solitary activities by individuals, the very fact of their occupation for a certain legitimate purpose implies a social act, and thus a communication.) The type and the probable features of the designated

213 This distinction is analogous to the distinction of co-text vs context in linguistics (pragmatics).
214 See chapter 6.3.1 Relating Spatial to Social Organization and chapter 6.3.2 Territorialization and Integration.
social interaction can be anticipated on account of the territory’s relative location and visible morphological features. The character of the expected social encounter can be sensed and intuited on account of the atmospheric ambience of the territory. The territory thus prepares or primes the participants.

The theory of architectural autopoiesis has identified the applicability of the distinction of inside vs outside as the defining differentia specifica that distinguishes architecture, including urban, interior and (to a certain extent) furniture design, from all the other design disciplines that (together with architecture) form the autopoietic function system of architecture/design. This distinction of inside vs outside can now be employed as the crux in the formal definition of the concept of territory: a territory is an entity that distinguishes and thus establishes an inside (its inside) as distinct from an outside (its outside). That suffices.

Every communication is dialogical. Every communication offers itself, or is exposed to, the binary choice of being accepted or rejected. A verbal communication, for example, in the form of a declarative sentence or assertion, is either accepted as true or rejected as false. It makes no sense to accept or reject single words unless they represent a compressed sentence. A command is either obeyed or resisted etc. The acceptance of a communication allows it to become a premise and point of reference for further connecting communications. In the same way a territory or spatial frame can be rejected or accepted as premise for further communications: the territory can be entered – which implies an acceptance and engagement with the signified and anticipated type of social interaction to be expected within the entered territory – or the territory can be exited, or altogether avoided. This spells rejection, and implies the refusal to participate in the signified social interaction. The acceptance of a communication allows for the connection of further communications that build upon each other. To enter a designated territory implies the acceptance of the territory as meaningful frame, ie, the acceptance of its communication as grounding premise for further communications. Those who enter become participants agreeing to engage in the social interactions unfolding within this frame and thus allowing further communications to build upon the grounding premise and upon each other.

215 The centrality of the inside-outside distinction, the centrality of enclosure and territory, is expressed in Le Corbusier’s dictum that ‘the exterior is always an interior’. There is never an absolute outside. On the exterior of a building there is another composed interior. ‘The elements of the site rise up like walls, ... like the walls of a room.’ Le Corbusier, Towards a New Architecture, Dover Publications (New York), 1986, unaltered republication of English translation of 13th French edition, published by John Rodker (London), 1931, pp 191-2.

184
Thus it should be evident that the territorial unit functions as a communication that can be accepted or rejected. Any smaller architectural unit, below the level of the territorial unit, for example, a column, is not subject to such a binary choice of acceptance vs rejection. The column’s muteness in this respect implies that it is not to be counted as communication.\(^{216}\) By itself the column means little, unless it is establishing its own (tenuous) place or territory, perhaps for an intimate rendezvous. In all other (usual) cases it has only a subsidiary meaning as it contributes somehow to the characterization of a territory. This territory might be established with or without the column as part of a demarcating boundary. This difference does not affect the column’s status as dependent, subsidiary signifying component. As long as the column exists within the territory it is a potential contributor to the signification. The definition and analysis of the general semiological base category of the sign are thus instituted by the architectural territory as follows: the framing territory is the sign as the unity of its bounding and characterizing physical devices, which together constitute the signifier, with the framed (expected) type of social interaction constituting the signified. The signifier operates in the domain of architectural form, while the signified encompasses the domain of architecture’s substantial functions. Thus the conceptual pair *signifier vs signified* is aligned with the conceptual pair *form vs function* and thus with the distinction of architecture’s self-reference (internal reference) vs architecture’s world-reference (external reference). However, the signifier is only a part of architecture’s form, and the signified captures only a part of architecture’s function.\(^{217}\) The basic conceptual arrangement that underlies the analysis of architectural sign systems can thus be summarized and displayed as follows:

\[
\begin{align*}
\text{the sign} &= \text{designed and designated territory} < \text{architecture} = \text{communication} \\
\text{the signifier} &= \text{ensemble of territory-defining devices} < \text{form} = \text{self-reference} \\
\text{the signified} &= \text{type of social interaction to be framed} < \text{function} = \text{world-reference}
\end{align*}
\]

This conceptual set up excludes much of what has traditionally been called ‘architectural symbolism’, for instance, in the sense that the Eiffel Tower might be construed to ‘symbolize’ the technological prowess of the

---

\(^{216}\) Every communication presents itself and its meaning as a proposal and invitation that is to be either accepted or rejected. This bifurcation unfolds the moment of understanding, one of the three necessary moments that constitute any communication.

\(^{217}\) Only substantial but not subsidiary functions belong to architecture’s signified. Also, not all of architecture’s formal operations are enlisted within the plane of the signifier. Thus the unequal (\(<\)) rather the equal sign (\(\equiv\)) is used to indicate the alignment of the conceptual pair form/function with the conceptual pair signifier/signified.
French nation. The theory of architectural autopoiesis rejects this kind of symbolism as not belonging to the domain of architecture. Indeed, this kind of symbolism was fully expunged from the autopoiesis of architecture with its refoundation as Modern architecture. If there is meaningful ‘symbolism’ within architecture then it can only be ‘self-referential symbolism’.\footnote{Term used by Stanislaus von Moos to characterize work by OMA in an article published in OMA issue of \textit{L'Architecture d'aujourd'hui}, 238, April 1985.}

To illustrate the conceptual set up we might use a very simple example: the bedroom in my London apartment is a sign/communication, that signifies/communicates the social act/interaction of going to bed. The signifier comprises the bounding surfaces, the apertures, as well as the furnishings of the room. The broadcast of the sign is contextualized within the ensemble of the apartment unit, which in turn is contextualized within the apartment block, estate, neighbourhood etc. The basic semiological operation involves the simple mapping of a typology of territories onto a typology of social interactions. Onto this primary constitution of a base meaning further, more nuanced meanings might be superimposed, for example, a sense of non-romantic, no frills, matter-of-factness, or perhaps a sense of romance and sensuousness, depending on the specific textures and colours of the surfaces as well as on the selection and arrangement of the furnishings. These additional characterizations of the territory are considered semiologically active, ie, communicative, to the extent to which they give further information as well as cognitive-emotive preparation about the social interactions that one might expect here. The semiological distinction of \textit{connotation vs denotation} might serve here to label this kind of additional elaboration of the basic (denotative) meaning. The various architectural elements – below the level of the room or territorial unit – receive their always subsidiary meaning, like the words within a sentence, from their position within and contribution to the space-making and sense-making ensemble of the total sign that is always a territorial unit in relation to which one is either inside (with the choice of leaving) or outside (with the potential option to enter).

Above, the medium of architecture’s built communications was characterized as the totality of the materials, fabrication processes and construction methods that the global construction industry makes available. One could also define the medium more theoretically, as Preziosi does: ‘The physical medium of the built environment, then, is potentially coterminus with the entire range of material resources of the planetary biosphere which can be employed to construct significative
formations addressed to the visual channel.\textsuperscript{219} If one conceptually opens the medium to this extent – beyond the domain of what is now industry-wise available to the contemporary professional architect – one has to introduce the conceptual restriction to material constructs that can be deployed in a territorializing capacity. This is indeed what Preziosi does: ‘The medium of the built environment is in fact anything and everything visually palpable which can be employed to serve place-making functions.’\textsuperscript{220}

The reference to perception is pertinent here (although the restriction to the visual channel is unnecessary). Architecture is always very much concerned with appearances (although not only appearances). It certainly never concerns itself with what remains invisible, ie, foundations, hidden ducts, hidden machines, hidden cables etc. To this extent we must admit that some of the products of the construction industry are excluded from the medium of architecture, even if the cool air and the electric light as effects of these invisible systems do belong to built architecture’s medium of communication. They belong to the medium to the extent to which they can be deployed in a territorializing and/or atmospheric capacity.

The medium of building comprises virtually everything that can be used for perceptually palpable territorializing operations. If this defines the medium of all built architectures, of architecture’s final communications delivered into society at large, what is its relationship with architecture’s internal medium of communication, with architecture’s own discursive design medium of the drawing? The crucial category of territory is recognized within the design medium of drawing by the prominence of lines and outlines in their capacity as delineating boundary operations. The importance of establishing, distinguishing and relating territorial units is also recognized in the crucial drawing type for diagramming and sketching that establishes the essential organization and parti of any design at the early design stages: the bubble diagram. The bubbles of bubble diagrams imply nothing but the unitary, topological primitive we are positing as the categorical substrate of all sense-making processes within architecture: the territorial unit.

If territorial units, as elemental semiological units and correlates of determinate social situations, are the alpha and omega of all processes of architectural semiosis, where does this leave the field-concept or, more precisely, the concept of the \textit{continuously differentiated field} that seems

\textsuperscript{219} Preziosi, \textit{The Semiotics of the Built Environment}, p 5.
\textsuperscript{220} Ibid, p 4.
to suspend the very concept of boundedness? There is no doubt that this innovative concept needs to be integrated into any worthwhile contemporary theory of architectural semiosis. Can this be done if the precondition of ascribing meaning to built architectural works is that they are built up from (or can be decomposed into) territorial units? The insistence that this has to be possible was the reason why Preziosi’s concept of ‘space-cell’ had to be replaced with the concept of territory. Territories might be variously bounded. A blurred boundary is still a boundary, even if its threshold operation is stretched and softened into a gradient zone of transition. Such a boundary is a more sophisticated territorializing device than a crisp outline. Fuzzy sets are still sets, albeit sponsoring a more sophisticated logic. But the concept of territory can be stretched even further to encompass territories defined by intrinsic field qualities rather than any sort of boundary. These field qualities might be structured by smooth gradients so that the concept of boundary is suspended altogether. The fundamental choice of staying, accepting and participating on the one hand, or avoiding, moving on and leaving, on the other hand, remains. Moving up or down the gradient makes a communicative difference. The subject is either (deliberately) approaching and moving closer to an anticipated type of social encounter, or is moving away to avoid the communication scenario expected in a certain direction. Both moves can be understood as communications responding to the framing communication of the field.

Territories, as the fundamental units of spatial organization and functional designation, are the fundamental units for the ascription of meaning within architecture and the built environment. In this sense they are analogous to sentences within verbal languages. We have also established that the meaning signified by a territory is the social interaction to be expected within its ambit. This does not yet tell us anything about how territories acquire and convey this meaning.

The basic denotative meaning of a territory is nothing but its functional designation, the basic type of social interaction to be expected. This much might be legible via the territory’s spatial position within an array of territories, its position within a network of circulation, together with the bare volumetric proportions of the territory. Further connotations rely on the further architectural elaboration (nuanced characterization) of the territory. Various registers of architectural articulation are coming into play here: geometry, tectonic detail, materiality, texture, colour, light etc. These are the registers that are

221 See Volume 1, chapter 5.4.4 From Space to Field.
available on the level of the signifier. The totality of these registers might be referred to as **architectural morphology**. The main question to be raised here is a question that is central to all semiological inquiries: what does it take to elevate such a panoply of articulatory registers to become a system-of-signification, ie, an operating medium of communication, a language that is able to coordinate the elements and features of an articulated spatial ensemble into a comprehensible, information-rich message? That the socio-cultural evolution has achieved this feat over and over again is clear. The point here is to unravel its mechanisms and structural devices in order to assess to what extent and how this feat can be made the (likely) result of a design effort.

**6.8.5 SAUSSURE’S INSIGHT: LANGUAGE AS SYSTEM OF CORRELATED DIFFERENCES**

As mentioned above, the two independent founding fathers of semiology/semiotics are Ferdinand de Saussure (1857–1913) and Charles Sanders Peirce (1839–1914). Saussure’s work establishes linguistics as a science of human language understood as a synchronic system. He conceived of linguistics to be encompassed by an anticipated general science concerned with the totality of human sign systems. Saussure proposed to call this science semiology (sémiologie): ‘A language system is a system of signs... comparable to writing, the deaf-and-dumb alphabet, symbolic rites, forms of politeness, military signals, and so on. It is therefore possible to conceive of a science which studies the role of signs as part of social life. We shall call it semiology (from Greek semeion, “sign”). The linguist’s task is to define what makes languages a special type of system within the totality of semiological facts.’

Saussure’s definition of the basic concept ‘linguistic sign’ can be (and has been) generalized to the concept of signs in general. ‘In our terminology a sign is the combination of a concept and a sound pattern... We propose to keep the term sign to designate the whole, but to replace concept and sound pattern by signified and signifier. The latter terms have the advantage of indicating the distinction which separates each from the other and both from the whole of which they are a part.’

This simple triad of terms should not deceive us. It does not imply that language is simply an arsenal of such signs, each by itself established as the correlation of a concept with a sound pattern.

---

Saussure warns against ‘the superficial view taken by the general public, which sees a language merely as a nomenclature’. He elaborates: ‘For some people a language, reduced to its essentials, is a nomenclature: a list of terms corresponding to a list of things. . . . This conception . . . assumes that ideas already exist independently of words.’ Instead Saussure argued that concepts are a product of linguistic operations, ie, achievements of a social system of interaction beyond anybody’s reach. An individual speech act can only be meaningful as an instance that follows and reproduces the rules of a shared language system. Each individual word within this system has meaning only due to its participation and specifically allocated role or position within the system. This allocated position or role Saussure terms (synchronic or linguistic) value. The identity and meaning of a word depend upon its value in the linguistic structure or system. Saussure illustrates his concept of value by analogy with what defines each of the pieces of the game of chess, namely the overall set of pieces, differentiated by the rules or ‘grammar’ of the game, and the relative role of the individual piece within the thus constituted system. Saussure’s notion of value implies that the individual sign cannot be isolated from the system to which it belongs, and that it would be ‘a great mistake to consider a sign as nothing more than the combination of a certain sound and a certain concept, . . . to suppose that a start could be made with individual signs, and a system constructed by putting them together. On the contrary, the system as a united whole is the starting point, from which it becomes possible, by a process of analysis, to identify its constituent elements.’

224 Saussure, Course in General Linguistics, p 67.
226 This insight would have shaken up Western philosophy if Saussure’s work had entered philosophical discourse at the time Saussure gave his lectures on general linguistics between 1906 and 1911. Instead philosophy had to develop this insight on its own. Ludwig Wittgenstein was one of the key protagonists of the later so-called linguistic turn in philosophy. His starting point – many years after Saussure’s lecture courses – was also the rejection of the naive conception of language as the trivial operation of labelling pre-existing ideas. See Ludwig Wittgenstein, Philosophical Investigations (Philosophische Untersuchungen), Blackwell Publishing (Oxford), 1953.
227 It is impossible to give meaning to one’s utterances by fiat, by intention, or force of one’s will. To grasp this see Wittgenstein’s arguments against the possibility of a private language in his Philosophical Investigations. Meaning is only conveyed via a language system or structure. That’s why Saussure insists on the importance of the distinction of language (langue) and speech (parole).
228 The chess game was also one of Wittgenstein’s leading analogies.
229 Saussure, Course in General Linguistics, p 112.
initially as counterintuitive as it is ultimately compelling, is stated in the first sentence of Chapter IV on ‘Linguistic Value’: ‘Language itself can be nothing other than a system of pure values.’\textsuperscript{230} And further: ‘Values remain entirely a matter of internal relations.’\textsuperscript{231} Saussure elaborates: ‘What we find, instead of ideas given in advance, are values emanating from a linguistic system. If we say that these values correspond to certain concepts, it must be understood that the concepts in question are purely differential. That is to say they are concepts defined not positively, in terms of their content, but negatively by contrast with other items in the same system. What characterizes each most exactly is being whatever the others are not.’\textsuperscript{232} And: ‘The content of a word is determined in the final analysis not by what it contains but by what exists outside it.’\textsuperscript{233} This leads Saussure to the following summary formulation: ‘The language is, so to speak, an algebra which has only complex terms. . . . Nothing is simple. Always and everywhere one finds the same complex equilibrium of terms holding one another in mutual juxtaposition.’\textsuperscript{234}

Concepts are co-produced together by somehow correlating experiences, perceptions, actions etc with an otherwise abstract, formal calculus of differentiated sound patterns. ‘Just as the conceptual part of linguistic value is determined solely by relations and differences with other signs in the language, so the same is true for its material part. The sound of a word is not in itself important, but the phonetic contrasts which allow us to distinguish that word from another.’\textsuperscript{235} But how to identify and individualize one sound pattern versus another? How to pick out the relevant from the irrelevant contrasts? There are many different idiosyncratic ways of pronouncing a certain word. What are the criteria for discriminating two individual utterances or alternatively identifying them as versions of the same sound pattern? This question cannot be solved in the domain of perception alone. Anybody trying to learn a foreign language realizes that the first and most persistent problem is simple listening comprehension. An utterly alien language appears like an undifferentiated blur of sound. We are confronted with the apparent
paradox that the two levels that are both inherently indeterminate – the level of the signified and the level of the signifier – are able to act as each other’s scaffold of determination, resulting in a determinate structure. Saussure poses the paradox as follows: ‘No ideas are established in advance, and nothing is distinct before the introduction of linguistic structure. But do sounds, which lie outside of this nebulous world of thought, in themselves constitute entities established in advance? No more than ideas do. The substance of sound is no more fixed and rigid than that of thought. It does not offer a readymade mould, with shapes that thought must inevitably conform to. It is a malleable material which can be fashioned into separate parts in order to supply the signals which thought has need of.’

The description of how this happens, gradually, within a long process of historical evolution whereby language use coevolves within socio-cultural evolution as one of its primary tools and engines, lies outside the scope of Saussure’s synchronic science of linguistics. To get a tangible sense of how a language gradually acquires meaning and builds up complexity within pragmatic circumstances of cooperation one might read Ludwig Wittgenstein’s attempt to model such a process by describing very simple language games operating in very simple forms of life. Saussure just offers the striking vista of the paradoxical, final achievement, the creation of order from chaos: ‘So we can envisage the linguistic phenomenon in its entirety – the language that is – as a series of adjoining subdivisions simultaneously imprinted both on the plane of vague, amorphous thought (A), and on the equally featureless plane of sound (B). This can be represented very approximately in the following sketch. . . . The combination of both a necessary and mutually complementary delimitation of units. Thought, chaotic by nature, is made precise by this process of segmentation. . . . What takes place, is a somewhat mysterious process by which “thought-sound” evolves divisions, and a language takes shape with its linguistic units in between these two amorphous masses.’

This co-production of structure out of the two levels implies that it is impossible to change the plane of the signifieds without at the same time changing the plane of the signifiers. Every sign is co-determined by all the other signs within the system. In large systems, the effects are more localized within the vicinity of a given sign constituted by its competing and collaborating signs. If a signifier drops out of use, the use of the neighbouring signs is inevitably affected. Similarly, if a signified drops

---

236 Ibid, p 110.
238 Saussure, *Course in General Linguistics*, p 110.
6.8 THE SEMIOLOGICAL DIMENSION OF ARCHITECTURAL ARTICULATION

away, other collaborating or contrasting signifieds will be affected. If a concept loses or changes its primary contrast it has become a different concept. If a new signifier pushes into a semantic field it squeezes and re-arranges positions of many if not all competitors. The two planes are inseparable as the two sides of a sheet of paper. The scissors always cut through both sides.\(^{239}\)

### 6.8.6 EXTRA-SEMIOLOGICAL DEMANDS ON ARCHITECTURE’S MEDIAL SUBSTRATE

Above, Saussure is giving a dramatic image of a seemingly paradoxical process: two unstructured, amorphous planes use each other as scaffold in the build up of determinate structures. The cognitive processes that are coming into play here have been alluded to in the chapters on the psychology of perception.\(^{240}\) However, what should be noted here is that the evolution of a language is not proceeding in the wilderness. Language coevolved with the built environment together with other media of conspicuous differentiation like body adornments etc. The settlement structures with their delimitation of spaces and the spatial sorting of

---

\(^{239}\) Historical linguistics offers a reservoir of evidence to corroborate these theses. Saussure notes that ‘when one word gives birth to two alternative pronunciations . . . the phonetic difference which has emerged will tend to acquire significance, although perhaps not immediately.’ Saussure, *Course in General Linguistics*, p 110.

\(^{240}\) See chapter 6.7.1 *The Perceptual Constitution of Objects and Spaces* and chapter 6.7.2 *Cognitive Principles of Gestalt-perception.*
people, objects and activities must have been an important scaffold for early language and concept formation. In turn, the evolution and structuring of the built environment must have been supported by the evolving language and its categorizations. This collaboration and coevolution of language and built environment as complementary systems-of-signification continues. Thus a comprehensive theory must reckon with a multi-modal social system of communications. This implies that additional layers must be added to Saussure’s picture. These layers are somehow mapped onto each other, but never in simple one-to-one, item-to-item mappings. And certainly they do not all refer back to a single objective signified. Both verbal sign system and the sign system of the built environment have their own double articulation into the signifying and the signified layer. But they somehow function together in structuring the social life-process, as complementary media, each with its own specific affordances and limitations.

The central thesis of Saussure, namely that a language operates always on the basis of differences, as a complex system ‘in which all the elements fit together, and in which the value of any one element depends on the simultaneous coexistence of all the others’, should still hold, at least to some extent, for any ‘architectural language’ worthy of the name.241

However, there is a fundamental difference between verbal and architectural languages. Verbal languages are indeed pure communication media, purely concerned with information processing and the coordination aspect of social life. Accordingly, verbal languages possess an incredible material lightness. This sense of a nearly dematerialized physical existence has also been carried forth into the derivative medial forms of writing, printing and language-based telecommunication. This dematerialized purity also predestines verbal language to be the universal medium that can, in principle, communicate about anything and everything that could ever be communicated about. Its level of the signified is unlimited, unconstrained in comparison with other media like the built environment, the design media of drawing/modelling, body-language, body-adornment or fashion etc. These latter media are all characterized by a limitation of their domain of the signified.

241 Perhaps Saussure’s thesis is even overstated for the case of verbal languages where semi-autonomous regions might exist where influences are bound to close neighbourhoods. But then, we might speak of different languages or, like Wittgenstein, of different language games. So what is at stake here is not the fundamental thesis or principle Saussure has discovered, but the theoretical decision about the criteria of individuation one should use with respect to the concept of a unified language. Perhaps English should not be considered as one language but a series of overlapping languages?
The built environment is not purely a medium of communication. The built environment does more: it shelters from (counteracts) the cold, hot, dark, bright, wet, dry, noisy and polluted environment. These physical operations are part of the medial substrate of the medium of built architecture. To the extent that these operations are deemed necessary for the bodily functioning of the accommodated social institutions, they impose limitations on the free disposition over the built matter in the service of functioning as medium of communication. Also, these physical aspects are no longer under the full control of the autopoiesis of architecture. They are engineering matters.

Thus the medium of built architecture is burdened with these non-architectural requirements that are imposed upon its medial substrate. There are also architectural aspects that cannot be construed as mere communications. These are the organizational requirements of the functioning of social institutions. These organizational aspects/requirements involve the distancing and separating of people who could be disturbing or dangerous to each other. The organization via distancing and solid/secure enclosures operates in ways that cannot be construed as mere communication (although such separations are always unavoidably communications). Organization involves the organization of connections and proximities via channels of movement. These connections also do not (primarily) function as communications. They involve the physical channelling of bodies. These organizational aspects – space planning layouts, accessibility networks etc – are (still) controlled within the domain of architecture. However, they impose functional criteria on the medial substrate of built architecture that are not the same as the functional criteria of signification/communication. Every medium, even the medium of verbal language, is subject to physical-material constraints (as well as to the general constraints of human cognitive capacity). In the case of verbal languages these are the constraints of the articulatory organs, acoustic transmission properties of air etc. In the case of built architecture, the constraints involve the laws of physics (building physics, structural laws), as well as constraints inherent in the historically available fabrication and construction techniques. In principle, these material constraints cannot be summarily compared or weighted across such fundamentally different kinds of sign systems with so radically different material substrates. However, an important

242 It would in principle be possible for these aspects to be outsourced to another engineering discipline. However, the limitations on the medial substrate of any architectural sign system would be all the more severe if architecture were to lose control of the organization of the built environment.
difference between the two types of sign systems that can be asserted is the fact that the built environment serves more than just communicative functions. It cannot be monofunctionally driven to become a pure and 'perfect' instrument of communication. This is also the reason why the language of the built environment is not, as is verbal language, characterized by absolute and inherent arbitrariness. The different building forms of world history, even if they have evolved independently of each other, seem rather similar to each other. It seems comparatively easy to guess and grasp the meaning of buildings the world over, certainly in comparison with the utter hopelessness of understanding a foreign language. We will return to the discussion of arbitrariness below.

6.8.7 SYNTAGMATIC VS PARADIGMATIC RELATIONS
When Saussure introduces the concept of system or structure, what he has in mind initially is primarily the idea of a matrix or set of terms that co-depend on each other for defining and demarcating each other as different and opposed to each other in a ‘complex equilibrium of terms holding one another in mutual juxtaposition’. He is not, as yet, concerned how these different terms form a rational structure, or how they collaborate and function together. The concept of value – initially denoting the position of a term within the system of differences – is then augmented by considering the relations and connections such a term is able to engage in. Saussure is distinguishing two types of relations that terms might engage in that together elaborate the concept of value. ‘The relations and differences between linguistic items fall into two quite distinct kinds, each giving rise to a separate order of values.’ Saussure distinguishes syntagmatic from associative relations. (The latter term has later generally been replaced by the term paradigmatic. Thus we get the mnemotechnically motivated pair syntagmatic vs paradigmatic.) Syntagmatic relations are the relations within strings, for example, within multi-syllable words, phrases, sentences and sequences of sentences. They are based on the linear, sequential character of language. Associative relations are relations of belonging to a certain associative group. An association might be based on semantic associations or on sound similarities, ie, associative relationships can operate on the level of the signifier, the signified or both. Saussure's concept of associative relations is a rather open-ended notion: "Any given term acts as the centre of a constellation, from which connected terms radiate ad

243 Saussure, Course in General Linguistics, p 120.
244 Ibid, p 121.
infinitum." Later authors have not only supplanted the term ‘associative relation’ with the term ‘paradigmatic relation’ but have mostly tried to rein in the scope and openness of this notion to give it more precision. Usually, a set of terms is considered paradigmatically related, forming a paradigm, if they can somehow substitute for each other as contrasting and therefore significant alternatives of expression. ‘Signs are in paradigmatic relation when the choice of one excludes the choice of another.’ Or, put another way: ‘Paradigmatic relations are those which belong to the same set by virtue of a function they share. . . . A sign enters into paradigmatic relations with all the signs which can also occur in the same context but not at the same time.’

Saussure contrasts the two types of relations as follows: ‘Syntagmatic relations hold in praesentia. They hold between two or more terms co-present in a sequence. Associative relations, on the contrary, hold in absentia. They hold between terms constituting a mnemonic group.’ It has been noted that the concepts of syntagmatic and paradigmatic relations have general semiological application, also with respect to architecture. It is indeed a commonplace to rehearse this distinction within semiological accounts of architecture.

The syntagmatic relation, which in verbal language is a relation in time, is transposed into a relation in space. (In neither case must the concept be restricted to relations of immediate adjacency, succession or antecedence.) This transposition of the conceptual pair into architecture was made easy by the fact that Saussure chose to illustrate the distinction of the two types of relations with reference to architecture: ‘Considered from these two points of view, a linguistic unit may be compared to a single part of a building, for example, a column. A column is related in a certain way to the architrave it supports. This disposition, involving two units co-present in space, is comparable to a syntagmatic relation. On the other hand, if a column is Doric, it will evoke mental comparison with the other architectural orders (Ionic, Corinthian etc), which are not in this instance spatially co-present. This relation is associative.’

245 Ibid, p 124.
248 Saussure, Course in General Linguistics, p 124.
250 Saussure, Course in General Linguistics, p 122.
The point of introducing the two types of relations that can be identified in any communicative impartation (utterance, building) is to understand how they are involved in the functioning of communication. To say that one set of relations is ‘present’ and the other ‘absent’ is a poignant contrast but also a simplification that might lead to a misunderstanding. The meaning of any particular sequence or arrangement of terms/items presented depends not only on the different alternative items that might otherwise be chosen in place of each placed item, it also depends on the ‘absent’ rules of the language or system-of-signification that make a particular sequence/arrangement either expected, or surprising, or even incomprehensible. What has to be taken into account is the fact that syntagms are usually constructed on regular patterns and that a system of rules, a grammar, is involved that determines not only the well-formedness of a construct but also the particular meaning of the composite impartation. The question of the systematicity of the language thus arises, in particular with respect to any supposed architectural language. Not all built environments display the same degree of regularity. Superficial regularity is by itself not a sufficient criterion for language systematicity. Spatial and formal similarities and differences must be systematically correlated with differences in uses, types of social interaction and social structure. Mario Gandelsonas compares the systematicity of the Classical architectural canon that dominated architecture since the Renaissance with Modernism: ‘In both circumstances the aim was to produce a systematic organization of the codes of architectural practice, to define an apparently finite and stable number of forms and their correlated meaning within a closed system. . . . But whereas in classicism a fully constituted language in this sense can be observed in the way in which the elements of antiquity, deployed in an entirely new way, sustained a grammatical framework, in modernism the linguistic organization was essentially illusory. . . . It proposed new words but no rules for their combination, no grammatical framework for their use.’ Whether Gandelsonas’ assessment of Modernism is correct or doubtful, there can be no doubt that the radical expansion of architecture’s repertoire and the abandonment of the strictures of symmetry and proportion initially implied a certain loss of overall redundancy and thus structure or systematicity. However, if one reads Henry-Russell Hitchcock and Philip Johnson’s International Style, presenting the canonization of the first 10 years of the Modern

Movement, a strong sense of systematization, at least on the side of the signifier, comes across.

Leaving this question of the language-likeness of the style of Modernism aside, the more important question concerns the built environment in general. The built environment is the outcome of the intersection of architectural efforts (that are programmed according to the heuristics of the dominant style) and the contingencies of the societal environment outside architecture’s control. It is in this societal environment that processes of semiosis occur. Indeed, prima facie it seems that the built environments of traditional, closed societies developed much stricter rules and exhibited more regular syntagmatic patterns in their settlements than can be detected in the seemingly amorphous, randomly sprawling urban agglomerations of modern societies. The semiological systematicity of the global built environment seems to have further degenerated since the onset of globalization, Post-Fordism and the resultant crisis of architectural Modernism. The emergence of Postmodernism, Deconstructivism and Minimalism did exacerbate this situation rather than leading to more semiological systematicity. Although this historical tendency of semiological degeneration seems to be undeniable – despite the efforts of Postmodern architecture – this does not mean that the attempt to develop architectural grammars for new projects must be considered hopeless from the start.

If the natural semiosis of the built environment, left to its own devices within contemporary conditions, is failing, is there a chance to induce a new semiosis artificially? Is it possible to create, and to a certain extent steer, an artificial language for the built environment analogous to the artificial languages that were developed within early 20th-century philosophy? Proposing and launching more rigorously conceived and structured compositions is always possible. But can the semiosis that will engulf them be even vaguely anticipated, let alone predicted or controlled? As Charles Jencks put it 40 years ago: ‘the minute a new form is invented it will acquire, inevitably, a meaning. This semantization is inevitable’. 252 There is some evident truth here, but what Charles Jencks includes in the concept of meaning in architecture is much more vague and wide-ranging than what the theory of architectural autopoiesis considers. Jencks thinks about symbolic allusions and all sorts of connotations that might cross the mind of a disengaged connoisseur, rather than the operative meanings that frame and orient the interaction

processes of the immediate users. The latter, more constrained and precise definition of the concept of meaning in architecture is the definition proposed here, and further elaborated below. With respect to this notion, the envisioned semiological project has more plausibility, notwithstanding the fact that the only real and relevant meanings are produced within the social systems that communicate within the designed projects, with no regard to the intentions of the designer.

6.9 Prolegomenon to Architecture’s Semiological Project

THESIS 33

Contemporary architecture must push the expressive power of its architectural language far beyond the simple correlations between forms and designations that have usually been considered under the heading of ‘meaning in architecture’.

The theory of architectural autopoiesis states that the autopoiesis of architecture operates globally, as a single, worldwide system of communications. In this sense contemporary architecture is world architecture. Does this imply that the ‘language of architecture’ must be a single world architectural language? Not necessarily. We can speak about world society without necessarily assuming the existence of a single world language (although English might be a plausible candidate to become this world language). However, it does imply that a single world architectural language is possible in principle. As will be explored below, this idea of a world architectural language, not understood metaphorically as another term for a global architectural style but as a new level of semiosis involving a grammar that allows for the construction of composite architectural signs, cannot emerge spontaneously. This possibility, which until now existed only in theoretical speculation, can only be advanced by strategically selected design research projects, i.e., via individual design projects of sufficient scale, and with briefs that imply a high level of social complexity and communication density to warrant the design of a new, autonomous, project-specific system of signification. Before outlining the conditions and criteria that such projects should meet, some further insights, concepts and premises must be assembled. For instance, before further investigating the general question of a language’s systematicity or grammaticality, it is opportune to determine more precisely the particular types of meaning built architectural works might acquire. The theoretical task here is to define the domain of architecture’s signified.
6.9.1 THE SCOPE OF ARCHITECTURE’S SIGNIFIED

Above it was asserted that the basic architectural sign is the designated territory. Its basic denotative signified is the social interaction type accommodated within it.\(^{253}\) This demarcation of architecture’s signified concurs with Ludwig Wittgenstein’s general insight that the meaning of a sign is its use. The identification of architecture’s signified with its function, understood as accommodated activity or social action, has often (although not always) been the basic premise for theorizing architecture as sign system. For instance, Mario Gandelsonas, one of the main protagonists of such theorizing in the 1970s, states that, for both Classical and Modern architecture, meaning coincides with function. Although he does not restrict the architectural sign to territories, he posits that the domain of architecture’s content coincides with ‘the system of social actions’.\(^{254}\) The most condensed formula for this axiom reads: form signifies function. Or alternatively it might be put like this: architecture’s signified must take the categorical form of a function-type.\(^{255}\)

An architectural sign – a territory – always points to itself, to its inside. That’s the meaning of Stanislaus von Moos’ phrase self-referential symbolism. All other forms of symbolism have or should have been expelled from the domain of architecture. The question now arises of the overall scope of possible contents of architectural communication. In which ways, to which of its aspects, does an architectural work – a building, space or field – refer?

In analyzing this question in abstracto, ie, without analyzing a concrete building, we will be guided primarily by the words/concepts that have sedimented within our (ordinary) verbal language (English). Architectural and verbal language have evolved together. Verbal conceptualization is omnipresent and thus prestructures and guides the decomposition of the world of experience, also the world of architectural experience. (In turn, verbal language is prestructured by the partitioning of space within the built environment.)

What are the types of information one might expect to be denotated or connotated by a built architecture?\(^{256}\) The base information is the type of

\(^{253}\) Ontologically, the primary signified, the ‘meaning’ of the sign/territory, is neither a physical nor a mental thing. Neither is it an ideal (Platonic) entity. It is a socially attributed, dispositional property of a territory: its expected capacity to host specific activities and types of interaction.


\(^{255}\) The concept of function-type was formally introduced in chapter 6.1.4 The Categorization of Function-type.

\(^{256}\) To overcome the total abstraction of the following analysis, the reader might picture and keep in mind the Bauhaus in Dessau as illustration.
social interaction, ie, the function-type the territory instantiates. This function-type can be classified with various degrees of resolution or specificity, ie, the conveyed information might be more or less specific. The building or space might denote ‘institution’, or more specifically ‘educational institution’, or more specifically ‘university’, or more specifically still ‘school of architecture’. Thus it seems as if the denoted signified is structured in layers or nested categories that conform to a system of classification within which function-types can be defined with a variable degree of resolution. The first point to be noted here is that in each layer the signified information is based on a system of implicit distinctions in the paradigmatic dimension. ‘Institutional’ is part of the paradigmatic set ‘institutional vs commercial vs residential’. It is thus defined negatively as ‘neither commercial nor residential’. ‘Educational’ is understood only in opposition to ‘political’, ‘legal’, ‘medical’, ‘military’ etc. ‘University’ is defined as distinct from both ‘secondary education’ and ‘adult education’, constituting the selection/substitution set: ‘university vs secondary school vs adult education’. The second point to be noted here is that this kind of functional classification seems to have a natural point of termination. Perhaps ‘university’ (or ‘university institute’) suffices to inform about the patterns of interaction to be expected within the thus designated territory. The further qualification as ‘school of architecture’, or even more so as ‘Modernist school of architecture’, or nearly absurd, as ‘German Modernist school of architecture and urbanism’ seems to add rapidly diminishing returns in terms of offering orientation with regards to anticipated patterns of social intercourse and communication. To investigate another example, one might imagine, for instance, approaching one of the Bauhaus masters’ houses in Dessau. Here there might be no series involved at all. The denotation might simply be ‘family house’. Or there might be the short series: ‘residential’ (vs ‘commercial’ vs ‘institutional’), and then more specifically ‘single family house’ (vs ‘multi-parti territory’). Again, any further qualification, for instance in terms of architectural (rather than functional) typology – ‘detached house, vs semi-detached, vs terrace house’ – only delivers much diminished informational returns. Or consider the series ‘commercial’ (vs ‘institutional’ vs ‘residential’ vs ‘offices’), or more specifically ‘retail’ (vs ‘entertainment’ vs ‘catering’), or more specifically ‘fashion store’ (vs ‘food store’ vs ‘book store’ vs ‘electronics store’). Here the last qualification also adds little of relevance. Here ‘retail store’ seems to be the terminal, most pertinent level for identifying the function-type that should be architecture’s denotative signified here. The structure of the signified is thus a nesting structure or order of subsumption with a relative determinate, privileged, terminal level of
classification. The function-types thus classified correspond to
determinate, stable social institutions or types of interaction. This much
can be asserted about the structure of architecture’s signified on the
fundamental level of denotation.

However, there is more relevant information about territories that
could be communicated within an architectural language. For instance,
information about which social strata or classes are to be encountered, to
which social group the territory belongs. During the epoch when
stratification was still the dominant mode of societal and social
differentiation, this aspect of social status or stratum was indeed the
dominant dimension of architecture’s signified. In the era of Modern (and
Postmodern) functionally differentiated society, functional classifications
of the kind explored above provide the dominant and most pertinent
categories structuring architecture’s signified. It is the terminal level of
the function-type that establishes the denotative signified of the
architectural territory in question. The function-type dominates the
determination of the expected social encounter/interaction almost
irrespective of the class position (status in a general societal stratification)
of those involved in the encounter/interaction. This strongly contrasts
with the previous historical era. During the feudal order – when the
stratification of society was of primary relevance in all circumstances –
the pertinent, primary, denotative signified of all architecture (as well as
of all fashion and product design) was the position and role of the
territory in the system of status distinctions, almost irrespective of the
function of the encounter/interaction. With the transformation of the
predominantly stratified social order into an order based on functional
differentiation, the respective roles of function-type and status-type have
been reversed. Now the function-type is a matter of architecture’s
denotation and the status-type, to the extent to which it still exists in
various new guises, is relegated to the domain of connotations. Not that
connotations are irrelevant or to be neglected. But there is a definite
hierarchy of determination to be observed here: first the pertinent
denotation is to be settled, and within this primary frame, connotations,
ie, secondary qualifications and nuances, can be played out.

The transition from a stratified to a functionally differentiated society
coincides with the emergence of architecture as autopoietic system of
communications as distinct from tradition-bound building. Thus, in theory
at least, architecture’s primary signified should have been functionally
oriented since its inception. If one only consults architecture’s theoretical
self-descriptions – starting with Leon Battista Alberti’s *De re
aedificatoria* – this is indeed the impression one receives. Although
references to social status are still relevant and explicit in Alberti’s
discourse, they seem to be subordinated to a fundamentally functional discourse. The real historical semiosis on the ground might still have been a different matter until about 1800.

Although the concept of status-type with its connotations of hierarchy and stratification still exists today, its general social relevance and acceptance are no longer guaranteed. The concept of status-type should therefore be generalized to the concept of social-type, comprising all qualifications on the basis of any possible social classification: ethnic group, race, age, gender, educational level, sub-cultural type, or lifestyle group in general. The expected or desired social-type is one of the primary connotative signifieds of architecture. Architecture can, does and should communicate social typologies of the kind indicated above, but only in the mode of connotation. Architecture shares this communicative task with the fashion system. However, what is the denotational signified of the fashion system is a mere connotational signified within architectural systems-of-signification. For example, a restaurant might be characterized as formal vs informal, or cheap vs expensive etc. A workplace is corporate vs creative etc. The rules of engagement are more or less the same – the social situations are of the same type – but there are nuances to be observed. This is what the theory of architectural autopoiesis proposes to capture via its assimilation of the linguistic distinction denotation vs connotation. The connotative dimension of the social-type seems more open-ended and freewheeling than the denotative function-type. Function-types are based on social communicative institutions that are relatively stable in the time dimension and geographically nearly universal across global society. While status-types used to have this level of stability during the epoch of stratification, the social-types of today are much more unstable, and geographically more localized. That is another reason why social-types cannot be the primary signified for the medium of architecture, or even urbanism.

There is a third category of information that might be revealed or communicated via an architectural language or system-of-signification, namely information about the location or spatial position of the territory (zone, building, field, space, room) within a larger configurational matrix. Information about the otherwise hidden configurational measures of Hillier’s space syntax, for example, the integration value of a territorial unit, might be coded and communicated. This mode of

---

257 Anybody of supposedly high status will realize this when he/she enters a public place like a post office, or train station etc, and finds him/herself compelled to either join the queue or leave.

258 Concerning the suggestion of articulating space syntax information consult the end of chapter 6.4.5 Space Syntax: Concepts and Tools of Analysis.
communication is also concerned with indicating (leading to) adjacent or near territories that are somehow connected and relevant to the territory in question. This dimension of the signified might be called the dimension of navigation. The signified itself might be called *location-type* (as distinct from function-type and social-type). Its role is to assist wayfinding. The design strategy of contextual affiliation might be brought to bear here as a formal operation on the level of the signifier to signify/convey this kind of information. Within this dimension a navigation function (rather than denotative or connotative function) of the architectural sign also entails the task of making comprehensible the internal spatial organization of a complex territory into smaller territorial units. The location-type, comprising organizational (positional) information, looking spatially outwards from the territory as well as looking inwards into the internal organization of the territory, is a type of information that is necessitated by the fact that architectural works/territories, unlike other designed artefacts, mostly exceed what can be perceived in a single instance. It is not possible to simultaneously perceive both the inside and the outside of a building. (Even within a convex space it is impossible to perceive the totality of the territory in a simultaneous image.)

With regard to revealing the (outward and inward) organizational structure of a territory, semiological articulation is directly isofunctional (but not identical) with phenomenological articulation. The task is the same but the means are different. Semiological and phenomenological efforts might complement or substitute each other in this respect. They are functional equivalents here. Here the organization of the territory becomes the signified of the architectural language. The structure of the signified in this dimension is either the structure of spatial nesting – territories within territories – or a network structure like sequences, rings, branching systems etc. These structural logics would have to be taken into account by any language structure with the ambition to articulate the organization of the territory.

On the premise that the architectural sign always takes the form of a territory, the dimensions of architecture’s signified, ie, the pertinent dimensions that any architectural sign might address as its information or content, can now be summarized as follows:

<table>
<thead>
<tr>
<th>sign-function:</th>
<th>denotation</th>
<th>connotation</th>
<th>navigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>dimensions of the signified:</td>
<td>function-type</td>
<td>social-type</td>
<td>location-type</td>
</tr>
</tbody>
</table>

Communications comprise the moments impartation, information and understanding. Above, three types of information were distinguished in
the domain of architecture’s signified: the function-type, the social-type and the location-type. An information-rich built environment or architectural work should cover all three types of information. However, any graded notion of (the degree of) information-richness or information-density, as a comparative term, depends upon the richness or expressive power of the architectural language. The expressive power of an architectural language, for example, in the domain of the function-type, depends upon the correlated conceptual and formal manifold that is co-created by the language as it builds up a structure between the planes of the signifier and the signified. It depends on the number of distinct alternative signs that is available in the domain of the function-type. The larger this number of possible alternatives to any chosen sign, the higher the amount of information conveyed with this single sign.

6.9.2 THE COMPOSITE CHARACTER OF THE ARCHITECTURAL SIGN
Above, the central category of semiology – the sign-concept – was imported into the theory of architectural autopoiesis as co-extensive equivalent to its central concept of communication. The more specific concept of architectural sign, synonymous with built architectural communication, was concretized by being identified with the concept of (designed and designated) territory as the minimal self-sufficient communicative unit within the domain of architecture, equivalent to the unit of the sentence as the minimal self-sufficient communicative unit of speech acts utilizing a verbal language. However, it must be recognized (and terminologically accommodated) that architectural signs, as much as the sentences of a language, are composite entities. This composite character is not only to be observed in the case of larger territories like buildings or urban ensembles that can be analyzed as aggregation of elemental territorial units but, most importantly, concerns the constitution of the elemental territorial sign-units from components that by themselves do not constitute autonomous communications. These components are not complete signs. They might be referred to as sign-radicals. The term alludes to the concept of (free) radicals in chemistry. Sign-radicals (in analogy to their chemical namesakes) have a certain connective force, and combinatorial potential. They require each other to complete a sign. However, as in a chemical reaction, depending on the cojoining elements, the radical actualizes one of a set of meaning potentials. These potentials might be rather different. The re-use of
sign-radicals in rather different contexts might lead to different overall meanings. The notion thus allows the combination of sign-radicals to be similar to chemical reactions where the components might lose their original identity in emergent results (signs) that would have been difficult to predict. There can be no inexorable logic or rationality that allows for the unfailing deduction of composite meanings from their components. However, although the concept thus allows for emergence and surprise, the theory does not privilege unpredictable outcomes. The normal case must be the predictable extrapolation of the uses of sign-radicals. It should be possible to guess the meaning of a sign even if the exact combination of sign-radicals was put together for the first time. Familiarity with the prior uses of sign-radicals should enable the anticipation (understanding) of new combinations. This must be the normal case in a well functioning language.

It is necessary to distinguish the ordinary use of language in familiar circumstances from the extension of language use to new situations. As Noam Chomsky has stressed, a competent language user should be able to understand a sentence even if he/she has never heard the exact same sentence before. This means that even with respect to ordinary language uses there can be 'new' sentences in the sense that they have not been uttered before. If the meaning of such sentences is unproblematic it is because the operation of the language's rules is predictable for the socialized language users. This case of ordinary, trivial newness must be distinguished from the process of language extension where new situations are encountered that exceed what can be covered by the ordinary usages of the given language. In such situations the meanings of words (sign-radicals) have to be stretched. Their usage has to be extrapolated. This usually happens via metaphor or metonomy. Or, if new words are coined (by resuscitating old language roots from Latin or Greek), they are usually domesticated by means of certain endings that bring them into alignment with known words of similar meaning. In all these cases of language extension, the situation is inherently open, and ultimately unpredictable. However, the extension of word uses can never be utterly arbitrary. That would be bizarre and unacceptable, and mnemotechnically irrational. It should be possible to guess the meaning of the new language use, even if the expression could not have been predicted. It must be motivated somehow, although there are no strict rules here.

Although the distinction between ordinary and extraordinary newness seems clear enough, it has to be noted that there is no strict dividing line here. Where does ordinary usage become extraordinary usage? Where does the ordinary creativity of language Chomsky talks about become an
extraordinary creativity that creates a new language possibility rather than a new sentence within a given language? These questions escape general answers. (Here it can only be a matter of being aware of them.) However, even in the absence of a strict definition and dividing line, the distinction between ordinary and extraordinary extrapolations makes sense. Ordinary usage cannot be reduced to mere repetition. Otherwise the whole rationale and advantage of a systematic grammar over and above the individual conditioning of fixed phrases in fixed contexts would be inexplicable.

Actual language use is indeed acquired by training with individual examples, without explicit rules. To make the rules explicit is the task of grammarians. The difficulty of this task is attested to by several hundred years of painstaking attempts that never reached a satisfactory result. As Wittgenstein has pointed out, the formulation of explicit rules that fix everything in advance works only as long as it works, i.e., until a situation emerges that exposes the rule’s ultimate indeterminateness. Even with the supposedly ordinary usages there is no logical guarantee of the rule’s functioning, only its pragmatic success. Grammar works, although there is no inexorable force of logic.

Although there is no inexorable force of logic in any language (not even in formal logic itself), there are and should be at least strong, shared biases within a community of socialized users of a language/built environment that make certain associations and understandings of given ensembles more likely than others, so that signification/communication does not only function with standing phrases and stereotypical set pieces. For this to be possible a language, whether verbal or spatial, must have a grammar. A grammar is a set of rules (super-strong biases) that regulates not only how (well-formed) composite signs can be constructed from sign-radicals but also how composite meanings can be retrieved on the basis of the meaning-potentials of the sign-radicals. For this to work, grammars have to severely restrict the ways in which sign-radicals can come together. These restrictions reflect the structure-potential of the domain of the signified. In most natural languages, grammatical rules defining the syntactic well-formedness of expressions are insufficient to prevent well-formed expressions that nevertheless produce nothing but incomprehensible nonsense. In certain artificial languages, the attempt was made to constrain the domain of the syntactically legitimate to the domain of the semantically meaningful. The syntax of such a language might be called logical syntax.\textsuperscript{260} This is only possible if the semantic

domain is circumscribed in advance. This cannot be the case with natural languages that should be able to take up anything whatsoever, including any future unknowns. In contrast, architectural languages, and especially project specific languages, have sufficiently pre-constrained signifieds to admit the attempt to construct a logical syntax, ie, a grammar that excludes nonsensical expressions.

Grammars allow for semiosis to progress beyond simple one-to-one mappings of atomic signifiers to atomic signifieds in the manner of behaviourist conditionings. For very simple societies or smaller social systems with a short list of rigidly defined institutions this kind of one-to-one correlation, every single one being fixed separately by repetition leading to convention, might be sufficient. But such a system of rigid spatial signs could not frame the social life-processes of contemporary society.

The concept of grammar allows for the identification of well-formed (grammatically correct) compositions. However, the concept of grammar cannot be reduced to the purely syntactical level. A grammar operates also in the semantic dimension. The grammar of a language determines how the meaning of a sign/communication is constituted or derived from the meaning-potentials or associative valencies of the involved sign-radicals. Although any grammar as a whole is inherently arbitrary – as the diversity of grammars and their continuous evolution demonstrates – each particular grammar introduces limitations to utter arbitrariness within the language in question. The logic of a language (as well as the language of logic) can take many structural forms or grammars, as long as it provides more than the one-to-one mapping of rigid institutions onto fixed territorial settings. (This mapping would imply that it would make no sense to analyze signs into constituent parts.) A separate convention would be required for each correlation which treats the correlated signs as atoms. ‘One requirement that a grammar must certainly meet … the grammar cannot simply be a list of all morpheme (or word) sequences.’

Grammar presupposes that signs/communications are composed and that the composition is somehow structured, ie, limited. As a minimal requirement grammars must provide ‘grammatical restrictions that limit the choice of the next word at this point in the production process.’

261 The concept of grammar presupposed here involves more than the everyday notion that mostly only implies grammaticality in the sense of well-formedness without regard to the constitution of meaningful communications. The notion implied here is aligned to Ludwig Wittgenstein’s use of the term.
262 Noam Chomsky, Syntactic Structures, Mouton de Gruyter (Berlin/New York), 2002, 1st edition published in 1957, p 18. Chomsky and Carnap can both be enlisted here even if their concept of grammar (in the works quoted) is restricted to syntax.
utterance. These limitations concern both the syntactic as well as the semantic dimension. However, the limitation of the arbitrariness of the elements and their combinations that is (practically but not inexorably) given by any language’s structure or logic, once a language is given or chosen, must be understood in the context of the inherent arbitrariness of its overall structure or logic (as well as of its particular material instantiation in comparison with other isomorphic material instantiations) that always could have been otherwise. As the logician Rudolf Carnap pronounced in connection with his famous ‘Principle of Tolerance’ with regard to the construction of systems of logic: ‘We have in every respect complete liberty with regard to the forms of language;... both the forms of construction for sentences and the rules of transformation (the latter are usually designated as “postulates” and “rules of inference”) may be chosen quite arbitrarily.’ In Saussure, this tension between arbitrariness and its limitation by an ‘arbitrarily chosen’ systemicity is expressed in his distinction of absolute versus relative arbitrariness.

6.9.3 ABSOLUTE AND RELATIVE ARBITRARINESS

The notion that the connection between a sign’s signified and its signifier is arbitrary, based on mere convention, is one of the most well-rehearsed commonplaces that trickled down from the discipline of semiology into the stock of insights of academic architects. The point seems obvious, and it could hardly have been overlooked. After all, in Saussure’s Course in General Linguistics, the statement that ‘the link between signifier and signified is arbitrary’ is posited as the first principle of linguistics: ‘First principle: the sign is arbitrary.’ However, in this raw state as a singular truth the insight has perhaps done more harm than good for the development of architectural intelligence. Sure enough, in the further progress of Saussure’s Course, the principle is relativized and receives a nuanced treatment that starts to do justice to the complexities involved. Saussure links his insistence on the centrality of the concept of value that reveals the dependency of any individual meaning on the total network of meanings to the central thesis of language’s arbitrariness. Referring back to his diagram of the two planes of the signifier and the signified, Saussure states: ‘Not only are the two areas which are linguistically linked vague and amorphous in themselves but the process which selects one

263 Ibid.
264 Carnap, The Logical Syntax of Language, p xv.
265 Saussure, Course in General Linguistics, p 67.
266 Ibid.
particular sound-sequence to correspond to one particular idea is entirely arbitrary. If this were not so, the notion of value would lose something. For it would involve a certain element of imposition from the outside world. But in fact values remain entirely a matter of internal relations, and that is why the link between idea and sound is intrinsically arbitrary.¹²⁶⁷

The point of outward impositions is of interest here. The medial constraints inherent in any medium have been alluded to already above. They cannot undermine the ultimate arbitrariness of the particulars of any language. In verbal languages, the only case where individual words seem natural is the case of so-called onomatopoeia: for example, the word tick-tock referring to the sound of the clock via imitation. But as Saussure suggests, onomatopoeia is only ever an approximate, conventionalized imitation. In architecture the case is rather different: here the signifier stands in a much more direct relation to its signified. Also, the medial substrate of architectural signification is often directly involved in establishing the physical conditions of the signified, ie, the type of social interaction to be expected.

However, there is another important sense in which the arbitrariness of signification has to be relativized, and this applies even more to verbal languages than to any existing or projected architectural language. The requirement for systematicity constrains the utter arbitrariness of the signified-signifier correlations. This requirement is a general, internal rather than external, imposition that must be met by all systems-of-signification. Ultimately, this requirement refers back to the cognitive capacities of the participants who have to acquire the respective language competency. The systematicity of language, expressed in its grammar, does not only concern how words are composed into sentences but also the formation of words (sign-radicals), for example, the endings of regular verbs indicate tense etc. Irregular verbs violate this requirement of systematicity. If too much is irregular the language falls apart. For instance, languages tend to assimilate the terms of conceptual pairs to each other, or tend to use certain endings to characterize the general role a word plays in the discourse, for example, the ending ‘ism’ marks terms naming an ideological doctrine or attitude etc. Grammaticality implies that a complete sign or unit of meaning, ie, in our terms a particular, self-sufficient communication, like a sentence in the case of verbal languages and a territory in the case of architectural languages, must be composed of parts put together according to rules. Systematicity on the level of sign-radical formation is achieved by clustering sign-radicals into

¹²⁶⁷ Ibid, p 111.
groups or families so that some form of ‘similitude’, in whatever respect, in the domain of the signifiers finds a correspondence in a clustering based on another ‘similitude’, constituted in whatever respect, in the domain of the signified. The inherent, inevitable vagueness of the (ultimately undefinable) base concept of similitude, as well as the recurrent phrase ‘in whatever respect’, indicate that the signifier-signified relations remain ultimately arbitrary, or to put it in more functional terms: the options for making connections and stitching up correlations between the two planes remain flexible and open ended. Or to put it in even more positive terms: the inventiveness and resourcefulness of semiosis are inexhaustible. But the mnemotechnic necessity to build up some form of systematicity after all, implies that initial choices constrain further choices, and that the arbitrariness that might have been nearly absolute becomes a relative and constrained arbitrariness. As complexity is accrued within a language, many paths remain open for further elaboration. But not all paths can count as further elaboration.

Saussure recognizes that the sign, although in the last analysis ultimately arbitrary, in the sense that the form it takes can never be deduced or predicted with certainty, might to a certain extent be motivated. Motivation works against absolute arbitrariness and produces relative arbitrariness. Saussure introduces this concern with systematicity as follows: ‘So far we have looked upon units as values, as elements of a system, and considered principally the oppositions between them. But now we are taking stock of their interdependencies, both associative and syntagmatic, which combine to set a limit on arbitrariness.’

The importance of understanding systematicity in sign systems is acknowledged by Saussure: ‘Everything having to do with languages as systems needs to be approached...with the view to examining the limitations of arbitrariness.’ The principle of arbitrariness remains the first principle: ‘For the entire linguistic system is founded upon the irrational principle that the linguistic sign is arbitrary. Applied without restriction, this principle would lead to utter chaos. But the mind succeeds in introducing a principle of order and regularity into certain areas of the mass of signs. That is the role of relative motivation.’ This relative motivation of the signs, and the regularities they participate within, follow a functional rationality. However, this rationality ‘provides

268 Saussure, Course in General Linguistics, p 131; Saussure gives a simple example: the French word vingt (20) is wholly arbitrary, or unmotivated, whereas dix-neuf (19) is to a certain extent motivated.
269 Ibid.
270 Ibid.
only a partial correction to a system which is chaotic by nature'. Not all languages exhibit the same degree of systematicity. Saussure distinguishes **lexico-logical languages** in which the absence of motivation reaches a maximum from **grammatical languages** in which it falls to a minimum. Chinese is offered as an example of the former and Sanskrit as an example of the latter extreme. ‘There exists no language in which nothing is motivated. Even to conceive of such a language is an impossibility by definition. Between the two extremes – minimum of organization and minimum of arbitrariness – all possible varieties are found. Languages always exhibit features of both kinds – intrinsically arbitrary and relatively motivated.’

Language evolution is not necessarily an evolution towards more systematicity. French, for instance, is much more arbitrary than Latin. Saussure discusses the mechanisms that are involved on the plane of the signifiers. There is a tendency for languages to degenerate by sound changes that obscure the network rationality of words and phrases. ‘Sound change is a linguistic disturbance loosening the grammatical connections which link words together. It increases the sum total of linguistic forms to no purpose.’ Although elsewhere Saussure recognizes that all initially arbitrary sound changes and arbitrary sound differentiations eventually lead to meaning changes and meaning differentiations, and thus operate creatively like mutations, here he focuses on the aspect that they initially create mere irregularity: ‘The linguistic mechanism becomes obscure and complicated.’ Another spontaneous process, **agglutination**, also reduces the rationality of a language. It is an involuntary process whereby the components of motivated composite words fuse into an unanalyzable single word or standing phrase. Originally the components came together to construct an overall meaning that could be traced back to the meaning of the component parts. The process thus involves a loss of structure. There are also structure elaborating processes. The primary process here is **analogy**. ‘Analogy works in favour of regularity and tends to unify formational and flexional processes.’ Saussure celebrates analogy, its ability ‘to replace old, irregular and ailing formations by new ones of greater regularity, composed of living elements’. If new words are introduced by analogy

---

271 Ibid.
272 Ibid.
274 Ibid.
276 Ibid, p 169.
with existing forms, the speaker tries to detect and extend the rationality of the language he is trying to augment. Although somehow prepared by the existing systematicity of the language, the analogical innovation is an intelligent, creative act that convinces and finds imitators. Here is Saussure’s definition of analogy: ‘Analogy presupposes a model, and regular imitation of a model. An analogical form is a form made in the image of one or more other forms according to a fixed rule.’\(^{277}\) We should not be deceived here by the phrase ‘fixed rule’. The rule might be fixed, or seem clear, only as long as it is followed. But as Wittgenstein revealed in his famous discussion on rule following, there is nothing in a rule that predetermines or forces its extension to new, unforeseen cases. And what is new rather than the same can also not be fixed in advance. Saussure seems to have grasped this inherent precariousness and potential instability of the rule concept: ‘it is impossible to say in advance how far imitation of a model will extend’.\(^{278}\) Rules make things orderly and predictable only until someone finds another, perhaps more convincing way to follow the rule. What is logical or illogical is a question of practice evolving on the basis of pragmatic criteria. Nothing predetermines which analogies are drawn in which way and how far. The inherent arbitrariness of all semiological constructions remains the first principle to be remembered even in the discussion of how to achieve a relative move away from total arbitrariness to relative arbitrariness. This is good and encouraging news for avant-garde designers who are keen to try their luck in the creative construction of semiological potential.

However, this creative construction effort can indeed only create a **semiological virtuality**. For this to become an actual language, the accommodated social system has to be enlisted and relied upon. The actualization of the architecture’s semiological offerings is altogether outside the architect’s control, and in fact outside anybody’s control. Semiosis is an evolutionary process that unfolds within and contributes to the evolution of a social system. In the case of natural, verbal languages that evolve with a whole society or, like English, with world society, the uncontrollable dynamic of language is part of the autopoietic self-organization of a society that has long since lost its control centre. The size and complexity of natural languages, and the fact that they are unrestrictedly available across the totality of a given society, being used by everybody every day, imply that they are ‘immune from arbitrary

\(^{277}\) Ibid, p 160.

\(^{278}\) Ibid, p 161.
alteration'. 279 This aspect of the inherent inertia and tenacity of natural languages comes across strongly in Saussure: ‘No individual is able...to modify in any way a choice already established in the language. Nor can the linguistic community exercise its authority to change even a single word. . . . The rules the community accepts are imposed upon it and not freely agreed. . . . Any given linguistic state is always the product of historical factors. . . . Historical transmission is the overriding factor, to the point of excluding the possibility of any general or sudden linguistic change.’ 280 These features of gradualism and resistance to control are the general features of any distributed evolutionary process that has reached a high level of organized complexity. The balance of variation and redundancy is heavily tilted in the direction of redundancy. This relative slowness distinguishes natural languages from other social institutions and communication structures that rely upon it (and its stability) as a medium for their own accelerated evolution. ‘If stability is a characteristic of languages, it is not only because languages are anchored in the community. They are also anchored in time. The two facts are inseparable. Continuity with the past constantly restricts freedom of choice.’ 281 Historical continuity is preserved despite the lightness of its medial substrate and the ephemerality of individual speech acts. Inertia and historical depth are also features of the built environment and its system-of-signification. However, here it might be more anchored in the heavy physicality and thus permanence/inertia of its material substrate than in the highly evolved and organized complexity of its code. The question of the systematicity and complexity of the language of the built environment, and to what extent it is language-like at all, will be, once more, considered in the following chapters. Saussure closes his chapter on language’s invariability with a reflection on the dialectic between the inertia of tradition and arbitrariness: ‘It is because the linguistic sign is arbitrary that it knows no other law than that of tradition, and because it is founded upon tradition that it can be arbitrary.’ 282

6.9.4 NATURAL AND ARTIFICIAL SEMIOSIS
It is necessary to recuperate some further basic concepts and insights from semiology/semiotics that can serve to inform our ambition to

279 Ibid, p. 72.
280 Ibid.
281 Ibid, p 74
282 Ibid.
enhance architectural intelligence with respect to the task of articulation. The triadic distinction **iconic** vs **indexical** vs **symbolic** signs stems from Charles Sanders Peirce and is a commonplace in semiology/semiotics. Not unlike Saussure, Peirce conceived of the sign as the unity of the ‘sign itself’ and the ‘interpretant’. These terms might be translated into the terms signifier versus signified taken up from Saussure. Peirce then distinguished three principal types of signs – iconic signs, or icons, indexical signs, or indexes, and symbolic signs, or symbols – based upon the distinction of three different modes by which the relationship between the signifier and the signified is established and maintained. Peirce’s typology of signs can be integrated into the framework synthesized here. The three types of signs might be characterized as follows:

- **The iconic sign** or **icon** is a sign whereby the relationship between the signifier and the signified is established on the basis of a direct resemblance between the signifier and the signified, via imitation. Examples are the Olympic graphic icons that signify the different types of sport, cartoons, ‘realistic’ sounds in a radio drama, or imitative gestures. It might be noted here that drawings and models are also to be classified among the iconic signs. Buildings that are designed to act as iconic signs are rare. Venturi gave examples like the hamburger stand that is designed to look like a gigantic hamburger. To a certain extent Saarinen’s TWA terminal at JFK has been designed as iconic sign representing flight by shaping the roof to look like wings.

---

283 Peirce’s system also distinguishes a third term, the thing or object being referred to as distinct from the interpretant understood as the (supposedly mental) concept of the thing/object. This ontological doubling of the level of the signified seems, at first sight, to enrich and complete the discussion in comparison with Saussure’s neglect of the referent (extension) as distinct from the concept. However, the philosophical quicksands are closing in all around any such attempt. Peirce’s own life-long struggle with clarifying this distinction attests to this. With Luhmann’s theory of communication this ontological schism can be closed as follows: instead of posing the two ontological domains everything is reduced to observable communications. The distinction between the signifier (‘object’) and the signified (‘concept’) comes down to the distinction of impartation, information and understanding as observable moments of communication. The moment of impartation/signifier is observed on the simplest level of observing a direct presence. The signified, both in terms of information and understanding, is observable (and analyzable, reconstructable on the basis of many more simple observations) in terms of the networkedness and connectivity of the communication events. The moment of information can be analyzed in terms of paradigmatic relations, both actual and virtual. The moment of understanding can be observed by focusing on responses in terms of syntagmatic relations, ie, in terms of the retrospective and prospective connectivity of the communications within an ongoing process. Everything remains in a single, socially observable domain, the domain of communications hooking up to, referring back to and triggering further communications. The semiological discourse itself becomes observable as communication about communications.
The indexical sign or index is a sign whereby the relationship between the signifier and the signified is established because the signifier is directly (causally) connected in some way to the signified. This link can be observed or inferred, for example, ‘natural signs’ (smoke, thunder, footprints), medical symptoms (pain, a rash, pulse rate), measuring instruments (thermometer), ‘signals’ (a knock on a door, a phone ringing), or unintended ‘trademarks’ like accents or idiosyncratic cultural habits. The built environment is full of indexical signs. For instance, facades usually indicate the type of institution accommodated behind, ie, an experienced city dweller can usually read the type of function a building accommodates from its facade. Umbrellas mounted along a pavement index/signify ‘street café’ or at least more generally ‘street business’. There is no need here to impute the intention to communicate. Indexicality is based on an act of judgement or inference (whereas iconicity is closer to direct perception).

The symbolic sign or symbol is a sign whereby the relationship between the signifier and the signified is arbitrary or purely conventional – so that the relationship must be learnt, for example, alphabetical letters, words and language in general, Morse code, traffic lights, national flags etc. There is neither any resemblance, nor any natural connection between the signifier and the signified. In architecture a pertinent example would be the deliberate use of a Classical Doric portico to signify that the respective building accommodates a law court, or the use of Gothic motifs in the design of churches and city halls in the 19th century. The 19th century was the great era of symbolic signs in architecture. The symbolic sign does presuppose an intention to communicate.

The three types of signs differ with respect to their degree of conventionality. Symbolic signs are highly conventional; iconic signs always involve some degree of conventionality; while indexical signs are initially not based on any conventionality, but instead ‘direct the attention to their objects by blind compulsion’, as Peirce observed. The three types of signs differ with respect to the degree of constraint that operates between the signifier and the signified and/or vice versa, ie, icon, index and symbol differ in the degree to which the signifier is constrained by the signified and, inversely, with respect to the degree to which the signified is constrained by the signifier as an element in a system of interrelated signifiers. Indexical and iconic signifiers can be

284 Sometimes pointers (a pointing ‘index’ finger, a directional signpost) are listed alongside the examples given above. However, this makes the concept ambiguous as these signs are ultimately conventional in nature, even if they seem somehow natural or motivated.
seen as more constrained by their referential signifieds. Saussure would talk about ‘motivation’ here. The more a signifier is constrained by the signified, the more ‘motivated’ the sign is: iconic signs are highly motivated; symbolic signs are unmotivated. This traditional teaching of the unmotivated character of the symbolic sign can, in relation to verbal languages, only refer to words only, or in our terms, to sign-radicals only. Once we enter the realm of composite signs based on the syntactic and semantic rules of a grammar, motivation enters without requiring either iconicity or indexicality. We might therefore distinguish internal motivation from external motivation. Then we can say that symbolic signs are internally motivated but externally unmotivated.

The less motivated the sign (sign-radical), the more learning of an arbitrary convention is required. To a certain extent, even iconic signs (like the drawings and models of architecture’s medium) are built on conventions which must be learned to be ‘read’. Such evolving conventions are the essence of semiosis. In the case of symbolic signs, the reverse determination holds: the signified can be seen as being defined to a greater extent by the signifier. This is due to the fact that meanings, as discussed above, are a function of how the language system dissects and conceptually orders the world. Meanings are constituted by language, ie, they are constituted by the interplay of the planes of the signifiers and the signified. This dependency on the plane of signifiers – in terms of its substrate as well as in terms of its evolving formal structure – imposes a strong constraint upon what can be distinguished and referred to as a signified. However, also in the case of iconic signs, the individual signs sometimes constitute their meaning within a system of signifiers that to a certain extent mutually define each other rather than operating in isolation. However, the possibility of isolated operation is not absolutely excluded in the case of icons.

One important peculiarity about semiosis within the domain of architecture has to be noted at this point. While semiology/semiotics describes the symbolic sign as arbitrary and assumes determination here to run only from the signifier to the signified, in architecture there is sometimes a certain constraining force that runs in the opposite direction, from the signified to the signifier. This is due to the fact that in the case of the architectural articulation the always necessary physical embodiment of the signifier is mostly not constructed in such a relatively light-footed, dematerialized domain such as, for example, the spoken words in the domain of acoustic waves, or the printed word in the domain of nearly immaterial ink-marks or in the domain of the states of an electronic computer screen. In architecture, signifiers are often the tectonic forms of the heavy and physically burdened structures.
themselves, which in turn are determined by the signified, in as much as the signified, in the case of architecture, is precisely the social life-process that the architectural components (like walls, roofs, windows, doors) are supposed to serve. The signifying aspects of the sign-radicals that constitute the territory as sign are also burdened to physically organize, support and accommodate the denoted life-processes. Of course, there are also some lighter registers of articulation like colour, texture and ornament etc. But even the available colour spectrum might be constrained by the fact that the signified life-process might be disturbed by the coloured light that might otherwise be available to signify this life-process.

All three types of signs – indexical, iconic and symbolic – feature within architecture. However, the symbolic signs – which are the most evolved/advanced type of sign that dominates in all verbal languages – are least prominent within architecture. Within architecture most signs are either iconic signs or indexical signs or, if they progressed to operate as symbols, they nevertheless still betray their origin as either icon or index. This betrays the fact that ‘the language of architecture’ (architectural semiosis) is in a very primitive and crude state when compared with spoken/written language proper.

The language analogy might therefore afford clues and inspiration for the potential expansion of the semiological power of architecture. That is the motivation for rehearsing the basic concepts and insights of linguistics within architecture. The semiological project within architecture (as distinct from vernacular building/decorating) must replace intuitive sensitivity with theoretically grounded expertise. The theoretical conclusion to insist on and elaborate here is that the primarily indexical functioning of the current architectural and vernacular built environment must be challenged and overcome by a primarily symbolic-conventional articulation based on a systematic, grammar-based architectural language.

Strictly speaking, the principle of indexicality does not really belong to the proper domain of semiology, at least not in its pure state, unmediated by conventionalizing selections. Indexes can function in isolation. Pure indexes should not even be classified as signs. They are not communications. The moment of impartation is lacking. They cannot be attributed and understood as communications. They are analogous to behaviours as distinct from actions. Pure indexes do not operate as parts of systems-of-signification. Reading the built environment as a collection of indexes is very much like reading natural environments. Everything is full of clues on the basis of regular correlations. Indexicality functions to the extent to which built environments exhibit quasi-natural regularities.
Indeed, in nature such regularities or correlations exist so that nearly everything is a ‘sign’ of many other things. Certain flora indicate soil-quality, or allow for the anticipation of certain fauna. The movement of the topography indicates the direction where a river might be found etc. Within nature such regularities are very deeply and rigorously determined. This is the natural precondition on which the natural sciences succeed. However, in nature these spontaneous regularities never become the material for a selective, amplifying systematization, ie, there is no semiosis in nature, at least not in inorganic nature and flora that determines our natural landscapes. Within built environments indexicality operates too but far less rigorously and consistently. There is no full equivalent to nature’s determinism. The attempt to develop a science to uncover the laws of formation of built environments, modelled on the methodologies of the natural sciences, for example, via computational simulations, can only succeed on a very abstract, urban, organizational level, if at all, and only historically localized. Most facts and nuances uncovered by a morphological close reading of the human habitat must remain outside the scope of such an analysis. Here, indexicality still operates somehow, but not with rigorous correlations that would allow for predictability. Historically, the more modernization has progressed, the more fabrication and construction processes have proliferated, the less legible has the built environment become. Its indexical functioning is weakened when compared with earlier periods with much more constrained and thus uniformly applied construction materials and processes. This progressive degeneration of the environment’s indexical legibility, it seems, is being compensated for by the spontaneous process of semiosis that, to a certain extent, selects and orders the materiality of the built environment according to communicative intentions. Indexes are transformed into symbols. Contrasts are amplified, alignments tightened etc. This has been happening all along, and perhaps more during the pre-architectural, vernacular eras (dominated by traditional user-led building) than during the past 500 years of architecture.

At least since the advent of architecture as autopoietic expert discourse and profession, the sign system of the built environment, to the extent that it operates as such, exhibits the peculiarity that the architectural impartations (‘utterances’) are not directly produced within the accommodated social system itself. Instead they are delivered from outside, by the hired expert architect, as shells to be appropriated. Of course, a certain more ephemeral level of furnishings, or at least the artefactual paraphernalia of everyday life that accompany most appropriations, are still operating as utterances of the users, albeit as selections rather than as creations. On this level of the occupant’s
personal fitting out the vernacular still exists. Thus a close, nuanced evolutionary adaptation of these environments with respect to the specific communicative interactions that they accommodate and frame can be expected to lead to some kind of spontaneous semiosis that might develop some of the characteristics that can be observed in natural languages. This process works even, and perhaps all the more, under the premise of a world of artefacts/products that are largely provided by a professional design discipline together with a worldwide industrial production and distribution system. On this basis at least the conditions for globally operating codes or ‘languages’ are in place. The interior fit-out of the architect’s shells is thus more closely looped with the interaction processes than the architectural shells themselves. Recently, the fit-out of more and more interiors has come under the auspices of professionals (and their discourses): enriched provisions in places of work in depersonalized work environments, restaurants, hotels, shops and cafés that are taken over by chains are designed by professionals. Semiological nuance is getting lost when articulation is decoupled from the adaptive loops that keep it close to communicative interaction.

Does this decoupling of the production of the signifier (impartation) altogether compromise the status of designed architectural works as communications that operate within the accommodated social systems? No, this question was answered at the very outset, and is not undermined by the closer look provided here: the framing environment is understood as communication and locally attributed to the client, owner, host etc, no matter whether the host – individual, family, organization, or institution – has built and decorated the provided place of interaction, or whether he/she/it has provided for it by selecting, hiring and instructing a professional architect. The following scenario can illustrate this: the suitor who takes his date to a certain restaurant of his choice – with its particular location, style, ambience – as scene for a romantic evening becomes the point of attribution for the architectural communication that frames the ensuing communicative interaction of the date itself. Architectural signs/communications, although conceived within the autopoiesis of architecture, come alive as framing communications only within the social systems they are delivered to.  

285 Architectural signs, the built architectural communications – architecture’s service to society – are delivered to all social systems that rely on them. They are the final, boundary-crossing communications of architecture. They circulate as communications both within architecture and within the social systems they have been delivered to.
The following six theses/pointers are to serve as summary of the results of this chapter – with some references back to preceding chapters – and as premises for the final chapters to come:

- The legibility of the built environment relies heavily on indexes or conventionalized indexical signs.
- Pure indexes do not belong in the domain of semiology. They are not communications and do not integrate into systems-of-signification.
- The indexical functioning of the contemporary built environment is degenerating. Spontaneous semiological selection/correlation is too weak and fragmented to compensate for this. Overall legibility of the environment decreases resulting in a sense of urban chaos.
- The diversity of materials, construction/fabrication techniques and styles leads to a richness of architectural morphologies that is insufficiently correlated with the increasing diversity of types of social interactions. Spontaneous semiosis is in crisis.
- The language-likeness of the built environment as system-of-signification, to the extent that it operates as such, hinges on the systematicity or ordering of its signs, as well as on the build up of composite signs from sign-radicals on the basis of a grammar.
- The lack of an effective grammar is the key limitation of the built environment and spells out the key task for the development of an architectural language.

6.9.5 DESIGNING ARCHITECTURE’S SEMILOGICAL PROJECT
The idea of an architectural semiology poses two related theoretical challenges. It poses an analytical challenge, i.e., the attempt to describe, analyze, and critique how the built environment is already functioning as system-of-signification, and it poses the challenge of developing a semiological model that allows architects to design projects that might be able to function as new, artificial systems-of-signification. Above, insights from general semiology and linguistics have been gathered, a conceptual apparatus for the application of semiological concepts within architecture has been elaborated, and a series of first theses and pointers has been assembled. On this basis architecture’s semiological project should be further outlined and directed.

At the peak of the Postmodern, semiological wave in architecture, Mario Gandelsonas contrasted ‘two entirely opposed...extensions of the...

\[286\] With respect to the progress of linguistics these two strands of theoretical work can also be identified. An extensive body of descriptive linguistic research on the one hand and the synthetic-constructive work on artificial languages on the other hand were combined into the analytic/generative model of Chomsky’s transformational grammar.
traditional modes of generating meaning in architecture as represented by the work of Robert Venturi and Peter Eisenman respectively, both positioned as reaction against Modern Functionalism. ‘The first . . . Robert Venturi . . . advocates the reinstatement of a multivalent and eclectic language. . . . This position . . . understands in a critical way the nature of conventional meanings, and relishes the complexity of a plurality of meanings. The second . . . Peter Eisenman . . . tries to address the more basic questions of language, the grammatical questions.’

Eisenman reacts against the ‘open condition in which there exists no syntactic criteria for the language and no definitions of its formal structure’. Instead he focuses on the constitution of a formal, purely syntactical system, that considers only architecture’s formal aspect, ‘structured according to finite and specific rules, prescribing particular lines of action’. Eisenman’s approach and design process, as experimented with in his series of houses, are inspired by the idea of rewriting rules taken from Chomsky’s generative, transformational grammars. He starts with a general, abstract geometrical primitive, mostly a cube, and then proceeds to rewrite or redraw this primitive according to rules – regulating operations like subtraction, division, rotation etc – that successively substitute parts with more articulated parts. The process, if rigorously defined, is a rather powerful one. The power of such a formalized or regulated process – as distinct from just regulating the final result – had already been established by Jean-Nicolas-Louis Durand’s system of composition. As in the case of Durand, Eisenman’s developmental sequence thus moves from the simple to the complex. Often, the same operations are applied recursively. Eisenman progresses beyond Durand by going from a single rule set offered as the rational method to solve the tasks of architecture, to a series of experiments in rule-set construction as exemplified in the series of houses from house I to house X. Supposedly, ‘at every stage there are rules that permit the selection of what can be called correct configurations’. Eisenman’s work in the domain of architectural syntax must be recognized as an important, original contribution here. However,

288 Ibid.
289 Ibid., p 203.
290 Ibid, p 203.
291 See below, chapter 10.3.2 Durand’s Précis des leçons d’architecture.
there are two fundamental problems with Eisenman’s work. First, it is
doubtful that Eisenman’s processes were really rule-based in a strict
sense. The rules that governed a particular house were never explicitly
stated. Even if they were somehow stated, in the verbal terms of a natural
language like English the rules would have lacked precision and
completeness. Only the operationalization via computationally realized
algorithms can guarantee the operation of an invariant rule set. The only
other way in which rules can be established and maintained is via a
collective process of intersubjective socialization and control. Eisenman’s
informal, solitary process lacks either condition and thus implies that the
‘logically correct’ next step was whatever seemed to be somehow
‘logically correct’ to Peter Eisenman at the moment when the next step
was to be taken.\footnote{On this point the reader might refer to Wittgenstein’s
discussion on rule following and on the impossibility of a private language. See: Ludwig
Wittgenstein, \textit{Philosophical Investigations}
(Philosophische Untersuchungen), Blackwell Publishing (Oxford), 1953.}
The second problem is that the lack of explicitness of
the rule set prevents the possibility of an iterative process of
rule-modification on the basis of a feedback loop with the results of the
rule application. These problems of rule-based design have been solved
by current computational techniques. The much more serious limitation
of Eisenman’s approach is the fact that his process lacks explicit criteria
that could guide the selection and improvement of the (supposed) rule
set employed. These criteria must, in the last analysis, refer to the social
functioning of the architectural language that is to be constructed.
Because Eisenman’s work lacks engagement with social meanings, his
approach can only reach the status of a preliminary exercise.

The idea of constructing a language for architecture on a purely
syntactical basis without concern for and correlation with the semantic
and pragmatic levels is not a meaningful endeavour. It effectively reduces
the idea of language, even the idea of syntax, to a mere metaphor.
Eisenman is indeed explicitly rejecting social function as the domain that
gives meaning to architectural form. He presumes that architecture
should aspire to a supposedly generalizable ‘new cultural attitude’ or
‘Modernist sensibility’ evident in the abstract art, atonal music and
non-narrative film of protagonists like Mondrian, Schoenberg and
Richter.\footnote{Peter Eisenman, ‘Post-Functionalism’, in: \textit{Oppositions} 6
Fall 1976, reprinted in: K Michael
Chomsky understood the task of linguistics. Work on syntax can never be
regarded as an autonomous project that could on its own fulfil the aims of
linguistics or semiology/semiotics. This can be said independently of the
validity of the thesis of the autonomy of syntax, i.e., whether syntactical mechanisms are in themselves sufficient to establish the ‘grammatical’ correctness of speech acts. When it comes to the creative endeavour of conceiving, constructing and developing a new language-model for architectural design that should have a chance to be actualized in the social life-process of the end users, a purely syntax-based approach is out of the question. The potential for semantic interpretation and pragmatic contextualization provides the required selection criterion for proposed syntactic structures in an iterative process of developing a spatial language. The specificities of architecture’s signified must be considered. Syntactic and semantic principles have to be developed together. It is this richer concept of a semantically interpreted syntax that is implied with the concept of grammar proposed here as key ambition of architecture’s semiological project.

The final elaboration of an architectural language must proceed as architectural design research project in architecture’s medium of drawing/modelling/scripting. What can be done here are pointers about what might be heuristically promising parameters and criteria for such a project. Despite the criticisms launched above, the kind of project recommended here is certainly more in the tradition of Eisenman’s rather than Venturi’s work. Considering the totality of aspects discussed so far, perhaps the best way to proceed in advancing the semiological project within architecture is via individual design projects that are of sufficient size and complexity to plausibly warrant the establishment of an autonomous, project specific language without regard to conventional semantic associations otherwise circulating in the environment at large. Starting with an autonomous sign-system for a single (large-scale) project implies a decoupling from the general, spontaneous semiosis of the built environment.

295 This question has stimulated much debate in philosophy. Willard van Orman Quine’s position, for instance, is that grammatical concepts must be defined on the basis of semantic notions, that the concept of phoneme must be defined in terms of synonymy. This implies, crudely speaking, for example, that r and l are different phonemes because ramp and lamp do not have the same meaning. See: Noam Chomsky, On Language, New Press (New York), 2007, p 138.

296 Below will be discussed how this relatively circumscribed ambition might be extended by proposing a general semiological heuristics that might serve to systematize a whole architectural style in view of enhancing its capacity to contribute to a unified architectural system-of-signification that is able to operate beyond single projects.

297 The author has indeed started to experiment with semiological design projects in two of his teaching arenas: The Semiological Project was a year-long design project for the academic year 2010/2011 at the Zaha Hadid Masterclass, University of Applied Arts in Vienna. At the AADRL in London, the author introduced Parametric Semiology as design research project for 2011. In both cases the complex programme of a university campus is being utilized as basis for
 Engagement with the given network of meanings is too constraining for an avant-garde design research project that wants to push the capacity of the discipline beyond its current status. The development of a new, separate architectural language could be compared to the specialist languages that have been developed in various branches of science. Any new language must cut the contaminating associations with ordinary discourse. The more radical the cut and thus the strangeness of the new, artificial language, the greater is the likelihood that new associations, internal to the project, can form. For this to happen, scale and internal coherence are important factors. Then the design can take the risk of making a radically new start, creating something analogous to the artificial languages that have been created in the domain of mathematical logic: ‘to cast the ship of logic off from the *terra firma* of the classical forms’.  

The initial disengagement from existing meaning contexts allows a language to be designed as an original, internally coherent system where the meaning of every term depends solely on the structure of the system of formal differences and their correlation with different types of social interaction within the project. The language can be learned by the users detecting the differences that make a difference, without any presupposed prior knowledge.

The overall size of the project, as well as the richness and complexity of the brief, are critical parameters, if the ambition is to make architectural semiosis more language-like in the sense of building up a grammar rather than a mere lexicon of features. Indeed, only project briefs that imply a very high complexity in terms of the diversity, dynamism and communicative density of the expected/required patterns of social interaction are able to make use of complex proto-grammars. (Individual family residences certainly do not require the kind of semiological upgrade aspired to here.) Perhaps the most pertinent task domain, where a semiological design experiment would find a sufficiently complex (as well as sufficiently analyzed and documented) life-process, is the domain of the large-scale, highly integrated and elaboration of a design brief. The complex institutional organization of a university, its rich/diverse schedule of events, the different status groups to be distinguished, and the spatial expanse of its premises together make the university the perfect project category for the exploration of the semiological project in architecture.

Rudolf Carnap, *The Logical Syntax of Language*, p xv. The radical reconstruction of logic as abstract calculus, arbitrary, but internally coherent, and backed up by an artificial language that allows logical processes to be mechanized, was the pioneering effort of Frege, Russell, Carnap and others during the early 20th century. This work must be recognized as one of the fundamental contributions that enable the creation of our computer-based civilization.
communication-intensive business organizations of today’s knowledge economy. It is with respect to the organization and articulation of these highly ambitious and complex social systems that the semiological upgrade of architecture’s capacity would make pragmatic sense. The design briefs of large corporations contain complex challenges in all three dimensions of architecture’s signified: function-type, social-type and location-type. The legibility of the environment with respect to all three types of information is very useful, if not vital, to the establishment and overall productivity of the complex network of coordinated communications that is supposed to evolve and operate within the space (or field) of the corporate territory.

The corporate life-process is the object of intense attention and study within the corporation itself, mediated by professional management consultants armed with the reflection theories provided by management theory as well as organizational sociology and psychology. Empirical studies of current communication patterns accompany the continuous efforts in space planning as part of the overall, ongoing organizational reform processes. These facts are mentioned here to indicate that such projects offer a rich informational resource upon which to construct sufficiently rich criteria of semantic adequacy that could motivate an equally rich architectural syntax.

The fact that the corporate business organization as social system, and thus the communication processes within it, is at least to a certain extent subject to organizational design, rather than being based wholly on spontaneous processes of self-organization, adds to the viability of the idea of starting the project of architecture’s semiological upgrade via the construction of artificial proto-languages within this particular task domain.

Design research concerning the ‘spatialization of the complexities of contemporary business’ was conducted over a period of three years utilizing London-based corporations as quasi-clients within the context of the Design Research Lab at the Architectural Association in London. The design research effort focused on the architectural response to emergent forms of corporate organization. This general agenda was specified in seven project briefs which became manifest in 24 experimental design

projects elaborated by 56 architects working in teams of two to five. Each project team was collaborating with one of the following corporate quasi-clients: BDP, DEGW, M&C Saatchi, Ove Arup, Microsoft UK, Razorfish. The results of this research were published under the title *Corporate Fields*.\(^{300}\)

In retrospect, these projects can be classified as following the style of Parametricism. Starting with the corporation’s official organigrams, the projects developed abstract spatial systems that were trying to register and accommodate the actual patterns of communication of the investigated corporate organizations. Both issues of spatial organization and issues of visual articulation were prevalent. The problem of articulation was approached more in terms of phenomenology than of semiology, at least not in terms of an advanced semiological ambition involving the construction of a grammar. Thus the results cannot be taken as examples or illustrations for design research in the domain of architectural semiology or as experiments in the construction of an artificial architectural language. However, these projects revealed enough to recommend this task domain as the most prominent within which to launch semiologically focused design research projects.

The rich design briefs that can be developed for such firms cover the dimensions of both function-type and social-type. The task of articulating the location-type can only be posed later, on the basis of the spatial organization developed within the design. The dimension of the function-type contains the various activity types and types of social interaction that one can distinguish within the life-process of a corporation: individual, concentrated work; concentrated work taking place in parallel, in close proximity; one-to-one formal talks; one-to-one informal chats; small formal meetings; small informal gatherings; anonymous, quasi-public encounters; large conferences etc. All these function-types occur with various departmental affiliations which qualify or mark each of these situations. The dimension of the social-type is equally rich and differentiated: first of all there are the different specialisms or professional qualifications that need to be considered; second, there are all the general levels and positions within the corporate hierarchy that call for consideration; further, there are relations of immediate subordination; finally, there are various social-types that come from outside the firm to join social interactions within the designed space of the firm, including clients, consultants, job applicants etc. All these types that exist within the domain of the signified are prestructured by

our shared language and by the official operational categories of the business firm. Many more nuanced, connotational distinctions might be relevant once insider knowledge and careful observation are enlisted to further enrich the brief. Each (official or unofficial) function-type or social-type that is architecturally articulated is thereby made prominent and thus reinforced. Thus, to a certain extent, Saussure’s image of two amorphous planes engaging in the co-creation of a definite structure does also apply here. The designed spatial organization – together with its phenomenological and semiological articulation within a designed architectural language – reinforces and further structures the latent, prestructured function-types and social-types, by making them public, explicit and relatively permanent.

6.9.6 COGNITIVE AND ATTENTIONAL CONDITIONS OF ARCHITECTURAL COMMUNICATION

Before considering how the domain of the signifier might be structured and related to the domain of the signified to achieve this (mutual) reinforcement, the pragmatic and cognitive conditions under which an architectural sign system has to operate must be considered because there are some important differences here, in comparison with the pragmatic and cognitive conditions of verbal (spoken or written) languages. These differences affect the further elaboration of the language analogy within architecture.

The comprehension and information retrieval via a complex verbal language – both in its spoken/heard as well as in its written/read form – requires focused, concentrated attention. The same level of attention cannot always be expected from the users and supposed ‘readers’ of architectural information. Thus any conception of an architectural language that presupposes this level of attention is doomed to fail. Most (although certainly not all) of the information embedded within built environments, designed or not, is retrieved subliminally. The level of attention given to the environment is not always the same. When entering a new environment our level of attention is heightened, in particular if we are trying to orient ourselves or if we are looking for something specific. Thus two modes of engaging the frames of architecture must be distinguished according to the level of attention subjects give to the specific characteristics of the architecture that surrounds them. The two modes of engagement relative to architecture are attention vs distraction.

The mode of distraction prevails when subjects are absorbed in specific activities or social interactions, or in an environment where subjects feel familiar, safe and thus are willing to daydream. The mode of attention prevails in new environments, when subjects are trying to find their way,
or when they first enter a territory and try to orient themselves and read the situation. Later, when the territory is revisited for repeat interactions, the mode of attention subsides. Now what was previously carefully read and (intuitively) analyzed is condensed into a quickly recognized, wholistic Gestalt. Such routinization also happens with respect to verbal messages. They condense into phrases that no longer need to be analyzed but are taken in as a whole, integral Gestalt. A certain level of verbal information retrieval is also possible in the mode of distraction. For instance, subjects understand sentences even if they are caught out by being addressed unawares without anticipation. However, the distinction of attentional levels in the mode of engagement is of particular importance in the domain of architectural communication.

There is a lot of specific research on attention in the field of cognitive psychology that might be consulted. The distinction *mode of distraction* vs *mode of attention* proposed here is roughly equivalent to concepts like *pre-attention* vs *attention*, or *parallel attention* vs *focal attention* one can find in the relevant literature: ‘A first important distinction in the processing of information in visual search tasks is its separation in two stages. The first, early “preattentive” stage operates in parallel across the entire visual field extracting single “primitive features” without integrating them. The second “attentive” stage corresponds to the specialized integration of information from a limited part of the field at any one time, ie, serially…. There are two experimentally observed modes of visual attention, namely: the serial focal attention and the parallel spread of attention over space.’

The critical aspect that affects the ambition to construct a grammar that regulates the construction and comprehension of composite architectural signs is the distinction between the wholistic comprehension of a sign as a Gestalt, or integral figure that doesn’t rely on being somehow deciphered or analyzed on the one hand, and, on the other hand, architectural signs that presuppose such an analysis, however quick and intuitive, as a capacity in the ‘reading’ subjects. Such analysis would be required if the composite architectural sign, ie, a given territory that has its relevant information encoded via the rule-based assembly of recognizable sign-radicals, is encountered for the first time. Here information retrieval would require a concentrated, close reading of the territory. Can such a ‘reading’ of an architectural ensemble ever be presumed or presupposed? That this presumption is not implausible is indeed an important premise of the

---

semiological project promoted here. Of course the reading of the territory is not presumed to take the form of explicit forensic analysis, nor should it take the form of effortful deciphering as when a child first learns to read. The extensiveness of the required ‘analysis’, operating intuitively rather than explicitly as conscious mental effort, depends on the complexity of the language, in terms of both signifier and signified.\footnote{Since we are entering a kind of virgin ground here, speculation can only be advanced in parallel with design experiments. The questions raised here can only be answered via empirical evidence generated on the basis of theoretically controlled design experiments.}

Above, three types of architectural information were distinguished, ie, function-type, social-type and location-type. It is also important, independently, to distinguish the functions that these types of architectural information are utilized for. One might distinguish the facilitation of navigation, orientation and (successful) immersion as the three functions of architectural information. Navigation is concerned with wayfinding, ie, with finding desired sites of social interaction. The retrieval of the spatial type of information (location-type) is relevant for the facilitation of navigation. Navigation might oscillate or switch between the two modes of engagement. For example, close attention is required in new territories, at junctions where decisions about the further path have to be made. Orientation is concerned with understanding and anticipating the communicative situation upon entering a designated territory. Here, especially if the territory is entered for the first time, the mode of attention can be presumed to dominate, and indeed would be required to prepare the next step, the immersion in the social interaction. With respect to immersion, which implies the mode of distraction in relation to the surrounding environment, it is the atmospheric ambience of the territory, its operation as an undifferentiated Gestalt, that supports this function.

Architectural signs (territories) that operate as undifferentiated atmospheres might be referred to either as atomic signs, if they are inherently undifferentiated, or condensed signs, if they operate as atomic signs if encountered in the mode of distraction, while operating as composite signs if engaged in the mode of attention. This theoretical set up implies that the same architectural ensemble should be able to operate as both composite and condensed sign, first facilitating orientation in the mode of attention, and then sustaining immersion in the mode of distraction. Thus the same ensemble lives a double life, one regulated by a relatively elaborate grammar that allows for the rule-governed construction of signs from sign-radicals, and another one,
regulated by a rudimentary grammar that operates only with a simple series of contrastive opposites that correlate with a simple series of distinguished interaction types.

The conceptual set up can be summarized in the following matrix:

<table>
<thead>
<tr>
<th>Informational function:</th>
<th>Navigation</th>
<th>Orientation</th>
<th>Immersion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information type</td>
<td>location-type (relative position)</td>
<td>function-type (interaction-type) social-type (status, affiliation)</td>
<td>function-type (interaction-type) social-type (status, affiliation)</td>
</tr>
<tr>
<td>Mode of engagement</td>
<td>oscillating between modes of attention / distraction</td>
<td>mode of attention</td>
<td>mode of distraction</td>
</tr>
<tr>
<td>Sign type</td>
<td>composite sign condensed sign</td>
<td>composite sign</td>
<td>atomic sign condensed sign</td>
</tr>
<tr>
<td>Grammar</td>
<td>elaborate grammar</td>
<td>elaborate grammar rules composing sign-radical</td>
<td>rudimentary grammar contrastive oppositions</td>
</tr>
</tbody>
</table>

The foregoing reflections upon the modes of cognitive engagement that any architectural language must reckon with have not compromised the plausibility of conceiving an architectural language that is able to communicate information via the rule-based composition of composite signs. The following chapter will push speculation about the possibility of such an architectural language further than has hitherto been attempted.

6.9.7 SPECULATION: EXPANDING THE EXPRESSIVE POWER OF ARCHITECTURAL SIGN SYSTEMS

The amount of information conveyed in a single impartation (speech-act or built piece of architecture) depends on the expressive power of the language’s signs, the number of signs used and the degree of redundancy in the imparted ensemble of signs. (Redundancy makes messages robust, but reduces the potential amount of information that can be packaged into a certain number of sign units.) The expressive power of a language depends not only on its lexicon, the number of fixed, standing terms available. It depends on its capacity to combine its simple terms in many different ways. It also depends on the kinds of terms it has available, ie, the categorical character of these terms. For instance, it makes a
difference if a language has only simple predicates or also allows for the expression of relations, i.e., predicates that accept two or more terms as their arguments, rather than only a single term.

The architectural sign, the essential unit of any architectural system-of-signification, is the territory. The notion of territory comprises both elemental and internally differentiated territories. Both elemental and differentiated territories are located within encompassing territories. Differentiated territories encompass at least one or more encompassed territories (sub-territories). To the extent that the participation in multiple events or interactions is plausible, interpenetrating or superimposed territories are also to be considered. All the organizational tropes of contemporary architecture must be accommodated. However, it has to be remembered that the concept of territory is conceived as the synthesis of signifier and signified and thus its identification or individuation as this versus another territory always includes the aspect of the expected or unfolding social interaction. In the standard case, at least, the assumption is that a territorial unit denotes a unitary social interaction type. Considering differentiated territories, an architectural code can be expected to include the spatial disposition (relative position) of the sub-territories within the encompassing territory, as well as in relation to each other, to have significative import. The dimension of spatial organization will thus, on the one hand, be a syntactic register that can modulate/contextualize the meanings of signs (sub-territories), while, on the other hand, it is a dimension of the signified, i.e., the location-type. Thus a feedback loop must be established between the organizational and the semiological project.

The more detailed discussion of how an encountered territory can be coded and then recognized as a territory with a certain designation should commence with the case of the elemental territory. The task – initially thought to be limited to a single, sufficiently large/complex design project – is thus to define a correlation or mapping from the universe of the signified (function-type, social-type, location-type) to the universe of the signifier. One early design decision that might recommend itself here is to allocate to each information type a distinct formal register within the domain of the signifier. Which registers can be distinguished and made available here? (It must be remembered here that we are considering only fully fitted and furnished territories. Urbanism, architecture, interior design, as well as furniture design, are assumed to operate together here.) Above we have broadly distinguished between the registers of spatial organization (territorial configuration) and morphological articulation (comprising tectonic form as well as materiality, texture and colour). This
distinction must now be developed and refined in conjunction with the proposed alignment with the dimensions of the signified:

- The **configurational geometry** is the register that might be aligned with the function- or interaction-type. In the case of the elemental territory it comprises the **bounding geometry** of the territory in question as well as anything that serves to configure the **spatial diagram of the social interaction**, ie, the relative position and geometric orientation of the communicating users (bodies) relative to each other.
- The **morphological geometry** is the register that might be aligned with the social-type. It comprises geometric articulations below the scale/scope of territory formation, and includes everything that one can include under the traditional concepts of **ornament** (mouldings) and **tectonics** (joints, articulation into components).
- The placement, geometry and morphological articulation of **openings and perforations** might be utilized as register for the coding of location information. In the case of elemental territories, this information concerns the location of the territorial unit within a larger territorialized context.
- The further registers of **materiality, colour, texture, lighting** etc might be utilized for various further connotational qualifications and nuances of both function-type and social-type.

These alignments are here no more than illustrative suggestions. They are certainly not meant as general theoretical postulates. These **registers of semiological coding** that together constitute the plane of architecture’s signifiers are, in principle, functionally equivalent. They can substitute for each other with respect to the task of coding. However, they are, evidently, not freely disposable purely for the purposes of signification. They are not only burdened by the conditions and constraints imposed by the engineering disciplines, they are also burdened by functional concerns that are internal to architecture, namely the concerns of organization and phenomenological articulation. Here resides potential for conflict but also opportunities for partially motivating signs.

The different registers operate as sign-radicals that together compose the composite sign. These registers, as layers or aspects of the overall design of the territory, can be classified as sign-radicals because each has a (semi-autonomous) semantic alignment, potential, or bias that contributes to the constitution of the final meaning that is attributed to the territory. The distinctions within each separate register combine to contextualize and fulfil each other’s semantic potential. However, these
distinct registers are not the only way to establish sign-radicals. An architectural language or code might operate with a lexicon of discrete geometric components as sign-radicals that can come together in various significant ways, for example, to delineate the boundary of the territory. One might think here of the walls, columns, balustrades etc or various types of opening. Just like the riders on the library cards in the library catalogue constitute a sentence-like proposition, namely the book is loaned out and thus absent from the shelf, so might the ensembles of architectural sign-radicals produce propositional statements. The rider on the library card, and indeed the card itself, are sign-radicals constituting the composite sign which is the card contextualized within the catalogue, with or without rider. The example shows that within a system-of-signification absences can be made to speak as much as presences. The capacity of a system of signification to signify via absences depends upon the existence of a grammar.

Above, the territory was compared to the sentence as a minimal unit of determinate signification. Both territory and sentence are constituted from sign-radicals. This implies a grammar that regulates the systematic re-use of sign-radicals according to semantic rules. However, the deployment of these sign-radicals is also subject to the rules of syntax that determine – certainly in the case of language use – what is usually referred to as the grammatically correct use of words. The basic syntax of a sentence, for instance, demands the presence of a subject and a predicate, and sometimes an object, usually in this order (SPO). Chomsky prefers to speak of a noun phrase and a verb phrase. These are necessary types of components (sign-radicals) that constitute the sentence. In the same way a new, systematic architectural language might involve a syntax that distinguishes and posits types of components that are necessary for the constitution of a meaningfully organized and articulated territory. For instance, it seems pertinent to pose territorial demarcation and occupiable surface as two necessary types of sign-radicals that must be present to correctly constitute a meaningful territory.

Rather than starting with the invention of a formal syntax here, it is important to consider in more detail what kinds of information and which proposition-types might be communicated via architecture. The general form of architectural signs is propositional. For instance, consider: this is an individual office (function-type) for a director/board member (social-type), in this direction leading to the boardroom, in that direction.

303 The theory of architectural autopoiesis does not restrict the term grammar to syntax. A more comprehensive concept of grammar includes syntactic, semantic and pragmatic rules.
leading to a conference room (location-type). In this case the quest for the language’s systematicity would demand that the signifier expressing the location-type by indicating the adjacency or direction to the boardroom shares, according to a rule, certain signifying characteristics with the generic signifier denoting the function-type ‘boardroom’.

Considering that the coded information that is communicated within an architectural language takes the logical form of the proposition, leads to the idea that an architectural language might be designed that allows for the utilization of the logical operations of the so-called propositional calculus, i.e., negation, as well as connectives like conjunction, disjunction, implication etc. (These more abstract, propositionally composed modes of architectural communication might indeed be accessible to users engaging within the mode of attention, eager to close-read the environment’s rich information.) One might consider negation in comparison to disjunction as follows: rather than only working with positive statements like this is public, or communal, or individual, a negative qualification might sometimes hit the mark quicker without needing to be overdeterministic: this is not restricted. One might also consider extending the expressive power of the designed architectural proto-language by allowing for the incorporation of modal operators and probabilities. The classic modal qualifications of propositions are necessity, possibility and contingency. Rather than mere declarative propositions like this is a meeting room for managers, the language might be able to express modal propositions like this might be a meeting room for managers (possibility), or this is currently a meeting room (contingency), versus this must remain a meeting room (necessity). A possibility statement might be combined with an implication or conditional statement: this could be used as a meeting room, if so then social restrictions do not apply. How could modality be expressed on the plane of the signifier? The possibilities are infinite. For instance, one might use colour, or just colour saturation, or just brightness, exclusively and rigorously throughout the project to indicate modality. The spectrum from necessary (fully determined) to contingent (indeterminate) might be mapped onto the brightness spectrum from very dark to very light, across all function-types. In this case the modality of territories would be a prominent layer of information that could even be navigated and immersed in while engaging the environment in the mode of distraction. How about quantifiers like all, some, one, none? That might be yet another useful expansion of the expressive power of the envisioned architectural language. For instance, a long row of (differently sized) office cells might be marked with the all-quantifier: all meeting units here are restricted to
managers. This kind of information saves the potential user checking availability individually. Another possibility is the utilization of the variable components of the environment, like doors being open or closed, curtains being drawn or open, light being switched on or dimmed etc to dynamize an architectural language (like the rider on the library card). This variable layer of the built environment already functions in terms of indexicality, sometimes even via an individual user’s communications, for example, when a manager keeps the door open to indicate that his subordinates are free to enter his office without prior appointment. One might conceive of the total environment as comprising various layers of transience, from the structure, via flexible partitions to all the mobile and kinetic elements. The most variable and responsive layer could be electronically augmented and systematized under the auspices of a rigorous code. Within a corporate environment with facility management and intelligent building systems, such a code could be implemented according to a designed language incorporating dynamic sign-radicals.

The various, suggested lines along which the possible content of an architectural language could be enhanced – negation, the logical connectives of propositional calculus, modal operators, degrees of determinacy, quantifiers, variables – would push the expressive power of an architectural language far beyond the simple correlations between forms and designations that have usually been considered under the heading of ‘meaning in architecture’. How plausible are these extensions, and how can they be implemented? This is perhaps the point where this book reaches its most speculative moment. The author can cite no precedents or successful design experiments that could back up the intuitions and proposals put forward here. This is where avant-garde design must take over and lead further research. Theory must hand over to design research until further problems are posed by progressing design work.

After completing the three-year research agenda of Corporate Fields (1998–2001), the AA Design Research Lab conducted a three-year design research on Responsive Environments (2001–4), concerned with the design of architectural systems that are capable of interaction by means of real-time reconfiguration in response to users via embedded electronic intelligence. The agenda was focused on social organization via action-artefact networks with carefully designed interaction patterns. (However, no emphasis was placed on the semiological dimension.) See: Patrik Schumacher, ‘Responsive Environments – From Drawing to Scripting’, in: 01 AKAD – Experimental Research in Architecture and Design – Beginnings, Katja Grillner, Per Glembrandt, Sven-Olov Wallenstein (Ed), Royal Institute of Technology (Stockholm), 2005.
6.10 The Semiological Project and the General Project of Architectural Order

THESIS 34

The semiological dimension of architecture engages most directly with architecture’s unique societal function. It is the leading dimension of architecture’s task. It is the expertise in this dimension that is most required to succeed in the provision of effective communicative spatial frames.

This section theorizes the relationship of semiology to phenomenology and organization. All three aspects contribute to the achievement of architectural order. The thesis that transpires in this section is that the semiological dimension is the leading dimension of architecture’s three tasks: organization, phenomenological articulation and semiological articulation. However, the semiological dimension must lead from behind. Also, its leadership has mostly been obscure, hidden by stealth. To enable it to assert itself more fully and openly, as a precondition of its further advancement, is the task that the theory of architectural autopoiesis posits here.

The semiological project depends and builds on both the organizational and the phenomenological project. There seems to be a logical sequence of project development that starts with the organizational project, then moves to the phenomenological project and finally to the semiological project. Leadership from behind means that an experienced designer reflects on and employs the conditions for a successful semiological project as selection criteria within the build up of organization and phenomenological articulation. The phenomenological project tries to enhance the perceptual palpability of the spatial organization. The semiological project in turn relies on the perceptual presence of forms that are to acquire meaning within the semiological system. The inherent ambiguity of the perceptual decomposition of a scene directly affects the expected semiosis. In fact, a sophisticated semiological project should be able to take advantage of the possibility of phenomenological double readings to further enrich the expressive power of the respective architectural language. The semiological structuration of the perceptual material will in turn feed back into stabilizing some rather than other perceptual possibilities via so-called top-down processing. The exploration of these relations of mutual dependence, embeddedness and feedback merits further detailed research. In this final section on

305 Concerning the sequencing of the three projects see below, chapter 7.6.3 Processing the Three Task Dimensions of Architecture.
architecture’s semiological dimension, some further reflections and conceptual preparations are offered that can help to frame this research.

6.10.1 THE SEMIOLOGICAL PROJECT IN RELATION TO THE ORGANIZATIONAL AND THE PHENOMENOLOGICAL PROJECT

The theory of architectural autopoiesis is bringing the phenomenological and the semiological dimension of architecture under the shared heading of articulation, as distinct from organization. The latter distinction is based on the difference between handling passive bodies versus enlisting active, cognitive agents. The former distinction is based on the difference between the enlistment of behavioural responses from cognitive agents and the communicative engagement of socialized actors. The phenomenological project enlists the users as cognitive agents perceiving and decomposing their environment along the lines of the cognitive principles of pattern-recognition or Gestalt-perception. The phenomenological project is all about making organizational arrangements perceptually legible by making important points conspicuous, avoiding the visual overcrowding of the scene etc. To do this well requires either a special intuitive talent or an expertise in the psychology of perception. This project of increasing the perceptual palpability of the main structural features of the environment does not yet constitute a communication in the strict sense of Luhmann’s concept adopted here. A more loose, everyday meaning of the word communication seems to be satisfied here. But for the concept adopted in the theory of architectural autopoiesis this does not suffice. The three moments that need to be distinguished and satisfied here are impartation, information and understanding. The third moment is not satisfied in the case of the phenomenological project. The moments of impartation and information are not distinguished, they fuse in the case of perception. Also, the moment of understanding is not reached. Understanding not only presupposes the distinction of impartation and information, it also involves the attribution of the communication, as communication, to some person, organization or general social institution. (It is this attribution that requires the distinction of impartation and information.) Understanding thus implies a communicative engagement, or social interaction, even if it only consists in an action of avoidance, for example, the refusal to enter. Here an important distinction comes into play, the distinction on which the discipline of sociology was originally founded: the distinction between mere behaviour and social action. Social action only exists in the domain of social meaning. This distinction also relates to the central distinction between the modes of knowledge in the social
sciences versus natural sciences: explanation vs understanding. Behaviour can be explained, action has to be understood. The apparent ontological gulf between the two categories has since been closed by social systems theory. A behaviour becomes an action only if an intention and a social meaning are attributed to it in the context of a social action system. Luhmann generalized the sociological concept of action to the concept of communication and insisted upon its systemic rather than individual constitution. His arguments run a similar course to Saussure’s: the system constitutes its elements rather than vice versa. Communications can thus be observed and explained with reference to the specific medium or system-of-signification that is being used and reproduced within the respective autopoietic system of communications. The scientific analysis and explanation of communications are thus in principle possible. This, however, does not vitiate the theoretical (and practical, real-life) distinction of action vs behaviour. The understanding of an action on the basis of shared meanings remains distinct from the observation and explanation of behaviour.

A behaviour becomes a communication if it solicits connections that draw it into a structured network of behaviours-become-communications. In the context of built architectural offerings this happens all the time, but to become a virtuoso in making this happen as a designer one needs either an intuitive sensitivity with respect to socially circulating meaning structures or to develop a theoretical expertise with respect to the functioning of systems-of-signification within autopoietic social systems. The intuitive talent in this respect might be due more to the general social sensitivity of the respective architect than to his/her training and experience as a designer, due more to general rather than specifically architectural socialization. In any case, whether strategically designed on the basis of theoretical grasp and expertise or intuitively on the basis of a more general social sensitivity, only such aspects of the design that engage its users as communicative agents, via the nuanced deployment of the medium as a system-of-signification, are communications. Thus only these aspects operate, stricto sensu, as communicative frame as defined in the context of theorizing architecture’s societal function. However, the assessment of which aspects and features of a building operate semiologically, rather than merely phenomenologically, or merely organizationally, is not a trivial matter. It certainly cannot simply be read

---

off the material construct itself. Neither does the reference to the designer’s intentions help. This assessment can also not merely rely on the social expertise of the architectural analyst as a socialized participant with respect to the social institution accommodated. Although such familiarity helps, and might indeed be the precondition for any successful assessment, it must be complemented by the theoretically guided self-reflection of the analyst’s intuitive perceptions, associations and responses, as well as by a close, theory-led observation of the social communication processes unfolding within the building.

In accordance with the three dimensions of architecture’s task – as it is posed by architecture’s societal function – we can distinguish three levels of framing: physical, perceptual and communicative framing. Although we might say that both the organization of space, and its perceptually palpable presentation ‘frame’ processes of social interaction, it is only through processes of semiosis that gather the topology and the figural features of the material construct into a system-of-signification that the conditions are prepared for the functioning of the respective building or space as frame in the sense required by architecture’s societal function, namely to address the exigency of communication’s inherent double contingency by helping to define and stabilize the always required definition of the communicative situation.  

To summarize, we can thus distinguish the contributions the three fundamental dimensions of architecture make (via their respective design projects) to architecture’s essential societal function:

<table>
<thead>
<tr>
<th>task dimension</th>
<th>framing contribution</th>
<th>engagement of users</th>
<th>solicited response</th>
</tr>
</thead>
<tbody>
<tr>
<td>organizational project</td>
<td>as physical frame</td>
<td>as physical bodies</td>
<td>passive movement</td>
</tr>
<tr>
<td>phenomenological project</td>
<td>as perceptual frame</td>
<td>as cognitive beings</td>
<td>active behaviour</td>
</tr>
<tr>
<td>semiological project</td>
<td>as communicative frame</td>
<td>as socialized actors</td>
<td>communicative action</td>
</tr>
</tbody>
</table>

Strictly speaking, it is only the semiological project that addresses the core societal function of architecture. The other two dimensions either provide services that might eventually be outsourced – following the fate of the engineering project that has already been outsourced – or their contributions are subsidiary to the semiological project in the sense that they must be redeemed by being incorporated within a successful design.

307 See Volume 1, chapter 5.1.4 The Definition of the Situation as Precondition of Social Interaction.
The configurational arrangements worked up within the organizational project do indeed become relevant within the semiotic project. Both the relative spatial positions of territorial units as well as their circulatory linkages become important factors in the construction of the communicative frame. An architectural system-of-signification that has configurational relations at its disposal is much empowered in comparison to a language that can only work within the morphological register. There might exist many coincidences where organizational criteria and concerns harmonize with and support semiotic concerns, for example, if the alignment of two entrances on two opposing ends of an axis both establishes the most efficient connection between two institutions that produce frequent circulatory movement between them, and at the same time works in terms of signifying an important social distinction between symmetrically opposed institutions of equal rank. Although such coincidences might exist and should be looked for, there is plenty of scope for conflict because the two dimensions of the architectural project follow different functional prerogatives. They need to be balanced. To put it another way, the organizational project becomes a medial constraint for the medium of architecture which is handled and advanced within the semiotic project. The same dialectic of potential support vs potential distraction exists between the organizational and phenomenological project, as well as between the phenomenological and semiotic project. The three projects might be aligned as in the example of the symmetrically opposed entrances. Here the phenomenological project would consist in making both the spatial configuration and the symmetry relation visually conspicuous. The phenomenological project is caught between the two other projects and thus has to face two tasks which are potentially in conflict with each other: it has to perceptually heighten the objective organizational relations, for the sake of efficient wayfinding, and it has to use its articulatory registers to perceptually heighten the semiotically active features and suppress everything else. Thus it seems that the orchestration of all three dimensions from the perspective of the total task, in line with architecture’s societal function, requires an oscillating and iterative process rather than a linear progression from organization to phenomenological and then semiotic articulation. Only a process that keeps all three dimensions in play throughout has a chance of finding the coincidence referred to above.

If the societal function of architecture can only be fully addressed by the semiotic project, as is being argued here, then it seems as if the semiotic project is the ‘most architectural’ of the three dimensions of
architecture. This is indeed the consequence to which the theory of architectural autopoiesis points. The problem with this conclusion is that the semiological dimension in architecture is not only the dimension that is most difficult to grasp and control, but the semiological project, as conscious, theory-led design project, is also the least developed of the three projects that correspond to the three dimensions of architecture, despite the efforts made under the auspices of Postmodernism and Deconstructivism between 1970 and 1990. This state of affairs implies that the theory of architectural autopoiesis is pushing itself into a tight corner here. The theoretical conclusion implies that architecture’s most salient capacity does not yet exist as a fully reflected and controlled competency. In emphasizing the semiological project, the theory seems to marginalize itself, it seems to distance itself from the very discourse and discipline it purports to speak for. However, there are sufficient points of connection within the 500-year discourse of architecture, not only in the period of 1970–1990 but also throughout the history of architectural theory. These points of connection are contained in the discussions of the role of decoration and ornament, as well as in the concepts of expression and character. These historical concepts have already been alluded to above.\(^{308}\) Below, in the section on the self-descriptions of architecture, in particular on the classic treatises of architecture, more relevant points of contact will be revealed.\(^{309}\) The reinforcement of such redundancies is important in order for the theory to establish its embeddedness within architecture’s historical autopoiesis, to maintain the credibility of its allegiance to the rationality of the real, and thus to maintain enough plausibility and authority to push ahead. Still, it is within this section, as will become even more clear below, that the theory of architectural autopoiesis reaches its most risky and most speculative moment, with only minimal backing by established design theory and practice. The ambition of the theory to become architecture’s most recent, most authoritative self-description exists in an inevitable tension with its simultaneous ambition to advance the autopoiesis of architecture along the lines of a coherent set of theoretical decisions. Whether this tension can be sustained and eventually resolved must, at this stage, remain uncertain.\(^{310}\)

\(^{308}\) See chapter 6.2.1 Organization and Articulation: Historical and Systematic.
\(^{309}\) See section 10.3 Classic Treatises.
\(^{310}\) The success or failure of the author’s own design efforts in this direction, within the contexts of the AADRL and Zaha Hadid Architects, might become a factor that bears on this question.
6.10.2 RELATIONSHIP BETWEEN ARCHITECTURAL LANGUAGES AND ARCHITECTURAL STYLES

The relatively circumscribed ambition of creating a self-enclosed, semiological project-world might be extended by proposing a general semiological heuristic that might serve to systematize a whole architectural style with a view to enhance its capacity to contribute to a unified architectural system-of-signification that is able to operate beyond single projects. However, before an enhanced semiological practice has been established, the formulation of a concrete semiological heuristic (beyond the reminders and pointers assembled above) is premature. The normative design heuristics of a style are ideally drawn from an emerging practice to further clarify and guide this practice. This is what the theory of architectural autopoiesis is able to do with respect to the general functional and formal heuristics of the maturing style of Parametricism. However, what can and must be addressed here are questions concerning the conceptual relations set up within the general theoretical edifice proposed. In order to understand what relationships might exist between architectural languages and architectural styles, it is necessary to determine the theoretical relationship between the concept of architectural language and the concept of architectural style. The two concepts are set up as conceptually independent in the sense that neither of them enters into the definition of the other. The concept (category) of architectural style has already been precisely defined within Volume 1 of The Autopoiesis of Architecture: an architectural style is a coherent and comprehensive design (research) programme, complete with both a functional and a formal heuristic. As this definition indicates, the concept entails more than what the concept of architectural language delivers. Thus an architectural language is not, eo ipso, a full blown architectural style, although it might be a component of a full-blown architectural style. On the other hand, the concept ‘architectural style’ does not demand the presence of an architectural language or system-of-signification. It does, however, not exclude it either.

Once more: what relationships might exist between architectural languages and architectural styles? An architectural language might be a component of an architectural style. Would this component belong to the formal or to the functional heuristic of the style? It would feature implicitly in both, but could not be fully formulated in either. Thus one

---

311 See chapter 11.2.2 Operational Definition of Parametricism: The Defining Heuristics of Parametricism.
312 The concept of style is a category within architecture (rather than mere concept) as it denotes a fundamental permanent communication structure within the autopoiesis of architecture.
should expect that a *semiologically enhanced style*, or *semiologically empowered style*, if explicitly reflected in a programmatic statement of its heuristics, would comprise the formulation of a semiological heuristic that provides both positive principles about as well as prohibitions on how to design systems-of-signification in coherence with the style. Similarly one might expect the evolving organizational and phenomenological competency of a maturing style to lead to the explicit formulation of additional heuristic principles that enhance or empower the style with respect to these dimensions.

Thus we must distinguish the **core heuristics** of a style, comprising its formal heuristic and its functional heuristic, from possible **supplementary heuristics** the style might encompass. There are three potential supplementary heuristics that can be identified on the basis of the conceptual scheme elaborated within the theory of architectural autopoiesis: organizational heuristics, phenomenological heuristics and semiological heuristics. However, the three supplementary heuristics cannot enter the set of necessary features required to define a style because then the concept of style would exclude both the most promising contemporary style and architecture’s great historical styles. The phenomenon and concept of style constitute a pervasive category and permanent communication structure of architecture. To insist on hypothetical upgrades (too early) as definitory for the concept of style would result in a purely normative rather than a reconstructive definition. The concrete application of the concept would be made impossible as its extension would be empty. Rather than proposing utopian normative substitutions, the theoretical definitions of the theory of architectural autopoiesis are supposed rationally to reconstruct and thus explicate and systematize the real operating concepts and categories that structure architecture’s ongoing autopoiesis in its currently most advanced manifestations. Thus the thesis remains that styles might be further empowered by additional heuristics, inclusive of the formulation of architectural languages. Here this notion can only assume the status of a programme for future design research with the long-term ambition of empowering the encompassing style/research programme which frames this research.

Could there be an architectural language that operates across several styles? This is possible and indeed happens within the spontaneous, index-based semiosis of the built environment. For instance, balconies index the residential function-type whether the design is Modern or Postmodern. A projecting canopy indicates ‘main entrance’ in various styles etc. Can this independence from the choice of style be maintained even in the case of the more elaborate, grammar-based architectural
languages envisioned here? Although this possibility cannot be excluded on purely conceptual grounds it seems unlikely. The general hypothesis of the theory of architectural autopoiesis is that all variable communication structures are regulated under the auspices of a chosen style, i.e., the default presumption is that any design is designed within a style, whether the architect/designer knows and acknowledges this or not. A style must be chosen. The kind of semiological project envisioned here will thus be launched within one of the styles available within contemporary architecture. There are only three distinct styles active today: Neo-Historicism, Minimalism and Parametricism. The formal registers of these styles are so different from each other that an elaborate architectural language that operates across the three styles seems implausible.

6.10.3 THE REQUISITE VARIETY OF ARCHITECTURAL ARTICULATION

Having unfolded the task of establishing architectural order in terms of the underlying organizational task, the precarious perception of complex order and finally the problematic of effective semiosis, we can formulate an ambition for contemporary architecture that advances beyond what is expected and achieved – even in the most accomplished segment of the contemporary avant-garde. This ambition can be given a precise theoretical formulation.

We are assuming that the organizational/articulatory task is – for all practical purposes – infinite. This task is infinite in the sense that the social, institutional task-domain – for instance a large corporate headquarters – is so complex and nuanced that the architectural design effort of organization/articulation can never fully exhaust the reservoir of social distinctions and relations that would deserve articulate spatial organization. Therefore we can say that the complex, contemporary social processes that challenge contemporary architecture are excessive with respect to the task of architectural articulation. Therefore, the spatial organization and articulation of the social life-process are always selective, engendering a reduction of the assumed social complexity. Social space is always under-articulated. This means that the social processes that can be anticipated to unfold in the articulate spatial organization – for example, in the fully furnished headquarters building – will entail significant differentiations and affiliations that find no registration and receptacle within the designed environment. The ideal limit case here would be a fully articulated social space where all social distinctions and affiliations that are relevant to the respective social
institution would have been registered and articulated by means of spatial, morphological and material features.

This assumption of under-articulation allows for the fact that unforeseen and unaccounted for social/programmatic distinctions do indeed end up appropriating/utilizing found features of the environment that were intended to code for other social distinctions, or were simply ‘random’ features that had no programmatic counterpart. Excessive social distinctions might therefore be confronted with an abundance of unaccounted-for formal features. One might call such random features architectural excess, i.e., features that are not taken up within any semiological system. According to the three registers of architectural articulation we can distinguish spatial, morphological and material excess. Any architecture or space that contains excess is in this sense subsystematized. Some of this excess might later be semiotically systematized and interpreted by the accommodated social system with its distinctions and communication processes.

In the ideal limit case of a fully systematized space there would be no excess, no such ‘random’, or ‘excessive’ unaccounted-for features. Every detectable spatial, morphological or material difference would be accounted for in terms of a semiological system. However, this does not imply that every feature in such a fully systematized space is indeed significant in the sense of ‘making a difference’ to the social process that utilizes this space. Such a space would be a fully interpreted space. The systematized does not necessarily coincide with the interpreted. We might call this part of the formal material that has been semiotically systematized without being socially interpreted the architectural surplus within the system. (This idea of a semiological surplus presupposes that the syntactic layer of an architectural language can be identified independently of its semantic layer. This assumption is problematic. It is plausible only in so far as we assume here that most of the language’s syntax is interpreted, and only partially under-interpreted.)

Such a fully systematized space could on the one hand still lack the requisite variety to fully register the complexity of the social process, while on the other features of the articulatory system remain

---

313 However, this is an unrealistic limit case. With respect to highly complex social institutions, the articulatory effort might run into the problem that the semiological system becomes too complex to be learned quickly enough by the more or less transient user groups in question. The average tenure of the respective user group is therefore a significant point of reference. There seems to be no immediate cognitive limitation with respect to the overall complexity of a semiological system for architecture. Language and writing systems demonstrate that if there is sufficient learning time, the cognitive capacity for semiological complexity reaches far beyond what might ever be expected with respect to an architectural language.
uninterpreted, leading to an **under-interpreted** space. Thus we can distinguish the following concepts to facilitate a nuanced and precise discussion:

- Under-articulated – relevant social content remains unregistered
- Substantially articulated – the most relevant social content has been articulated, ie, registered and matched by semiologically structured spatial properties or architectural features
- Fully articulated – all relevant social content has been articulated
- Sub-systematized – formal material remains semiologically unstructured
- Fully systematized – all formal material is semiologically structured (limit case)
- Under-interpreted – there remains a residue of structured but uninterpreted semiological offerings
- Fully interpreted space – all that is semiologically structured is socially interpreted

Usually we can expect a space to be sub-systematized, under-articulated and under-interpreted, ie, there are excessive social contents, excessive formal material and excessive semiological offerings. We might term the theoretical limit case where all these excesses are assumed to be absorbed and balanced a state of **total articulation**, only to assert that there can be no totally articulated space. The reservoir of formal possibilities (differences) in a design project – differences that could be semiologically systematized and socially interpreted – is open ended. The world of social differences is equally open ended. Therefore there can be no exhaustive mapping between the two domains. The semiological system mediates between these two domains by means of a selective and systematized mapping which leaves both a residual reservoir of unaccounted formal material and a residual domain of social differences that are not yet articulated. However, the process of semiological systematization of the formal material usually produces a new surplus of semiologically structured spatial properties and formal features that have no equivalent in terms of the institutional or social differences that are to be articulated. This condition has been termed ‘under-interpreted’ here. This condition of under-interpretation produces an interesting effect: it constitutes an open invitation to the social life process to interpret this semiological offering. For instance, the semiological system has arranged a series of colours into a colour code representing functional domains or has structured a hierarchical series from the top floor to the lowest floor representing the levels in the social hierarchy. However, the number of colours distributed in the building exceeds the number of functional
domains that have been institutionalized, and the number of floors exceeds the current number of levels in the social hierarchy of the respective client organization. In both cases these structural offerings might catalyze the social life-process into a further structuration. This kind of architecturally catalyzed process of social structuration does indeed occur all the time, at all scales, including the urban scale. As suggested above, we might speak of the *demiurge-like power of architecture*. This catalyzing power of architecture operates in two dimensions: virtuality and potentiality. Excess produces virtuality and surplus produces potentiality. We have defined *architectural excess* as random formal features that are not accounted for within the semiological system. These features provide unstructured raw material for future spontaneous semiosis. The way these features might be taken up later by the evolving social institution is not prescribed or prestructured by the semiological system. Therefore we speak of *semiological virtuality* to express the radical openness that is given in this case.

We have defined *architectural surplus* as systematized formal features that have no social-programmatic counterpart. These features provide well-structured empty places within the semiological system that are likely to be taken up later – in a prestructured way – by the evolving social institution. Thus architectural surplus provides *semiological potential*.

The most pertinent ambition for architectural design can be formulated by means of the concepts elaborated here. The first task would be to register and absorb the most institutionally relevant social distinctions, striving to reach or approximate a state of substantial or even full articulation. However, since social institutions can be expected to evolve – probably in the direction of higher complexity – the designer should provide both *semiological potential* by means of architectural surplus and *semiological virtuality* by means of sufficient architectural excess. There is a balance to be struck here. The more excess there is in the system, the more might we expect the scene to be visually polluted. Too much excess might lead to overall visual chaos that defeats the articulatory effort and prevents swift orientation. Architectural surplus should also be kept within bounds. The majority of the semantically systematized architectural features – configurational properties, morphological motifs and material textures – should be socially interpreted, i.e., the interpreted features must dominate the uninterpreted features. Thus we can summarize that, in the case of highly complex, evolving social institutions, ambitious architectural design would have to aim for a substantially articulated space that contains moderate architectural excess offering sufficient semiological virtuality, as well as sufficient architectural surplus, to provide semiological potential and thus
considerable demiurge-like power to catalyze the further social structuration.

Architecture’s capacity to design substantially articulated territories in the sense promoted above is being augmented by the new design media. Design within the phenomenological dimension has already been augmented by new digital visualization techniques. Design within the organizational dimension has already been augmented by the techniques of space syntax as well as by crowd simulation techniques. Design within the semiological dimension might be augmented if current crowd simulation techniques could be extended and generalized – via multi-agent modelling – to encompass the simulation of patterns of occupation and social interaction in space. Such modelling would imply that the domain of the signified – the meaning of the designed territories – could be represented and worked on within the design medium of the parametric model. Both the function-type (for example, the different interaction types of a university such as lecture, seminar, workshop, tutorial etc) and the social-type (for example, students vs visitors vs staff within a university) could be represented and systematically correlated with the positional, spatial and morphological features of the simultaneously modelled territories. The (currently still utopian) dream of the semiological project would thus be a single parametric model whereby the signifying relation would be instantiated via scripted correlations between the signifier and the signified within the parametric associative model, or programmed agents would ‘read’ and respond to the system of designed semiological clues. Signification is nothing but systematic correlation, ultimately reducible to the systemic concatenation of communications.