



# The Appropriation of Autopoiesis in Architecture

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Liverpool for the degree of Doctor in Philosophy by

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# Abstract

This thesis investigates the merits of cross-disciplinary appropriations of natural-scientific theory in architecture, particularly of the theory of autopoiesis as appropriated in Patrik Schumacher's two-volume tome *The Autopoiesis of Architecture*. This investigation began with an interest in perceived connections between urban dynamics and autopoietic processes in biological cells. In this context, Schumacher's work was expected to offer, but did not deliver, an explanatory theoretical framework. This raised questions about the role of cross-disciplinary appropriations of natural-scientific theory in architecture in general and the appropriation of autopoiesis in architectural theory in particular.

A review of related literature shows that investigations of these questions are confounded by the conceptual broadness granted to theoretical ideas and the indirect route along which autopoiesis has been appropriated in architecture. From its original conception by Maturana et al. in microbiology in the 1970s to its appropriation by Luhmann in sociology in the 1980s, on to the appropriation of its sociological interpretation by Schumacher in architecture around 2011, the phenomena described by the three instances of autopoiesis theory, and their varying grounding in empirical evidence, have changed significantly. Meanwhile, natural-scientific theories inform architectural practice and research across a broad spectrum between metaphorical ambiguity and literal exactitude, from conceptual inspiration in applied design and literal design guidance as is common in biomimicry, to scholarly explanation and empirical prediction. Between these intricacies, the following research question arises: *What are the merits of Patrik Schumacher's appropriation of the theory of autopoiesis from the perspective of academic architectural research?*

To address this question from an academic architectural research perspective, this study uses a mixed-method approach, drawing on discourse analysis, close read-

ing, visual interpretation, and inference to the best explanation to analyse 16 pertinent samples from *The Autopoiesis of Architecture* both individually as well as in aggregate, using previously-established categorisations of language use and merits of theory appropriation. It thereby determines how Schumacher's theory relates "architecture" to prior (i.e., Luhmann's or Maturana et al.'s) instances of autopoiesis theory, the degree of literality of these references, and their likely beneficiaries.

The outcomes of this analysis show that the connections drawn between architecture and autopoiesis in *The Autopoiesis of Architecture* evoke (or at least do not preclude evoking) biological systems rather than aligning exclusively with Schumacher's conceptualisation of architecture as a social system. They also suggest that a significant portion of these connections appear to benefit the author (Schumacher) rather than the reader by legitimising and obfuscating rather than providing explanatory convergence. Furthermore, the analysis shows how these connections are not committed to a uniform use of language, ranging across literal, metaphorical, analogical, and similitudinal modes. Schumacher thus seems to operate somewhat ambiguously across all analytical frameworks and distinctions applied in this study, taking an approach that may benefit conceptual inspiration of the design practice rather than rigorous descriptions of academic research his theory purports to do. In this view, Schumacher's theory appropriation appears to enjoy the conceptual tolerance cultivated on the design practice side of the field but seems unlikely to substantially benefit either the professional practice or academic research arms of the discipline.



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# Declaration

I declare that this thesis represents my own work, except where due acknowledgment is made, and that it has not been submitted previously, in whole or in part, to this University or any other institution for a degree, diploma or other qualifications.

*Signed:* .

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# Chapter 1

## Introduction

This chapter presents the background, relevance, research questions, research scope, and research methods of this thesis. Furthermore, it outlines the structure of this thesis and explains key terminology used in it. Specifically, Section 1.1 offers a personal reflection on how my experience of fast-developing urban spaces in China led me to engage strangely obvious-yet-vague connections between urbanism and biological systems and to investigate the extent to which a scientific theory about biological systems may be adopted to inform research into urban spaces. Section 1.2 outlines the relevance of cross-disciplinary appropriations of scientific theory in architecture and introduces the biological theory of autopoiesis and its appropriation proposed by Patrik Schumacher. The following Section 1.3 articulates the research question pursued in this thesis and outlines its aims. Section 1.4 presents the scope, which centres on the appropriation of the biological theory of autopoiesis in Schumacher's (2011; 2012) two-volume theoretical treatise, *The Autopoiesis of Architecture*. This section also outlines the methods employed in this thesis and follows by Section 1.5 which anticipates its contributions. The final two sections, 1.6 and 1.7, outline the structure of this thesis and explain key terminology used in it, respectively.

## 1.1 Personal Background and Motivation

I embarked on the research journey presented in this thesis with a background in architectural studio education and practice. While this background prepared me to thrive in ambitious architectural practice settings by routinely completing challenging design projects in relatively short periods of time, it offered me only a limited preparation for abstract theoretical thought and academic research. With this background, I arrived in Suzhou Industrial Park (SIP), a county-level administrative area located in Suzhou, China, in 2017. My experience as a participant in, and as an observer of, the social, cultural, and economic processes of this fast-developing urban centre – captured in Figure 1.1 – has been a key inspiration of the work presented in this thesis.



Figure 1.1: Myself, a participant in, and observer of, fast-developing urban centres in China. (Photo by Sofía Quiroga).

Compared to other developing cities with which I am familiar, Suzhou's recent growth has been much faster and affecting larger areas of space, thus lending itself to observations of significant developmental processes over shorter periods of time

and at broader spatial scales. The growth and development of urban environments in SIP and numerous other Chinese cities manifest themselves mainly in concrete-and-steel high-rise and large-scale developments, while much at the street level is occupied by temporal and informal structures such as individual street vendors' stalls and vehicles, street markets of different sizes, migrant workforce settlements, bicycle-sharing systems, and, for much of the duration of this study, improvised pandemic control facilities.

I arrived in this context intending to investigate the street-level production and use of these temporal and informal structures by way of participatory research-through-design. This proved prohibitively difficult for a combination of reasons. The language barrier between the local population and myself, a native Spanish – as well as English speaker; local suspicions towards outsiders enquiring into operations of often highly competitive and, in their physical presence, no more than tolerated and sometimes outright illegal structures; and eventually, a decree by the Xi'an Jiaotong-Liverpool University (XJTLU) Graduate School in response to the COVID-19 pandemic that ongoing field Ph.D. research projects be converted into lab or desk research projects. In response to these factors and the bafflement I encountered while reviewing the literature (particularly the biological theory of autopoiesis as appropriated by the architect Patrik Schumacher – see Section 1.2), I shifted my attention away from street-level participatory field research and toward more theoretical aspects of my interest in Chinese urban development.

I noticed soon after my arrival in Suzhou that the city's large-scale high-rise and street-level dynamics are highly interdependent. The development of new residential estates, for example, depends on a construction workforce which, in turn, is supplied with food prepared and sold with the aid of temporary street-level facilities, whereas those temporary street-level facilities rely on the construction of concrete-and-steel residential living spaces. Some street-level facilities such as mobile deployable structures used by street food vendors remain temporary in terms of daily cycles of deployment, commercial use, re-deployment and re-location, yet establish themselves as permanent staples in their neighbourhoods over extended time spans and, in this way, continue to serve local residents in the long term. These relationships suggest that the growth of the city, once started, unfolds as a continual process of self-development and self-maintenance. Figure 1.2 shows a visual interpretation of this process.

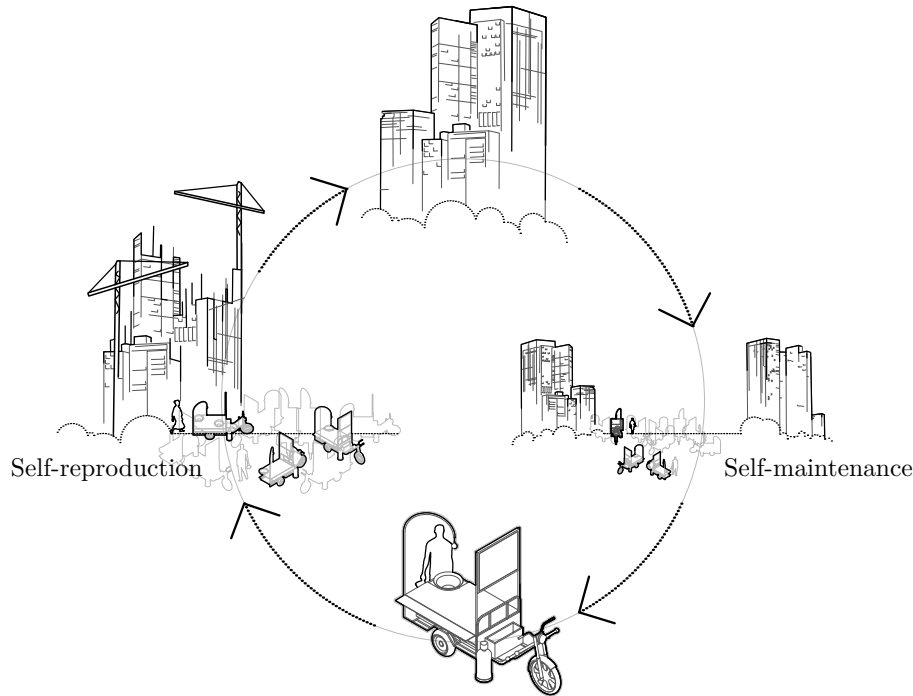


Figure 1.2: Visual interpretation of urban growth and self(re)production.

In this view, the interrelations between manifestations of urban life at different scales are characterised by the kind of systemic closure and interdependence that also characterises the interrelation between chicken and egg. With biological terms like *viability*, *growth*, *development*, *nourishment*, *self-maintenance*, and *self-reproduction* entering my thinking about my observations of these urban processes, I began to ask myself: *Is the city like a living system?* Or even: *Is architecture a living system?*

This association between urban processes and biological systems (particularly that of the theory of *autopoiesis*) seems to “grasp more complex characteristics of the city within the contemporary urban design discourse, in particular, tendencies of patterns to grow or decay according to inhabitants’ requirements, distribution flows of energy, costs, goods, services or city networks connectivity (virtual, physical or social) related to an entire urban metabolism” (Buš et al., 2017, p. 696). I find, therefore, this obvious-yet-vague connection between urban processes and biologi-

cal concepts, this sensation of *this-is-like-that* and the questions it provokes not only intriguing but also profoundly related to how new understanding is gained. They are captured in the narrator's opening monologue of the 2020 film *Tesla*, purporting the pondering of a young Nikola Tesla after his early encounter with static electricity:

“One day, when he stroked the cat's back, he saw a miracle: A sheet of light cracking under his hand. ‘Lightning in the sky,’ his father explained. ‘It's the same thing as a spark shooting from [the cat's] back.’ And Tesla asked himself: ‘Is nature a gigantic cat?’” (*Tesla* 2020 film, opening monologue, min 0:43 – 1:35, my underlines)

The use of language to elucidate something by connecting it to something else has been prominently described by the philosopher Ludwig Wittgenstein (1958, PI 194'–197\*) in his *Language Games* and, more specifically, with his notion of *seeing as* in contrast to *seeing that*. *Seeing as* is common where new ways of seeing help in the creation of new knowledge. Particularly common in such contexts are explanations of challenging-to-grasp aspects of human experience in terms of biological concepts. Albert Einstein (1929, p. 117), for instance, describes the socio-political dynamics of nationalism as “an infantile disease. It is the measles of mankind.” The French philosopher Michel Foucault (2008, p. 317) labelled this rhetorical strategy as “biopolitics,” describing it as the political tendency to “rationalize the problems posed to governmental practice by phenomena characteristic of a set of living beings forming a population.” In the context of architecture, the British architect Cedric Price uses a (culinary rather than biological) reference to condense and illustrate millennia of urban evolution with an ovo-urban analogy – “The City as an Egg,” i.e., boiled, fried, or scrambled in different historical periods (see figure 1.3).

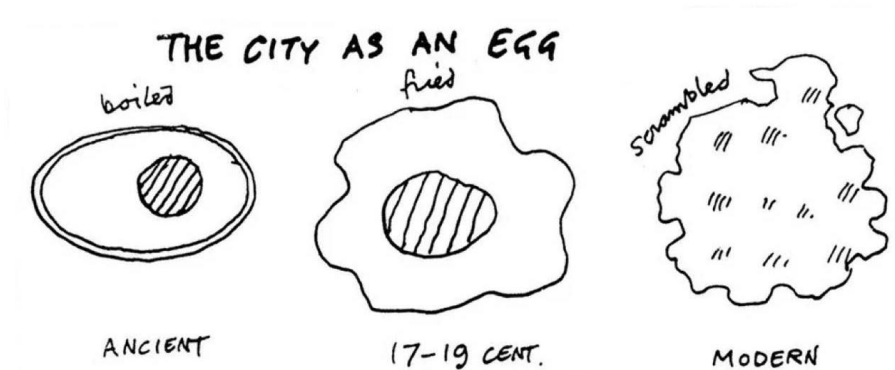


Figure 1.3: “The City as an Egg.” Figure reproduced from Cedric Price Fonds, Canadian Centre for Architecture, Montréal, 1903–2006, predominant 1953–2000, Series: Professional and Personal Records, 1955–2006, Sub-series: Articles, 1959–2006.

The urban environment and its various aspects are often elucidated with references not only to natural phenomena but also to concepts that originate from natural scientific theory (Collins, 1998, p. 148; Forty, 1999, p. 213; Forty, 2000, p. 97; Steadman, 2008, p. 8). A possible explanation for this is that “cities are complex entities that are never entirely stable, always in a state of flux, growing, decaying, or dying” (Verebes, 2014, p. 13), thereby inviting explanations in terms of knowledge that deals with just such patterns, i.e., explanations in terms of natural scientific theory. Biological imagery and theories thus feature frequently in descriptions of urban environments (Lynch, 1981, p. 88; Kostof, 1991, pp. 52–53). With the city being seen as a living organism, parks are frequently referred to as “lungs,” and urban centres are described as hearts “pumping blood” – traffic – through their “veins” – roads (Kostof, 1991, p. 52). Iklé (1958, p. 8) observes that, as with any living organism, a city may get “ill,” and that it “readjusts to destruction somewhat as a living organism responds to injury.” This thesis presents an analysis of a recent instance of such explanations, namely the attempt to elucidate “architecture” with reference to the biological theory of cellular autopoiesis.



## 1.2 Research Relevance

Cross-disciplinary appropriations from biology to architecture are not only used to describe and explain but also to inspire and inform creative processes. This is particularly the case in biomimetic design and engineering practice in which design outcomes are derived by mimicking the appearance or performance characteristics of biological systems (Vincent et al., 2006, pp. 474–475; Blok and Gremmen, 2016, p. 203). For example, Frei Otto (1995) draws insights from bone structures to guide the creation of lightweight architectural designs. Similarly, *Herzog & de Meuron* and CADG utilise a bird's nest as a reference point in designing the Beijing National Stadium (Pasternack, 2008, p. 92), and Francis Kéré, the recipient of the 2022 Pritzker Architecture Prize, references a *palaver* tree in the design of the 2017 Serpentine Pavilion (Ahuja, 2021).

Other examples of the cross-disciplinary appropriation of biological concepts in architecture and urbanism include the notions of *catalysis*, *evolution*, *metabolism*, and *autopoiesis*, among others that will be discussed in section 2.1.1. Adrian Forty (1999, p. 213; 2000, p. 97) notes that such appropriations of natural-scientific theory have been tacitly naturalised and widely accepted within the discipline of architecture. They facilitate the development of a “metalanguage” for the proactive exploration of new conceptual connections and thereby enable the formulation of design proposals, theories, and discourse (Johnson, 1994, p. 44; Steadman, 2008, p. 12; Linder, 1992, p. 167; Lockton et al., 2019, pp. 319–321). In this way, the appropriation of natural-scientific theory is integral to the creative and intellectual cross-pollination of architecture as a whole, and encountered in both its practice and academic sub-domains.

As mentioned above, one of the natural-scientific theories that have been appropriated in architecture is the theory of *autopoiesis*. Developed by Chilean neurobiologists Humberto Maturana, Francisco Varela, and Ricardo Uribe in the early 1970s, this theory describes the capability of living systems to perform processes of self-reproduction and self-maintenance while their constituent elements are subject to disintegration (Maturana and Varela, 1980). The team focused on the living cell as a representative exemplar, and as an essential common building block of the vast majority of biological organisms. In the autopoietic process, according to the

team's theory, the cell's constituent molecular elements continually interplay with each other and their environment (Rose, 1970, pp. 11–18). While the material integrity of, and the relationships among, the cell's constituent elements are subject to disintegration, some of the chemical processes that arise from this interplay lead to the new production of these very constituent elements and to the re-establishment of relationships among them. This process gives rise to a systemic closure and the continuous circular re-production and maintenance of the cell as a whole (Maturana, 1980, p. 135; 1975, p. 46; Maturana and Varela, 1980, pp. 78–79). The team describes the cell's autopoietic capability as a characteristic that sets living systems in general apart from non-living (“allopoietic”) systems such that it can, in effect, be seen as a definition of life itself (Maturana and Varela, 1992, p. 43).

Since its inception in biology, the theory of autopoiesis has been used to describe a range of phenomena beyond biology. It was adopted to describe the dynamics of systemic family therapy (in psychotherapy) (for example, Elkaïm, 1989, pp. 85–88), the ontology of law (for example, Teubner, 1993, pp. 13–16), and literary theory (for example, Paulson, 1988, pp. 121–130), among others.

The most prominent adoption of autopoiesis among these appropriations has been Niklas Luhmann's use of the concept to describe social processes of communication (Luhmann, 1986, p. 174). Luhmann (1982, pp. 131–132) characterises social systems such as art, science, or politics as autopoietic closed systems of self-referential communications that re-constitute and re-produce themselves. Luhmann's appropriation was widely adopted but also met with criticism – chiefly from the originators of the biological theory of autopoiesis. Maturana notes that in biological autopoiesis, “Molecules produce molecules, form themselves into other molecules, and may be divided into molecules,” whereas “Communications [...] presuppose human beings that communicate. Communications can only produce communications with the help of human beings,” Luhmann's theory, according to Maturana, fails to account for this human agency (Maturana and Poerksen, 2011, p. 107).

Resonant with my question “*Is architecture (like) a living system?*,” the notion of autopoiesis has recently been appropriated in architecture by a prominent representative of contemporary architectural practice and academia – Patrik Schumacher, principal of *Zaha Hadid Architects*, writer, and architectural educator. In 2011 and 2012, Schumacher published his self-proclaimed “opus-magnum” (Schumacher, 2019) – a two-volume treatise on *The Autopoiesis of Architecture*.

My review of this work, however, did little to enlighten my interest in the connection between urban architectural spaces and biological systems. Contrary to my initial expectation, Schumacher's use of the term "architecture" refers to the professional and academic architectural community rather than the built environment, and the term "autopoiesis" refers to dynamics of communications within the architectural profession rather than the hen-and-egg relationships that perpetuate the manifestations of urban vernacular life in the city. This discrepancy between my interest in manifest urban dynamics and Schumacher's interest in communications within the architectural profession reflects the emergence of the architectural profession in the transition from the Middle Ages to the Renaissance. Up until this time, construction required the physical presence of master builders who relied on verbal communication and on-site layouts. Advancements in perspective representation and orthographic drawing during the Renaissance, however, allowed architects to convey their designs on paper and detach themselves from the construction process. As a result, architecture gradually separated from the practicalities of building construction and emerged as a distinct profession (Porter, 1997, pp. 18–19; Koutamanis, 2001, p. 60; Fischer, 2012, pp. 30–31; Cabral Filho, 2007, pp. 1267–1268; Schumacher, 2011, pp. 81–87). This in itself, however, did not offer a sufficient and satisfactory explanation for the above-mentioned discrepancy, as Schumacher's architectural theory left me uncertain in three additional regards:

(1) While Schumacher positions his theory as a subset of Luhmann's appropriation of autopoiesis –i.e., describing architecture as a closed, self-referential communication system – rather than as a direct descendant of Maturana, Varela and Uribe's theory of living systems, his appropriation does not break away unequivocally from the biological origins of autopoiesis theory. Multiple passages of Schumacher's work left me wondering to what extent it explains architecture in terms of living systems, in terms of communicating social systems, or both. (2) Schumacher presents his theory of autopoiesis as an ostensibly rigorous academic "discourse analysis." Yet, he proposes it in conjunction with his own architectural "epochal style," with the ambition to push the current convergence in architecture's avant-garde – Parametricism – into the mainstream as an inevitable long-term stylistic successor to Modernism, concluding with a call to readers to "join Parametricism's drive to conquer the mainstream of world architecture!" (Schumacher, 2012, pp. 735–736), leaving me wonder whether Schumacher contributes a theoretical description, promotes a personal

agenda, or both. (3) Further compounding (1) and (2), Schumacher does not seem to commit clearly to either the ambiguous, evocative, and metaphorical modes of writing architects tend to use to inspire or describe creative practice or to the analytical and unambiguous modes of writing academic researchers tend to use in their formal communications. On the one hand, for example, Schumacher describes architecture in terms of a theory of communication, which, in turn, was formulated in terms of a theory of living systems. On the other hand, he also claims to proceed from a “data set” of patterns of architectural communication and “moves on to the abstract level of concept formation and proposes theoretical formulas that serve as axioms of a comprehensive theoretical system” (Schumacher, 2012, pp. 4–5).

Facing these ambiguities, I found myself not only wondering whether and how a biological theory may explain the dynamics of the built environment, but also wondering about the merits of appropriations in architectural theory in general, and Schumacher’s theory appropriation in particular.

Aiming to gain a better appreciation of the merits of Schumacher’s theory of architecture, I looked for responses in the literature. Yet, I found little in the way of either a broader, structured discourse, or a coherent critique. This lack of discourse stands in clear contrast to the reception of Luhmann’s appropriation of the theory of autopoiesis, which resulted in considerable bodies of application, critique and development, and thereby further compounded my confusion. In an attempt to take a direct route to a clear answer, I asked Schumacher himself during the question-and-answer session following a lecture entitled *Architectural Communication as Human Universal* he delivered on the evening of the 5th of March 2020 in Madrid. I asked: “Is your use of the concept of autopoiesis scientifically formal, or designerly informal? And do you think your readers know?” In response, Schumacher offered a 12-minute summary of his two volumes. A transcript of this response is presented in Appendix A of this thesis. This response, albeit no more than tangential to my question, reminded me that his theory leans on Luhmann’s sociological adoption of Maturana, Varela and Uribe’s biological theory of autopoiesis, drawing connections between the architectural discipline and social processes of communication rather than between the architectural environment and biological systems.

### 1.3 Research Focus and Aims

Connections to different incarnations of the theory of autopoiesis notwithstanding, the puzzles I had on my mind remained unsolved: How is it possible that a seemingly obvious question about the architectural environment and its production is addressed directly by a leading architectural practitioner and scholar in a well-established body of theory developed in two volumes on well over one thousand pages (with a third volume apparently in the making (see appendix A) without offering much in the way of guiding insight, let alone a simple answer to my question? What are the purpose and the value, i.e., what are the merits of natural-scientific theory adoptions across disciplinary boundaries into architecture? What do we mean, and what do we gain when we say that a city is like an egg? What do we mean, and what do we gain when we say that informal street markets emerge, grow, nurture, or develop like cellular tissues, colony organisms, or coral reefs do? What do we mean, and what do we gain when we say that the role of the architectural profession within society can be described as a systemically closed process of communication? What currency do such appropriations of biological or sociological notions have in rigorous design research? Do they help to *describe* or *predict* as theories do in other academic contexts? Do they *suggest*, *galvanise*, and *inform* creative processes as design inspirations do? Either way, what justifies such adoptions? I consider these questions fundamental to how architects inquire into, and develop the built environment. This thesis is the result of my attempt to shed light on them.

From the perspective of academic architectural research, I narrowed the questions raised above down to enquire more narrowly into how cross-domain appropriations in architecture might be productive and tenable. What are their merits in architectural theory? Do such borrowings contribute differently to architectural practice and academic research? Should they be held to different standards in architectural practice and academic research? To investigate these questions, I examine Schumacher's (2011; 2012) *The Autopoiesis of Architecture* specifically with regards to its merits within the context of academic architectural research. To do so, I employ a mixed-method text analysis approach centred around discourse analysis methods. This is outlined in the following Section 1.4, and presented in detail in Chapter 3.

## 1.4 Research Scope and Method

Aiming to shed light on these questions, I found myself with the challenge to move beyond my design studio background and venture into academic architectural research. This challenge arises, in part, from the seeming difference between the rational reasoning of academic research and the designerly reasoning of architectural practice. The appropriation of ideas from natural-scientific theories (such as the biological theory of autopoiesis) that enter the discipline of architecture and cross-pollinate its dual nature from architectural practice to academic research makes the understanding of this relationship and the understanding of the appropriation itself increasingly challenging.

As one particular instance of a broader tendency of theory appropriation across disciplinary boundaries, I examine in this study the appropriation of the biological theory of autopoiesis in architecture, particularly in Schumacher's theory of architecture. From the perspective of academic research, I found and developed one of many selective and limited but useful lenses to scrutinise the appropriation of autopoiesis in architecture.

To enquire into the merits of Schumacher's theory appropriation, I conduct a mixed-method approach drawing primarily from procedures of discourse analysis – i.e., a linguistically and contextually sensitive, textually-oriented method. Bridging the gap between the *micro* linguistic analysis and the *macro* impact of the text, this mixed-method approach, as discourse analysis, takes a constructivist approach to language (van Dijk, 1980, p. 8, 14, cited in Fairclough, 1992, p. 193). It approaches language as a vehicle to produce knowledge that is not just *influenced by* but also has an *influence on* our social environment.

From this perspective, I select key passages of Schumacher's text that draw explicit or implicit connections between autopoiesis and architecture. Employing *close reading* and *inference to the best explanation*, I analyse and code these samples systematically using a colour and a line code. I then locate their references to autopoiesis in a unified analytical framework comprised of two overall distinctions: Firstly, I distinguish references to two earlier instances of the theory of autopoiesis. That is to Luhmann's theory of autopoiesis in social systems and Maturana et al.'s biological theory of autopoiesis. As Schumacher leans on Luhmann's theory di-

rectly by explicitly positioning architecture as a social system in Luhmann's sense, I take Schumacher's reference to Luhmann's autopoiesis to be *literal*. However, since Luhmann's theory refers to Maturana et al.'s theory of autopoiesis loosely (see Maturana's criticism mentioned above), I take this reference to Maturana et al.'s autopoiesis to be *figurative*. I furthermore differentiate these figurative references into several modes of language use (besides the above-mentioned *literal* use), namely: *simile*, *metaphor*, *analogy*, *metonymy*, and *synecdoche*. Secondly, I distinguish between two possible beneficiaries of Schumacher's appropriation of the theory of autopoiesis in this context. That is, to the reader (myself), in seeking to understand strangely obvious-yet-vague connections between the built environment and living systems and to the writer (Patrik Schumacher) in putting forward a theory of architecture.

From these two overall distinctions, I further qualify references to the theory of autopoiesis based on a categorisation of *motivations* (which I refer to as *merits*) of theory appropriation in architecture put forward by Michael Ostwald (1999). This categorisation comprises the merits of *legitimisation*, *obfuscation*, *explanation*, *transmission*, *theorisation*, *equalisation*, *occupation*, and *accommodation*. I then associate each reference to autopoiesis with a type of language use as well as with one or more of Ostwald's categories. Thereby, a reference to autopoiesis may be categorised, for example, as a *metaphorical obfuscation* or a *literal equalisation*.

With the superimposition of all samples at a micro level of analysis within this unified analytical framework, I establish an aggregate macro pattern of *language uses*, *merits* and respective beneficiaries of theory appropriation across all samples in the case of Schumacher's *The Autopoiesis of Architecture*.

## 1.5 Anticipated Contributions

With the work I present in this thesis, I condense a theory of architecture based on earlier theories of biology and communications, along with its model of language use and their associated merits, put forward across two volumes totalling well above 1,100 pages in a unified framework. I believe this, along with a review of the theory of autopoiesis, will serve as a rich theoretical platform for those design practitioners and academics seeking to engage with the architectural ideas of one of the most

prolific contemporary architects – Patrik Schumacher. With a confounded route by which the theory of autopoiesis is appropriated in Schumacher’s architectural theory, this thesis might help others contextualise and understand what to make from *The Autopoiesis of Architecture*. Furthermore, the contextually and syntactically sensitive analysis of Schumacher’s architectural theory sheds light on the relationship between the domain of architectural practice and the domain of architectural academia. Specifically, it provides me, and hopefully others, after reading this thesis, with a better understanding of the extent to which reasoning and language use in architectural academia and practice may (or may not) justifiably inform each other. By highlighting the in-principle limitations of this relationship, I hope this work will help design researchers – especially early-career researchers with design backgrounds similar to my own – understand strangely obvious-yet-vague connections between urban architectural spaces and biological systems.

By combining previous methods established in social science and incorporating categorisations of language use and merits of theory appropriation proposed elsewhere, this thesis proposes a mixed-method text analysis approach to evaluate cross-disciplinary appropriations of theory and terminology. While the findings obtained from the analysis of the sampled passages of *The Autopoiesis of Architecture* are necessarily limited to the interpretation of Schumacher’s appropriation of autopoiesis and, by extension, to the linguistic specificity and discursive context of his architectural theory, the mixed-method approach presented in this study might serve others as a valuable analytical framework to analyse, contextualise and appreciate other theory appropriations equally unclear in architecture. I hope that future research (including my own) will corroborate the generalisability of this methodological framework and potentially extend it to other creative disciplines.

## 1.6 The Structure of this Thesis

This thesis consists of five chapters and three appendices followed by a bibliography listing all referenced sources.

The introductory Chapter 1 has presented the background, relevance, research questions, research scope, and research methods of this thesis. Furthermore, this section outlines the thesis structure, and follows by explaining key terminology used



in this thesis. Specifically, Section 1.1 has offered a personal reflection on how my experience of fast-developing urban spaces in China led me to engage strangely obvious-yet-vague connections between urbanism and biological systems and to investigate the extent to which a scientific theory about biological systems may be adopted to inform research into urban spaces. Section 1.2 has outlined the relevance of cross-disciplinary appropriations of scientific theory in architecture and has introduced the biological theory of autopoiesis and its appropriation proposed by Patrik Schumacher. The following Section 1.3 has articulated the research question pursued in this thesis and has outlined its aims. Section 1.4 has presented the scope, which centres on the appropriation of the biological theory of autopoiesis in Schumacher's (2011; 2012) two-volume theoretical treatise, *The Autopoiesis of Architecture*. This section has also outlined the methods employed in this thesis and was followed with Section 1.5 which has anticipated its contributions. This Section 1.6 outlines the structure of this thesis, and the final section 1.7 explains key terminology used in it.

Chapter 2 reviews prior research relevant to the research presented in this thesis. This second chapter consists of three main sections. Section 2.1 examines previous discussions of adoptions of natural-scientific theory (and related terminology) in the field of architecture. Furthermore, it reviews earlier discussions of literal and figurative language uses by which architectural practitioners and academics can benefit from theory appropriation, along with possible associated motivations and pitfalls. Section 2.2 focuses on the biological theory of autopoiesis and reviews some of its forerunners that have recently been appropriated in the architectural context. The section begins with a discussion of the theory's key concepts and the process of its formulation. It also reviews conceptual precursors of the theory of autopoiesis with a focus on key cellular automata and related systems, followed by a review of the computer-based cellular automata model developed by the originators of the theory of biological autopoiesis to illustrate and test their theory. Section 2.3 reviews and comments on different contexts to which autopoiesis has been applied since its conception, with a focus on the varying scales of these contexts. The chapter concludes with section 2.4, which summarises the three preceding sections and, based on that summary, formulates the research questions that will be investigated in the remaining chapters of this thesis.

Chapter 3 contextualises and reviews the research methods used in the remain-

ing part of this thesis. It consists of two main sections and a summary. The first section (3.1) offers an overview and – with a view towards an analysis of Schumacher’s work – an examination and synthesis of several previously established text analysis methods, namely content analysis, argumentation analysis, rhetorical analysis, and, in greater detail, discourse analysis. The second section (3.2) then develops the mixed-method approach taken in this study based on the methods reviewed in the first section. It explains why the investigation of the research question presented at the end of the previous chapter calls for a mixed-methods text analysis approach, introduces several sets of previously established analytical categories that offer utility in this context, establishes an analytical framework from these methods and criteria, explains the sampling of passages from the source material for analysis, and develops modes of reasoning and interpretation by which I analyse and code the sampled text passages. This chapter then concludes with a short section (3.3) summarising the methods thus established.

Chapter 4 documents the analysis of Schumacher’s appropriation of the theory of autopoiesis in architecture as presented in his two-volume *The Autopoiesis of Architecture*. This analysis follows the methodological approach outlined in Chapter 3 and aims to answer the research questions posed at the end of Chapter 2. This chapter consists of two main sections 4.1 and 4.2, examining sample passages from the two volumes of *The Autopoiesis of Architecture*, respectively. Section 4.1 analyses nine of the 24 theses put forward in Volume I. Section 4.2 analyses seven of the 60 theses put forward in Volume II. Each section consists of subsections, each examining one of the sampled passages. Each subsection begins with a linguistic contextualisation. This includes a discussion of the context of the respected passage and of how the passage relates the concept of autopoiesis to architecture. Each subsection examines references in the respective sample passages to prior (i.e., Luhmann’s or Maturana et al.’s) instances of the theory of autopoiesis. Each subsection concludes by categorising language use in the respective sample passage and the merits its references to autopoiesis offer to me (*vis-à-vis* my interest in understanding strangely obvious-yet-vague connections between the built environment and biological systems) and, presumably, to Schumacher (in putting forward a theory of architecture). Each subsection contains my coding of the respective sample passage and my visual interpretation of its reference to autopoiesis, and it concludes with a diagrammatic representation of the analysis.

The concluding Chapter 5 consolidates the outcomes of this thesis, offering answers to the research questions posed at the end of Chapter 2, alongside related reflections and contextualising observations. It consists of four sections. Section 5.1 recaps the objectives and outcomes of the work presented in this thesis. Subsection 5.1.1 consolidates key findings of the analysis discussed in the previous Chapter 4, and presents them in the form of a textual narrative, a tabular summary of findings, and a unified diagrammatic summary. Subsection 5.1.2 presents observations and reflections on both the findings and the enquiry that led to the findings. Section 5.2 discusses the implications and contributions to knowledge of the work presented in this thesis in the context of architectural research and beyond. Reflecting the scope initially outlined in Section 1.4, Section 5.3 discusses the limitations of this thesis. Section 5.4 concludes the chapter by outlining possible future work through which the findings presented here may be extended.

Appendix A contains a transcription of Patrik Schumacher's response to my question: "Is your use of the concept of autopoiesis scientifically formal or designerly informal? And do you think your readers know?" I posed this question during the question-and-answer session that followed the lecture entitled *Architecture Communication as Human Universal*, which Schumacher delivered on the evening of the 5th of March 2020 in Madrid.

Appendix B contains a partial transcript of the email conversation on the subject of "varying scales of autopoiesis discourse" that occurred between Pille Bunnell and myself on the 25th of March 2021. For many years, Bunnell has worked alongside Humberto Maturana. Together, they have engaged in extensive reflections and conversations related to cybernetics and biology, co-authored multiple papers, and worked closely on editing much of Maturana's work. To her, Maturana was not only a friend but her mentor. Given her familiarity with Maturana and his work on the theory of autopoiesis in particular, I asked her: "how is it possible, that Humberto Maturana himself appears to apply the theory of autopoiesis across different (cellular and molecular) scales, while criticising Niklas Luhmann for applying autopoiesis at the scale of society? I wonder whether there is a clear limit to the application of autopoiesis theory across scales and, if so, where and why? Do you have any insight into this?" This appendix contains Bunnell's response to these questions.

Appendix C presents the complete table of sampled text passages from Schumacher's two-volume theoretical treatise. While the subsection 3.1.4.4.1 provides

an excerpt, this complete table contains each of Schumacher's 60 *theses* (24 in Volume I and 36 in Volume II) and their associated *central messages*.

## 1.7 Terms and Abbreviations Used in this Thesis

This section lists and explains key terms and abbreviations used throughout this thesis to make the flow of the argument in later chapters comprehensible.

**Appropriation** is the term used to describe the process through which we (designers and architects) take knowledge from biology and other fields and use it for our own creative pursuits. We draw upon external knowledge, including insights from nature, to inspire new design proposals as well as describe or explain relatively unfamiliar contexts. When this process gives rise to innovative design proposals, we categorise them as *concepts*, representing tangible expressions of ideas inspired by nature. Concurrently, through the utilisation of external knowledge to describe and explain, we enable the development of *theories* that shed light on the complexities of the subject at hand (see also *theory* in this section).

**Autopoiesis** is the term coined by the Chilean neurobiologist Humberto Maturana, Francisco Varela, and Ricardo Uribe to explain the nature of living systems. They describe living systems as closed networks of invariant, circularly causal relationships between their various kinds of constituent components. These systems can produce new components from available resources in their environment, which may then enter the living systems' networks of relations, allowing them to regenerate and reproduce. Living systems are capable of performing these processes of self-reproduction and self-maintenance while their constituent elements are subject to disintegration.

**Discourse**, as a means of communication, encompasses the use of language through interconnected texts or utterances.

**Discourse analysis** is understood as a linguistically and contextually sensitive, textually-oriented analytical method. Given the nature of the data analysis and the understanding of discourse (see also *discourse* in this section), this study uses the term discourse analysis somewhat loosely. Although it is necessary to adapt and extend this method with other methodological approaches, I consider that the nature of discourse analysis offers valuable lenses for examining theory appropriations in

architecture at different levels: Firstly, discourse analysis takes a critical approach to taken-for-granted knowledge, adopting a sceptical perspective toward an objective observation of the world. Secondly, it considers that observations of the world are dependent on the observer, making thus every discourse analysis a product of interpretation. Thirdly, discourse analysis acknowledges that knowledge is socially constructed and, therefore, plays a pivotal role in shaping our understanding of the world. And finally, it commits to exploring how knowledge is linked to actions through language, particularly those bound up with power dynamics.

**IBE** is Inference to the Best Explanation, and is a mode of reasoning that stipulates accepting those hypotheses that offer the best explanation of the evidence observed. This type of reasoning comprises two main activities: inference and explanation. During the inference phase, logical conclusions are drawn based on the observed evidence. This process involves deriving justificatory or evidentiary phenomena that require further explanation. By explaining the inferred statements or premises, it becomes possible to deduce valid conclusions that cannot be solely derived from the statements or premises alone.

**Merits** in this thesis refer to the purpose and value of theory appropriation. It pertains to the categorisation of motivations proposed by Michael Ostwald (1999) (see also *motivations* in this section). Acknowledging von Foerster's (1998, p. 100) postulation that "it is the listener [i.e., the reader], not the speaker [i.e., the author], who determines the meaning of an utterance [i.e., a text]," and Barthes's (1977, p. 148) call for "the death of the author," I substituted Ostwald's term motivation with the term merit. This shift of words emphasises the benefits theory appropriations may offer users of appropriated theory (readers) rather than emphasising the possible interpretations of, and benefits for, appropriators of theory (authors). The categorisation comprises the merits of *legitimation*, *obfuscation*, *explanation*, *transmission*, *theorisation*, *equalisation*, *occupation*, and *accommodation*.

**Motivations** in this thesis refer to the categorisation of the driven factors behind theory formation through appropriation in architecture put forward by Michael Ostwald (1999). It is widely acknowledged that architects draw on knowledge from diverse disciplines to construct architectural theories. To establish a consensus on the reasons and appropriateness of this practice, Ostwald analyses descriptions of theory formation through appropriation and categorises a range of motives that underpin such appropriations. His categorisation is presented above (see *merits*).

**SIP** Suzhou Industrial Park is a county-level administrative area located in the city of Suzhou and province of Jiangsu, China.

**Theory.** A theory functions as a systematic and logical framework that organises knowledge, offering descriptions and explanations through hypotheses or models to observations that require understanding.

**Theory appropriation** in this study is defined as the process of taking and using the descriptions and explanations generated in the formulation of theory into architecture. These descriptions and explanations are often associated with discipline-specific words or concepts, such as autopoiesis. Therefore, theory appropriation inherently involves the adoption of discipline-specific terminology associated with those theories (see also *theory* and *appropriation* in this section).

**Urban processes** in this thesis are understood as the social, cultural, and economic processes I observed in China's fast-developing urban centres, particularly the city of Suzhou. A city populates its built environment with the architectural building blocks that comprise its existence, which, in turn, depend on vernacular architecture in the form of street-level facilities. By creating the conditions from which it has emerged, the city maintains a circular balance between decay and abundant re-creation, which is, in my view, akin to autopoietic processes (see also *autopoiesis* in this section).

## Chapter 2

# Review of Literature

This chapter reviews prior research relevant to the research presented in this thesis. It consists of three main sections. Section 2.1 examines previous discussions of adoptions of natural-scientific theory (and related terminology) in the field of architecture. Furthermore, it reviews earlier discussions of literal and figurative language uses by which architectural practitioners and academics can benefit from theory appropriation, along with possible associated motivations and pitfalls. Section 2.2 focuses on the biological theory of autopoiesis and reviews some of its forerunners that have recently been appropriated in the architectural context. The section begins with a discussion of the theory's key concepts and the process of its formulation. It also reviews conceptual precursors of the theory of autopoiesis with a focus on key cellular automata and related systems, followed by a review of the computer-based cellular automata model developed by the originators of the biological theory of autopoiesis to illustrate and test their theory. Section 2.3 reviews and comments different contexts in which autopoiesis has been applied since its conception, with a focus on the varying scales of these contexts. The chapter concludes with Section 2.4, which summarises the three preceding sections and, based on that summary, formulates the research questions that will be investigated in the remaining chapters of this thesis.

## 2.1 Theory Appropriations in Architecture

In the eighteenth-century, Newtonian philosophy represented a significant departure from the preceding century. Rejecting the rigid confines of earlier philosophies, eighteenth-century thinkers embraced Newton's empirical methods, considering them universally applicable. The influence of Newton paved the way for the systematisation and mathematisation of knowledge – an approach that set the stage for nineteenth-century positivism. Architectural theory was not immune to this paradigm shift. It looked beyond the profession of architecture and urbanism to seek influence and appropriate theory and terminology from the core tenets of Newtonian science (Pérez-Gómez, 1983, pp. 10–12; Vesely 2004, pp. 230–233). In the twentieth-century, referring to the historical moment of the fall of the Berlin Wall and its replacement with parks and gardens, the architectural writer Botond Bogner (1992, pp. 70–71, cited in Ostwald, 1999, p. 52) observed a comparable rupture of conventional isolated boundaries among disciplines. Since then, delineations between disciplines have become more ambiguous than they were before, enabling architects to broaden their scope of inspiration and influence.

In this section, I review previous discussions of cross-disciplinary appropriations of natural-scientific theory and terminology in architecture and urbanism, with a focus on architectural theory formulation and its subsequent possible motivations and critics.

### 2.1.1 Appropriations of Natural-Scientific Theories

Architects borrow concepts, theories, terminology, and methods freely from a broad variety of fields. The natural sciences stand out as a particularly rich source of such acquisitions (Collins, 1998, p. 149; Forty, 1999, p. 213; Forty, 2000, p. 97; Steadman, 2008, p. 8). Models derived from all science but, especially from biological phenomena, draw the attention of architects interested in describing and/or explaining their work and observations. This interest in biology is openly captured in Le Corbusier's (1960, p. 155) proclamation "BIOLOGY! The great new word in architecture and planning."

As the science of biology developed, cities were increasingly thought of and described as living organisms (Lynch, 1981, p. 88; Kostof, 1991, pp. 52–53). Alluding



to features of living when describing cities “seemed to explain many previous normative precepts that seemed intuitively correct” (Kostof, 1991, p. 90; Amati, 2021, pp. 1–3). Those explanations, based on biological imagery, involved describing the public space and parks as the city’s “lungs,” the urban centres as hearts “pumping blood” – traffic – through their “veins” – roads (ibid., 1991, p. 52; ibid.). In this view, architecture and urbanism were approached as having functionally separate elements which involved arranging “organs in order, thus creating an organism or organisms” (Le Corbusier, 1960, p. 155). Similarly, yet with a focus on the evolutionary factors that affect societies, the English philosopher Herbert Spencer (1864, pp. 373–374) describes a factory or a town as analogous to a gland or organism, and a worker to a cell or germ. As economic activity increased, workers multiplied and gradually specialised in different functions. This specialisation, along with the structure and functions of the “mother-society,” could give rise to a new social organism, such as a colony.

Other approaches (see Geddes, 1915, p. 93; Mumford, 1938, pp. 303–304) employ the analogy of *growth* and *evolution* to describe the city’s development as *organic*. The ‘branching tree’ analogy, for example, explains the internal organisation and hierarchy of a city from which separated social communities (units and sub-units) emerge. Despite those units being autonomous due to their self-consolidation of boundaries and centres, they mature and establish a thriving community by maintaining relationships with their respective counterparts. As these social communities mature, they *grow*, suggesting the emergence of new social networks. They do so until the consolidation of a state of *homeostatic* balance or a “stage of ecological climax, with a maximum diversity of elements, an efficient use of energy passing through the system, and a continual recycling of material” (Lynch, 1981, pp. 91–94). When the balance breaks down, the city gets “ill,” yet it “readjusts to destruction somewhat as a living organism responds to injury” (Iklé, 1958, p. 8). While the tree analogy helps to describe and explain the city’s *growth* and *evolution*, Christopher Alexander (1965, pp. 59–60; 1965) argues that it forces an unnatural separation of normally intertwined aspects of life. Instead, he proposes a *semilattice* analogy, which better captures the intricate relationships between elements of cities.

Further examples of cross-disciplinary appropriation of biological theory and terminology in architecture and urbanism include the notion of *metabolism*, *symbiosis*, *catalysis*, *homeostasis*, *co-evolution* and *autopoiesis* among various others.

The biological term *metabolism* refers to the molecular process by which living cells transform nutrient intake into energy in order to grow, reproduce, and sustain themselves (Nagel et al., 1992, p. 160). The Japanese architects Kisho Kurokawa, Kiyonory Kikutake, and Arata Isozaki draw similarities between this energy-related process of life and the constant adaptation to external factors, destruction, and construction of cities. With this parallelism between molecular processes and urban processes, they coin a post-war movement of change aiming to inform both architectural theory and practice (Kurokawa, 1977, p. 27). In their theory, they proclaim how architecture – with its design and technology – could shape a new social order. This draws us to consider the biological notion of metabolism not only as employed to describe and explain, but also used to inspire and inform creative processes in architecture and urbanism.

The term *symbiosis* is another biological term appropriated by Kurokawa (1994, pp. 14–15). It describes the relationship between various elements, including those of nature and humans, wherein each element provides the other with the necessary conditions to thrive. Kurokawa (ibid.) uses this term and its related processes to characterise the “new age” of society and architecture. Since then, the term *symbiosis* has found prominence beyond a descriptive theoretical context and is now used as a source of inspiration for the practice of architecture. Examples include design outcomes that are informed by their relation to the environment, which mimic the performance of symbiotic attitudes (Šijaković and Perić, 2018, p. 71) or relationships between structural (i.e., material used and their organisation) and non-structural elements (i.e., digital design processes and digital technology) that equally mimic symbiotic interactions (Meibodi and Aghaiemeybodi, 2012, pp. 602–606).

A *catalysis* process refers to an acceleration of chemical reactions which occurs by adding a *catalyst* substance. The term *catalysis* is frequently appropriated in the architectural domain to characterise transformations in urban development that are triggered by the introduction of new elements (Attoe and Logan, 1989, pp. 45–46). It describes and explains architectural design objects or initiatives as having catalytic effects that activate urban public spaces (see Oswalt et al., 2006, p. 128; Kristo and Dhiamandi, 2016, pp. 45–53). Other approaches (see Pask, 1969, p. 495; Frazer, 1995, p. 7) also utilise the term to characterise the role of the architect in developing the built environment or, as Gordon Pask (1969, p. 495) argues, in developing “systems (controlled systems) which he [the architect] designs.”

As intuitively approached when describing the city, the term *homeostasis* refers to a set of self-regulatory phenomena that aim to maintain constant the composition and properties of the internal environment of an organism (Martin et al., 1996, pp. 251–252). The human body is regulated by homeostasis as it requires a balance between internal physical conditions and chemical composition. This homeostatic mechanism is manifested in feedback structures that adjust body temperature, blood glucose regulation, blood clotting, and numerous other physiological processes (ibid.). Beyond its use in urban development, the term has recently also been appropriated to characterise building envelopes as “projecting [...] outwards in a prosthetic extension of the skin” (Lee, 2008, p. 193). It has furthermore been used to describe architecture as establishing dynamic equilibrium between indoor and outdoor spaces, gaining stability through mechanical assistance (see Worall, 2011, pp. 87–95).

*Evolution* by natural selection is a widely recognised biological process whereby a species’ characteristics change over time in response to its changing environment. This biological term has not only been used to describe and explain urban processes but also to describe and explain design ideas (Crilly, 2021, p. 310; 2021, p. 334; Cambell, 1960, p. 380; Dawkins, 1976, pp. 189–201). Architect John Frazer (1995), for example, investigates the underlying processes that generate architectural forms in his seminal work *An Evolutionary Architecture*. Viewing architecture as a manifestation of artificial life, he puts forth the concept of genetic representation as a DNA-like code script, allowing for developmental and evolutionary processes in response to user needs and environmental conditions. Along with evolution, the term *co-evolution* has gained attention in design theory. Co-evolution in biology refers to the idea that a species’ environment is also evolving in response to the species’ evolution (Crilly, 2021, p. 339). This biological term has been used in design to describe the action of designing as a search process and hence, as a problem-solving activity. In this way, problems and solutions recursively interact over time and are said to be co-evolving (see Maher, 1994, pp. 2019–2020; Dorst and Cross, 2001, pp. 436–437).

Despite being sometimes considered “naïve,” appropriations – such as those mentioned above – remain at the forefront of contemporary thinking about architecture, urbanism, and design in general (Amati, 2021, p. 3; Sennett et al., 2018, p. 72).

### 2.1.2 Literal and Figurative Modes of Appropriation

Frequently used to describe and explain architectural and urban phenomena as well as inspire and inform the creative design process, cross-disciplinary appropriations from natural science to architecture can be seen as constituted along figurative and literal connections. These connections can be further mapped into “weak” and “strong” understandings of the concept of *biomimicry* (or *biomimetic*) (Blok and Gremmen, 2016, pp. 206–210). Biomimicry is “a new science that studies nature’s models and then imitates or takes inspiration from these designs and processes to solve human problems” (Benyus, 2002, p. 1). While the “strong” concept of biomimicry (literally) imitates nature’s models by copying its designs and manufacturing its processes to solve human problems (ibid., 2002, pp. 4–5), the “weak” concept (figuratively) draws on natural solutions as inspirations to creative design (Bensuade-Vincent et al., 2002, pp. 1–5).

Philip Steadman (2008, pp. 8–20) suggests that the connections between architecture and living systems, both literal and figurative, can be categorised based on their natural scientific interest, which encompasses both function and form. Architects and civil engineers typically share a common interest in the anatomical structure of living organisms. In particular, they analyse the anatomy of organisms by examining static properties, including weight distribution and strength, in order to inform their design proposals (ibid., 2008, p. 12). Examples of figurative adoptions based on performance include Le Corbusier’s modern free-standing type structure in which the structure as the skeleton is separated from the skin (Rigotty, 2017, p. 681) and Frei Otto’s (1995) studies of bone structures to inform the design of lightweight structures.

Instances in which appropriations can hardly be termed figurative based on their performance yet somewhat literal are the ones based on “balance and proportioned appearance” (Steadman, 2008, p. 15). This approach reflects the observation that architects consider any living organism’s physical proportions and match them to constitute the architectural proposal. Examples include Giorgio Vasari (1907, p. 96–7 cited in Steadman, 2008, p. 6), which compares the face of a human body with the façade of the building, the design of the Beijing National Stadium with reference to a bird’s nest by Herzog & de Meuron and CADG, Francis Kéré design of the 2017 Serpentine Pavilion with reference to a palaver tree or the Lyon-Saint Exupéry Air-

port Railway Station in France by Santiago Calatrava which resembles a bird at the point of flight. Organic forms inspired by vegetation have been a common source of biological inspiration for architecture and design, yet often employed for ornamental purposes. Examples can be found in the Art Nouveau movement and throughout architectural history (Steadman, 2008, pp. 19–20). Despite not being an appropriation derived from natural science, the work of the landscape architect Charles Jencks embodies a wholly literal approach. Jencks (2003, p. 97) appropriates mathematical theories, specifically *chaos theory*, to design landscapes that look like mathematical attractors. Critical analysis has shown, however, that major philosophical and ethical issues remain to be resolved in both the “weak” and the “strong” distinction of biomimicry. Despite such challenges – which I discuss in detail in Section 2.1.5 – the literal and figurative appropriations of natural-scientific theory are integral to the creative process of the discipline of architecture.

In design-educational settings, figurative connections, and analogies in particular, are commonly used to explain and understand a relatively unfamiliar world (i.e., “the target domain”) in terms of familiar patterns (i.e., “the source domain”) (Holyoak and Thagard, 1995, pp. 2–5). As an example of the potential of analogical reasoning, Keith Holyoak and Paul Thagard (ibid.) present the reasoning of a four-year-old child who suggested that the branch of a tree could serve as a bird’s chair. With this analogy, the child attempted to understand a relatively unfamiliar world of a bird’s habitat by underlying similarities to an ordinary object in human households. Minutes later, however, the child had second thoughts and pointed out that the tree could be the bird’s backyard instead. As Holyoak and Thagard (ibid.) noted, the example shows how the intention behind the analogy frames the analogical thinking and can trigger new questions and formulate new intentions, which in turn modifies the way the analogy is used. With the potential to inspire further questions, analogies are essential “metacognitive tools” for creativity and discovery (Crilly, 2021, p. 337; Johnson-Laird, 1989, p. 313; Gentner, 1999, p. 17). By comparing a well-known source to a relatively unknown target, “we can engage in exploratory processes that allow us to see the target in new ways and look for things that we hadn’t previously considered” (Crilly, 2021, p. 337).

Metaphors function similarly to analogies by facilitating the transfer of knowledge between disparate domains. Going beyond the rhetorical formulations of the use of metaphors, Klaus Krippendorff (1993) establishes a connection between language

and the creation of perceived realities in his article *Major Metaphors of Communication and Some Constructivist Reflections on their Use*. He argues that “metaphors are not mere poetic embellishments in language, they affect their users’ perceptions and actions” (ibid., 1993, p. 5). Sharing a similar perspective on metaphors as more than linguistic constructs, the French philosopher and sociologist Henri Lefebvre (1991, p. 140) regards metaphors (and metonymies) as essential tools in unravelling the intricacies of spatial production. He emphasises their role in navigating the interplay between material space and the symbolic, lived experiences that contribute to its formation.

Donald Schön (1993, p. 137) explains that metaphors serve a dual purpose, both as “a certain kind of product – a perspective or frame, a way of looking at things – and to a certain kind of process – a process by which new perspectives on the world come to existence.” In this view, metaphorical utterances are particular kinds of *seeing as* relationships from one domain of experience to another, which Schön calls as “generative metaphors.” Dan Lockton et al., (2019, pp. 319–321) put into practice the potential of metaphors in a creative context with the card game *New Metaphors*. Participants in their workshop explored novel metaphors by juxtaposing “hard-to-visualise phenomena” in the form of a text-only concept with “a provisional set of inspiration material” in the form of an image described by a text-label (ibid.). With this *game*, Dan Lockton et al. (ibid.) create a toolkit “for generating ideas and reframing problems” that is a resource that prompts us to proactively venture into new semantic connections as a creative strategy. Therefore, we move beyond finding new metaphorical meaning to deliberately producing new metaphorical meaning.

Similar use of visuals in metaphor-generated divergence, but to check each other respond to figurative connection, was used in the 2000s for the annual undergraduate student intake tests for the Industrial and Product Design department at the School of Design at The Hong Kong Polytechnic University. The test contained about ten questions, one asking students to respond to metaphorical connections. Examples of those questions were: “A submarine is like a sea turtle” – visualise this metaphor by means of drawings – give as many examples as you can (from The Hong Kong Polytechnic University’s School of Design Industrial and Product Design intake test 2007). “My HK minibus is like a shark” – visualise this analogy by means of drawings – give as many examples as you can (from The Hong Kong Polytechnic University’s School of Design Industrial and Product Design intake test 2008). Or “This

woodpecker is like a jackhammer” – VISUALISE this analogy<sup>1</sup> by means of DRAWINGS or STORYBOARD (from The Hong Kong Polytechnic University’s School of Design Industrial and Product Design intake test 2009).

While George Lakoff and Mark Johnsen (1980, p. 140) cover evocative “metaphors that are outside our conventional conceptual system, metaphors that are imaginative and creative” they do not, however, seem to discuss the deliberate designerly strategy of facilitating divergent thinking by proactively exploring new figurative connections. The above-mentioned examples show that it is “undeniable that architects invent metaphors in order to progress in design and to create particular unforeseen combinations” (Gerber, 2013, p. 22).

As essential elements in fostering creativity, figurative connections in the form of metaphors and analogies have been the focus of numerous empirical studies exploring their role in design processes (Hey et al., 2008, p. 286). For instance, Casakin and Goldschmidt (1999, p. 174), investigated the use of visual analogies by designers completing design tasks and found that analogies are catalyst for enhancing designerly skills. Ball et al. (2004, p. 507) examined the spontaneous use of analogy and demonstrated its prevalence in creative, real-world problem-solving in both the practice of expert and novice designers. They found that novices use more “case-driven analogies”, where a specific concrete example is used to develop a new solution, while experts often rely on “schema-driven analogies”, which derive more general design solutions from multiple examples.

### 2.1.3 From Scientific to Architectural Language

The appropriation of natural-scientific theory and terminology, whether literal or figurative, within the architecture domain, has facilitated the development of innovative arguments, ideas, and design proposals. In order to further understand this common mechanism of theory appropriation within the context of academic architectural research, this section reviews previous discussions on the language use and theory formation of the scientific discipline in comparison to the language use and theory formation of the architectural domain.

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<sup>1</sup>These were accompanied by this footnote: An analogy is a comparison of certain similarities between things which are otherwise unlike. “A street light is like a star” = Both provide light at night, both are in predictable locations, both are overhead, both serve no function in the daytime...

### 2.1.3.1 In Science

At the end of the seventeenth century, the *Philosophical Transactions of the Royal Society*, the journal of the Royal Society of London, pointed out that scientific language should be an “accurate language of description” (1675, p. 552 cited in Forty, 2000, p. 76). The Royal Society emphasised that scientific language was not adequate if the language used to report scientific experiments distorted them “or was untruthful to the findings” (Forty, 2000, p. 76). Since then, scientific theories have assumed the form of objective statements that avoid commanding or expressing emotions or feelings. Instead, their primary objective is to accurately describe specific characteristics or properties of observed phenomena within particular space-time contexts, while commonly disregarding the act of observing itself (Morris, 1946, p. 297; Montgomery, 1996, pp. 2–5). In this view, science “rejects, or at least is unable to cope with, the richness and ambiguity of symbolic thought” (Pérez-Gómez, 1983, p. 6). Yet, it ensures that experimental results can be tested, confirmed, or falsified, making language “merely an instrument” – a transparent and neutral “medium of thought” (Barthes, 1989, p. 4). It is thus not surprising that Galileo expressed that “the book of nature is written in the language of mathematics” (Kantorovich, 1993, p. 59) and that Pearson advocates for the “strive at self-elimination” of scientists’ judgement (Weizenbaum, 1976, p. 25).

Disagreeing with this position that scientific theories are only driven by logical criteria, Thomas Kuhn (1996, p. 4) posits that beliefs, values, techniques, and so on also influence scientific progress. This depends on scientific communities that tend to uphold existing theories without challenging them until, on rare occasions, a scientific theory is revised, leading to a “paradigm shift” and the establishment of new scientific paradigms (ibid.). Karl Popper rejects Kuhn’s suggestion to view scientific progress in terms of scientists’ sociological and psychological aspects and criticises it as too dependent on “fashions and uncontrolled dogmas” (see Popper, 1970, p. 58). Notwithstanding such perspectives, in order to predict, explain, or control (Davidson, 2006, pp. 2–8), scientists construct hypotheses and models *as if* they were mirror images of the natural world. Through these figurative connections, scientists are able to render new and unfamiliar knowledge intelligible and familiar to others (Bartha, 2010, pp. 1–7; Dubin, 1978, pp. 3, 211–212; Hesse, 1966, p. 140). This is achieved through testing and validating these connections using rig-



orous empirical and quantitative evaluation. Despite their potential for generating new knowledge, these models generally simplify our observations, thereby attracting criticism as overlooking scientific complexity and thus “on the wrong track” (Ruse, 1972, p. 106).

The use of figurative connections is also present in Cybernetics. Cybernetics, as defined by Pask (1975, p. 13), refers to “the science or the art of manipulating defensible metaphors.” Akin to scientific practices, the figurative connections between dissimilar things drawn by Cybernetic studies are often validated through demonstration of implementations. For example, Penrose and Penrose (1957) demonstrate the biological phenomena of *reproduction* through analogue mechanisms of mechanical prototypes (see the following Section 2.2.4). Varela et al. (1974) illustrate and corroborate principles of the biological theory of *autopoiesis* through a cellular automata computational model (see the following Section 2.6). Or, Ashby (1960, pp. 100–122) develops a device (called *Homeostat*) capable of exhibiting the biological process of *homeostasis* in a changing environment. However, the primary difference between ‘hard science’ and second-order cybernetics lies in the inclusion of the observer within the observed system as I discuss in Section 2.2.1.

In addition to its use in understanding and explaining a relatively unfamiliar world in terms of a familiar pattern, figurative language use, particularly analogies in the practice of science, are also widely prominent for creativity and discovery (Gentner, 1999, p. 17). For example, Johannes Kepler employed the concept of light as an analogy to propose that the planets are driven by an unseen force originating from the sun.

### 2.1.3.2 In Architecture

The understanding of scientific language as being transparent, neutral, and accurate leads Barthes (1989, p. 8) to consider scientific language as the neutral state of language “from which would branch off, [...] a certain number of special languages, such as the literary language or the poetic language.” In the domain of architecture, this view aligns with the fact that architectural ideas, for example, in contrast to scientific concepts – which are often clearly defined – “are subject to interpretation and critique, which render them seemingly more complex” (Ostwald and Moore, 1997, p. 246).

Notably, language has often been overlooked and excluded from discussion within the domain of architecture (Bonta, 1990, p. 38–39 cited in Johnson, 1994, p. 43; Forty, 2000, pp. 12–13; Forty, 2018, p. 64; Markus and Cameron, 2002, pp. 1–3). As Forty (2000, p. 13) argues, however, “language is not something that simply gets in the way of architecture, but is a system of its own on a par with that of buildings.” In Forty’s view (2018, p. 64), “the virtue of [architectural] language is that it is metaphorical, it allows one to see one thing as another.” In contrast to drawings, which “lack this ‘seeing as’ capacity,” language, offers the possibility to “escape from certainty” (ibid.).<sup>2</sup> This perspective reflects the observation that metaphors and analogies are not only descriptive and explanatory devices (as commonly used in scientific fields) but are also evocative tools. Perceived as *elusive*, *vague*, or *unstable* by nature (see Zitouni, 2013, p. 147), metaphors thus do not offer literal interpretations (Gerber, 2013, p. 18), but “open up new ways of understanding the world” that moves from “the known of affirmation into the unknown of negation” (Snodgrass and Coyne, 2005, pp. 189–190). This non-literal interpretations constitutes a fundamental engine of innovation (as well as dependency) for the discipline of architecture (Kipnis, 1995, p. 62 cited in Ostwald, 1999, p. 61), as seen in some examples in section 2.1.2 above.

To bring forth the virtue of metaphorical ambiguity in architectural language, Forty builds upon Barthes’s understanding of language as being “by nature, fictional; the attempt to render language unfictional requires an enormous apparatus of measurements: we convoke logic, or, lacking that, sworn oath” (Barthes, 1981, p. 87). Yet, architectural theory expands across a range of perspectives, moving from objective empirical principles – such as attempts to ‘scientificise’ architectural theory and practice (see Pérez-Gómez, 1983; 1999) as well as design processes (see Simon, 1996; Schön, 1983; Cross, 2006) – to subjective values and philosophical, theological and artistic theories that reflect ideologies, political agendas and aesthetic

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<sup>2</sup>While in this context, Forty (2018, p. 64) is referring to technical drawings to reinforce the potential of metaphorical language in the discipline of architecture; it is also important to mention that architectural design as a creative process also benefits from ambiguity in drawings such as sketches (Goel, 1995, pp. 177–180). For example, in the illustration of the rabbit-duck illusion originally created by Fliegende Blätter and reiterated decades later by the ‘later’ Wittgenstein (1958, p. 14), multiple realities are presented simultaneously. The ambiguity in drawings is a way to encourage exploration in the same way that architectural theorists benefit from the ambiguity in language. This openness towards ambiguity is not only present in language and drawings but also in other types of communicative media, such as the construction of physical and computational models or tools.

predilections (Ostwald, 1999, p. 54; Younés, 2003, p. 251; Smith, 2012, pp. 5–6). This breadth of discourse is a symptom that design is “not merely a technical specialization but a new liberal art” (Buchanan, 1992, p. 14). In this view, the language of architectural theory operates on a continuum that encompasses scientifically formal and designerly informal language.

#### 2.1.4 Theory Formation Through Appropriation

As discussed above, the discipline of architecture has never been characterised by a single set of concerns but instead encompasses an amalgamation of various approaches. Often “classified as something between art and technique, between the social and the hard science,” this inherent ambiguity of the discipline “may be what gives architecture its uniqueness and richness” (Cabral Filho, 2005, p. 357).

Architectural theory, in particular, “has worn many faces; and those who influenced it have not always been architects or practicing architects” but also doctors, scientists, mathematicians, engineers, writers, or artists of various kinds (Younés, 2003, p. 249). In Peter Downton’s view (1997, p. 83; 2003, p. 13), the overlapping between different approaches, ideas and practices from other fields inevitably influences the development of architectural theory and its different methodological approaches. Jean-Claude Guédon (1995, p. 88, cited in Ostwald, 1999, p. 52) disagrees with this view and instead claims that architectural theory develops as a consequence of a constant interplay among diverse bodies of theory. Extending this view, Guédon (*ibid.*) argues that architecture is a boundless field that has never possessed a set of its own body of knowledge, and further questions whether it can be regarded as a discipline in itself.

This argument was echoed two years earlier by Mark Linder (1992, p. 167), who similarly contends that “architecture’s limits prove elusive and theoretical attempts to understand architecture inevitably appeal to the authority of disciplines perceived to be more universal or nimble than architecture.” While acknowledging that architecture is vast by nature, Samir Younés (2003, p. 249) in his article *Constructing Architectural Theory*, rejects the idea that architectural theory is entirely dependent on other domains, cautioning that “the confluence of many a discipline within the architectural endeavour involves two risks: eroding architecture’s clear boundaries, or treating it as symptomatic of these disciplines.”

The formation of architectural theory through appropriation can be interpreted in the writings of architectural historian Michael Hays (1998, p. v), who argues that new theoretical discourse arises from the active equivalence of two pre-existing *codes* or worldviews. Through this equivalence, a new *metacode* is created, which is not a *synthesis* of the original worldviews but a distinct construct in its own right (Jameson, 1991, p. 394; Hays, 1998, p. v). This process of constructing theoretical discourse by combining worldviews “becomes a solution rather than a problem, being maximized into an instrument in its own right” (ibid.). In this way, the appropriation of a worldview results in a loss of its original meaning, as it takes on a new significance in the context of the new *metacode*.

Paul-Alan Johnson (1994, p. 44) suggests that although meanings may lose their former specificity when used in another discipline, they still bear some of their original meaning from the discipline they were appropriated from. In Downton’s view (1997, p. 82), however, the *migration*<sup>3</sup> of knowledge does not take a new meaning or partially lose its original understanding, but “co-exists at more than one site at once.” With theories generally thought to be derived from two entities – i.e., observations of the world, and the intuition that certain aspects of the world can be described or explained through hypothesis or models (Dubin, 1978, p. 9) – Downton (ibid.) suggests that when a theory is appropriated, the number of entities involved increase.

In his article entitled *Architectural Theory Formation Through Appropriation*, Michael Ostwald (1999, pp. 54–56) consolidates various approaches to the development of architectural theory and posits a tripartite sequence of interdependent operational processes. The *Uni-directional appropriation* – consists of appropriating a conceptually “pure” theory into the discipline of architecture. “This implies that a theory appropriated from [for example] mathematics is presumed to be untainted by contact with other disciplines” (ibid., 1999, p. 54). However, once the theory is assimilated into the new domain, the original concept loses every connection to the original discipline – a process referred to as *hybridisation*. A particular consequence of this operation, as already acknowledged by Jameson (1991, p. 394), is that “when a body of theory migrates between one knowledge domain and another it frequently, or inevitably, loses its original meaning in the process of translation and translocation” (Ostwald, 1999, p. 55). The last operation conceived by Ostwald is the

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<sup>3</sup>The term *migration* is in itself a metaphor which, according to Ostwald and Moore (1997, p. 246), is apt “for the manner in which theory shifts between disciplines.”

*multi-directional appropriation* and consists of at least two consecutive appropriations. For example, “philosophy appropriates a concept from architecture. Then architecture appropriates the newly formed philosophical hybrid back again” (ibid.). Ostwald considers this process to be an appropriation from a hybrid construction, which he characterises as an “impure theory.”

### 2.1.5 Motivation and Critique of Theory Appropriation

The act of appropriating typically involves incorporating theory and terminology from other domains into the discipline of architecture. It is a recursive operation that not only underscores its significance within the discipline but indicates that the discipline is constantly redefining its identity (Galison, 1999, p. 2; Gerber, 2013, p. 19). Utilising such an “unauthorized jargon as its terms” (Scruton, 1983, p. 26–27, cited in Johnson, 1994, p. 44), architects establish a “metalanguage” for the discipline, enabling participants of the discipline to talk and write about urbanism and architecture (Johnson, 1994, p. 44). Hence, figurative connections to other fields – particularly those in science – should not be “immediately abandoned” as useless or entirely misleading (Steadman, 2008, p. 5). Similarly, within Cybernetics, a field that encompasses various academic societies and underpins the biological theory of autopoiesis, language incorporates elements from diverse domains. In her article, *Cybernetics of Cybernetics*, presented at the inaugural conference of the American Society for Cybernetics, Margaret Mead (1968) advocated adopting “a language sufficiently sophisticated to be used to solve complex human problems.” She further emphasised the need for this language to be “sufficiently abstract to make it possible to cross disciplinary boundaries” (Mead, 1968, cited in Umpleby, 2005). Despite initial disregard, she suggested the development of a metalanguage as the communicative medium within Cybernetics, which implies incorporating elements from diverse domains to enable their adoption within the various academic societies that constitute Cybernetics.

However, as Forty (1999, p. 213) points out, “we should not assume that a scientific term, just because it comes from science, is a successful metaphor for architecture.” Michael Hensel (2006, p. 25) approaches “weak” metaphorical appropriations with scepticism and advocates for a more literal integration of biochemical processes (such as metabolism or the property of homeostasis) and the functionality

of life into buildings. To him, this integration is aimed at benefiting not only humans but also other species and the environment. “One might think of it as a highly performative synthesis between house and garden embedded within its specific micro-environments and niches and embedded within macro-ecological systems” (ibid.).

Vincent Blok and Bart Giremme (2016, p. 214) raise major concerns when critically reflecting on the ethical dimension of natural scientific appropriations in both the “weak” (figurative) and “strong” (literal) approaches of biomimicry. They notice that “nature and naturalness operate as a normative standard to judge ‘rightness’” because natural principles are assumed to “conduce to ecological health and integrity of the eco-systems of planet earth” (ibid.). In this sense, health is conceived in natural terms and, thereby, as nature is not only splendid but also ruthless, diseases should also be approached as a natural product (Moore, 1903, p. 94). However, “the fact is that in the very words ‘health’ and ‘disease’ we do commonly include the notion that the one is good and the other bad” (ibid., 1903, p. 95). Moore (ibid.) describes this as a “naturalistic fallacy” which consists of arguing that “a thing is good *because* it is ‘natural,’ or bad *because* it is ‘unnatural.’”

*Appealing to nature* is also critically approached in politics and power dynamics with Foucault’s (2008, pp. 317–324) notion of *biopolitics*. The term refers to the use of biological metaphors in governance, with public health rationales being instrumentalised in public policy. An extreme negative example is the utilisation of the term ‘hygiene’ to justify state racism. The *growth* imperative is prevalent in Western civilisations, often promoted through the built environment as an inherently desirable goal. However, *The Club of Rome*, utilising Jay Forrester’s *System Dynamics* model, noted in the early 1970s that the exponential growth of population and capital – yet appealing – relies on finite resources, ultimately leading to an economic collapse (Meadows et al., 1972, pp. 23–24). Other *naturalistic fallacies* can be observed in the marketing of food products labelled with the prefix ‘Bio-’ as synonym of ‘natural’ and in beliefs that medical interventions are ‘unnatural,’ which in turn leads to arguments against vaccination (Meier et al., 2019). Biological appropriations are thus not inherently ‘good’, less than rigorous, and a double-edged sword.

Other critical approaches to appropriations of natural scientific theory in architecture focus on tracking specific terminology throughout history, aiming to discern the evolving meanings of these terms across their historical usage. One such term is

*organic*. This term has not only been employed to understand urban processes but has also been essential in describing and communicating architectural design and physical forms. However, according to Forty (2000, p. 103), the word *organic* has been “overworked and unsatisfactory.” For example, Frank Lloyd Wright famously characterised his architectural work as *organic* – using the term to refer to “an architecture that develops from within outward in harmony with the conditions of its being as distinguished from one that is applied from without” (Wright, 1914, cited in Collins, 1998, p. 152). Notably, his definition of *organic architecture* was criticised as vague due to its broad interpretation, which includes the characterisation of architectural plans as well as the social relationship between the architect and the client (Collins, 1998, p. 156).

Forty (1999, pp. 213–220; 2000, pp. 87–101) critically analyses the appropriation of the term *circulation*. Originally used to describe the movement of blood around the body, the term was appropriated by French critic César Dely (1857, p. 346–347, cited in Forty, 1999, p. 214) in an article referring to Barry’s Reform Club in London to describe the building as “almost a living body with its own nervous system and cardiovascular circulation system” (*ibid.*). Similarly, years later, the French architect Viollet-le-Duc (1872, cited in Forty, 1999, p. 214) used the physiological term to refer to the human movement as a different system in a building (Figure 2.1 shows the physiological inspiration of the metaphor) influencing Le Corbusier (1930, p. 47) to claim that “architecture is circulation.” While Forty (1999, p. 220) suggests that other physiological metaphors, such as *respiration* or *breathing*, may more accurately portray human movement within buildings, *circulation* has become “a factor in the design of buildings as well as “an absolute, objective property of architecture.” Forty (*ibid.*, 1999, p. 218) concludes his analysis by stating that “its introduction must be seen as a symptom of the desire to bring scientific method into architecture,” revealing, at least, a problematic relationship between science and architecture.

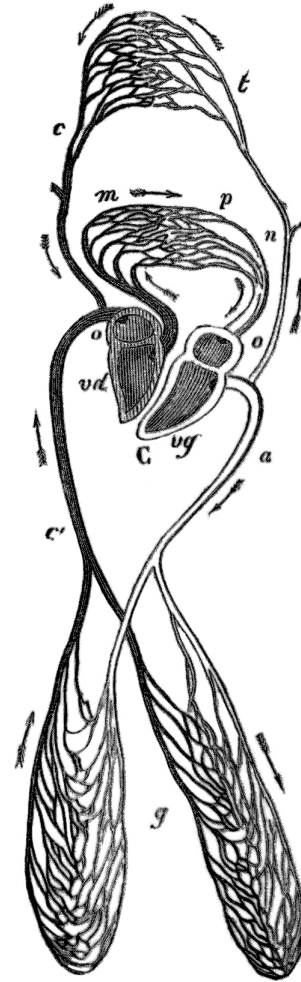


Figure 2.1: The human circulation system – “circulation” as a metaphor for human movement within buildings. Figure reproduced in Forty (1999, p. 215) from Larousse (1869, p. 330).

Nathan Crilly (2021, p. 336) has critically approached the appropriation of the term *co-evolution* in design discourses, highlighting that its biological reference is often disregarded. To him (*ibid.*), the “failure to adopt and develop the biological analogy is surprising because design researchers invoking co-evolutionary accounts generally do so to explain creativity, and that same research community promotes the role of analogies, especially biological analogies, in stimulating creativity in design.”

With a focus on understanding what purposes motivates architects and architectural theoreticians to appropriate theory and terminology from other



non-architectural domains, Ostwald (1999, pp. 52–70) proposes a list of eight possible motivations. Based on “suggestions made by others,” his list includes the motivations of *legitimisation*, *obfuscation*, *explanation*, *transmission*, *theorisation*, *equalisation*, *occupation*, and *accommodation*, which I discuss in detail in Section 3.2.3.2.

## 2.2 Contextualisation of the Theory of Autopoiesis

The theory of *autopoiesis*, as mentioned in Section 2.1.1 above, is among the various and numerous natural-scientific theories that has been appropriated in architecture. The term autopoiesis, a neologism made up of the two ancient Greek words *autos* (self) and *poiesis* (production/creation), was coined by the Chilean neuro-biologists Humberto Maturana, Francisco Varela, and Ricardo Uribe in the early 1970s to describe the organisation of living systems (Varela et al., 1974; Maturana and Varela, 1980). The team describes living systems as closed networks of invariant, circularly causal relationships between their various kinds of constituent components. From resources available in their environments, these components can produce further components, which may then enter the living systems’ networks of relationships, allowing these systems to thereby regenerate and reproduce (ibid.). Early conceptions of these autopoietic relationships can be traced back to the late 1680s with John Locke’s essay: *An Essay Concerning Human Understanding* (Locke, 1997, p. 299). Using a watch as an analogy, Locke (ibid.), observed that:

“If we would suppose this machine one continued body, all whose organized parts were repaired, increased or diminished, by a constant addition or separation of insensible parts, with one common life, we should have something very much like the body of animal, with this difference, that in an animal the fitness of the organization and the motion wherein life consists, begin together, the motion coming from within; but in machines, the force, coming sensibly from without, is often away when the organ is in order, and well fitted to received it.”

A comparable machine analogy to describe and explain the difference between *autopoietic* (living) and *allopoietic* (non-living) machines is also employed by Maturana and Varela in their seminal work *De Máquinas y Seres Vivos* (Maturana and

Varela, 2004) – originally written in Spanish, meaning *Of Machines and Living Beings*.<sup>4</sup> In the following sections, I review the biological theory of autopoiesis in detail.

### 2.2.1 Key Terminology Used in the Theory of Autopoiesis

Maturana, Varela and Uribe construct a theoretical foundation that emanates from second-order cybernetics (Glanville, 2012, p. 183). This approach, also known as the *Cybernetics of Cybernetics* or the *New Cybernetics*, supposes a continuation of the work developed within first-order cybernetics (Fischer and Herr, 2019, p. 12). Cybernetics is a field of study concerned with feedback, communication, and control in diverse systems, encompassing both machines and living organisms. Based on cybernetics, second-order cybernetics is considered a “more general, and therefore more powerful case” (Glanville, 1997, p. 6). It differs from first-order cybernetics by taking into account the circular causal relationship between an involved observer and the observed phenomena (von Foerster, 2003, pp. 283–285; Maturana and Varela, 1980, p. 8; Maturana, 1975, p. 315). In other words, “what is considered is not the observed (as in the classical paradigm), but the observing system” (Glanville, 2012, p. 176).

The underpinning of second-order cybernetics also sheds light on the distinctions between the principles of the biological theory of autopoiesis and conventional paradigms in natural science (Maturana and Varela, 1987, p. 11). Eric Dent and Stuart Umpleby (1998, pp. 513–518) note that the theory of autopoiesis stands out by acknowledging circular causality and the subjective role of the observer, in contrast to the pursuit of objective scientific truth. They (ibid.) further emphasise that the biological theory embraces non-determinability rather than adhering to strict scientific determinism. While the theory of autopoiesis differentiates from ‘hard science’ (i.e., mathematics, physics, chemistry, among others), it incorporates terminology widely accepted in these fields. Nevertheless, these terms are used in an unconventional manner to describe the particular observations made by the team during their study of living systems. Before engaging with the literature on autopoiesis, I will describe a selection of key terminology that might be subject to confusion.

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<sup>4</sup>This book was subsequently translated into English and published as *Autopoiesis and Cognition, The Realization of the Living* (Maturana and Varela, 1980).

### 2.2.1.1 Observer

Before introducing the biological theory of autopoiesis, Maturana (1969, p. 4) defined the observer as a human being capable of making distinctions. According to Maturana (1980, p. xix), making distinctions is “the basic cognitive operation that we perform.” In his view, by observing, an observer distinguishes entities from himself and the general background. Within ‘hard science’, scientists argue for and assume that observations can attain ‘objectivity’ by separating observers from their observations. This objectivity is achieved by agreeing upon similar descriptions when observing the same phenomena (Dent and Umpleby, 1998, pp. 513–518). However, Maturana et al. (1968, p. 1) question this assumption in their investigation of the nervous system, claiming that each observer’s reality is shaped by their past experiences. According to Maturana (1969, p. 4; 1975, p. 315; Maturana and Varela, 1980, pp. 8–9) and second-order cybernetic perspectives, every observer’s distinction is processed by the observer’s own actions and understating (thoughts) recursively. It is this recursive relationship between “observer (observing) and observed” what is understood to be circular (Glanville, 2012, p. 176).

In Maturana’s view (Maturana, 1980, pp. 46–47; Mingers, 1995, pp. 13–14), the observer’s “choice and purposes” determine the description and explanation of distinctions or the conditions under which the observed phenomenon is generated. As a result, the observer is no longer separated from the system but instead becomes a part of it, being “appreciated and acknowledged rather than disguised” (Glanville, 2012, p. 175; Dent and Umpleby, 1998, pp. 513–518). The observer is thus “able to interact independently with the observed entity and with its relations” (Maturana (1969, p. 4; Maturana and Varela, 1980, p. 8).

### 2.2.1.2 Unity

Maturana (1975, p. 315; 1980, p. 47), in agreement with Varela (1980, p. xix), defines *unity* as “any entity (concrete or conceptual)” that can be distinguished from its background and other unities by an observer. This type of unity – referred to as a *whole unity* – defines itself through “its properties, the space in which it exists and the phenomenal domain which it may generate in its interactions with other unities” (Maturana and Varela, 1980, p. xix; Varela, 1979, p. 310). To illustrate this concept,

John Mingers (1995, pp. 13–14) uses the example of a car: “In calling something “a car,” certain basic attributes or defining features (it is mobile, carries people, is steerable) are specified.”

Maturana and Varela (1980, p. xix) propose that when an observer applies the operations of distinction while observing a unity in greater detail, they can distinguish its components. They (ibid.) refer to this level of observability as a *composite unity*, which exists “through the specified properties of its components that we observers distinguish it” (ibid.). While a *whole unity* encompasses essential properties and does not allow for distinguishing components – such as a person without referring to its cells or organs – a *composite unity* consists of components and their relations. For example, a person treated as a multi-cellular system composed of components (cells). The combination of the components and their relations in a *composite unity* forms a *whole unity* that “does not exist in the space of its components, but which exists in a space that it defines through the properties that characterize it as a simple unity” (Maturana and Varela, 1980, p. xix).

### 2.2.1.3 Organisation

While traditional scientific research focuses on isolated components of living systems (Varela, 1979, p. 5), Maturana et al. take a different approach by focusing on the *organisation* of every living system as a whole. The term *organisation* stems from the concept of *self-referentiality* in second-order cybernetics (Maturana, 1975, p. 315; Maturana and Varela, 1987, pp. 4–50). *Self-referentiality* in this context denotes a system’s ability to maintain a circular relationship between its components and the processes they undergo, which allows it to continue existing. Prior to the formulation of the theory of autopoiesis, Maturana (1969, pp. 5–12; Maturana and Varela, 1980, pp. 10–11) referred to this self-referential process. However, it was not until the emergence of the concept of autopoiesis that Maturana et al. explicitly labelled this process as *organisation*.

The *organisation* of a unity defines its classification within a particular type or class of system (Maturana, 1975, p. 315; 1980, p. 48; Mingers, 1995, p. 14). Even though a system tends to remain stable, any changes in the relationships between its components can result in a change in the system’s classification. In other words, as Maturana (1987, p. 71) explains, “if the organization changes, the thing changes.

A chair is a chair, a composite unity of a particular kind, only as long as its organization is an invariant.”<sup>5</sup> Therefore, to define a system as a unity, it is necessary and sufficient to refer to its organisation (Maturana, 1975, p. 315). Despite being open to external information, the organisation of a unity remains self-referential and closed to the environment. Varela (1978, p. 292; 1979, p. 15) describes this stable and internal circular process as *organisational closure*, which is a crucial concept in characterising *autopoiesis* and its associated notion of *autonomy*.

#### 2.2.1.4 Closure

Maturana and Varela (1980, p. 88; 1992, p. 89) define *closure* in conjunction with, and as a consequence of, the system’s organisation. According to their explanation, (autopoietic) systems are *operationally closed* if “their identity is specified by a network of dynamic processes whose effects do not leave that network” (Maturana and Varela, 1992, p. 89). In other words, the term refers to process dynamics by which a given system responds to effect arising within itself, such that the system’s output affects the system in turn as input, resulting in a circularly-causal feedback loop by which systems are capable of responding to effects of their own (past) actions, i.e., to self-regulate. The pairing of the term “organization” with “closure” and the phrase “network of dynamic processes” refer to process dynamics in which the product of a system’s organisation is the organisation itself. The phrase “whose effects do not leave that network,” however, tends to be misunderstood to refer to closed boundaries such as cellular membranes, skins, façades, or borders that isolate systems from interaction with their environments, such that organizationally closed systems are isolated and entirely independent (see also Fischer, 2019, pp. 376–377). Varela and Goguen (1978, p. 294) clarify: “when we speak of organizational closure, by no means do we imply *interactional* closure, i.e., the system in total isolation. We do assume that every system will maintain endless interactions with the environment which will impinge and perturb it. If this were not so, we could not even distinguish it.” Mingers (1995, p. 33) also addresses the misconception: “[t]his is not at all the case. Such systems are organizationally closed but *interactively* open.” Living cells,

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<sup>5</sup>Seeing that the term autopoiesis was appropriated with the synonym of self-organisation, Maturana (1987, p. 71) uses the presented explanation to clarify that he would “ever use the notion of self-organization, because that cannot be the case.”

for example, interact with the environment by taking in signals and nutrients of various kinds and releasing signals and waste products of various kinds.

### 2.2.1.5 Autonomy

Autonomy arises from organisational closure. It constitutes a fundamental characteristic of every living system, and consequently, it is pivotal to understand the organisation that defines living systems as unities (Maturana, 1980, p. 45; Maturana and Varela, 1992, p. 48). Highlighting the importance of autonomy, Maturana (1980, p. 15) argue that “all biological phenomena, from reproduction to cognition, are necessarily secondary to the constitution of living systems as autonomous unities, and that they result from the different ways in which living systems realize their autonomies together or independently, in the same or in different media.”

According to Maturana and Varela (1992, pp. 47–48), “a system is autonomous if it can specify its own laws, what is proper to it.” In this context, autonomy is “revealed in the self-asserting capacity of living systems to maintain their identity through the active compensation of deformations” (Maturana and Varela, 1980, p. 73; Varela, 1979, p. 3). Therefore, systems are autonomous by depending on themselves for their continued production as well as physically by defining themselves through the production of their own boundaries (Mingers, 1989, p. 166). In this view, it can be said that autonomous systems possess “(a) a recursive form of organization of (b) processes which continually constitute their own unity by maintaining (c) a boundary within which its organization is realized” (Krippendorff, 1986, p. 5). It is this distinct operational phenomenology that stems from an autopoietic organisation (Varela et al., (1974, p. 188).

### 2.2.1.6 Structure

According to Maturana (1980, p. 48), the *structure* of a system refers to “the actual components and the actual relations among them” that satisfy the construction of a given composite unity. The physical structure of the system can vary based on the nature and properties of its components (Maturana, 1980, p. 81). Although the structure of the system can be perturbed by interactions among its components or between the systems and its environment, it does not determine the properties of

the unity or its particular class (ibid; Maturana, 1975, pp. 315–316). For instance, a plane “as a whole can fly [...] Sucking in a bird can stop an engine; a short circuit can damage the controls. These are perturbations of the structure, which may affect the whole and lead to a loss of organization or which may be compensable, in which case the plane is still able to fly” (Mingers, 1995, p. 14).

### 2.2.2 Autopoiesis, the Nature of Living Systems

Maturana’s early work led him to characterise the nervous system as an autonomous and organisationally closed system (Maturana, 1980, pp. 124–134), i.e., as a system that “computes “realities” within and through its functioning” (Glanville, 2012, p. 186). After conducting research on the nervous system and engaging in several conversations with Francisco Varela (who was his student at that time), Maturana developed the *Biology of Cognition*. This work, which served as a precursor to the theory of autopoiesis, was initially published as a report from the *Biological Computer Laboratory Research* in 1970, to be, ten years later, reprinted in the seminal book on autopoiesis *Autopoiesis and Cognition: The Realization of the Living*. In it, Maturana develops a description of a circular organisation as sufficient to characterise living systems as autonomous.

The theory of autopoiesis emerged from a question the team set out to investigate – “what is common to all living systems that we qualify them as living?; if not a vital force, if not an organizing principle of some kind, what then?” (Maturana and Varela, 1980, pp. 74–75). Biologists in their respective fields of expertise also asked this question yet from different perspectives. They commonly emphasised different features of isolated components within living systems – for example, considering reproduction as an intrinsic characteristic of living organisation. These approaches, for Maturana and colleagues, are limited to a descriptive account of the characteristics of isolated components but do not ask about “the organization which makes a living system a whole, autonomous unity that is alive regardless of whether it reproduces or not” (Varela et al., 1974, p. 187). Building from this position, the team introduces a novel explanation of the nature and organisation of life. They move from mere descriptions of living systems as a collection of isolated components to observing and understanding living systems as whole unitary entities. Mingers (1989, p. 160; 1995, p. 10) recalls three fundamental observations made by Maturana et al.:

- (i) That every living entity is *autonomous* despite belonging to species and groups affected by their environment (Varela, 1979, pp. xi–xii).
- (ii) That the operations within the living system are *mechanistic*, i.e., the behaviour and development of the system depend on the component's interactions with neighbouring elements but not on the properties of the components.
- (iii) That “anything said is said by an observer”<sup>6</sup> external to the system (Maturana, 1969, p. 4; Maturana and Varela, 1980, p. 8; Maturana, 1975, p. 315). In agreeing with Maturana and Varela, this sentence is later extended by von Foerster (2003, p. 283) to accommodate the other by saying: “Anything said is said *to* an observer.”

With these observations Maturana and Varela (1980, p. 85) postulate that living systems are autonomous systems that emerge as a result of mechanistic interactions of neighbouring components without purpose or aims. Building on this understanding, Maturana et al. develop the conceptual argument that the *organisation* of living systems leads to its characterised *autonomy* by virtue of a self-production process of components. The team describes this process as *autopoiesis* (self-production or self-creation). In Maturana and Varela's words (*ibid.*, 1980, pp. 78–79), an autopoietic system (machine) is:

“a machine organized (defined as a unity) as a network of processes of production (transformation and destruction) of components which: (i) through their interactions and transformations continuously regenerate and realize the network of processes (relations) that produced them; and (ii) constitute it (the machine) as a concrete unity in space in which they (the components) exist by specifying the topological domain of its realization as such a network.”

Even when subjected to environmental disturbances, any autopoietic system maintains constant relations that define them as autopoiesis (Maturana, 1980, p. 45). Perturbations are ‘resolved’ by internal structural changes, thereby always maintaining the organisation of the system stable. The recurrent interactions between

<sup>6</sup>Some original texts contain the word ‘everything’ instead of ‘anything,’ yet both words conveying an inclusive meaning of ‘all things’ in this quote (see Maturana and Varela, 1980, p. xxii; 1987, pp. 26, 28, 99, 138).



the autopoietic system and the medium as plastic systems result in structural adjustments to each other, i.e., what the team named *structural coupling* (“conservation of adaptation”) (Maturana and Varela, 1980, pp. xx–xxi). The system’s structure determines the “domain of allowable perturbations” (Varela, 1979, p. 33). However, as they are subject to continuous change, they allow endless (re)configurations of the same phenomena (Maturana, 1980, p. 54). The conservation of the possible environmental interactions between the system and its physical space is the system’s *niche* (Maturana and Varela, 1980, pp. 9–11; 1987, pp. 112–113). Conditions that prohibit autopoietic systems’ production of constituent components – such as the medium disrupting the organisation – however, lead to the disintegration of their production networks and, thus, the loss of its autopoiesis (ibid.).

### 2.2.3 Biological Autopoiesis

In order to prove and explain that “autopoiesis is necessary and sufficient for the occurrence of all biological phenomena,” the team focuses on demonstrating that “all the phenomenology of a living system can be either reduced or subordinated to its autopoiesis” (Maturana and Varela, 1980, p. 88). To do so, the team focuses on an individual living cell (Mingers, 1995, p. 13). A living cell consists of a membrane enclosing identifiable components such as *mitochondria*, the *nucleus*, and the *endoplasmic reticulum*. These components are in a constant chemical interplay with one another and their medium, ultimately giving rise to and sustaining themselves within the same physical space (Zelený and Hufford, 1992, pp. 147–148; Rose, 1970, pp. 11–18). In order to maintain this production process, essential chemicals are imported from the medium while malfunctioning components are systematically discarded.

Maturana and Varela (1980, p. 90) consider that at a cellular scale, autopoiesis can manifest explicitly by its vital cycle – where cell A divides into the same cell A’, cell A disintegrates leaving cell A’ as cell A existed before. However, “what is not trivial is how the cell is a molecular embodiment of autopoiesis” (ibid.) being it by the production of *constitutive*, *specification*, and *order relations*:

- Constitutive relations: The production of these relations “determines the topology of the autopoietic organization, and hence its physical boundaries”

(Maturana and Varela, 1980, pp. 90–91). In the cell, this relation occurs through the production of molecules that establish the necessary conditions of physical proximity, size, and shape for the components to maintain the relationships that define them.

- Relations of specification: Cellular molecules “determines the identity (properties) of the components of the autopoietic organization, and hence, in the case of the cell its physical factibility” (Maturana and Varela, 1980, p. 91). In other words, the components produced by the various production processes within the cell are the ones necessary for the continuation of the cell’s autopoiesis (Mingers, 1989, p. 162).
- Relations of order: The production of relations of order regulates “the concatenation of the production of relations of the constitution, specification and order, and hence its actual realization” (Maturana and Varela, 1980, p. 91). In other words, this relation of order regulates the appropriate amounts of components that need to be produced along with the rate and time.

These production of relations leads to a systemic closure that facilitates the ongoing circular re-production and maintenance of the cell as a whole. The molecular embodiment of autopoiesis is graphically illustrated by Maturana and Varela in Figure 2.2. The resulting illustration portrays a close network of multiple possible instances of production of relations that collectively constitute an autopoietic system. Maturana and Varela explain their illustration with the caption:

“All arrows that do not cross the boundary of the represented unity indicate production relations. The uniformly shaded areas, including the boundary line and the wedges, together with the names, indicate constitutive relations. The general form of closure with respect to production and constitution in a recursive network realized as a concrete unity through the preferential relations of the components within the network, indicate order relations and the consequent cleavage of the network as a simple unity from its medium. The whole represents a closed network of productions, but the arrows across the depicted constitutive boundary of the network indicate the necessary material openness of the system as it realizes the physical space” (Maturana and Varela, 1980, p. 90).

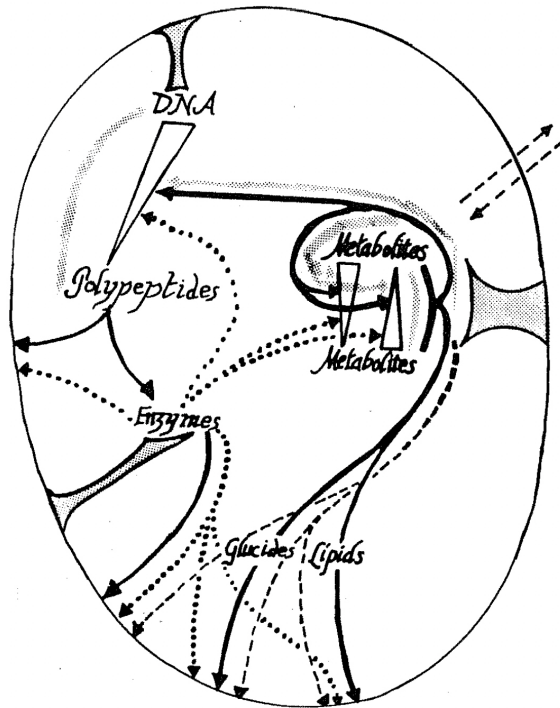


Figure 2.2: Representation of the cellular autopoietic network. Figure reproduced from Maturana and Varela (1980, p. x).

As a concrete molecular instance of multiple possible network of production of relations, I illustrate a eukaryotic cell, in which *proteins* are produced through the highly specific processes of *transcription* (*DNA* information is transcribed to *RNA* in the *nucleus*) and *translation* (*RNA* is decoded to form *proteins* in the *cytoplasm*). Many types of proteins can be produced, such as those constituting the cell membrane allowing the exchange of metabolites with the environment (see (1) in Figure 2.3). The external *metabolites* that enter the cell can join a previously created *enzyme* to form an *Enzyme Substrate* (see (2) in Figure 2.3). Such production of relations pertains to the previously defined topological substrate by the *production of constitutive relations*. The *production of relations of order* finally crystallises the interdependency between each production of relations – the *Enzyme Substrate Complex* regulates the production and transformation of molecules necessary for the remaining processes of the cell. Those processes happen simultaneously in a directly dependent course – where one process affects the others (see (3) in Figure 2.3). It controls the production speed of *constitutive relations*, *specification* and *order*, configuring the cell as a systematic invariant network.

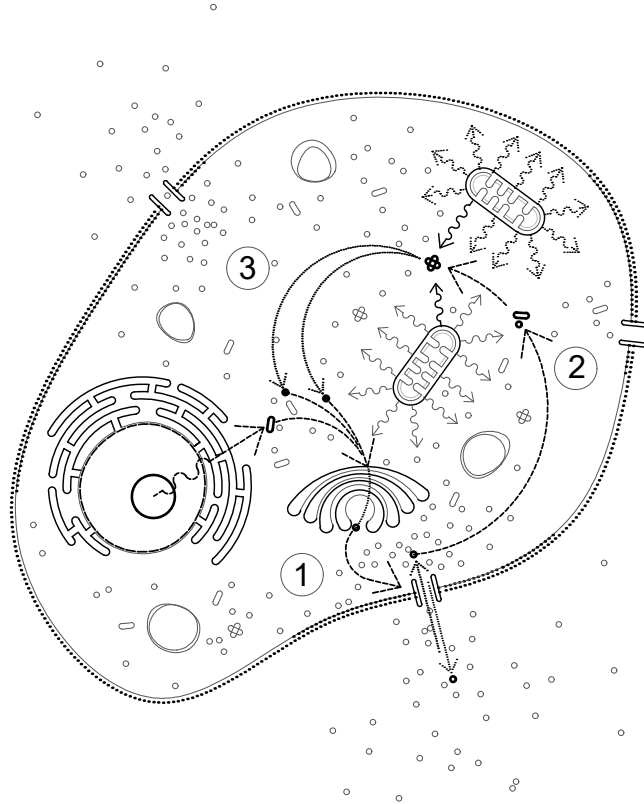


Figure 2.3: An example of autopoiesis embodied at the cellular level – cyclical causal interdependence between three types of *production of relations*.

#### 2.2.4 Prehistory of Varela's Model

Between formulating and publishing their theory of autopoiesis, Maturana and Varela (Varela et al., 1974, pp. 187–196) – based at the University of Chile's Department of Sciences in Santiago de Chile at the time – were joined by Uribe – then based at the *Biological Computer Laboratory* at the University of Illinois – to implement a computer-based demonstration of the theory, based on a cellular analogy (Varela, 1996, p. 414; Maturana and Varela, 2004, pp. 4–49; Varela, 2018, pp. 36–39).<sup>7</sup> The resulting computational model of the biological theory of autopoiesis, referred to by

<sup>7</sup>These three publications by Varela present the same content, but differ in their languages and formats. Initially, the text was published in Spanish as a preface to the sixth edition of the book *De Máquinas y Seres Vivos*. Years later, Varela's preface is translated into English in a journal article named *The Early Days of Autopoiesis: Heinz and Chile* (Varela, 1996), but some of the final remarks were excluded. Varela's original Spanish writing is reprinted in a small book called *Autopoiesis, Orígenes de una Idea* (Varela, 2018). For clarity, I will exclusively cite the English version, referring to the original Spanish preface only when discussing the omitted content.

the team as the “Protobe” (Varela, 1996, p. 413), implements autopoiesis as a two-dimensional *cellular automata* system.

Before formulating their simulation, Varela and the team were influenced by the various authors exploring cellular automata and related systems. Cellular automata models provide visual illustrations and validations of natural growth and production processes from precise rules that govern neighbouring *cells*<sup>8</sup> within a uniform infinite grid. In the following paragraphs, I will provide a chronological overview of authors who have investigated formal and physical configurations pertaining to some form of self-reproduction.

The computational simulation of cellular automata models was firstly introduced by John von Neumann together with Stanislaw Ulam but developed in the 1970s by Robert Schrandt and Ulam. Through the variations of recursive rules, which led to the exhibition of *motion* and *self-reproduction* phenomena in dying cells, they discovered patterns of growth (Schrandt and Ulam, 1970, p. 413). They illustrate these growing patterns by starting from a single alive cell (represented in black) and defining simple rules that specify when a new alive cell is formed (see Figure 2.4).

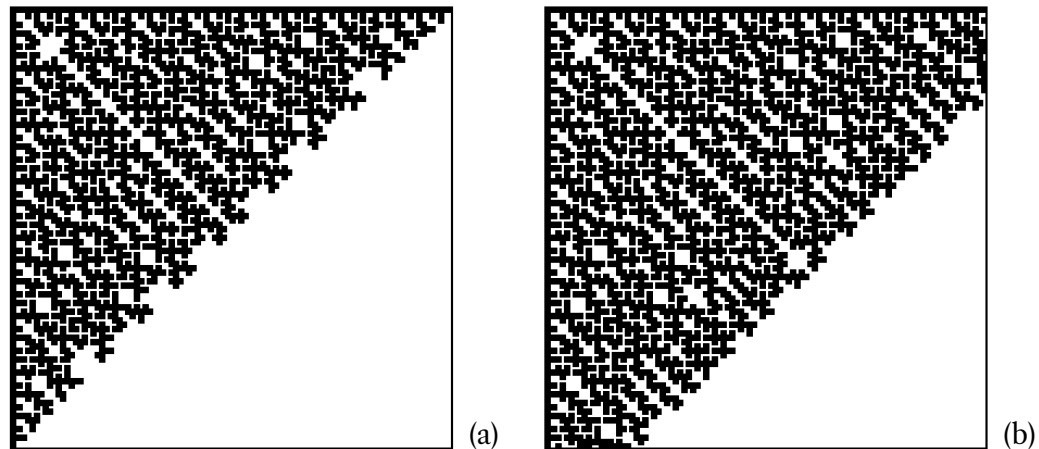


Figure 2.4: Two-dimensional pattern of growth. (a) After 100 generations; (b) after 120 generations. Generated based on Schrandt and Ulam (1970, p. 236).

John von Neumann used a computational model to explore the logical organisation that is sufficient for a machine to self-reproduces (1966, pp. 91–131;

<sup>8</sup>The term *cells* in cellular automata refers to the squares (or any geometrical form such as triangles) that belong to a physical and regular grid from where the model is illustrated.

Burks, 1970, p. 4). According to von Neumann (1966, pp. 83–87), to build a self-reproducing machine, it is necessary to copy the machine itself and duplicate the information that specifies it. To do so, he developed the *universal constructor*, a machine capable of storing and reading information from any other machine, and constructing an identical one using the information that was previously read (Burks, 1970, p. 43; Pesavento, 1995, pp. 339–340).

Building upon von Neumann’s cellular automata, Lionel S. Penrose and Roger Penrose (1957, p. 1183) demonstrated the biological phenomenon of reproduction using simple yet effective analogue mechanisms. They designed and constructed mechanical prototypes consisting of plywood units cut into specific shapes. These units were arranged on a track that facilitated unrestricted sliding while maintaining a constraint that prevented them from passing one another (Figure 2.5 illustrates one of their models). By varying the condition and complexity of these alike plywood units, Penrose, father and son, observed that a *seed* (i.e., a link peer) was necessary to activate the self-reproduction process.<sup>9</sup> They further observed that the *activated structure* needed well-defined boundaries to prevent attachments to units of the wrong kind while facilitating communication of its state to neighbouring units in close contact (Penrose, 1958, pp. 61–63).

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<sup>9</sup>For an audio-visual description of the experiments, see Penrose, L.S. and Penrose, R. (1957). Automatic mechanical self-replication. 16mm.

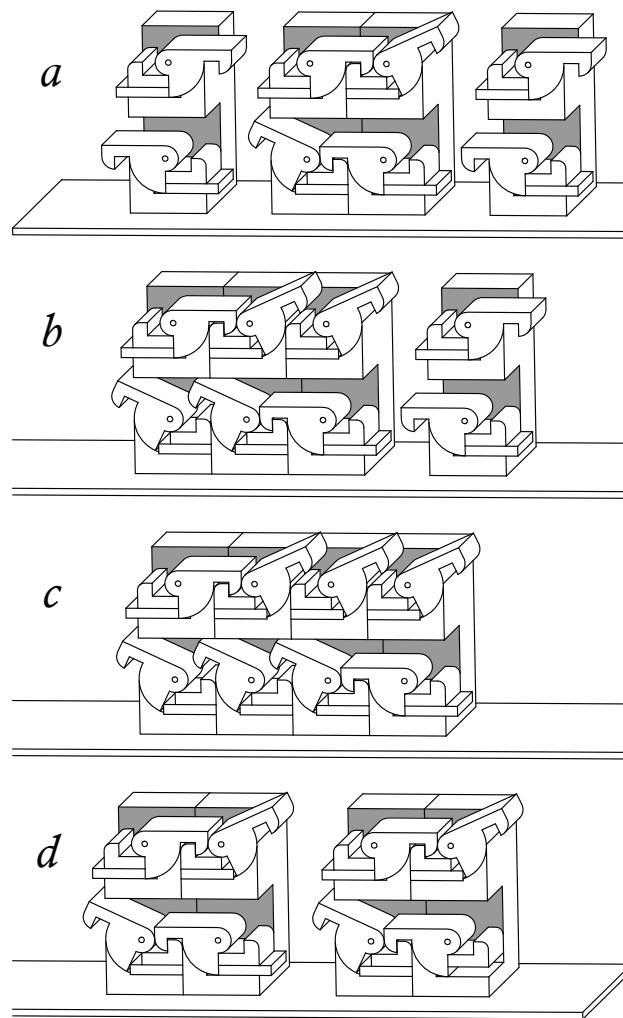


Figure 2.5: Illustration of the self-reproducing physical model posed in a four-step temporal sequence. Image redrawn from Penrose (1959, p. 110). “Cycle begins with linked group and two neutral units (a). Addition of neutral unit at left (b) causes one of two hooks in linked group to release. Addition of fourth unit (c) causes second hook in linked group to release. Linked group parts (d) in two replicas.”

The *Game of Life*, created by John Conway and initially presented by Gardner (1970, pp. 120–123), is one of the most well-known cellular automata implementations. It follows a set of simple rules that neither leads to an identifiable pattern nor any limits, resulting in unpredictable behaviour and seemingly endless growth.

Conway demonstrated visually that even the most elementary rules, or “genetic laws” (ibid.), can result in highly complex consequences (Sigmund, 1993, pp. 13–14). This cellular automaton served as a metaphor for life, where the essential rules of physics, chemistry, biology, and psychology are used to explain the most intricate structures in the world.

### 2.2.5 Varela’s Autopoiesis Model

Influenced by the different computational implementations of biological phenomena, particularly from von Neumann’s esoteric idea of cellular automata, Varela et al. (Varela et al., 1974, pp. 189–192; Varela, 1979, pp. 19–23) construct a highly formalised computational model of the biological phenomenon of *autopoiesis*. It illustrates a simple but cogent autopoietic system that forms self-enclosing boundaries and restores them when they collapse.

In their model, the positions of the infinite two-dimensional grid may be occupied by several mobile or immobile “particle” types, which correspond to different “components”: *substance* (a basic particle), *link* (a particle with bonding capability), *catalyst* (a rare particle in whose presence two substance particles may turn into a link particle), and the absence of particles: *void* (empty space in the grid). Substance and link particles may occupy the same cell at the same time. Neighbouring link particles may *bond*, thereby becoming immobile. A bond is a shared property of two neighbouring cells, not a particle type as such. With specified probabilities, bonds may disintegrate, releasing their link particles to become mobile again, and link particles may break down into two substance particles each. As is typical for cellular automata models, these transformation and mobility rules are performed, and the visual rendering of the overall model is updated in distinct time steps, giving onlookers an animated view of an *artificial chemistry* (Varela et al., 1974, pp. 189–190; Varela, 1979, pp. 19–21).

Due to the described rules, chains of bonded link particles tend to form around catalysts in larger “cellular” structures (consisting of multiple “particles”) with catalyst “nuclei” that are surrounded by bonded link “membranes.” The disintegration of bonds and the breakdown of link particles are offset by the synthesis of new links in the vicinity of catalysts and the establishment of new bonds between adjacent links. Coming apart in different places at different times, they are capable of self-repair,



likely being configured differently than their predecessors were. The shapes, sizes and locations of multi-particle cellular structures thus change over time (Varela et al., 1974, p. 191).

To observers of such models, these multi-particle cellular structures exhibit a notable, *life-like* tendency to maintain their identity over time despite their changing configurations and locations. Figure 2.6 shows how the system compensates the disintegration of the boundary by spontaneous decay of links while the ongoing production of links re-establishes the unit.<sup>10</sup>

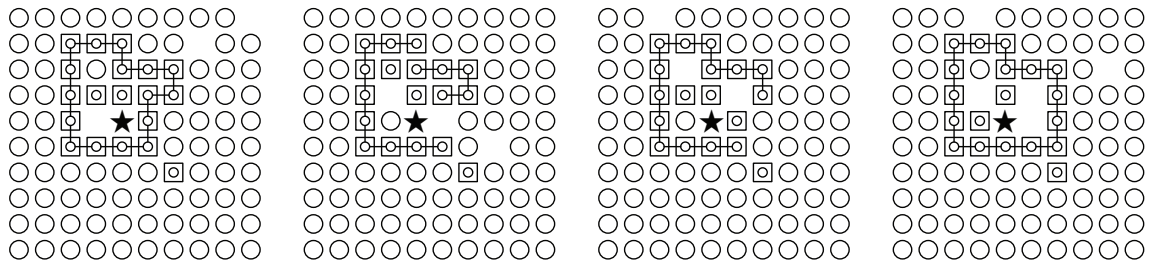


Figure 2.6: Four consecutive time steps of an autopoietic multi-particle cellular structure redrawn from Varela et al. (1974, p. 190).

The “Protobe” allowed its originators to test what their intuition had led them to expect – namely the spontaneous emergence of composite units that self-distinguish by maintaining “membranes” capable of self-repair, and, thereby, of counter-acting their simultaneous decomposition (Varela, 1996, p. 414). Beyond that, the model also has much potential to serve readers of the theory of autopoiesis as a cogently clarifying illustration. Discussions of autopoiesis published by the team, mainly in Spanish in the first instance, have occasionally been criticised for being somewhat ambiguous (Razeto-Barry, 2012, p. 547). The theory’s computational implementation, however, leaves little ambiguity about the kinds of temporo-spatial interre-

<sup>10</sup>Since this initial implementation from the early 1970s, several other researchers, mostly in the context of complexity studies and artificial life, have produced re-implementations of this model. Zelny (1977, pp. 13–28) re-implements and extend the original model. Jullien and McMullin (1995), as well as Mingers and McMullin (1997), produced two independent re-implementations in Pascal for MS-DOS. McMullin and Varela re-implemented the initial 1974 model using the UNIX-based SWARM simulation system (Askenazi et al., 1996) developed at the Santa Fe Institute. An adapted implementation has been presented by Suzuki and Ikegami (2009). A Python 3-based re-implementation based on McMullin’s (1995, pp. 5–19) description of Varela et al.’s (1974) initial implementation was presented in Fischer (2019, pp. 386–388) and its script code published in Fischer (2019).

relationships the theory refers to. Nonetheless, the “Protobe” remains relatively unknown, and only a small portion of the secondary literature on autopoiesis draws upon them for clarity.

### 2.3 Cross-Disciplinary Appropriations of the Theory of Autopoiesis

Since its inception in biology, the theory of autopoiesis has been given various interpretations and used to describe a range of different phenomena beyond biology (Bunnell and Riegler, 2022, p. 3; Varela, 2018, pp. 9–12). Most prominent among these adoptions is its use to describe the dynamics of systemic family therapy (in psychotherapy) (see, for example, Elkaïm, 1989), law (see Teubner, 1993), literary theory (see Paulson, 1988), social systems (see Luhmann, 1986; 1986), and recently architecture (see Schumacher, 2011; 2012) among others.

As Humberto Maturana informally explained to Pille Bunnell,<sup>11</sup> autopoiesis was the name his colleagues and himself used “to abstract the process that we call “life” (see Appendix B; Bunnell, 2011, p. 288). In my email exchanges with Bunnell, she explained that Maturana uses the term “abstract” in this context not as “the notion of an abstract concept, but rather the education, or drawing forth of what is a basic commonality for all situations that we call “life.” Despite the highly formalised computational model of autopoiesis and what Bunnell explained to me, Pablo Razeto-Barry (2012, pp. 544–545) argues that the concept has indeed a “high degree of abstraction,” which has led Maturana et al. and other scholars to use autopoiesis for new theoretical development in different fields while remaining largely unrecognised among biologists. In Mingers’s view (1995, p. 2), the broad appropriation is not because of the supposed degree of abstraction of the theory, but first and foremost because “autopoiesis addresses major themes and does so just at a time when they have become the preoccupation of many disciplines. [...] Second, because autopoiesis addresses these themes in an original and exciting way, turning traditional

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<sup>11</sup>Pille Bunnell is a system ecologist and second-order cybernetician. She has worked alongside Humberto Maturana for many years, engaging in extensive reflections and conversations as well as co-authoring numerous papers on cybernetics and biology. To her, Maturana was not only a friend but her mentor. I had the privilege of exchanging several emails with Bunnell on the subject of varying scales of autopoiesis discourse, which are included in Appendix B of this study.

philosophical problems such as autonomy, self-reference, and the nature of mind on their heads. Third, because the work as a whole has a consistency and coherence across a wide range of domains that is rare indeed.” In this section, I examine the appropriation of autopoiesis beyond its molecular scale, specifically in the fields of social science and architecture.

### 2.3.1 Varying Scales Within the Discourse of Autopoiesis

Appropriations of the biological theory of autopoiesis are already incentivised in the foreword of the seminal book *Autopoiesis and Cognition: The Realization of the Living*.<sup>12</sup> In it, Stafford Beer (Maturana and Varela, 1980, pp. 63–72) proposed that the notion of autopoiesis can be used to characterise not only molecular properties but also other types of systems. Despite Maturana and Varela’s (2004, p. 51) explicit disagreement with Beer, they acknowledge that autopoiesis could, in principle, be conceivable at various (physical and conceptual) scales.

Under the same biological process of autopoiesis, Maturana and Varela (1980, p. 90) distinguish two physical scales – cellular and molecular. At a cellular level, autopoiesis is manifested in the cell-division cycle, which requires the presence of autopoiesis at the molecular level. At this scale, the cell performs internal processes of self-reproduction and self-maintenance while its constituent elements are subject to disintegration (*ibid.*). Maturana et al. further extends the concept of autopoiesis to characterise a *multicellular* scale with their notion of “second order autopoiesis” (Maturana and Varela, 1987, p. 77; 1987, p. 77; 1980, pp. 110–111). At this level, multiple cells depend on the structural coupling between one another and their shared environment to realise their individual autopoiesis. As a result, the autopoiesis of these cells “become necessarily subordinated [...] to the maintenance of the autopoiesis of the higher order autopoietic unity” (Maturana and Varela, 1980, pp. 110–111). This subordination is presented at broader scales as Maturana together with Dávila and Ramírez (2016, p. 673) argue:

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<sup>12</sup>This seminal book is a reprinting of two key essays – *Biology of Cognition*, written by Maturana and *Autopoiesis, The Organisation of the Living*, written by both Maturana and Varela. This book also includes an extensive introduction by Maturana regarding his first essay and the foreword I am referring to in this section by Stafford Beer for the second essay.

“The validity of all that we say in this essay stands on the sensory-operational-relational coherences of our realization as *molecular autopoietic systems* in our daily living as human beings that operate as reflective persons doing all that we do and can do in our cultural present. And we do all that we do as we move in our daily living from home chores to science, technology, art, philosophy, child bearing or poetry as different manners of realizing our molecular autopoiesis alone as individuals or with others as social beings”

The possibility of conceiving autopoiesis beyond the molecular scale is also suggested in Maturana and Varela’s (1980, p. 81) sentence: “there may be many different kinds of autopoietic machines.” Furthermore, as Mingers (1995, pp. 124–125) points out, with Maturana’s definition of *unity* as “any entity (concrete or conceptual) separated from a background by a concrete or conceptual operation of distinction” (Maturana, 1975, p. 315) Maturana allows not only physical but conceptual applicability of autopoiesis. This implies that autopoietic systems “might consist of ideas, descriptions, or messages that interact and self-reproduce” (Mingers, 1995, pp. 124–125) aligning thus with concepts developed by other scholars such as Gordon Pask’s *Conversation Theory* (1975), Karl Popper’s *Third World* (1972) or Gregory Bateson’s *Ecology of Mind* (1973). Despite this apparent ambiguity between concrete or conceptual applications, however, the theory of autopoiesis “has been precisely and clearly specified for a particular domain – the physical” (Mingers, 1995, p. 321).

### **2.3.2 The Appropriation of Autopoiesis in Social Science**

Ever since Beer’s foreword (Maturana and Varela, 1980, pp. 63–72), in which he posits that: “human societies are biological systems,” numerous authors considered the possibility that human organisations, including social institutions, clubs, groups, businesses, and families, among others, can also be viewed as autopoietic systems. Instances include Claude Faucheux and Spyros Makridakis (1979), as well as Milan Zeleny and Norbert Pierre (1976), who establish a connection between the autonomy of living systems and human organisations. Or, Gareth Morgan (1986), who views the biological theory as a useful metaphorical tool for understanding how those organisations function. According to Mingers (1989, pp. 172–173), this cross-pollination into social science is because human organisations, in the form of social

institutions, are living systems that demonstrate long-term stability even when subject to internal structural changes caused by external environmental disturbances.

Years after the formulation of the biological theory of autopoiesis, the sociologist Niklas Luhmann extended the concept to a broader understanding of social systems, utilising it to construct a “macro” theory of society (Scott, 2021, p. 63). In Luhmann’s view (1986, p. 172), any system that is capable of reproducing its own components is autopoietic. Apart from *living systems* Luhmann (1995, p. 37) identifies two additional types of autopoietic systems: the *psychic* and the *social*. While components within the *living system* re-produce in virtue of life, the *psychic* does so through consciousness and the *social system* through communications (Seidl, 2004, p. 5). With a focus on the functioning of social systems, Luhmann (1982, pp. 13–132) characterises systems such as art, science, or politics as closed autopoietic systems of self-referential communications that re-constitute and re-produce themselves. In this view, social systems “use communications as their particular mode of autopoietic reproduction,” in which events (seen as ‘components’) of the system are periodically re-produced through the network of communication (Luhmann, 1986, p. 174). In appropriating the biological theory of autopoiesis, Luhmann (1985, p. 113) characterises social systems as *autonomous* entities that demarcate themselves from other systems of society, despite potential external perturbances. It is through the reproduction of communications that *meaning* is generated within the system. Through this process of *meaning production* and *meaning processing*, each system defines its own boundary, setting themselves apart from other systems of society (Luhmann, 1995, p. 37; 1989, p. 17; 1982, pp. 131–132). This is, in essence, what Luhmann (*ibid.*), building upon Maturana et al.’s theory, considers to be the autopoietic process of social systems.

This theoretical framework positioned Luhmann as a leading advocate and forerunner of the theory of autopoiesis, both within and beyond social systems. David Seidl (2004, p. 4) explains that this is due to Luhmann’s modification and integration of the biological theory of autopoiesis to align with his already consolidated concept of a differentiated society. Despite its widespread adoption, Luhmann’s appropriation has faced criticism, primarily from the originators of the original biological theory of autopoiesis. Maturana (Maturana, 1980, pp. 11–32; Maturana and Poerksen, 2011, pp. 106–107) responded to Luhmann’s theory appropriation with scepticism. He rejects Luhmann’s appropriation of autopoiesis due to its (supposed)

exclusion of relational involvement of living beings as the latter does not define social systems as aggregates of individuals. Maturana responds to Luhmann by stating: “thank you for having made me famous in Germany [...], but I disagree with the way in which you are using my ideas” (Maturana and Poerksen, 2011, pp. 106–107). And he explained “Molecules produce molecules, form themselves into other molecules, and may be divided into molecules” whereas “Communications, however, presuppose human beings that communicate. Communications can only produce communications with the help of human beings” (ibid.).

Maturana has further elaborated on his stance regarding the use of autopoiesis beyond the molecular level in personal communications with Bunnell (see Appendix B). He explained to her that the issue lies in the human ability to reflect and make choices: “people can think and choose to leave, to disobey, to innovate etc.” (ibid.). Only when the observed phenomena are not coming for a reflection prior to a choice can autopoietic phenomena be observed. In other words, only if the observed phenomenon is an entirely automatic reaction, not a human decision. Aligning with Maturana’s rejection of the utilisation of autopoiesis beyond the molecular domain, Varela (2018, p. 43) notes that such appropriations are based on “an abuse of language” (my translation from the original Spanish phrase: “un abuso del lenguaje”). Particularly referring to the appropriation of autopoiesis to family therapy, Varela (1989, p. 23) argues that negotiating the circulation of concepts between disciplines is essential. He emphasises that “we cannot simply and directly export or import such notions.” Accordingly, Varela clarifies that autopoiesis can only be observed beyond the molecular domain by continuing the idea – i.e., considering living systems endowed with interpretative capacities from their origin (Varela, 2018, p. 23).

Further criticising Luhmann’s theoretical approach, Bruce Scott (2012, p. 32) points out that Luhmann lacks crucial biological terms, resulting in “a partial metaphorical borrowing” and thereby leading to contentious debates and confusion. Following a similar line of reasoning, Whitaker (2012, p. 32) extends Scott’s criticism and questions Luhmann’s approach for “distorting both (a) those elements he selectively used and (b) the degree to which his theorizing innovatively applied them.” Mingers (1995, pp. 148–150) further criticises Luhmann’s appropriation and distinguishes six unresolved difficulties, three of which are particularly relevant in the context of this thesis: Firstly, the boundaries of the autopoietic system of communication remain undefined. Secondly, there is an undefined distinction

between *organisation* and *structure*. Finally, it is unclear whether social systems can be considered second-order autopoietic systems that emerge as a result of its molecular autopoiesis. Furthermore, Mingers (ibid., 1995, p. 151) argues that the result of Luhmann's (partial) metaphorical appropriation "have no greater claim on our attention" as it avoids interpreting autopoiesis objectively. Yet the problem arises from Luhmann's claim to objective truth while using autopoiesis metaphorically (ibid.).

### 2.3.3 The Appropriation of Autopoiesis in Architecture

The biological theory of autopoiesis gained increasing recognition in the design field during the early 21st century being prominently credited for its adoption in design practice with the architect Patrik Schumacher (2011; 2012). Before Schumacher's publication on autopoiesis, the British architect John Frazer (1995, pp. 102–103) referenced autopoietic dynamics alongside other biological phenomena such as metabolism or (auto)catalysis, to illustrate his vision of a "new architecture." With his systemic approach to architecture as a form of artificial life, Frazer hypothesised that architecture could adapt itself to environmental disturbances by emulating biological processes. More than a decade later, Nancy Diniz and Alasdair Turner (2007, p. 164) designed a wall with a responsive membrane capable of reconfiguring itself in response to environmental changes. Although their experiment demonstrated self-maintenance properties, they acknowledge that it lacked the essential autopoietic property of self-reproduction (auto-poiesis) (ibid.).

Based on autopoietic principles, Eduardo Lyon (2006, p. 324) advocates for a reformulation of the design process, shifting from linear object-based approaches to non-linear processes centred on design as networks of interconnected processes. Similarly, Ranulph Glanville (2007, p. 1192; reprinted in Glanville, 2019, pp. 49–50) in a paragraph of his seminal paper *Try Again. Fail Again. Fail Better: The Cybernetics in Design and the Design in Cybernetics*, argues that autopoietic dynamics can be observed in design processes. Design activities are recursive processes that regenerate themselves, resulting in independent and self-maintaining outcomes, much like living systems (ibid.).

Artist and architect Gins and Arakawa (2002, p. ix) postulate to work "in the fields of self-organization, autopoiesis, artificial life, and consciousness studies." In exam-

ining their appropriation of autopoiesis within their artistic and architectural works, Martin Rosenberg (2003, p. 165) critically argues that their utilisation of autopoiesis (coupled with other philosophical approaches they have appropriated) provides Gins and Arakawa's work a "conceptual/analogical landing sites that enables them to move beyond cognitive science and philosophy of mind to a profound reconfiguration of art and ethics" (ibid.).

Resonating with my ambition to examine strangely obvious-yet-vague connections between the built environment and living systems (see Section 1.1), the notion of autopoiesis has been appropriated by Patrik Schumacher. Schumacher is a prominent architect, writer, and educator. In 1988, he joined *Zaha Hadid Architects*, which has since emerged as a leading architectural firm at the forefront of international landmark architecture. Following the death of its founder Zaha Hadid in 2016, Schumacher became the firm's head. Both *Zaha Hadid Architects* and Schumacher himself have, at times, been the subject of political controversy (Murphy, 2011; Clark, 2014; Wainwright, 2016; Frearson, 2016; Richardson 2018). Schumacher teaches at the Architectural Association in London, the University of Applied Arts in Vienna, and Tongji University in Shanghai. His writings include the two-volume treatise titled *The Autopoiesis of Architecture*. Published in 2011 and 2012 in the wake of his earlier *Parametricist Manifesto* (Schumacher, 2008), Schumacher develops his appropriation of autopoiesis on the basis of Luhmann's appropriation of the biological theory of autopoiesis and positions it in relation to other architectural manifestos. While Luhmann (2000, pp. 45,60) did not see architecture as a separate function system of modern society but as a part of the fine arts alongside sculpture, painting, and poetry, Schumacher (2011, p. 13) describes architecture as an autonomous and differentiated subsystem of society which "deserves a monographic treatment." Schumacher (2011, pp. 4, 10) consolidates his "unified theory of architecture" as a subset of Luhmann's theory of social systems.

In this architectural theory, Schumacher describes architecture as a closed self-referential system of communication within the architectural discipline along Luhmannian lines (Schumacher, 2011, p. 8). That is, with a focus on exchanging verbal and visual communications within the professional and academic architectural community. Interested in the provision of professional service, and thereby applicable to the profession of architecture, the management cybernetician Allenna Leonard (1990, p. 5) offers the following "[n]on-examples" of autopoiesis (i.e., things she does



not consider autopoietic): “providing services to clients, curing the sick, training technicians, transporting goods,” among others. Leonard’s “[n]on-examples” seem to aim at distinguishing autopoiesis (self-production, unity of producer and produced) from “allopoietic” (other-production, distinction between producer and produced) (ibid.). While this approach does not seem to contradict Schumacher’s characterisation of communications within the architectural profession as autopoietic, it highlights a difference in my expectations of Schumacher’s theory and what it delivers. Where I anticipate insights into the dynamics of architectural self-production, Schumacher looks at the profession as distinct from its product.

Notably, according to Schumacher (ibid., 2011, pp. 2–3) himself, “the total mass of communications that constitutes this autopoiesis comprises diverse items such as sketches, drawings, CAD files, renderings, buildings and photographs of buildings that all circulate as communications.” Although one could argue that architects communicate through buildings (de Botton, 2006; Schumacher, 2011), Schumacher’s inclusion of “buildings” in the list of communicative formats challenges Luhmann’s framework of social communications and allows for alternative interpretations based on biological dynamics and urban interactions. This sensation of openness to different perspectives never disappears upon reading Schumacher’s theory and is likely to persist since a third volume is apparently in the making (see appendix A).

Notwithstanding this and other ambiguities (see Section 1.2), Schumacher (2011, p. 59) proposes his autopoiesis in conjunction with his own architectural “epochal style,” with the ambition to push the current convergence in architecture’s avant-garde – Parametricism – into the mainstream as an inevitable long-term stylistic successor to Modernism. In this regard, he describes historical transformations of architecture brought about by changes in architectural style as autopoietic. The theory advocates the unification of different architectural styles – with a particular understanding of style as a contemporary social condition that is continuously developing (ibid., 2011, p. 241). Accordingly, design research programmes (considered as historically variable communication structures) may affect and trigger new styles or formalise already-emerging ones (such as Parametricism) as a way of propagating design and architecture autopoietically (Schumacher, 2011; 2012).

Since Schumacher’s publication, there has been limited academic research building upon the biological theory of autopoiesis. Among this work stand out Tim Ireland’s and Emmanouil Zarouka’s (2015, p. 256) paper *Actuating (Auto)Poiesis*, in

which they argue that the concept of autopoiesis does not provide a mechanism for generating novelty in design due to the inherent integral nature of autopoietic systems in its constitution. However, they notice that autopoiesis “may be seen to share similarities with the notion of buildings as systems of spatial relations” and thus along the lines of Luhmann’s and Schumacher’s theories (ibid.).

Dennis Dollens (2015, pp. 14–15; 2017, pp. 19–46) uses the theory of autopoiesis to propose a research method for bio-generative metabolic architecture. In his work, Dollens (2015, pp. 14–15) critically approaches Schumacher’s appropriation due to its departure from the biological origins of autopoiesis. In alignment with my own observations when reading Schumacher’s architectural theory, Dollens (ibid.) notes that Schumacher “perpetuates confusion” by “not distinguishing how and when a system is autopoietic from how and when it is not – that is, how and when his theory of architecture accounts for buildings as living and cognitive, or how and why it does not.” Notably, Dollens’s critique aims to distinguish his approach from Schumacher’s autopoiesis rather than further enquiring into the source of this confusion.

With an aim to find out whether the theory of Parametricism is adequate in its goal to present digitalised design techniques as a new architectural style, Almantas Samalavičius (2020, pp. 359–360) looks at Schumacher’s *The Autopoiesis of Architecture* with scepticism. Samalavičius highlights Schumacher’s failure to address Maturana et al.’s critique of Luhmann’s theory and characterises Schumacher’s own theory as contradictory and ambiguous. He (ibid.) further observes that despite Schumacher’s attempt to demarcate himself from Modernism, “his perception of how aesthetic judgements are adopted remains stuck in the typically Modernist dogmatism.” He follows by arguing that “the role of an expert as the “high priest of value” was institutionalized in and by Modernist discourse” (ibid.).

Vytautas Petrušonis (2021, p. 57) explores a method for assessing the ability of architects based on their ability to identify autopoietic properties in urban development. In this context, Petrušonis critically assesses Schumacher’s understanding of autopoiesis, deeming it superficial. He further brings forth Graham McKay’s (2014) comment on his personal online post entry titled: *Is It Worth Reading Patrik Schumacher’s The Autopoiesis of Architecture?* where McKay posits that “If you do read it [Schumacher’s theory] I doubt you’ll be convinced Parametricism is the way architecture should be.”

Akin to my early associations between urban processes and autopoietic dynamics (see section 1.1), Buš et al.'s (2017, p. 697) identify autopoietic features of self-creating and self-maintenance processes in cities, proposing a computational design model to reflect these patterns. Despite their interest in the connection between built environment and autopoiesis, they neither acknowledge nor critique Schumacher's architectural theory on *The Autopoiesis of Architecture*.

## 2.4 Summary and Research Questions

In this review, I have examined positions and modes of cross-disciplinary appropriations of knowledge in the architectural domain in general and natural-scientific theories and terminology for the formation of architectural theory in particular. I have also documented an overview of the theory of autopoiesis and its cross-disciplinary appropriations, from biology to social science and, from social science to architecture.

The discipline of architecture is typically considered multifaceted by nature and thus limitless with respect to considering other sources of influence from neighbouring domains. While external fields such as philosophy and literature contribute to architectural thought and novelty, the impact of natural science is particularly predominant and influential. (This connection is illustrated in Figure 2.7.) The diverse ways in which architects appropriate natural-scientific knowledge show that this activity, while often performed as a matter of course, is essential for constructing the discipline as a whole. The ubiquity of such practices illustrates how the profession is openly and proactively exploring new conceptual connections, thereby enabling the formulation of design proposals, theories, and discourse. In this way, the appropriation of natural-scientific theory is integral to architecture's creative and intellectual cross-pollination and is encountered in its practice and academic sub-domains. Yet, many architects rarely explore the mechanics and consequences of such adoptions beyond vague and superficial narratives of creative inspirations and conceptual underpinnings.

Cross-disciplinary appropriation of knowledge relies on the different ways in which designers and architects use language. Language in architectural design discourse extends along a gradient from the precise and formally clear to the vague and



Figure 2.7: Illustration of the interest of this study – the connection between the scientific and architectural domain.

ambiguous. Architectural designers and researchers can find value anywhere along this gradient since architectural discourse expands across a wide range of perspectives. These perspectives encompass broad conceptual latitudes – from empirical principles to philosophical, theological and artistic principles, reflecting ideologies and aesthetic predilections. By comparison, discourse in the natural sciences is comparatively limited to avoid vagueness and ambiguity to ensure clarity. Notably, figurative language use, such as metaphorical or analogical connections, is fundamental in driving innovative thoughts in both science and design disciplines. Within design disciplines, this holds particular significance as figurative language serves as a well-spring of inspiration in the creative reasoning of architectural practice and forms the foundation for explaining and understanding architectural phenomena in the rational reasoning of academic research.

Architectural theory formation thus relies on this act of appropriating as much as it serves as inspiration in design practices. Architects who construct architectural theory not only appropriate but also assimilate the external body of knowledge into their own theories. This mode of operation often results in a partial loss of the original meaning, but it also leads to the acquisition of new properties that the field of architecture did not initially possess. As a result, a “metalanguage” is developed within

the discipline, enabling designers to articulate and express their thoughts about architecture and urbanism in both verbal and written form (Johnson, 1994, p. 44).

The biological theory of autopoiesis is among the various and numerous natural-scientific theories that have been appropriated in architecture. This biological theory offers a theoretical description of the organisation and nature of living systems. It describes the capability of living systems to perform processes of self-reproduction and self-maintenance while their constituent elements are subject to disintegration. Since its inception in biology, the theory of autopoiesis has been appropriated most prominently by the sociologist Niklas Luhmann to describe social processes of communication. While Maturana et al. describe autopoiesis as in-principle conceivable in non-living machines, they doubt whether autopoiesis can occur beyond the molecular scale. They approach Luhmann's appropriation of their notion with scepticism. For them, Luhmann fails to account for the human agency that communications entail. Despite the critical position of Maturana et al., the appropriation of autopoiesis in the field of social science is discussed and negotiated between equals facilitating the consolidation of discourse and knowledge.

Resonating with my ambition to examine strangely obvious-yet-vague connections between the built environment and living systems, the notion of autopoiesis has been appropriated in architecture by Patrik Schumacher, who in 2011 and 2012 published his self-proclaimed "opus magnum" (Schumacher, 2019) – a two-volume theoretical treatise entitled *The Autopoiesis of Architecture*. Based on Luhmann's autopoiesis, Schumacher characterises "architecture" as a self-contained, self-referential system of communication. However, given the title of Schumacher's two-volume theory, one might approach his work expecting a theory of living systems that sheds light on how biological development informs the built environment. With this understanding, Luhmann's appropriation of Maturana et al.'s theory of autopoiesis is expected to explain Schumacher's theory of architecture. As Schumacher's architectural theory unfolds, it becomes apparent that despite literally approaching architecture as a subset of Luhmann's social systems theory, Schumacher does not break away unequivocally from figurative references to Maturana et al.'s cellular biology and the dynamics of the built environment. Furthermore, given Schumacher's scholarly theory, one would expect his autopoiesis of architecture to address Maturana et al.'s critique of Luhmann's neglect of purposeful human agency and thus prioritise the dynamics unfolding the built

environment. Instead, I found an autopoiesis of architecture that focuses on the community of human agents who design, critique, and teach the production of the built environment. *The Autopoiesis of Architecture* offered thus little insights into the apparent connection between urban architectural spaces and biological systems, compounding my confusion about the merits of appropriations in architectural theory in general and Schumacher's theory appropriation in particular.

Since the publication of *The Autopoiesis of Architecture*, there has been very limited academic research building upon the biological theory of autopoiesis. Furthermore, the existing ones rarely relate to one another, or fail to construct an extended critique towards Schumacher's appropriation, which might help to develop a better appreciation towards the merits of his theory appropriation. With the intricacies of cross-disciplinary appropriations in architecture, the confounded route along which autopoiesis is appropriated in Schumacher's work, and the limited broader, structured discourse or coherent critique that has emerged from *The Autopoiesis of Architecture*, this begs the questions:

1. What are the merits of Schumacher's appropriation of the theory of autopoiesis from the perspective of academic architectural research?
2. How literally is this theory of autopoiesis to be taken, and to what ends?

## Chapter 3

# Research Methods

This chapter contextualises and reviews the research methods used in the remaining part of this thesis. It consists of two main sections and a summary. The first section (3.1) offers an overview and – with a view towards an analysis of Schumacher’s work – an examination and synthesis of several previously established text analysis methods, namely content analysis, argumentation analysis, rhetorical analysis, and, in greater detail, discourse analysis. The second section (3.2) then develops the mixed-method approach taken in this study based on the methods reviewed in the first section. It explains why the investigation of the research question presented at the end of the previous chapter calls for a mixed-methods text analysis approach, introduces several sets of previously established analytical categories that offer utility in this context, establishes an analytical framework from these methods and criteria, explains the sampling of passages from the source material for analysis, and develops modes of reasoning and interpretation by which I analyse and code the sampled text passages. This chapter then concludes with a short section (3.3) summarising the methods thus established.

### 3.1 Review of Text Analysis Methods

With architectural research ranging across technical, social, practical, academic, descriptive, and predictive interests, the methods used in architectural research vary significantly, contingent upon the contexts and objectives of particular inquiries. Following the earlier prioritisation of applied building over “talk,” it is now recognised that “[l]anguage is at the core of making, using and understanding buildings” (Thomas A. Markus, cited in Forty, 2000, pp. 11–12). In this sense, the investigation into the merits of the appropriation of the theory of autopoiesis in Schumacher’s two-volume theoretical treatise on *The Autopoiesis of Architecture* is situated well within the scope of contemporary architectural research. Yet, the accumulation, formalisation, and differentiation of text-based research methods have so far received limited attention within architectural research. This warrants the development of a purpose-designed mixed-method approach, leaning on approaches established in the social sciences, which have a longstanding tradition of scrutinising textual data.

Text analysis methods used in the social sciences and other adjacent fields vary based on the type and focus of the data being examined. *Narrative analysis* focuses on the analysis of texts that narrate their authors’ personal experiences (see Freeman, 2015, p. 21), *conversation analysis* focuses on the examination of transcribed conversations (see Myers, 2000, pp. 191–192), and *semiotic analysis* concerns itself with the meaning of messages enclosed in a sign system such as consumer products or publicity (see Penn, 2000, pp. 227–228), to name a few examples. While these methods do not align with the material and objectives of this study, other text analysis methods do. In the following sections, 3.1.1 through 3.1.4, I provide an overview, examination and synthesis of such methods, including *content analysis*, *argumentation analysis*, *rhetorical analysis* and *discourse analysis* which, in combination, form part of the purpose-designed methodology employed in this study. The varying degrees of dependence on these methods are reflected in the proportionality and level of detail presented in the respective sections. While a general overview of *content*, *argumentation*, and *rhetorical analysis* methods will be presented, the focus will primarily be on *discourse analysis* as it is the methodological framework for these and other text analysis methods, including the one developed and applied in this Ph.D. research project.



### 3.1.1 Content Analysis

*Content analysis* is a research method that involves identifying, quantifying, and analysing specific words, themes, or concepts within a given text to uncover underlying thematic or rhetorical patterns that run through the text (Huckin, 2004, p. 14). While most approaches to the study of texts are typically associated with qualitative research, content analysis has been developed as a quantitative research method owing to its objective statistical treatment of texts (Bauer, 2000, p. 132). However, according to Weber (1990, p. 10), “the best content-analytic studies use both qualitative and quantitative operations on texts.” Martin Bauer (2000, p. 132) concurs with Weber’s view, suggesting that content analysis is a method that “bridges statistical formalism and the qualitative analysis of the materials.”

The combination of both quantitative and qualitative analysis is implied in some definitions of the method. For example, Stone et al. (1996, p. 5) suggest that content analysis, “is any research technique for making inferences by systematically and objectively identifying specific characteristics within text.” Similarly, Krippendorff (1980, p. 21) defines the method as “a research technique for making replicative and valid inferences from data to their context.” And in Weber’s view (1990, p. 9), content analysis is “a research method that uses a set of procedures to make valid inferences from text. These inferences are about the sender(s) of the message, the message itself, or the audience of the message.”

These definitions inherently recognise content analysis as a method that focuses on the textual (and, at times, verbal) aspect as the fact and foundation from which the content derives. While other analytical approaches to texts, such as discourse analysis, examines not only the singularities of consolidated pieces of text but also “what is not said” (Gill, 2000, p. 180), content analysis “neglects the rare and the absent” (Bauer, 2000, p. 148). By neglecting the context and producing a systemic classification of words, phrases, or other units of text (coding), content analysis reduces a large amount of material into a particular focus of some of its features (Bauer, 2000, pp. 132–133; Weber, 1990, p. 12). In Siegfried Kracauer’s view (1953, pp. 631–632), this overemphasis on isolated units of analysis detaches citations from their context, which misleads the investigation, making it an inaccurate and imprecise analysis. Despite these criticisms, content analysis does identify patterns through the systematic classification of text, enabling valid inferences to be drawn *vis-à-vis*

the research question at hand (Krippendorff, 1980, p. 31). Typically, these results are then analysed statistically and represented using computational tools.

### 3.1.2 Argumentation Analysis

*Argumentation analysis* is a method to examine verbal or written material that takes the form of a discussion involving multiple individuals or a speech or text where a single person argues a position. Although often classified as a type of content analysis, argumentation analysis specifically focuses on analysing arguments that comprise a series of statements aimed at persuading a particular audience by justifying or refuting a standpoint (van Eemeren et al., 1997, p. 208; 2014, p. 7). The ambition of argumentative analysis is then to “document the manner in which [these] statements are structured within a discursive text, and to assess their soundness” (Liakopoulos, 2000, p. 167).

Like content analysis, argumentation analysis reduces “large amounts of material by capturing certain important aspects of the text and transforming them into units of analysis” (Liakopoulos, 2000, p. 167). To categorise these units of analysis, many approaches to this method rely on the framework developed by British philosopher Stephen Toulmin in his 1958 book (reissued in 2003) titled *The Uses of Argument*. In it, Toulmin (2003, p. 87) proposes a critical evaluation of the functioning of arguments by way of categorising them in terms of their structural basis, specifically *claims*, *facts* that support those claims, and premises (*warrants*) that asserts that the facts are legitimate to support the claim. He also emphasises that warrants may require *backing* to establish their sufficient authority if they are not immediately accepted (ibid., 2003, pp. 89–105). Under this analytical framework, “the merit of an argument is judged according to the function of its interrelating parts, and not on the basis of its form” (Liakopoulos, 2000, p. 154).

While Toulmin’s framework is widely used and has been highly influential in a range of disciplines concerned with argumentation (van Eemeren et al., 2014, p. 249), it has also met considerable criticism. This criticism is mainly due to its oversimplified approach to the intricate structures of sentence constructions (Ball, 1994, pp. 29–31) as well as the vagueness of its categorical definitions, which can result in numerous and diverse interpretations (van Eemeren et al., 2014, pp. 243–251).

### 3.1.3 Rhetorical Analysis

*Rhetorical analysis* is a method that examines the various aspects of a rhetorical situation, including the purpose, audience, writer, and context of a text, to investigate the reasoning behind the author's decision to employ specific rhetorical devices. While argumentation analysis focuses on assessing the validity of an argument by examining its structure, *rhetorical analysis* thoroughly explores the means of producing compelling arguments – i.e., following the Aristotelian view, the means of *persuasion* (Selzer, 2004, p. 280).

With interest to “understand better how particular rhetorical episodes are persuasive” (ibid., 2004, p. 281), rhetorical analysis “recovers the intentions of the speaker or author, discovers the systems of rules that organize the discourse, and evaluates the effectiveness of the intended persuasion by the effect on the audience” (Leach, 2000, p. 210). To guide their analysis, rhetorical analysts rely on the five *canons* (or categories) of rhetoric. These are (1) *invention* – which considers that the persuasiveness of the argument relies on the social status of the author (*ethos*), the appeal to emotions (*pathos*) and the logical construction of the argument to convince readers of their validity (*logos*); (2) *disposition* (also called *arrangement*) – which explores the organisation of the text; (3) *style* (or *elocutio*) – which connects the form of the argument and its context by virtue of figures of speech, such as metaphor, analogies, metonymy and synecdoche; (4) *memoria* – which involves recollecting the rhetorical resources of the writer; and (5) *delivery* (or *pronuntiatio*) – which explores the dissemination of a text and its context (Selzer, 2004, p. 284; Leach, 2000, pp. 213–217).

Acknowledging that rhetorical analysis pursues “the intention of authors and speakers and the intention ‘behind’ the behavioural or attitude changes of audience” Joan Leach (2000, p. 210) argues that these are, in part, dangerous if not fallacious assumptions. Uncovering an author's true intentions from the text under analysis can be difficult, if not impossible, and interpreting substantive information from changes in the reader's attitude is equally challenging. To address this limitation, Leach (ibid.) suggests focusing the analysis on “found” or “natural” discourses rather than text that require “second-guessing” such as interviews. Additionally, he argues that analysts should not judge arguments based solely on their potential persuasive value, but should consider them in the context of the entire discourse.

This approach avoids limiting the outcomes of the analysis to a mere interpretation of intentions, and instead allows for a more nuanced understanding of the discourse as a whole.

### 3.1.4 Discourse Analysis

*Discourse analysis* was originally introduced in the early 1950s by the American linguist Zellig Harris as a means to analyse the smallest unit of language with its own meaning, namely the morpheme (which may take the form of a word or a part of a word), and its interconnection with other elements within a text (Harris, 1981, p. 107). Over time, discourse analysis has expanded its scope to encompass not only linguistic analysis but also the exploration of social, cultural, and political meanings embedded in language use.

While some text-based methods, such as *narrative* or *content analysis*, are commonly discussed separately from discourse analysis, as I did myself in this review of the research methods section, they can still be useful analytical procedures for understanding how language constructs social, cultural and political meaning. Nelson Phillips and Cynthia Hardy (2002, p. 9) argue that the “microevents” examined in these approaches shed light on how narratives and content construct social experiences within broader discourse. Bridging the gap between the *micro* linguistic analysis and the *macro* impact of text, this method of discourse analysis becomes the methodological framework of multiple and diverse approaches to the analysis of texts. In this section, I will provide an extensive overview of discourse analysis, including various traditions and analytical procedures relevant to developing the methodology employed in this study.

#### 3.1.4.1 Language and Discourse

In recent years, most approaches to discourse analysis have been based on the premise that *language* ought to be conceived as “a form of social practice” (Fairclough, 1989, p. 22). Language is regarded as a neutral tool for reflecting on the world to establish a consensual domain of communication in society. From this perspective, language is not simply a means of representation, but rather a social activity that constitutes and shapes “our social and mental realities” (Karlberg, 2012,

p. 1). This constructive approach to language emerges as a response to the necessity of differentiating the use of language from traditional structuralist, poststructuralist, and postmodernist approaches, all of which considered language as a self-contained and rational semiotic system (Potter, 1996, p. 69; Gill, 2000, p. 173).

The idea that language can shape human thoughts and actions, has its origins in the work of philosophers such as Ludwig Wittgenstein and John Austin. Although Wittgenstein (1922, pp. 38–39) initially argued that language was descriptive of the world by picturing facts, he later abandoned this approach to consider language as a set of social actions (or activities) that serve different purposes (Wittgenstein, 1969, pp. 17–23). In the same line of thought as the ‘later’ Wittgenstein, Austin (1962, pp. 59, 70) emphasised the social nature of language and coined the term *speech acts* to describe the performative power of words. According to Austin, language is not merely a descriptive tool but a means of actively doing things, such as making promises or giving orders.

In the late 1980s, discourse analysts brought together diverse understandings of language to characterise discourse as both socially constitutive and socially shaped (Fairclough et al., 2011, pp. 357–358; Potter, 1997, p. 146; Karlberg, 2012, p. 1; Phillips and Hardy, 2002, pp. 2, 15). In this view, the relationship between discourse and language is “dialectical” (Karlberg, 2012, p. 2), in the sense that discourse frames communications in the medium of language. Within this dialectical relationship, “a coherent set of meaning” is constructed and disseminated within society, serving, particularly, “the interests of that section of society within which the discourse originates” (Fiske, 2010, p. 14). As a result, this process contributes to the redefinition of a specific domain of knowledge (ibid.).

According to the French philosopher Michael Foucault (1972, p. 82), meaning (discourse) is constructed through grouping statements (elements of text), which provide a set of assumptions, explanations, and expectations that facilitate or constrain the creation and understanding of a particular *object* (domain) of knowledge. Such discourse can also limit who can speak, what they can say, and where and when they can do so (Parker, 1992, p. 80). Deciding which statements are used implies stepping outside or inside the frame of discourse, thereby enabling a reflection on specific aspects of the domain while leaving other aspects at the margin. Notably, “there can be no statement that in one way or another does not reactualize others” (Foucault, 1972, p. 98). Norman Fairclough (2003, pp. 123–124; 1992, p. 28) argues, however,

that the construction of discourse is not limited to statements but occurs at multiple levels within a text. This includes the use of language, the construction of textual context, and the incorporation of external contextual elements from other works.

In Jacob Torfing's view (2005, pp. 6–9), these different approaches to discourse are “generations or traditions” that understand discourse differently. To him, the first generation views discourse in a narrow linguistic sense, while the second generation extends this view to encompass broader social and cultural practices. The third tradition sees discourse as a broader concept covering all social phenomena (*ibid.*). In other words, the understanding of discourse moves from considering language as a unified system, to a systemic connection of such language with other established bodies of work (Shotter, 1993, p. 25). In this view, a text, as an individual unit of language, is considered “a *discursive unit*,” which is a “*material manifestation of discourse*” (Chalaby, 1996, p. 688). However, these discursive units “are not meaningful individually; it is only through their interconnection with other texts, the different discourses on which they draw, and the nature of their production, dissemination, and consumption that they are made meaningful” (Phillips and Hardy, 2002, p. 4; *ibid.*).

### 3.1.4.2 Discourse Analysis and its Characteristics

As mentioned above, discourse analysis emerged from a conception of language not solely as a means of representation but rather as “a form of social practice” (Fairclough, 1989, p. 22) that constitutes and shapes “our social and mental realities” (Karlberg, 2012, p. 1). Accordingly, discourse analysis is argued to encompass four key tenets: Firstly, it adopts a critical position towards taken-for-granted knowledge, which entails scepticism towards an objective observation of the world. Secondly, discourse analysis recognises that the world is historically and culturally relative to the observers. Thirdly, it assumes that knowledge is socially constructed, and that, in turn, social processes determine how to understand the world. And fourthly, discourse analysis is committed to exploring the connection between knowledge (i.e., the social construction of people, phenomena or problems) and actions/practices (Gill, 2000, pp. 172–173; Burr, 1995, pp. 2–4).

Its constructivist foundation sets discourse analysis apart from most other qualitative research methods (Phillips and Hardy, 2002, pp. 2, 6). While many other text-

based methods are limited to analysing text as a means to access some other reality, discourse analysis examines the texts that constitute the discourse in its own right, whether in the form of natural conversations or formal writing. By analysing language through its rhetorical organisation, discourse analysis unearths the discursive mechanisms that construct meaning as constitutive of the social world (Gill, 2000, pp. 172–173; McCarthy, 1991, p. 5; Shaw and Bailey, 2009, pp. 413–418; Phillips and Hardy, 2002, p. 2). It can be said thus that discourse analysis is essentially manufactured from pre-existing linguistic resources that construct the world we live in (Potter and Wetherell, 1987, pp. 33–34; Gill, 2000, pp. 174–175).

From this understanding of language as constructive and constructed, discourse analysis views *discourse* as a form of *social practice* and, thus, a form of action. It can be used to blame, make excuses, and criticise, among many other acts. This perspective highlights the notion that discourse does not occur in a social vacuum but rather is continuously oriented towards an *interpretive context* that shapes the way in which we construct our language (Gill, 2000, pp. 174–175; Phillips and Hardy, 2002, p. 4; Fairclough and Wodak, 1997, p. 277). As Gill (2000, p. 175) notes, even seemingly objective descriptions can have multiple meanings depending on the interpretive context in which they are situated. For example, the sentence ‘my car has broken down’ can be an implicit request for a ride when said to a friend, an accusation or blaming when said to the person who sold you the car, or an excuse or mitigation when said to a tutor for whose lecture you were late (*ibid.*, 2000, p. 176). Therefore, discourse analysis places special emphasis on understanding the interpretative context that shapes and is shaped by the discourse being analysed.

Given that discourse emerges from social interactions between equals, it is thereby frequently influenced by ideological perspectives (Fairclough and Wodak, 1997, p. 277; Gill, 2000, p. 175). Even seemingly trivial statements can be imbued with ideology, shaping our perceptions of social reality in a desired manner. Considering talks and texts as ideological constructs that shape our perception of the world, discourse analysis explores how discourses aim to establish a particular version of reality over competing ones. It examines how such discourses are structured to be persuasive, such as by analysing the persuasive strategies used by politicians to influence others to adopt their worldview (Gill, 2000, p. 176).

As Rosalind Gill (2000, p. 177) points out, there is no single method of discourse analysis but many different styles of analysing discourse that claim the same name.

This is because, the method, which grew from linguistics, semiotics, psychology, anthropology, and sociology (McCarthy, 1991, p. 5), has expanded beyond these social science and humanities domains creating multiple interpretations of the same method. Indeed, the method is commonly used in the discipline of architecture, which itself is rooted in various discourses that extend beyond its singular domain of origin (Dorst, 2006, p. 15). Examples of discourse analysis in the field of architecture include approaches that critically analyse the link between buildings and their textual description (see, for example, Markus and Cameron, 2002), or studies that examine how architectural students present their work in educational settings (see, for example, Melles, 2008). Schumacher himself characterises his *The Autopoiesis of Architecture* as “an elaborate *discourse analysis*” of the discipline of architecture (Schumacher, 2011, p. 11). He proposes it in conjunction with his own “epochal” architectural style, proclaiming Parametricism as an inevitable long-term successor to Modernism, concluding with a call to readers to “join Parametricism’s drive to conquer the mainstream of world architecture!” (ibid., 2011, pp. 735–736).

### 3.1.4.3 Some Approaches to Discourse Analysis

The different approaches to the analysis of discourse in the medium of language result in different interpretations and applications of the same method (Stubbe et al., 2003, p. 351; Watterson, 2019, p. 38). In the following sections, I review three of the most prominent and well-established approaches to discourse analysis, namely: *discourse psychology*, *Foucauldian discourse analysis* and *critical discourse analysis*. Although these approaches share similarities, each one offers unique insights that inform the purpose-designed methodology employed in this study.

#### 3.1.4.3.1 Discourse Psychology

This approach to discourse analysis emerged in the late 1980s as a critical response to the prevailing cognitive psychology perspective, which considers that people’s behaviour is determined by cognitive states. Opposed to this approach and influenced by other forms of discourse analysis, *discourse psychology* considers cognitive psychology as the study of social cognition – in other words, the study that examines “how individuals perceive, categorize, interpret the social world, represent it



mentally, make inferences about it, explain it causally, such that the social lives of individuals flow from how they perceive, hypothesize or reason about each other” (Edwards and Potter, 1992, pp. 13–15; Potter, 1998, pp. 234–235). Discourse psychology thus recognises the profound impact that discourse, in the form of both talks and texts, has on the formation of social institutions such as family, religion, economic systems, and legal systems (Hepburn and Wiggins, 2007, p. 38). Furthermore, it acknowledges that psychological concepts, including emotions, are not innate but rather socially constructed through discourse (Potter, 1998, pp. 234–235). As a result, the meaning and significance of emotions are heavily influenced by the discursive practices prevalent in a given society. In this context, language is considered a cultural medium for thought and action, embedded within the discourse of everyday social practices (Edwards and Potter, 1992, pp. 13–15; Potter, 1998, pp. 234–235; Stubbe, 2003, p. 372).

By analysing “interpretative repertoires” or patterns of language use (Potter and Wetherell, 1987, p. 146), discourse psychology recreates and sustains broader patterns of social inequality (Stubbe, 2003, p. 372). The resulting analysis of the discourse is a solid outcome that produces “a rigorous analytic programme of mainly qualitative research” (Potter, 1998, p. 236). Discourse psychology thus offers a valuable analytical framework for examining the linguistic and discursive resources used to justify social practices – both to this study and to others (Potter, 1998, p. 235; Edwards and Potter, 1992, p. 17).

#### **3.1.4.3.2 Foucauldian Discourse Analysis**

Foucauldian discourse analysis is rooted in Michael Foucault’s understanding of social practices and objects as products of discourse (Hall, 1992, p. 291). These discursive constructions are based on “subjective positions,” i.e., different ways of seeing and being in the world (Willig, 2015, pp. 153–154). For example, “within a biomedical discourse, those who experience ill health occupy the subject position of ‘the patient’, which locates them as the passive recipient of expert care within a trajectory of cure” (ibid.). Foucault and Foucauldian discourse analysts are interested in this social process of legitimation and power that enable certain social practices while limiting others. Furthermore, they examine the historical perspective of these discursive mechanisms through what Foucault (1977, pp. 148–149) named *genealogy*,

which explores the socio-historical circumstances that led to changes in discourse over time (ibid.; Hook, 2005, p. 3).

Certain discourses have gained dominance over others, favouring “those versions of social reality which legitimate existing power relations and social structures” (Willig, 2015, pp. 153–154). Some of these discourses have become naturalised or *common sense*, despite being based on claims that lack evidence or explanation. These types of taken-for-granted statements are what Foucault (1990, p. xvi) named *self-evident* and is *counter-discoursed* under Foucauldian discourse analysis “to disturb people’s mental habits, the way they do and think things, to dissipate what is familiar and accepted” (ibid.). Foucauldian discourse analysis thus evaluates language and its use to shed light on how discourse shapes power and knowledge relations in society (Cheek and Porter, 1997, pp. 108–109). By presenting alternative conceptions of knowledge, Foucauldian discourse analysis encourages alternative ways of thinking about specific events in particular times and places. These alternatives to established norms demonstrate how certain discourses are meant to control a targeted population (Mills, 2003, p. 76). The interest in disclosing power dynamics and challenging self-evident statements that perpetuate such power structures has become essential for developing the methodology employed in this study.

### 3.1.4.3.3 Critical Discourse Analysis

Critical discourse analysis is a Foucault inspired form of discourse analysis. While there are many different approaches to critical discourse analysis, they all share the belief that “social theory should be oriented towards critiquing and changing society as a whole, in contrast to traditional theory oriented solely to understanding or explaining it” (Wodak and Meyer, 2009, p. 6).

According to Teun van Dijk (1993, pp. 249–250), critical discourse analysis focuses on the role of discourse in the “*(re)production and challenge of dominance*.” In this context, “*dominance*” refers to the exercise of social power by elites, institutions, or groups that result in social inequality, and the term “*(re)production*” refers to the various *modes* of discourse, including “enactment representation, legitimation, denial, mitigation or concealment of dominance, among others” (ibid.). *Ideologies* as “particular ways of representing and constructing society” are not foreign to the interest and focus of critical discourse analysis (Fairclough and Wodak, 1997, p. 275).

They are features of the discourse that “reproduce unequal relations of power, relations of domination and exploitation” (ibid.; Fairclough, 2001, pp. 121–124) and, therefore, are an essential part of the different forms in which power abuse is exercised. With this focus, critical discourse analysis aims to uncover the structures, textual strategies or properties that enable modes of “power abuse and the injustice and inequality” (Fairclough and Wodak, 1997, pp. 250–252). These modes of power abuse are prevalent in the discipline of architecture, making this method a valuable tool for taking a critical stance towards Schumacher’s theory appropriation.

#### 3.1.4.4 Review of Discourse Analysis Procedures

The three forms of discourse analysis presented above do not exhibit drastic variances but rather a slightly different lens to examine the same interaction (Stubbe et al., 2003, p. 380). For example, while the three types of discourse analysis focus on the broader socio-political contexts of existing social discourses, Foucauldian and critical discourse analysis focus mainly on those discourses related to power. The most notable distinction lies in critical discourse analysis, which adopts an explicit socio-political stance, in contrast to Foucauldian discourse analysis and discourse psychology. As van Dijk (1993, p. 252) explains, researchers employing critical discourse analysis are required to “spell out their point of view, perspective, principles and aims, both within their discipline and within society at large.”

Notably, none of these traditions, including others, lend themselves to a procedural description that can be adopted and followed. Instead, each discourse analysis method must be individually accommodated to the unique nuances of the research problem and question at hand (Jorgensen and Phillips, 2002, p. 76). However, most approaches to this method follow similar guidelines. In Fairclough’s view (1992, p. 225), every discourse analysis comprises three main steps: the data (collection), the (data) analysis, and the results. To him, each discourse analysis should expand upon these three basic steps to arrive at a justifiable argument. Gill (2000, pp. 177–181), in the tradition of discourse psychology, but applicable to other forms of discourse analysis, builds on Fairclough’s steps and adds: the process of *asking different questions, transcription, and coding* the data. Further splitting the process of doing discourse analysis, Potter and Wetherell (1987, pp. 160–176) propose ten non-consecutive stages: the *research questions, sample selection, collection of*

*records and documents, interviews, transcription, coding, analysis, validation, the report, and the application.* In the following section, I outline the procedures that inform this study, disregarding those that have no impact due to the nature of this investigation. I further incorporate observations made by others in the practice of discourse psychology, critical discourse analysis and Foucauldian discourse analysis.

#### 3.1.4.4.1 Sample Selection

Discourse analysis is a method of analysing various forms of communication, such as recordings, archives (texts and documentaries/videos), interviews, and, in certain instances, experiments. It is, however, a time-consuming and labour-intensive process that deals with a large amount of data, presenting a challenge for scholars who must decide on the appropriate sample size to collect and analyse (Potter and Wetherell, 1987, pp. 161–162; Wood and Kroger, 2000).

Jonathan Potter and Margaret Wetherell (1987, pp. 161–162) caution that collecting too many samples may hinder the identification of linguistic details and add unnecessary work to the already labour-involved analysis. They argue that in some instances, the focus may be on turn-taking, where a single conversation might be sufficient as it can provide numerous instances of role exchange between the listener and the speaker. Therefore, the success of the study does not necessarily depend on a large number of samples but rather on the identification of sources that are likely to provide compelling and relevant information *vis-à-vis* the scope of the study. Even so, it is crucial to ensure that the sample size is adequate to provide a comprehensive and precise characterisation of the material under examination and to gather enough data to support justifiable arguments. Bauer and Aarts (2000, p. 20) share Potter and Wetherell's perspective, stressing the importance of collecting sufficient samples to avoid losing information from the discourse. However, they argue that "the larger the sample, the smaller is the error margin of these estimates."

Although there is a shared desire to gather sufficient data to support valid arguments and avoid omitting critical information of the discourse, there is no clear consensus on what constitutes a sufficient sampling, nor is there a standardised process for selecting appropriate samples. Ultimately, the decision regarding sampling techniques rests with the researcher.

#### 3.1.4.4.2 Coding

Coding plays a crucial role as a preliminary step in analysing discourse. Fairclough (1992, p. 230) notes that it is particularly important because it allows researchers to handle large amounts of sampled data by breaking it down into manageable segments. In Potter and Wetherell's view (1987, p. 167), coding serves not only to manage a large number of samples but also as a preliminary analytic step that prepares the way for a more in-depth data analysis. By codifying the data set, researchers attribute predefined categories to phrases in the text facilitating the text's manageability and subsequent in-depth analysis.

In order to facilitate the systematic identification of patterns in the text, Gill (2000, p. 179), as well as Potter and Wetherell (1987, p. 167), propose starting from a categorisation of the text based on the initial interest and research question at hand. From then and throughout a preliminary examination of the data set, the researcher can expand or reduce the number of categories (or *themes*) depending on the necessities of the analysis. The categorisation can (at times) be straightforward – for example, mentions of a word or phrase linked to the nature of the research question – while, on other occasions, the coding may not appear conspicuous and thus require some preliminary analysis (Potter and Wetherell, 1987, p. 167; Gill, 2000, p. 179). The coding is, therefore, in these cases, a process that constantly moves from analysing to categorising and vice versa.

As suggested by Potter and Wetherell (1987, p. 167), the process of coding should be as inclusive as possible. It should include all marginal cases because their relevance may not be apparent until the formal analysis is conducted (*ibid.*; Gill, 2000, p. 179). Potter and Wetherell (1987, p. 167) also stress that before embarking on the categorisation phase, researchers must first become familiar with the collected material, similar to how ethnographers must immerse themselves in the culture they examine.

#### 3.1.4.4.3 Analysis

The analysis phase of a discourse explains how the discourse is formatted to achieve effects or consequences in the context from where it emerges. Potter and Wetherell (1987, p. 168) explain that this is accomplished by examining the actions performed

in discourse and the manner in which they are executed. However, there is no systematic approach on how to do so that parallels well-controlled experiments.

Notably, in the tradition of discourse psychology, Potter and Wetherell (ibid.) describe the analysis process as consisting of two interrelated phases. The first one implies a search for patterns – those can be in the form of “variability: *differences* in either the content or form of accounts” and “consistency: the identification of features *shared* by accounts.” The second analysis phase entails identifying potential functions and effects of the discourse and searching for linguistic evidence within the material under analysis. In the tradition of critical discourse analysis, Fairclough (1992, p. 231) considers the analysis of the discourse as jumping between scales – from *macro* to *micro*, i.e., from (social and political) context to linguistic focus. Stubbe et al. (2003, pp. 378–380) view these seemingly different approaches as complementary to one another suggesting that the search for patterns and the identification of possible functions and effects do not preclude the importance of bridging macro and micro approaches to text analysis.

According to Potter and Wetherell (1987, p. 168) the skills required to develop a discourse analysis are honed through the process of performing the analysis itself. Nonetheless, they identify two primary skills that are essential for conducting discourse analysis: reading and interpretation. In their view, our everyday reading tends to produce “a simple, unitary summary, and to ignore the nuance, contradictions and areas of vagueness.” Conversely, during discourse analysis, reading is focused on the details of the discourse, including what is said, i.e., identified solutions to pre-established problems, and what is not said, i.e., the *silence* (Gill, 2000, p. 180). By drawing upon what is not said, the analyst implicitly produces a particular interpretation of the discourse (ibid; Fairclough, 1992, p. 231). Therefore, to construct a rigorous interpretation of the discourse, the analysis must move from interpretation of the reading to description of the texts.

#### **3.1.4.4.4 Validation**

In order to construct a rigorous and trustworthy analytical argument, discourse analysts develop techniques that enhance (but do not guarantee) the validity and reliability of their analysis (Potter, 1996, pp. 20–22). Even though validity and reliability are often considered distinct forms of evaluating the quality and credibility of the

analysis – in which validity tests whether the instrument is accurate and appropriate for its intended purpose, and reliability assesses, in a quantitative manner, whether the instrument yields consistent and reproducible results – Potter (ibid., 1996, p. 20) argues that they “are not so clearly separated in discourse work”. This lack of clear separation is primarily attributed to the non-quantitative nature of discourse. In this context, Potter and Wetherell (1987, pp. 169–172) identify four primary techniques used to assess the reliability and validity of the analysis: *Coherence*, *participants’ orientation*, *new problems* and *fruitfulness*. Potter (1996, p. 20) refines these techniques into four considerations, with the same focus and scope: *deviant case analysis*, *coherence*, *readers’ evaluation*, and *participant’s understanding*.

- *Deviant case analysis*. This technique concerns the (analysed) cases that seem to go against or beyond the possible discursive pattern identified. Those *deviant* cases do not necessarily negate the pattern but corroborate its potential in the discourse (Potter and Wetherell, 1987, p. 170). In Potter and Wetherell’s view (ibid.), if there is an explanation for the case being off the pattern, it suggests that the scope of the scheme is correct. However, if there is no explanation, “the exclusive nature of our scheme must be questioned.”
- *Coherence*. This technique entails that the analytic claim developed should be consistent with an already established body of discourse (Potter and Wetherell, 1987, pp. 169–172). If there are features of the discourse that do not align with the explanation of broad patterns, the analysis will be deemed invalid or unreliable. However, if the interpretive argument aligns with established patterns but brings new nuances to the forefront, the analysis is considered coherent (ibid.; Potter, 1996, p. 20; Gill, 2000, p. 187).
- *Readers’ evaluation*. To ensure the academic rigour and validity of discourse analysis, Potter (1996, p. 20) suggests that the analysis should be presented in a way that enables readers to evaluate the interpretative analysis. This involves providing evidence, such as the original materials collected, which supports the arguments and the interpretation itself. This approach enables readers to assess the analysis critically and offer alternative interpretations.
- *Participant’s understanding*. One way to assess the validity of the constructed interpretative argument is by considering the perspectives of the interviewees

themselves, whenever interviews have been conducted (Potter, 1996, pp. 21–22). “It is not sufficient to say that as analysts we can see that these statements are consistent and these dissonant; the important thing is the orientation of the participants, what they see as consistent and different” (Potter and Wetherell, 1987, p. 170). If the participants have no orientation towards the suggested inconsistency in the analysis, it raises doubts about the reliability of the findings (ibid.).

Given its nature and emphasis on the appropriation of the theory of autopoiesis in Schumacher’s theory of architecture, this study focuses on the first three of the four techniques outlined above. These techniques will be outlined in more detail in Section 3.2.5.

### 3.2 Method in this Study

The methodological framework used in this study is based on the primary research question, which arose from a combination of personal experiences and influences, namely my observations of urban processes, association of these processes with biological processes, the expectation that Schumacher’s appropriation of the theory of autopoiesis might help clarify how urban processes and biological processes relate, and, finally, the body of literature outlined in chapter 2. The research question is: What are the merits of Patrik Schumacher’s appropriation of the theory of autopoiesis from the perspective of academic architectural research?

To enquire into the merits of Schumacher’s appropriation of the theory of autopoiesis, I employ a set of methods – many of which were reviewed in section 3.1 – centred around analytical procedures of discourse analysis. I apply these methods to my primary data set – Schumacher’s two-volume theoretical treatise, *The Autopoiesis of Architecture*. Even though I qualify the methodological approach in this study as a discourse analysis, it is arguably considered a full-fledged discourse analysis. I am using the term ‘discourse analysis’ somewhat loosely, given varying uses of the term and methodological modifications at three levels: First, Schumacher argues that “the discipline of architecture [may be characterised] as an integrated *discursive practice*” and that his methodological approach in *The Autopoiesis of Architecture* may therefore be characterised as “an elaborate *discourse analysis*” (Schumacher,



2011, p. 11). From an academic research perspective, this characterisation appears disputable, as his analysis relies more on personal reflections concerning broad disciplinary and social practices rather than on verifiable and quotable sources, as I mentioned above and as I will reiterate throughout the analysis of his architectural theory in Chapter 4 and discuss in more detail in Chapter 5. It is especially disputable given the common understanding of discourse as constituted by the use of language in the form of texts (or utterances) in mutual relationship with other texts (or utterances)<sup>1</sup> (Fairclough et al., 2011, pp. 357–358; Phillips and Hardy, 2002, pp. 4–5; Karlberg, 2012, p. 2). Second, my own analysis is largely limited to samples from Schumacher's *The Autopoiesis of Architecture* rather than a broader body of discourse comprising a plurality of voices. This is due to Schumacher's above-mentioned reliance on his own reflections rather than on quotable text, as well as on *The Autopoiesis of Architecture* having yet to result in a sustained critique or discourse consisting of quotable sources of its own. Third, while my methodological framework is generally based on discourse analysis, it is subject to some project-specific constraints and extensions. Specifically, I am using a discourse-analytical approach that is structured around an explicitly defined set of language uses and merits of theory appropriation, previously proposed by Ostwald (1999).

Despite the necessity to adapt and extend with other methodological approaches the method of discourse analysis due to, primarily, the nature of the data analysis, I consider the nature of discourse analysis and its different traditions – particularly the ones of *discourse psychology* (Potter and Wetherell, 1987; Edwards and Potter, 1992; Potter, 1998), *Foucauldian discourse analysis* (Foucault, 1990; Cheek and Porter, 1997) and *critical discourse analysis* (van Dijk, 1993; Fairclough and Wodak, 1997; Wodak and Meyer, 2009) – appropriate to frame the analysis of cross-disciplinary theory appropriation in general, and Schumacher's theory appropriation in particular. The following section (3.2.1) will outline the reasons why this is so, and the rest of this chapter will present the purpose-designed methodology employed in this study, which incorporates other sets of procedures and analytical categories of language use and merits of theory appropriation proposed elsewhere into a unified analytical framework. Figure 3.1 on page 89 outlines the sequence of steps followed in the mixed-method approach.

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<sup>1</sup>See the discussion of language and discourse in section 3.1.4.1.

### 3.2.1 The Nature of Discourse Analysis

Of the various forms of text analysis, the qualitative method of discourse analysis is the only one that offers this study the following insights and perspectives from where to approach texts.

First, discourse analysis offers an in-depth and systematic approach to analysing texts that is equally sensitive to both the linguistic formation, and the situational and cultural context in which the text emerges. Bridging the gap between the micro linguistic analysis and the macro impact of the text, this method takes a constructivist approach to language (see van Dijk, 1980, p. 8, 14, cited in Fairclough, 1992, p. 193). It approaches language as a vehicle to produce knowledge that is not just *influenced by* but also has an *influence on* our social environment.

Second, discourse analysis recognises that the impact of such linguistically produced knowledge on the social environment is intimately bound up with power dynamics. With power, participants of the discourse can influence the production of knowledge and thereby also limit it, leading to “a social reality that is taken for granted and that advantages some participants at the expense of others.” (Phillips and Hardy, 2002, pp. 14–15).

Third, discourse analysis produces rigorous interpretations of the texts under analysis. It complements “other bodies of theoretical work by introducing new ideas, new concepts and new challenges” (Phillips and Hardy, 2002, p. 16). Those new ideas, concepts, and challenges are presented together with the original material under analysis, in a way that can be refuted or corroborated by others. By doing so, the rigorous interpretation of the analysed text introduces additional degrees of freedom of thought that contribute to the development – and further construction – of discourse. As Cynthia Hardy and Stewart Clegg (1996, p. 8) point out, “it is in the struggle between different approaches that we learn, and from the diversity and ambiguity of meaning; not through the recitation of a presume uniformity, consensus, and unity, given in a way that requires unquestioning acceptance.”

With these lenses, I approach Schumacher’s (2019) self-proclaimed “opus-magnum,” *The Autopoiesis of Architecture* and its tied historical lineage of appropriations of the biological theory of autopoiesis. Under this framework, this study can thus be seen as providing a basis for connecting text to existing discourse, positioning discourse to a historical and social context by referring to particular

actors, relations of power, and practices, that characterise the appropriation of the theory of autopoiesis in architecture.

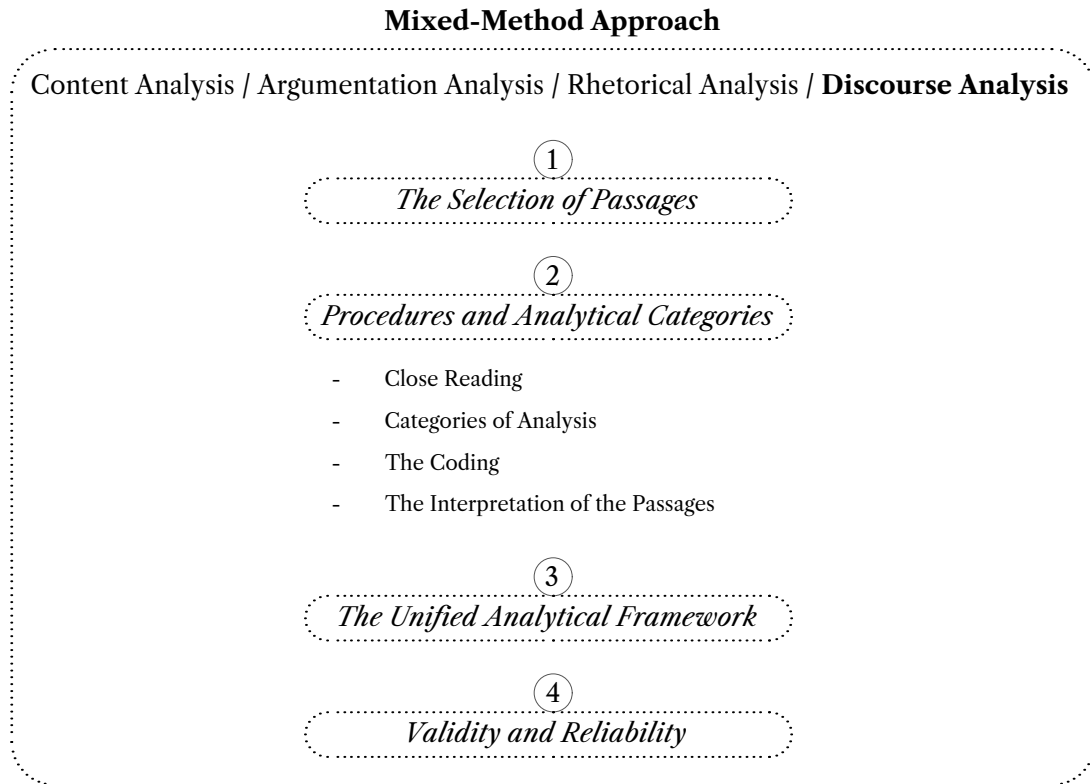


Figure 3.1: Sequence of steps of the mixed-method approach.

### 3.2.2 The Selection of Passages

Discourse analysts acknowledge that we “inevitably have to select a subset of texts for the purpose of manageability” (Phillips and Hardy, 2002, pp. 14–15; Wood and Kroger, 2000). With this premise, they conduct a sampling process that involves a selection of texts (named passage(s) in this study) that appear relevant to the scope of the project and research question(s) at play: that is, what has been generally named ‘positive sampling’ (or ‘purposeful sampling’) in other forms of qualitative research methods (Schreier, 2018, p. 88). This form of selection of passages, as opposed to

‘random sampling’ (which supports empirical generalisation of, for example, population sampling) or ‘convenience sampling’ (which selects cases from their availability), specifies instances of text that are not only relevant but information-rich for the research at hand (ibid., 2018, pp. 87–89).

This study draws upon discourse analysis’s ‘positive sampling’ yet proposes an implementation of a more systematic approach to sample Schumacher’s substantial work. His theory *The Autopoiesis of Architecture*, which can be considered a *discursive unit* and thus a material manifestation of a potential discourse (Chalaby, 1996, p. 688; Phillips and Hardy, 2002, p. 4), consists of two volumes published in 2011 and 2012 and adding up to over a thousand pages. Together, the two volumes put forward 60 “theses” – 24 in Volume I and 36 in Volume II. Each thesis is centred around a core idea or “central message” (Schumacher, 2011, p. xiii). Following the structure of Schumacher’s two volumes, I consider each of the 60 theses and their associated central messages to guide the selection of samples for analysis. I only select those theses whose central messages draw explicit or implicit connections between autopoiesis – which includes not only Luhmann’s social systems theory but also references to Maturana et al.’s biological autopoiesis – and architecture – which includes not only the built environment, but every aspect associated to the discipline. In other words, I select passages that fulfil the following three requisites:

Firstly, I select those theses that explicitly mention the term autopoiesis. Those mentions are not limited to Schumacher’s central message but can also be present in the opening writing of each section.<sup>2</sup> The theses meeting this criterion are noted with a cross (if the mention appears in the opening writing) and/or a bold cross (if the mention appears in Schumacher’s central message) in the table below (figure 3.2). Secondly, I select those theses that use concepts of autopoiesis subordinated, in principle, to Luhmann’s theory. And thirdly, I select those theses that contain (sometimes more, sometimes less explicit) references to the connection between autopoiesis and architecture. However, I exclude those theses that merely re-iterate connections already drawn in earlier samples, or those that claim autopoietic properties in their central message but do not follow through with the claim in the de-

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<sup>2</sup>It is imperative to highlight that while nearly every section includes an opening introduction, there are some that do not. In cases where an opening introduction is absent, the selection of passages is constrained to evaluating solely the central message.

velopment of the thesis.<sup>3</sup> In my reading, a total of 16 theses meets these criteria – nine in Volume I and seven in Volume II. The table below (3.2) shows an excerpt of the selection of passages from Schumacher’s six first theses as an example. The complete sampling is compiled in appendix C.

SCHUMACHER’S THESIS	SCHUMACHER’S CENTRAL MESSAGE	MENTIONS AND USE OF AUTOPOIETIC CONCEPTS	AUTOPOIESIS AND ARCHITECTURE	name of selected passage
THESIS 1	The phenomenon of architecture can be most adequately grasped if it is analyzed as an autonomous network ( <b>autopoietic system</b> ) of communications.	<b>XX</b> autonomy	The autonomy of autopoietic systems as the autonomy of the network of communications in architecture.	
THESIS 2	There exists a single, unified system of communications that calls itself architecture: World Architecture (the <b>autopoiesis</b> of architecture).	<b>XX</b> unity	Architecture as a unified distinguishable entity.	Passage 1.a (P.1a)
THESIS 3	Architectural theory effects an immense acceleration of architecture’s evolution.			
THESIS 4	Architectural theory is integral to architecture in general and to all architectural styles in particular: there is no architecture without theory.	<b>X</b> components	Theoretical treatises as essential components of the autopoiesis of architecture.	Passage 1.b (P.1b)
THESIS 5	Architecture observes and constitutes itself as a distinct domain within modern (functionally differentiated) society, claiming exclusive and universal competency with respect to the built environment. This demarcation is ultra-stable.			
THESIS 6	The emergence of architecture over and above building constitutes a significant evolutionary gain that elevates society’s self-transformative capacity to a new level. Resolute autonomy (self-referential closure) is a prerequisite for architecture’s effectiveness within an increasingly complex and dynamic societal environment.	autonomy		

Figure 3.2: Example of the selection of passages of the first six theses of Schumacher’s *The Autopoiesis of Architecture* Volume I.

From the body of text that follows each selected thesis, I sample self-contained passages that are information-rich *vis-à-vis* my research interest of examining the merits of Schumacher’s appropriation of the theory of autopoiesis: that is, in essence, those passages of text that both linguistically and contextually qualify how the theory of autopoiesis is presented in reference to architecture and design. The text within each section of both volumes of *The Autopoiesis of Architecture*

<sup>3</sup>Those excluded theses correspond to the ones that fulfil the said requirements but are not selected for a formal analysis.

is highly variable in size. Therefore, on multiple occasions, I find several possible passages suitable for a formal analysis. Assuming that those passages deal with similar reasonings, I select only the ones that best inform my research interest. Although the focus remains on the sampled passages, the subsequent analysis is not exclusively reliant on them; it also integrates contextual information from which these passages originate. The sampled passages are named in alphanumeric terms – the number 1 or 2 indicates the volume they belong to, while the alphabet letter corresponds to their sequential order.

### 3.2.3 Procedures and Analytical Categories

In this section, I present the procedures I use, and the analytical categories I consider in analysing each of the previously sampled passages. These procedures include *close reading* and coding each passage as well as *inferring the best explanation* at play when testing individual references to autopoiesis in architecture against different modes of language use (*literal connection, metaphor, analogy, metonymy, synecdoche*) and merits of theory appropriation (*legitimisation, obfuscation, explanation, transmission, theorisation, equalisation, occupation and accommodation*).

#### 3.2.3.1 Close Reading

This study, as well as the method of discourse analysis, “is concerned with the detail of passages of discourse, however fragmented and contradictory” (Potter and Wetherell, 1987, p. 168). In order to disclose information from the text and its details, researchers “have to immerse themselves in the material being studied” (Gill, 2000, p. 179). To do so, I systematically employ close reading to the sampled passages of Schumacher’s work on *The Autopoiesis of Architecture*.

The term close reading refers to either a reading method or to an account derived from the execution of that particular method. It emerged immediately before World War II within academic disciplines and has remained mostly invariant since (Gallop, 2007, pp. 181–183). In Gallop’s view (*ibid.*, 2007, p. 183), close reading “is necessarily the best way to read” and it is accomplished by not missing the details of the text under analysis. According to the literary critic Barbara Johnson (2014, pp. 347–356), the value of close reading is its capacity to attach significance to something that may

not be relevant in the first glance. Close reading thus avoids straightforward reading as doing so may obfuscate a deep understanding of what is being read. This way of reading aims to subtract information without ignoring either general striking features of the text (such as linguistic elements or cultural references) or selected features (for instance, particular merits of theory appropriation) (Schur, 1998, p. 5).

Close reading thus qualifies how I approach the textual context and sampled passages of Schumacher's theory appropriation. By employing close reading, I apply significance to individual references to autopoiesis that may not be relevant in the first place. This recurrently performed method of reading enables me to construct a deep understanding of the data by obtaining information that is not superficially obvious. Furthermore, it facilitates the construction of an analytical description of each sampled passage, respecting the 'purity' of Schumacher's text.

### 3.2.3.2 Categories of Analysis

While discourse analysts usually construct their own categorisation through a preliminary examination of the data under analysis, the analytical framework employed in this study is based on a categorisation of *motivations* (which I refer to as *merits*) of theory formation through appropriation in architecture developed previously by Michael Ostwald (1999, p. 66). This categorisation comprises the merits of *legitimation*, *obfuscation*, *explanation*, *transmission*, *theorisation*, *equalisation*, *occupation* and *accommodation*.

I substitute Ostwald's term *motivation* with the term *merit* to emphasise the benefits theory appropriations may offer users of appropriated theory (readers) rather than emphasising the possible intentions of, and benefits for, appropriators of theory (authors). By changing this term, I acknowledge von Foerster's (von Foerster and Pörksen, 1998, p. 112) postulation that "it is the listener [i.e., the reader], not the speaker [i.e., the author], who determines the meaning of an utterance [i.e., a text]" as well as Barthes (1977, p. 148) calls for "the death of the author," arguing that "the reader is the space on which all the quotations that make up a writing are inscribed without any of them being lost." In accordance with these perspectives, discourse analysts further position their interest on the effect that particular texts have on the listener/reader rather than on the possible internal (and thus challenging to distillate) motivations of the speaker/writer (see Gill, 2000, p. 184; Potter and Wetherell,

1987, p. 168). In this context, the word *merit*, as opposed to the word *motivation*, recognises that merits of theory appropriation are not exclusively beneficial to the writer but can be expected to be (sometimes more, sometimes less) shared between writers and readers of appropriated theory. This provides a basis for me to approach my analysis of Schumacher's work primarily from my (reader's) perspective instead of venturing to speculate entirely on Schumacher's (author's) intentions and gains.

While most approaches that investigate appropriations assume that behind the act of appropriating, there is a metaphorical or analogical connection (see, for example, Ostwald, 1999, p. 66), this study considers the multiple ways in which language (both literal and figurative) is used to connect two different domains. Besides the commonly considered *metaphorical* and *analogical* connections, this study includes the possibility of *literal connections*, as well as figurative *simile*, *metonymy*, and *synecdoche*. These language uses, while similar to one another, contribute to the effectiveness of the text, helping participants of the discourse to draw powerful new insights while being equally capable of distorting the understanding of the appropriated theory. Figure 3.3 on page 100 shows the categories of analysis.

### 3.2.3.2.1 Language Use

**Literal** and figurative connections. Any linguistic connection usually starts from understanding the literal meaning of words. From it, the possible linguistic uses can create either a *literal connection* between subjects or a *figurative* one. Literal connections reflect the observation that the transfer of meaning between entities is literal, i.e., that the meaning from one domain to another is equal. This equivalent meaning is relative to background assumptions and thus connected to a particular context (Searle, 1979b, pp. 211–212). For example, the literal meaning of the sentence “the cat is on the mat” depends on us assuming that gravitational forces exist (*ibid.*). One can also equate one domain to another in terms of its dynamics or processes rather than necessarily to its word meaning. This form of literal connection is what Humberto Maturana, in conversation with Kathleen Forsythe, named *isophor* (see Ison, 2022, p. 151). Figurative connections, on the other hand, supplement or modify the literal meaning of the words with additional connotations (Murfin and Ray, 2009, pp. 17–178). Every other form of language use that is not literal is thus figurative.



**Simile** and **metaphor** are both *figures of speech*. *Simile* generally refers to an explicit comparison between two unrelated subjects that share certain commonalities (Fadaee, 2010, p. 22). According to Israel et al. (2004, pp. 124–125), this understanding showcases three essential features of *simile*: that it involves comparison, that it is an explicit comparison and that it is a comparison between unrelated subjects. *Metaphor* is generally used to transfer the characteristics of one thing to another. It does so by drawing resemblance between two (different) things while the two are not literally equal yet share a single or multiple attributes (Edwards, 1997, p. 31; Sagarin and Gruber, 1999, p. 678). The distinction between *simile* and *metaphor* is one of the most tenuous, as the similarities in their definitions suggest. There are two perspectives:

On the one hand, the *non-equivalence* perspective considers that while simile and metaphor are figurative comparisons, they convey similar but not necessarily the identical messages. In this view, a simile is regarded as an explicit and direct comparison between two things in the form ‘X (the tenor) *is like* Y (the vehicle)’ or ‘X *as* Y’ (Murfin and Ray, 2009, pp. 477–478, 526). However, a metaphor is a direct – but not explicit – comparison in the form of ‘X *is* Y’ (Richards, 1936, pp. 115–138). This structure indicates that metaphor draws resemblances (in some respect) between ‘X’ and ‘Y’. In contrast, in similes, ‘Y’ predicates specific properties directly of ‘X’ (Croft and Cruse, 2004, pp. 212–213).

On the other hand, the *equivalence* perspective tends to unify both figures, grounding metaphors as implicit similes (Lakoff and Turner, 1989, p. 133; Miller, 1993, p. 368; Israel et al., 2004, p. 123). For example, the metaphorical sentence “my job is a jail” does not literally indicate what it pictures, but rather that my job has a strict working schedule and thus understood in the simile form “my job is like a jail” (Glucksberg and Keysar, 1993, p. 406). Implicit in this example is the idea that if a metaphor is taken literally, it can be absurd, which indicates that it “*always* creates distortions” (Morgan, 2006, p. 6). It may happen, however, that along the discourse, a previous metaphorical connection is overlooked. When this occurs, the tenor (‘X’) and vehicle (‘Y’) are no longer connected metaphorically but potentially literally. Edwards (1997, p. 31) regards this overlooked metaphorical connection as “dangerous,” particularly for what it may imply in the domain of use.

The scope of correspondence between the domains at play also varies – metaphor presents the domains blended, while simile invites to consider the two

domains together but presents them as distinct (*ibid.*). Therefore, a *simile* is a figurative linguistic form that communicates concisely and efficiently the relationship between subjects and hence, a nuance difference from the sometimes-considered poetic aim of metaphor.

**Analogy** is, like simile and metaphor, a *figure of speech* based on comparing two different things – the source (tenor) and the target (vehicle). The main difference is that while the three of them compare two other things based on similarities, an analogy includes additional information (or remarks) for the purpose of explaining or clarifying (Mumford and Porter, 1999, p. 71; Hofstadter, 2001, pp. 499–504; Gentner and Smith, 2013, pp. 2–3). Those explanatory statements are essential for education as they enable moving from the existing knowledge to the unknown. The use of analogies may, therefore, help readers to comprehend a less well-understood subject. For instance, in the scientific arena, analogies may help clarify a scientific discovery, or in the social context, analogies may assist in evaluating social experiences (Stepich and Newby, 1988, p. 129; Gentner and Smith, 2013, pp. 1–2). However, some overgeneralised analogies based on single analogies may have the opposite effect, i.e., by impeding understanding (Spiro, 1989, pp. 4–11). The creation of new knowledge implicit in analogies usually arises from actively manipulating existing concepts/categories that allow people to identify new emergent features, properties or principles (Mumford and Porter, 1999, pp. 71–77). In this context, it is not surprising that analogies are regarded as powerful tools for design, architecture, art, and related disciplines.

**Metonymy** refers to “a change of name” (Liddell and Scoot, 1996, p. 1123) in terms of a denomination shift from one thing or idea to another. While using metonymy, the *vehicle* – a well-understood aspect of something – substitutes (or “provide access to”) the *tenor* – the thing being represented – being both syntactically or conceptually close (Gibbs, 1994, pp. 319–320; Murfin and Ray, 2009, pp. 301–302, 526; Littlemore, 2015, p. 4). In other words, it is the mechanism that focuses and points out specific aspects of a subject to denote the subject itself. Lakoff and Johnson (1980, p. 38) exemplify the conceptual nature of metonymy with the sentence “she’s just a pretty face.” The sentence drives information about a person from a particular focus on the face. *Metonymies* tend to be discussed alongside instances of *metaphors* as both describe a connection between two things by substituting terms from one domain to another. For some authors (for example,

Searle, 1979a, p. 107), metonymy is a type or subclass of metaphor. However, metaphor links two separate conceptual domains in which one is understood in terms of another, whereas metonymy involves only (a close) one (Gibbs, 1994, p. 321; Lakoff and Johnson, 1980, p. 37).

**Synecdoche** is a figure of speech in which a part is used to represent the whole and, occasionally, vice versa (Murfin and Ray, 2009, pp. 507–508; Nerlich, 2010, p. 301). While using synecdoche, texts are made intelligible by avoiding word repetition. For example, a TV in our current times means a colour TV, or a fridge means an electric refrigerator. With the indiscriminate use of synecdoche, however, carries the risk of over-generalisation, potentially leading to a misunderstanding of the relationship between the part and the whole or vice versa. *Synecdoche* is often viewed as closely related to *metonymy* because both aim to establish connections between larger and lesser entities (Gibbs, 1994, p. 322). For example, Lakoff and Johnson (1980, p. 37) approach synecdoche as a “special case of metonymy.” However, the most noticeable difference is that while using metonymy, the connection between entities is based on contiguous relation in which the conceptual or syntactical similarities are closely related. In contrast, in synecdoche, the transfer is from a less comprehensive category to a more comprehensive one (Seto, 1999, pp. 113–114). For instance, referring to a monarch as ‘the crown’ involves metonymy, whereas the sentence ‘I have a temperature’ means that I have a fever and thus constitutes a synecdoche (ibid., 1999, p. 114).

### 3.2.3.2.2 Merits of Theory Appropriation

**Legitimisation**, according to Ostwald (1999, p. 66), refers to “appropriation for the purpose of gaining authority.” In Ostwald’s view (ibid.), this categorical merit, as well as the following one (*obfuscation*), is concerned with power. It reflects the observation that architects tend to appropriate external bodies of knowledge to catalyse the development of architectural theory. The appropriations tied to this category “are no doubt driven by the need to acquire a degree of external sensation” (ibid., 1999, p. 58). When the writer’s perspective aligns with that of the reader, appropriations motivated for this reason hold value not only for the writer in terms of gaining authority but also for the reader in terms of fostering a sense of partaking to the discourse. However, despite the search for legitimacy being “paramount in the ap-

propriative act,” it is a symptom of insecurity of the architectural discipline (Girard, 1990, p. 79, cited in Ostwald, 1999, p. 58; Gerber, 2013, p. 18). According to Sokal and Bricmont (2003, pp. 178–182), in the domain of philosophy, nothing productive can result from appropriations whose purpose for existing is the gain of authority.

**Obfuscation**, according to Ostwald (1999, p. 66), refers to “appropriation for the purpose of creating mystique.” This merit portrays the deliberateness of inhibiting clarity, whether for inspiring creativity in design pedagogy or for broadening the permitted scope of theory. In Ostwald’s view (ibid., 1999, p. 57), this merit is not necessarily problematic given its potential to serve the benefit of the reader. However, he points out that it can also portray a “deliberate attempt [of the writer] to confuse and mislead.” Through unintelligible prose, architectural theoreticians “hide behind a wall of obfuscation and dogma” that demarcates themselves from the readers (Downton, 1995, p. 39, cited in Ostwald, 1999, p. 57; Evans, 1997, p. 121). According to Vitruvius (1914, p. 129), this “obscurity of ideas from the unusual nature of the language [...] cannot be the case with architectural treatises.” As is the case with *legitimation*, nothing productive can result from appropriations that use “ambiguity as subterfuge” (Sokal and Bricmont, 2003, p. 179).

**Explanation**, according to Ostwald (1999, p. 66), refers to “appropriation for the purpose of clarification.” In his view, this merit and the following one (*transmission*) concern the transmission of theory. Architects do so by invoking “methods, terms, and concepts that seem only marginally architectural” (Linder, 1992, p. 167) in order to place ideas “in an unfolding story” (Downton, 1995, p. 39, cited in Ostwald, 1999, p. 56). The merit of explanation accomplishes its goal when understanding certain unknown phenomena is achieved on the reader’s side (see Lipton, 2009, pp. 43–44). However, architectural theoreticians “clarify concepts by steadfastly selecting and omitting words from other disciplines and remaining ignorant of their use, a liberty that does not always pertain to their readers” (Johnson, 1994, p. 45).

**Transmission**, according to Ostwald (1999, p. 66), refers to “appropriation for the purpose of processing and transferring knowledge.” This merit reflects the observation that through the act of appropriating, architectural theoreticians bring into account particular aspects of the discipline to the readers. Transmission encompasses two separate processes, yet one is a consequence of the other. It refers to the appropriative act in which concepts are transferred and processed from one domain to another. Once the appropriation is assimilated within the new domain as a

newly created knowledge, it can be transferred “from architect to client, teacher to student or discipline to discipline,” ultimately benefiting the listener/reader (*ibid.*). This functioning of theory appropriation leads others (see Guédon, 1995, p. 88; Grosz, 1995, p. 14 cited in Ostwald, 1999, p. 66) to ask whether architecture is a discipline in itself or a mode of transference of transdisciplinary knowledge.

**Theorisation**, according to Ostwald (1999, p. 66), refers to “appropriation for the purpose of being theoretical.” In Ostwald’s view (*ibid.*), this merit is, as well as the following two (*equalisation* and *occupation*), concerned with cultural and theoretical capital. Linder (1992, p. 167) observes that “architectural theory is not a theory that is architectural but is an attempt to make architecture theoretical.” This merit thus consists of making architecture theoretical, potentially serving as a means to facilitate the understanding of something not yet understood by the reader. To do so, architects borrow methods and theories from other non-architectural disciplines, particularly science (*ibid.*; Galison, 1999, p. 2).

**Equalisation**, according to Ostwald (1999, p. 66), refers to “appropriation for the purpose of equating architecture with another discipline. In this case, the other discipline must be one which, to use Pierre Bourdieu’s terminology, possesses greater ‘cultural capital’ than architecture,” thus offering potential benefits to both the writer and the reader. In order to gain cultural and theoretical capital, architects imitate what other specialised formulations of theory do (Linder, 1992, p. 167; Galison, 1999, p. 2). This is so, primarily due to the theoretical and practical success of other non-architectural domains (see Sokal and Bricmont, 2003, p. 182). As with the categories of *legitimation* and *obfuscation*, Sokal and Bricmont (2003, p. 179) argue that nothing productive can result from appropriations whose purpose is to be the mirror image of other disciplines. Building upon Sokal and Bricmont, Ostwald (1999, p. 67) explains that within the discipline of architecture, the categories of *legitimation*, *obfuscation*, and *equalisation* offer limited value to readers. He, therefore, concludes by considering appropriations motivated for these reasons as nonproductive.

**Occupation**, according to Ostwald (1999, p. 66), refers to “appropriation for the purpose of possession.” This merit reflects the observation that architects frequently appropriate a partial body of theories and assimilate it into the domain of architecture. This form of *hybrid theory* construction, if constantly produced, becomes occupied or possessed by the discipline ultimately benefiting its members. Therefore,

the merit of this categorisation concerns “the need to make theory architectural (the reverse of Linder’s position to make architecture theoretical)” (ibid., 1999, p. 62).

**Accommodation**, according to Ostwald (1999, p. 66), refers to “appropriation because it is convenient.” Ostwald (ibid.) points out that this “category exists simply because architecture can accommodate a relationship with another discipline.” It is the case of the relationship between architecture and philosophy, in which, according to Ingraham (1993, p. 113, cited in Ostwald, 1999, p. 64), the “two disciplines will continue to use each other opportunistically.” This assertion implies that architecture not only borrows, but is also borrowed from other domains as it is conceived as a *convenient* source of imagery and authority (Wigley, 1914, p. 16). Therefore, appropriations driven by this merit serve the interests not only of writers and readers within the discipline of architecture but also extend to those in other disciplines that incorporate (theory and) terminology from architecture.

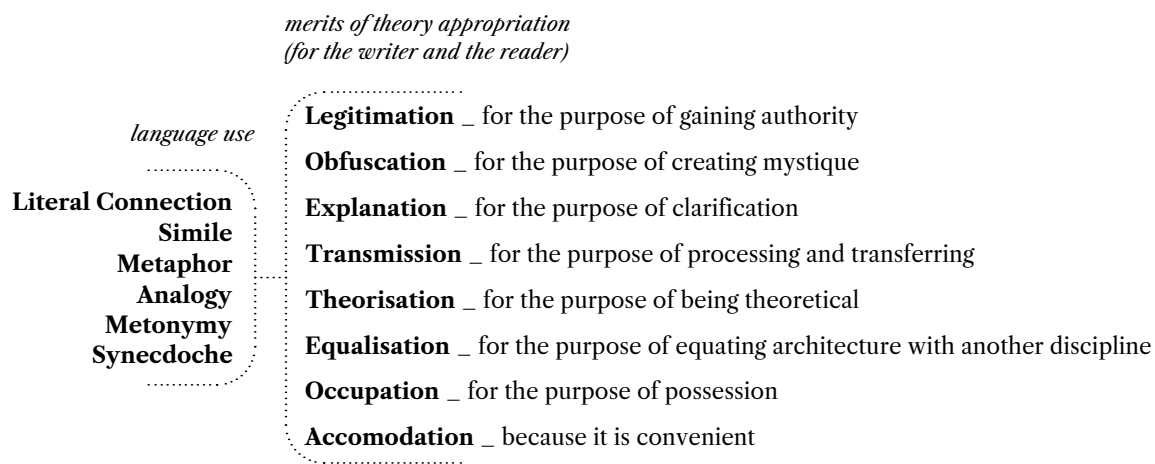


Figure 3.3: Categories of analysis.

### 3.2.3.3 The Coding

The coding in this study consists of attributing predefined categories to phrases in the text. In addition to the previously described categories of possible language use and possible merits of theory appropriation, this study uses four more: references to the theory of autopoiesis, connections between Luhmann’s theory and architec-

ture, connections between Maturana, Varela and Uribe's theory and architecture, and self-evident statements. Those categories arise from the need to understand Schumacher's theory appropriation at different levels of detail and dimensions. Keywords and sentences of the sampled passages belonging to these categories are visually differentiated through a line and a colour code, further facilitating the understanding and interpretation of Schumacher's text.

- *Reference to autopoiesis.* This category involves identifying segments of text and keywords that relate to autopoietic features, even if they are partly derived from Luhmann's theory. To do so, a prior understanding of both biological and sociological theories of autopoiesis is necessary. This process differs from *straightforward* categorisation, which typically does not require a prior examination of the context (see Potter and Wetherell, 1987, p. 167; Gill, 2000, p. 179). Examples of *reference to autopoiesis* category may include word choices such as "boundary management" or "regulative mechanism" (Schumacher, 2011, p. 31). This category is visually represented by a cloud line around the considered text (noted as (1), in Figure 3.4).
- *Connection between Luhmann's theory and architecture.* In this category I identify sentences in which Schumacher presents architecture in reference to Luhmann's theory of social systems. In it, as well as the following one, references to architecture are not only appreciated as concerning with the built environment in the way I was initially interested, but also every other communication-related aspect associated with Schumacher's approach. This category is visually represented by an underline of the sentence with a continuous black line (noted as (2), in Figure 3.4).
- *Connection between Maturana et al.'s theory and architecture.* In this category, I refer to sentences that suggest that architecture is presented in reference to Maturana et al.'s theory of autopoiesis. It is also possible that the same phrase evokes readings in reference to Luhmann's and Maturana et al.'s and thus with instances of overlapping categories. This category is visually represented by an underline of the sentence with a black dash line (noted as (3), in Figure 3.4).
- *Self-evident statement.* This category consists of identifying self-evident statements in Foucault's sense (Foucault, 1990, p. xvi; Lawlor and Nale,

2014, p. 517). That is in the form of possessing truth without empirical substantiation. Therefore, this category is intimately linked to the deployment of vagueness, even though vagueness is not limited to this category. This category is visually represented by underlining the phrase with vertical lines (noted as (4), in Figure 3.4).

- *Language use*. This category refers to the previously defined list of possible language use. In it, I refer to sentences that can potentially draw evidence of literal or figurative references to autopoiesis. This category is visually represented by a purple highlight (noted as (5), in Figure 3.4).
- *Merit of theory appropriation*. This category refers to the previously defined list of possible merits of theory appropriation. In it, I refer to sentences that can potentially draw evidence that substantiates my interpretation of possible merits. This category is visually represented by a yellow highlight (noted as (6), in Figure 3.4).

- (1) Reference to autopoiesis
- (2) Connection between Luhmann's theory and architecture
- (3) ..... Connection between Maturana et al.'s theory and architecture
- (4) Self-evident statment  
|||||
- (5) Language use
- (6) Merit of theory appropriation

Figure 3.4: Coding in this study.

### 3.2.3.4 The Interpretation of the Passages

Previously codified through a colour and a line code, I tested individual references to autopoiesis against the different modes of language use and possible merits of Schumacher's theory appropriation. In so doing, I developed an understanding of



Schumacher's text based on an analysis and interpretation that is documented extensively and assailable by others. The interpretation developed in this study is based on the premise that language and pictures function as representations of subjective realities. It also relies on particular forms of reasoning that allow us to arrive at valid arguments or conclusions based on available evidence. In essence, this interpretation closely aligns with Wittgenstein's *picture theory of language* and *language games* as well as the reasoning of IBE (*inference to the best explanation*), both of which will be presented in this section.

#### 3.2.3.4.1 Language and Visual Interpretation

The Austrian philosopher Ludwig Wittgenstein developed two different bodies of theory. The first one resulted in the *Tractatus Logico-Philosophicus* (Wittgenstein, 1922), in which he presents his *picture theory of language* (also known as the *picture theory of meaning*). Decades later, the second one resulted in the *Philosophical Investigations* (Wittgenstein, 1958), in which he presents his *language games*, arguing against his earlier work. While these two approaches are fundamentally incompatible, they do have some features in common: both focus on the role language plays in human thinking and life, and both are centrally concerned with demarcating valid from invalid uses of language.

Wittgenstein's work, including both his 'earlier' *picture theory of language* and his 'later' *language games*, applies to the work presented in this thesis in multiple ways and at multiple levels. His 'later' work plays a vital role in the development of the method of discourse analysis as discussed in section 3.1.4.1. His work is also present when we use language to elucidate something by connecting it to something else – as happened to me when observing urban processes and considering the possibility of approaching architectural development via an understanding of biological development (see section 1.1). Finally, Wittgenstein's work informs my interpretation of Schumacher's theory appropriation at two additional levels: Firstly, I draw upon his 'earlier' work in which he explores the connection between propositions – i.e., thoughts that make sense (Wittgenstein, 1922, TLS 4–4.021) – and realities presented in the world (ibid., 1922, TLS 2.022). Secondly, I consider the shift from his initial endeavour to characterise the world in objective terms to his later focus on subjective interpretation.

In his ‘early’ work, Wittgenstein (1922, TLS 2.022) posits that language serves as a representation of reality and that, therefore, shared characteristics must exist between a given proposition and the corresponding state of affairs. Wittgenstein suggests that the relationships between elements of a proposition (*elementary propositions*) mirror the relationships between things in the world described by the proposition (ibid., 1922, TLS 4.014). In their relationship to reality, he likens propositions to pictures and models: “A proposition is a picture of reality. A proposition is a model of reality as we imagine it” (ibid., 1922, TLS 4—4.021).

The idea of language as a picture of reality occurred to Wittgenstein while reading a magazine in a trench on the Eastern Front in 1914 (von Wright, 1955, pp. 532–533). The article is said to have discussed a possible sequence of events in a traffic accident (ibid.), and may have described the recreation of this sequence of events for litigation purposes after the accident occurred. At that time, Wittgenstein writes in his private notes: “In the proposition a world is as it were put together experimentally. (As when in the law-court in Paris a motor-car accident is represented by means of dolls, etc.)” (Wittgenstein, 1961, 7e).<sup>4</sup>

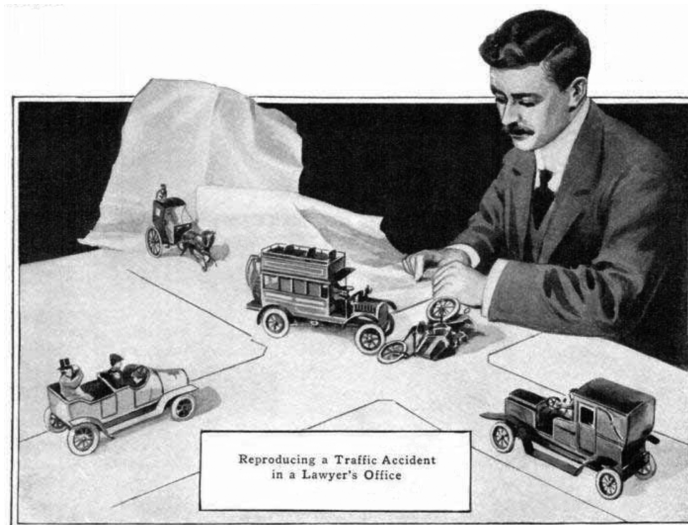


Figure 3.5: “Reproducing a traffic accident in a lawyer’s office”. Illustration reproduced from *Popular Mechanics Magazine* (1914, p. 819).

In a letter to Bertrand Russell, Wittgenstein lamented the lack of understand-

<sup>4</sup>While the article describing the reconstruction of a traffic accident with use of models in a Paris court case has yet to be identified (Klagge, 2022, pp. 67–68), an image showing a lawyer in London using models for this purpose is featured in the June 1914 issue of *Popular Mechanics Magazine* (1914, p. 819), where it is attributed it to the French magazine *L’Illustration* (see Figure 3.5).

ing among philosophers regarding the fundamental message of his ('early') philosophy and explained that "the main point is the theory of what can be expressed by propositions – i.e., by language – (and, which comes to the same thing, what can be *thought*) and what cannot be expressed by propositions, but only shown; which, I believe, is the cardinal problema of philosophy" (Stern, 1995, pp. 69–70). As David G. Stern (*ibid.*) explain, "the "cardinal problema of philosophy" is the question of the limits and nature of language." Wittgenstein thus presents the limits of language by distinguishing between what can be said – namely, factual assertion – and placing all philosophical theses about the nature of self and world, aesthetics, morality, or religion on the other side of the limit. For example, the sentence 'there is a cat on the mat' depicts a truth-fact of what it pictures. In this view, the only meaningful language is this fact-stating language that reflects the observation of an utterly objective world. However, nothing that Wittgenstein wanted to say about the essence of the world, the logic of our language, or meaning is regarded as a factual assertion (Stern, 1995, pp. 47–48). Ethics, religion, or aesthetics, for example, although of significant importance, cannot be empirically investigated and labelled with an elementary proposition. Consequently, according to this 'earlier' Wittgenstein, they are deemed nonsensical (Wittgenstein, 1922, TLS 5.5571). Furthermore, he points out that any attempt to make justice to them by language is meaningless.

Wittgenstein addresses this observation by suggesting that even though certain things cannot be *said* they can be *shown*. While factual propositions are intertwined with the representational relationships between language and the world, logical and mathematical propositions, for instance, display the internal structure of language and the world (Stern, 1995, p. 49). They do so by specifying rules for translating our ordinary language into a new symbolism that would display the rules governing the underlying structure of ordinary language (Wittgenstein, 1922, TLS 3.343–3.344). In this context, one can argue that models are symbolic representations that elucidate the principles governing the underlying observations of the world, thus providing a demonstration of the theory's essence.

This approach in which propositions represent an objective reality was characterised by a particular historical moment in philosophy and, perhaps, "the expression of deep aesthetic preferences and psychological attitudes" (Sluga, 1983, p. 136). However, at the time of germination of the *Tractatus*, Wittgenstein (1961), in numerous parts of his notes written between 1914 and 1916 and published years later,

points towards specifying this objective world “only as a subject’s world described in the subject’s language” (Sluga, 1983, p. 126). In Sluga’s view (*ibid.*, 1983, pp. 127–128), this subjective approach was already invading Wittgenstein’s work when, in one of his notes, he (Wittgenstein, 1961, 62e) hints at considering *simple objects* as becoming a logical requirement rather than something that can be empirically investigated or discovered, thereby the sentence “we can only foresee what we have constructed” (Wittgenstein, 1961, 71e).

This subjectivity is also present – yet subordinate to – the objective connection between propositions and reality, in the *Tractatus*: for example, one of Wittgenstein’s most quoted sentences reads: “*the limits of my language mean the limits of my world*” (Wittgenstein, 1922, TLS 5.6). In it, Wittgenstein approaches the relationship of language and world subjectively by using “my” instead of “the.” Furthermore, with the sentence “the logical picture of the facts is the thought,” Wittgenstein (1922, TLS 3) points even further to the subjective judgement of an observer when depicting a common state of affairs. Those thoughts or sensations may resonate with one another, yet they can ultimately not be substantiated or described. For example, while observing a picture of a mother and daughter, the observer can say that the daughter looks like her mother. However, nothing in the image substantiates this claim as “it cannot be discovered from the picture alone whether it is true or false” (*ibid.*, 1922, TLS 2.224; 1922, PI 225\*–227\*).

This subjective judgement is certainly present in Wittgenstein’s ‘later’ philosophy, where he moves from the *picture* metaphor to the *tool* (or *use*) metaphor (Wittgenstein, 1958, PI 6«). In this view, language functions in the way words are used in various activities and forms of life. It is in the multiplicity of uses of a word that it finds its meaning. Therefore, instead of saying that the structure of reality determines the structure of language, Wittgenstein, in his ‘later’ philosophical work, argues that the structure of a language guides what we think of as reality (*ibid.*, 1958, PI 107\*). In this sense, we cannot have a conception of the world independent of the conceptual apparatus we use.<sup>5</sup>

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<sup>5</sup>While the ‘later’ Wittgenstein may resonate with Benjamin Lee Whorf’s (1956, p. 214) *linguistic relativity principle*, which posits that “all observers are not led by the same physical evidence to the same picture of the universe,” Whorf focuses on placing words within grammatical and/or syntactic structures, thus leading to a language-specific context rather than emphasising the intimate relationship between language and extra-linguistic activities, as proposed by Wittgenstein. As Kienpointner (1996, p. 481) points out, “[t]he embedding of language in the context of actions and activities and, ultimately,

In accordance with this philosophical framework, I present my interpretations of the relationships between Schumacher's *The Autopoiesis of Architecture*, the theory of biological autopoiesis, and architectural practice throughout my analysis – not only in text but also in visual illustrations. These “picture” illustrations are informed by my understanding of Maturana, Varela, and Uribe's biological theory of autopoiesis, my understanding of Luhmann's social systems theory, and, finally, by the connections I perceive between urban dynamics and biological processes. They allow me to utilise a part of my architectural training to help convey the depth and quality of my analysis. As is the case with much of my textual discourse analysis, these illustrations are necessarily based on my personal judgement and my subjective sensation of *this-is-like-that*, which, as Wittgenstein suggests, cannot be empirically substantiated, documented, theorised, or described, but *shown*. However, it aims to draw a mental image in readers' minds to hopefully offer guidance throughout the presented analysis – especially by making my understanding of the historical lineage of appropriations of autopoiesis and my experience of urban development as transparent as possible in this thesis.

#### 3.2.3.4.2 The Analytical Reasoning

In order to rationally arrive at plausible merits and language use in Schumacher's theory appropriation of autopoiesis, this study relies on the different modes of logical reasoning, particularly the one of *inference to the best explanation*.

The logical reasoning of *deduction*, commonly known as *deductive reasoning*, consists of reaching logical conclusions from one or more general premises – for example, “if all humans speak a language, then John, being human, must speak one as well” (Krippendorff, 1980, p. 37). Implicit in this example is the understanding of a mode of reasoning that proceeds from the general to the particular (*top-down logic*) (Evans, 2013, p. 2). In other words, the range of conclusions under consideration is decreased by applying general premises until only one certain conclusion is left (see Peirce, 1935, p. 106).

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in a form of life constitutes a framework which shapes our picture of extra-linguistic reality much more than the purely structural system of our language. The system only provides general constraints for use and leaves a great deal of room for the creativity of the speaking individuals, who – at least in principle – are always free to follow their communicative intentions and their cognitive interests in the distinction of entities” (ibid.).

*Inductive reasoning*, by comparison, is not logically conclusive but draws probable conclusions. As Peirce (1935, p. 106) explains, “deduction proves that something must be; Induction shows that something actually is operative.” Unlike deductive reasoning, inductive reasoning proceeds from particular premises to generalisations rather than vice versa (Krippendorff, 1980, p. 37; Sternberg and Sternberg, 2012, pp. 518–521). For example, “I might infer from the fact that all of my neighbours speak English that all humans do” (example adopted from Krippendorff, 1980, p. 37).

According to Umberto Eco (1994, p. 59), “the logic of interpretation is the Peircean logic of abduction.” He refers to the formulation of Peirce’s (1932, p. 375) *abductive reasoning* as the process of generating an explanation of a given fact by creating multiple and testable “supposition[s].” For example, “if one has practical experience with infants’ language acquisition, one might be able to infer children’s ages from the sounds they make or from the vocabulary they use” (example adopted from Krippendorff, 1980, p. 37). This example implies that such inferences are not necessarily conclusive. Instead, abductive reasoning moves from the predictive nature of induction to suggesting how things “may be” (Peirce, 1935, p. 106). It is therefore not surprising that abductive reasoning is commonly discussed in design research literature as a mode of designerly reasoning (Cross, 2006, pp. 19–20). Westermann and Gupta (2023, p. 6) explain that “designers anticipate, but this form of anticipation, as Peirce highlights, is not predictive; it is suggestive.”

Building upon abductive reasoning, the philosopher Gilbert Harman (1965, pp. 88–89) develops *inference to the best explanation*. This reasoning stipulates the acceptance of those hypotheses that offer the *best* explanation of the evidence observed (Thagard, 1978, p. 77). Therefore, while *abductive reasoning* corresponds to the first stage of inquiry – i.e., the process of generating explanatory *suppositions* (hypotheses) – *inference to the best explanation* corresponds to the last stage of inquiry – i.e., addressing how to choose the hypothesis (Mcauliffe, 2015, p. 301).

*Inference to the best explanation* involves *inferring* and *explaining* as the two main activities that form new beliefs by presenting “why things are as we have found them to be” (Lipton, 2004, p. 1). Inference is a mental process that occurs in a person’s mind that arises from certain evidences observed. In Lipton’s view (ibid. 2004, p. 5), the inferences developed in this reasoning draws upon *deductive inferences* – in which the statements or premises reach logical conclusions – and *inductive inferences* – in which the statements or premises supply evidence in order to judge

probability. This inferential phase provides justificatory or evidentiary phenomena that are required to be explained (Janssen, 2002, pp. 459–460; Weintraub, 2013, pp. 203–216). The explanation of the statements or premises inferred enables the deduction of conclusions that cannot otherwise be obtained from the premise alone (Weintraub, 2013, pp. 203–216).

For instance, faced with footprints in the snow of a particular shape, we infer that a person on snowshoes has recently passed. However, it might be that a rabbit with human shoes has hopped on the snow. This mode of reasoning draws an uncertain conclusion but retreats from the best available explanation, as I aim to illustrate in Figure 3.6.

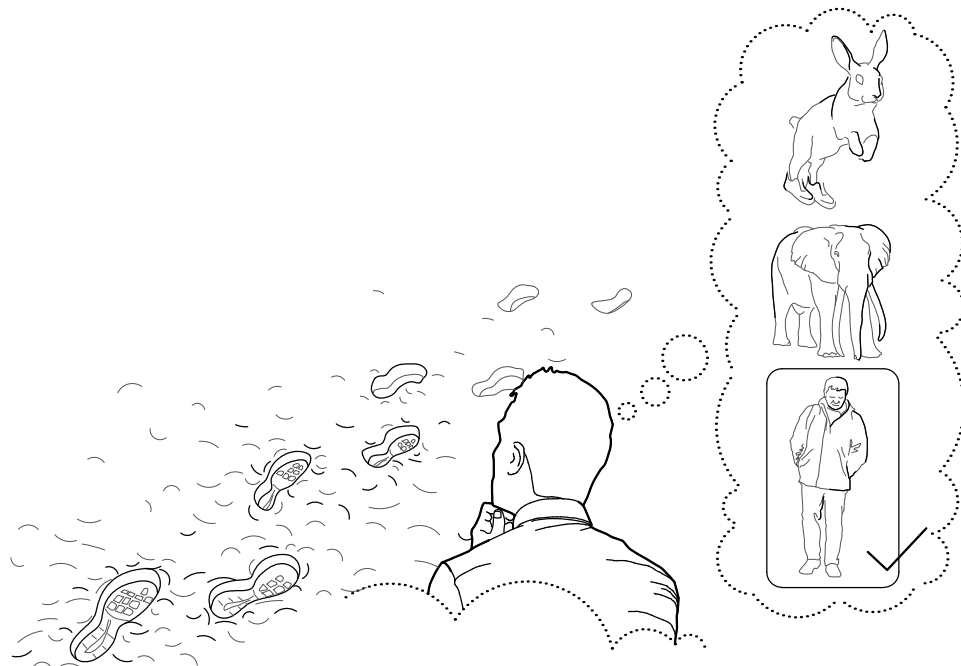


Figure 3.6: My interpretation of reasoning by inference to the best explanation.

Criticised as having weak outcomes, Harman (1968, p. 168) postulates that the best explanation “is more than just a highly probable explanation. It must also make what is to be explained considerably more probable than would be the denial of the explanation.” To achieve this, Day and Kincaid (1994, pp. 278–279) argue that it is necessary to substantiate the explanation with empirical details derived from

*contextual factors*. That is, incorporating knowledge that not only belongs to the facts (or observed phenomena) but to the context from which the fact emerged.

“Warranted by detailed argument and attention to the material being studied” (Gill, 2000, p. 188), the outcomes derived from this study should thus be considered to be “rigorously produced interpretations rather than ‘discoveries’” (Shaw and Bailey, 2009, p. 418). Hence, the proposed methodology in this study can be described as a documented description of a recurrent interpretative practice that allows readers to judge the credibility and plausibility of the outcomes of the analysis (Gilbert and Mulkey, 1984, pp. 14–15; Sitz, 2008, p. 178)

### 3.2.4 The Unified Analytical Framework

As mentioned above, I begin by sampling key passages in which the central message draws explicit or implicit connections between autopoiesis and architecture. Subsequently, I employ *close reading* and *inference to the best explanation* to analyse and code these samples systematically, all while considering their textual context. Based on my reading and interpretation of the text, I then locate references to autopoiesis identified in the samples in a two-by-two matrix formed by two overall distinctions. Firstly, I distinguish references to two previous instances of the theory of autopoiesis:

- References to Luhmann’s theory of autopoiesis in social systems. As Schumacher leans on Luhmann’s theory directly by explicitly positioning architecture as a social system in Luhmann’s sense, I take these references to autopoiesis to be *literal*. However, I remain open to the possibility of finding *figurative* references to Luhmann’s theory.
- References to Maturana et al.’s biological theory of autopoiesis. Since Luhmann’s theory (which Schumacher leans on) refers to Maturana et al.’s theory of autopoiesis loosely (see Maturana’s criticism mentioned in Section 2.3.2), I take these references to autopoiesis to be *figurative*. I furthermore differentiate these figurative references into several modes of language use presented in Section 3.2.3.2.1, namely: *simile*, *metaphor*, *analogy*, *metonymy*, and *synecdoche*. However, I remain open to the possibility of finding *literal* references to Maturana et al.’s theory.



Secondly, I distinguish between two possible beneficiaries of Schumacher's appropriation of the theory of autopoiesis in this context:

- The reader (me – Sánchez), seeking to understand strangely obvious-yet-vague connections between the built environment and living systems.
- The writer (Schumacher), putting forward a theory of architecture.

After placing the sampled references to the theory of autopoiesis within the two-by-two matrix formed by these two overall distinctions, I further qualify them based on the categorisation of *merits* of theory appropriation in architecture put forward by Ostwald (1999). This categorisation, introduced in Section 3.2.3.2 and expounded upon in detail in Section 3.2.3.2.2, comprises the merits *legitimisation*, *obfuscation*, *explanation*, *transmission*, *theorisation*, *equalisation*, *occupation*, and *accommodation*. Figure 3.7 shows the proposed matrix.

	<b>Living Systems</b> (Maturana et al.)	<b>Social Systems</b> (Luhmann)
<b>Merits</b> (Sánchez)		
<b>Merits</b> (Schumacher)		

Figure 3.7: Two-by-two matrix allowing the placement of samples based on referenced preceding theories and theory beneficiaries.

Given the nature of Schumacher's theory appropriation of autopoiesis, which invites other (literal or figurative) readings, each sampled and analysed passage contains a minimum of one, with the possibility of multiple interpretations. The rigorously produced interpretation of individual passages is placed in the two-by-two matrix and labelled by one or more language use and one or more merit of theory

appropriation. In this analysis, references to autopoiesis may be categorised, for example, as *metaphorical obfuscations*, *analogical explanations*, *literal equalisations* or *literal accommodations*. The following table 3.8 presents the combinatorial possibilities of language use and merits of theory appropriation, illustrating four combinations relevant to the forthcoming example in Figure 3.9.

To visually indicate the language use and merit of theory appropriation in each passage, I developed a notation system: basic geometrical shapes such as squares, circles, or triangles are used to visually differentiate each language use, while a linguistic abbreviation, such as ‘exp’ for the word *explanation*, distinguishes each merit of theory appropriation. Combining these visual notations makes each passage’s interpretation visually and easily recognisable within the quadrants of the proposed two-by-two matrix. In addition to the four examples of all possible combinations of language use and merits of theory appropriation, table 3.8 also introduces the visual legend of the notation used for each category of analysis.

	Legitimation (lgt)	Obfuscation (ofc)	Explanation (exp)	Transmission (trn)	Theorisation (thr)	Equalisation (eq)	Occupation (ocp)	Accommodation (acm)
Literal □						eq		acm
Simile ◇								
Metonymy ▭								
Synecdoche ○								
Analogy △			exp					
Metaphor ○		ofc						

Figure 3.8: Table presenting four examples of all possible combinations of language use and merits.

While the two-by-two matrix is primarily relevant for the spatial differentiation between the quadrants, it is worth noting that the location of the interpretations of individual passages in each quadrant does not hold any meaning. In order to avoid any potential reading sequences that might suggest otherwise, I place each language use and merit of theory appropriation emerging from the centre of each quadrant and growing outward in a seemingly random order. Figure 3.9 shows an example of the notation within the two-by-two matrix.

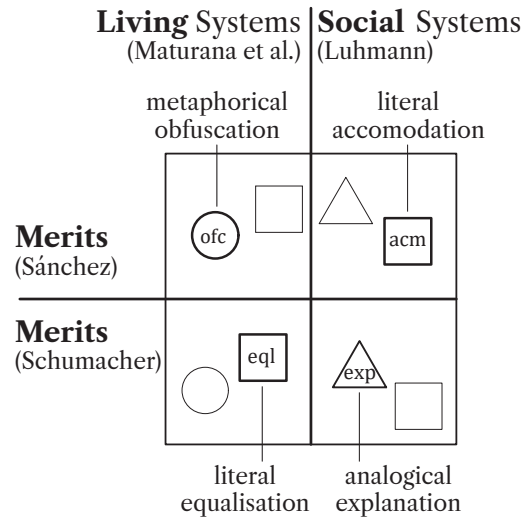


Figure 3.9: Example of the notation within the two-by-two matrix

Finally, after locating individual references to autopoiesis into the two-by-two matrix shown in Figure 3.7, I superimpose all placements in a single two-by-two matrix to establish an aggregate pattern of language uses, merits and respective beneficiaries of theory appropriation in the case of Schumacher's *The Autopoiesis of Architecture* across all samples. The superimposition of passages results in a graphically simple yet detailed distillation of textual information that facilitates the observation and reflection of insights in reference to the inquiry of this investigation.

### 3.2.5 Validity and Reliability

While being a detailed analysis of texts that is linguistically and contextually sensitive, the findings arise from a subjective interpretations and thus cannot be empirically substantiated. In order to strengthen the validity and reliability of the findings nonetheless, this study relies on techniques developed by discourse analysts, particularly by Potter and Wetherell (1987, pp. 169–172), Potter (1996, p. 20) and reaffirmed by Gill (2000, p. 187). These techniques deal with the common concern that, as discourse analysis is a qualitative research method, it is “merely an assembly of anecdote, and personal impressions, strongly subject to researcher bias” (Mays and Pope, 1995, p. 109). Despite developing additional procedures, Potter

and Wetherell (1987, pp. 169–172; Potter 1996, p. 20) recognise that the validity of the outcomes is not guaranteed. In the following paragraphs, I present the techniques I adopted and adapted from Potter and Wetherell to further strengthen the validity and reliability of the findings. These techniques appear, albeit implicitly, in the discussion chapter of this thesis (chapter 5), in which I observe and reflect on the findings presented as a superimposition of analyses.

- If the finding of a passage deviates from the pattern identified, the individual passage is considered a *deviant case* and thus further evaluated in a separate examination. Explanations of these cases provide new insights that potentially corroborate the correctness of the scope of the analysis and, therefore, its reliability.
- The analytical reasoning developed in this study is reliable if it gives *coherence* to an already established body of discourse. If the observations and reflections of the findings cover broad-well-established patterns that relate to a further explanation by capturing unknown nuances of the discourse, the analysis, in that case, is considered coherent with early work and thus valid.
- This study builds upon the premise that one criterion of validating rigorous academic work is that it can be refuted or corroborated. To achieve this, I present the rigorously produced interpretation and the original material collected as transparently and available to scrutiny as possible. In doing so, I enable participants of the discourse to assess my interpretation and, in case of disagreement, put forward alternative interpretations contributing to the development, consolidation and critique of the discourse.

### 3.3 Summary

The mixed-method text analysis approach developed to investigate the merits of Schumacher's appropriation of autopoiesis in architecture depends on methods established in social science, particularly those of *content analysis*, *argumentation analysis*, *rhetorical analysis*, and *discourse analysis*. Growing out from the turn of language to be constructive, discourse analysis, with its different traditions and pro-

cedures, offers this study a useful methodological framework from which to develop, in conjunction with other approaches, a purpose-designed methodology.

Given the nature of Schumacher's appropriation, the term 'discourse analysis' is used somewhat loosely in this study. Nevertheless, discourse analysis methods offer valuable lenses for examining Schumacher's theory at different levels: firstly, discourse analysis critically approaches taken-for-granted knowledge, which entails a sceptical view towards an objective observation of the world. Secondly, it considers that observations of the world are dependent on the observer, thus making every discourse analysis a product of interpretation. Thirdly, discourse analysis acknowledges that knowledge is socially constructed, and, therefore, shapes our understanding of the world. And finally, it commits to exploring how knowledge is linked to actions through language, particularly those bound up with power dynamics. Discourse analysis is, therefore, concerned not only with the linguistic aspects of a text but also with the context in which the text emerges.

Drawing upon the *positive* (or *purposeful*) sampling used in discourse analysis, this study proposes a more systematic approach to sampling Schumacher's theory appropriation. To this end, I follow the structure of Schumacher's two-volume treatise and consider the 60 theses and their associated central message. From those theses, I select those that explicitly mention the term 'autopoiesis', that use concepts of autopoiesis, and that contain (sometimes more, sometimes less) explicit references to the connection between autopoiesis and architecture. In my reading, a total of 16 *theses* meet these criteria. From the body of text that follows each selected thesis, I sample self-contained passages that are information-rich *vis-à-vis* the scope and research question posed at the end of Chapter 2.

After *closely reading* each thesis and passage I codify the text by attributing categories to phrases in the text. Those categories include references to the theory of autopoiesis, connections between Luhmann's theory and architecture, connections between Maturana et al.'s theory and architecture, self-evident statements, language use and merits of theory appropriation. The latter two categories are further divided into the subcategories of *literal connection*, *simile*, *metaphor*, *analogy*, *metonymy* and *synecdoche* for the category of language use. And, building upon Ostwald's (1999, p. 66) categorisation of motivations of theory appropriation, the subcategories of *legitimisation*, *obfuscation*, *explanation*, *transmission*, *theorisation*, *equalisation*, *occupation* and *accommodation* for the category of merits of theory

appropriation. These subcategories are, however, not codified in the passage under analysis, yet at play when interpreting the data. The interpretation of the passages is conducted based on insights from Wittgenstein's *picture theory of language* and *language games*, as well as the reasoning of *inference to the best explanation*.

The interpretation of each reference to autopoiesis in the form of, for example, a *metaphorical obfuscation* or a *literal explanation*, is then located in a two-by-two matrix consisting of two overall distinctions: Firstly, I distinguish references to two previous instances of the theory of autopoiesis – references to Luhmann's theory of autopoiesis or references to Maturana et al.'s biological theory. Secondly, I distinguish between two possible beneficiaries of Schumacher's appropriation – the reader (me), in trying to understand the connection between the built environment and living systems, and the writer (Schumacher), putting forward a theory of architecture. Finally, after locating individual references to autopoiesis into the two-by-two matrix at a micro level of analysis, I superimpose the locations of the sixteen sampled passages in a single two-by-two matrix presented in Chapter 5, particularly in Section 5.1.1, to establish an aggregate macro-pattern of language uses, merits and respective beneficiaries of theory appropriation in the case of Schumacher's *The Autopoiesis of Architecture*.

## Chapter 4

# Analysis of the Appropriation of Autopoiesis

This chapter documents the in-depth analysis of Schumacher's appropriation of the theory of autopoiesis in architecture as presented in his two-volume *The Autopoiesis of Architecture*. This analysis follows the methodological approach outlined in Chapter 3 and aims to answer the research questions posed at the end of Chapter 2. This chapter consists of two main sections 4.1 and 4.2, examining sample passages from the two volumes of *The Autopoiesis of Architecture*, respectively. Section 4.1 analyses nine of the 24 theses put forward in Volume I. Section 4.2 analyses seven of the 36 theses put forward in Volume II. Each section consists of subsections, each examining one of the sampled passages. Each subsection begins with a linguistic contextualisation. This includes a discussion of the context of the respected passage and of how the passage relates the concept of autopoiesis to architecture. Each subsection examines references in the respective sample passages to prior (i.e., Luhmann's or Maturana et al.'s) instances of autopoiesis theory. Each subsection concludes by categorising language use in the respective sample passage and the merits its references to autopoiesis offer to me (*vis-à-vis* my interest in understanding the strangely obvious-yet-vague connections between the built environment and biological systems) and, presumably, to Schumacher (in putting forward a theory of architecture). Each subsection contains my coding of the respective sample passage based on the coding introduced in Section 3.2.3.3 and my visual interpretation of its reference to autopoiesis, and it concludes with a diagrammatic representation of the analysis.

## 4.1 *The Autopoiesis of Architecture* – Volume I

This section presents the analysis of nine passages sampled from Volume I of Schumacher's *The Autopoiesis of Architecture*, based on the methodological approach introduced in Chapter 3.

### 4.1.1 Passage 1.a. – The Unity of Architecture

This passage is sampled from Section 1.1 “The Unity of Architecture” in Chapter 1 of Schumacher's Volume I entitled “Architectural Theory” (Schumacher, 2011, pp. 29–32). In this section, Schumacher (ibid., 2011, p. 29) presents his *Thesis 2* in which he postulates the following *central message*: “There exists a single, unified system of communications that calls itself architecture: World Architecture (the autopoiesis of architecture).”

In this central message, Schumacher (implicitly) refers to Luhmann's figurative appropriation (see Scott, 2012, p. 32; Whitaker, 2012, p. 32) of autopoiesis according to which social systems are constituted by communications (Luhmann, 1982, p. 131). According to Luhmann, architecture is not a social system in its own right but a part of the fine arts alongside sculpture, painting, and poetry (Luhmann, 2000, pp. 45, 160). Contrary to this conception of architecture, Schumacher postulates that the discipline is a “unified system of communication” in its own right, which he refers to as “World Architecture (the autopoiesis of architecture).” Schumacher describes it as the ongoing communication within the discourse that constitutes the autopoietic system of architecture (Schumacher, 2011, p. 30). Passage 1.a. provides an implicit definition of architecture as a social communicative process that may be concerned with the production of the built environment, yet perpetuates itself separately and distinctly from the built environment. This passage furthermore postulates that *architectural theory* provides a “regulative mechanism” by which architectural practice as a system facilitates its *unity* while *architectural discourse* preserves that unity by managing the system's boundary. By doing so, Schumacher postulates the existence of architecture as a singular distinguishable entity. This observation echoes earlier discussions of *organisational closure*, the circularly-causal regime through which systems maintain their integrity and identity (Varela, 1978, p. 292; 1979, p. 15), and of *occupational closure* in which professions “construct and de-



“...and defend social and legal boundaries that, in turn, affect the rewards of their members” (Weeden, 2002, p. 59).

“Architecture, like all the other subsystems of society, has developed its own reflective, (regulative mechanism), namely architectural theory that filters, selects and refocuses architectural practice and thus (facilitates the unity) of architecture. Architectural discourse (maintains the unity) of architecture by continuously distinguishing architecture from neighbouring domains. The discourse thus protects the integrity of architecture by means of (boundary management), denouncing incursions from neighbours such as engineers and artists who threaten to invade and blur the (boundary) and distinctiveness of architecture. The discourse also polices against (unsustainable overextension) of architects into alien territory.” (Schumacher, 2011, p. 31)

#### 4.1.1.1 References to Preceding Theories

With its central message describing architecture as a system of communication, and framing it “like all the other subsystems of society,” passage 1.a. approaches architecture literally from the perspective of Luhmann’s notion of autopoiesis. I read the word “like” in this context not as indicating figurative speech but in the literal sense of “alongside society’s other subsystems.”

References to Maturana et al.’s biological theory are nonetheless present implicitly by way of Luhmann’s *hybrid construction*<sup>1</sup> as well as explicitly by way of evocative word choices such as “boundary maintenance” and “unsustainable overextension [...] into alien territory.” The use of the term “regulative mechanism” points even further to the cybernetic foundation of both biological and sociological theories of autopoiesis in which processes of feedback and control are commonly studied in terms of *regulative* relationships.

The statement that architectural theory “refocuses architectural practice” as a “regulative mechanism” that limits architectural practice within an appropriate scope

<sup>1</sup>*Hybrid construction* refers to Ostwald’s (1999, pp. 60–62) notion of “hybridisation,” i.e., appropriations that result in hybrid theories “embodying aspects of both the old and the new disciplines.”

by demarcating it from neighbouring domains derives from Schumacher's observation (2011, p. 30) that different architectural styles and ideological positions stand within a single discourse, i.e., the *architectural discourse*. This understanding of the functioning of architectural theory within the discipline echoes Luhmann's (1982, p. 132) concept of *boundary* as being defined and formed by meaningful communications. Figure 4.2 on page 123 shows my visual interpretation of this description.

#### 4.1.1.2 Language Use and Merits

Maturana et al.'s references to biological systems are (predominantly but with exceptions) literal in the sense that they describe evidently observable phenomena. Luhmann's description of communication systems in terms of biological systems, however, is figurative in the sense that they describe communicative systems to be *like* biological cells. Schumacher's description of architecture as autopoietic, in turn, is literal when read along Luhmannian lines (given that Schumacher positions his theory as a subset of Luhmann's theory) and figurative when read along Maturanian lines (describing architectural discourse to be *like* biological cells). Figure 4.1 shows different kinds of (literal or figurative) relationships within and among the three instances of autopoiesis.

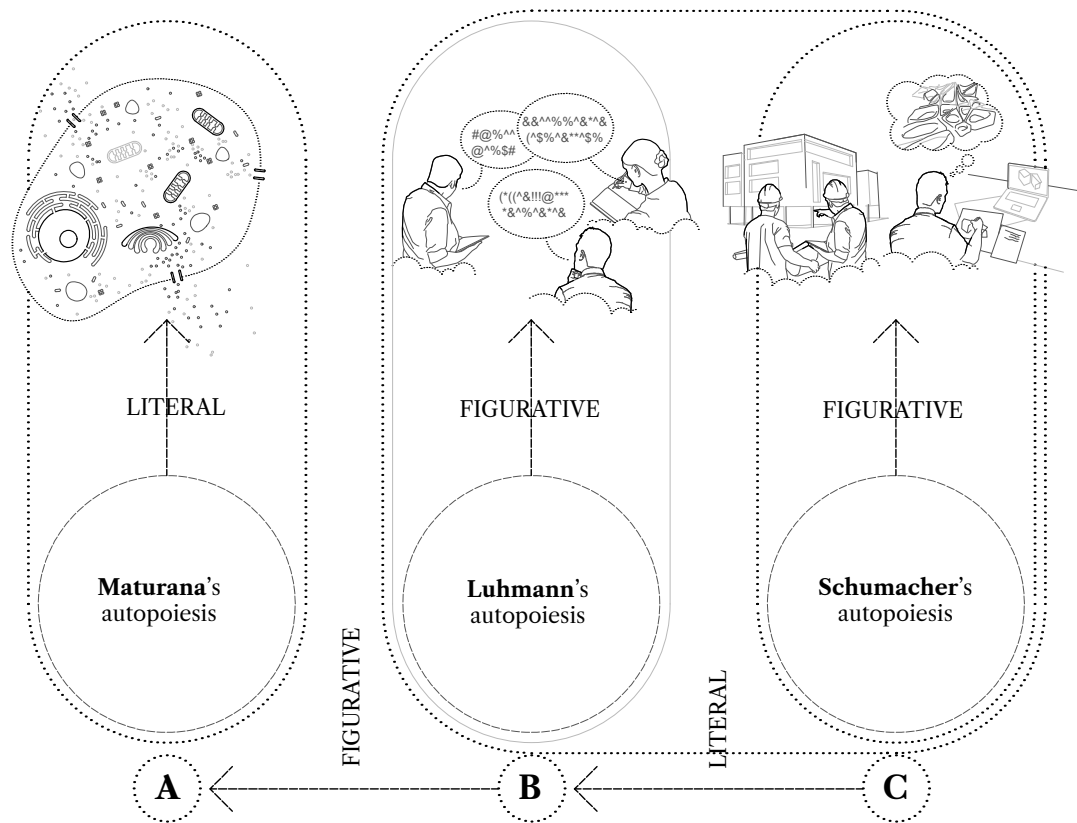


Figure 4.1: The different kinds of literal or figurative relationships within and among the three instances of the theory of autopoiesis.

This provides a basis for interpreting (literal or figurative) language use in Schumacher's theory. Bridging Schumacher's, Maturana et al.'s, and Luhmann's theories, "boundary" and "boundary management" are key terms in this passage. Schumacher posits his theory as *literally* describing a subset of Luhmannian communication systems. Similarly to Luhmann, he then postulates the existence of a (*figurative*) boundary around architecture with little empirical substantiation other than a reference to the existence of outsiders (engineers and artists). In lieu of empirical substantiation, and with Schumacher being a leading representative of the system his theory describes ("world architecture"), this postulation appears to be, at least in part, an argument from authority, suggesting its inherent truthfulness (Knight and Collins, 2005, p. 189).

In the last part of the first sentence, Schumacher describes architectural theory as acting as the proclaimed boundary by performing as a – “regulative mechanism” that “filters, selects and refocuses” its scope. In the absence of empirical substantiation, I read this claim as a **metaphorical**<sup>2</sup> claim that appropriates properties of the living cell membrane via the vaguely defined boundary proclaimed by Luhmann. Schumacher thereby **legitimises** (using Ostwald’s terms; see Ostwald, 1999, p. 66) his characterisation of architecture as a “single unified system of communications” (Schumacher, 2011, p. 29). With this rhetorical move, he establishes “architecture” as an entity with a systemic unity and a boundary (analogous to a living system, subordinate to social communication systems) and lays the foundation that makes all the following *Theses* possible.

Building upon the premise that *architectural theory* facilitates the discipline’s figurative *unity* (as the “regulative mechanism” that “refocuses architectural practice”), Schumacher implies that architectural theory (including his own *Autopoiesis of Architecture*) is the element that steers the practice of the discipline in the desired manner. The implied need for such steering legitimises Schumacher’s theory. In the same vein, Schumacher postulates that architectural discourse, “by means of boundary management,” “protects the integrity of architecture [...], denouncing incursions from neighbours such as engineers and artists who threaten to invade and blur the boundary and distinctiveness of architecture.” Using value-laden terms such as – *protect, denounce, incursion, threaten, invade, and police*, Schumacher implies an antagonistic relationship between architecture and its environment, underscoring the discipline’s proclaimed need for protection and thereby further legitimising his theory.

Stating that other “subsystems of society” have done similarly, Schumacher positions the discipline of architecture within the scope of Luhmann’s theory and thereby **literally equalises** the discipline of architecture to social (communications) systems. The implication that “what is true under certain conditions must be true under all conditions” (Engel, 1980, p. 40) bears the hallmarks of a *sweeping generalisation* (ibid.). Nonetheless, it legitimises his line of reasoning and position by shielding it from challenges since any challenge to his theory is necessarily also a challenge to Luhmann’s.

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<sup>2</sup>The use of bold font serves to emphasise the interpreted language use and merit(s) within the analysed passage.

Purportedly approaching the discipline of architecture through the lens of Luhmann's theory, Schumacher does not appear to counteract possible figurative interpretations of Passage 1.a along the lines that brought me to formulate the research question I investigate in this thesis. Word choices such as *territory*, (un)sustainability and *boundary*, in my reading, evoke **metaphorical** associations with the built environment as well as with living systems more than literal associations with social communication systems. Assuming that members of the architectural discipline (the core readership of Schumacher's thesis) are, by virtue of the creative and epistemic demands of the design process, particularly open to figurative references, these word choices may undermine and hence **obfuscate** purely literal readings in terms of Luhmann's theory at a broad scale.

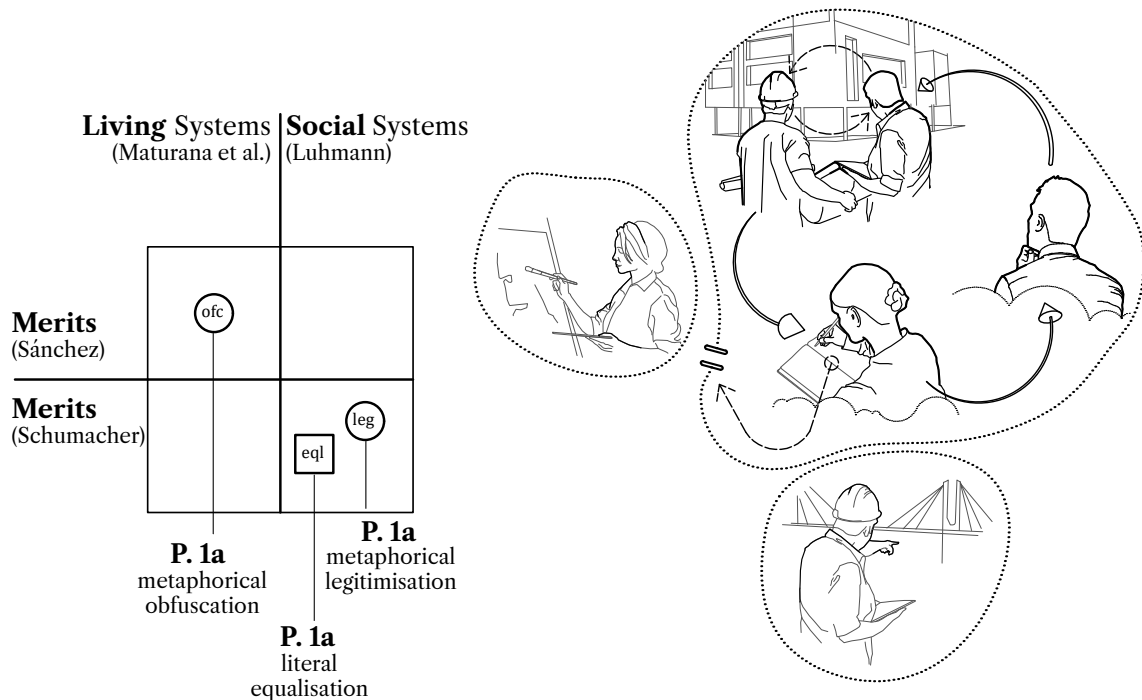


Figure 4.2: My visual interpretation of passage 1.a – the unity of the discipline of architecture through “boundary management.”

#### 4.1.2 Passage 1.b. – The Necessity of Theory

The following passage is a quote from Section 1.3 “The Necessity of Theory” in Chapter 1 of Schumacher’s Volume I entitled “Architectural Theory” (Schumacher, 2011, pp. 35–70). In this section, Schumacher (ibid., 2011, p. 35) presents his *Thesis 4* in which he postulates the following *central message*: “Architectural theory is integral to architecture in general and to all architectural styles in particular: there is no architecture without theory.”

“Theoretical treatises are (essential components) of (the autopoiesis of architecture.) Architecture in contrast to mere building is marked by radical innovation and theoretical argument. Innovation questions the way things are done and requires an argument which transcends the mere concerns and competencies of building. Innovation requires theory. In contrast, vernacular building relies on tradition, on well proven solutions taken for granted. The status quo does not require theory. This affords a functional explanation of the emergence of theory as a (necessary ingredient) of a self-steering (autopoietic function system): such theoretically reflective practice can considerably accelerate societal evolution.”  
(Schumacher, 2011, p. 35)

Postulating in his *Thesis 4* that “architectural theory is integral to architecture” as “there is no architecture without theory,” Schumacher further examines the role of theory in architecture. He elaborates in this passage that theoretical treatises (i.e., architectural theories) constitute “essential components of the autopoiesis of architecture.” This view deviates from portrayals of autopoiesis in both cellular biology and social systems. These two preceding theories do not proclaim dependencies of the autopoietic phenomena they describe on the existence of theory. The construction of the built environment (“mere buildings” in contrast to “architecture”), by contrast, is portrayed in this passage as being driven by the innovative powers of the discipline of architecture, whose autopoietic dynamics, in turn, are described as being dependent on architectural theory. With this theoretical view on the role of theory within the discipline, Schumacher’s own theory claims an abstract, “super-theoretical” position among architectural theory and within the autopoiesis of architecture (see Schumacher, 2011, pp. 58–59).

#### 4.1.2.1 References to Preceding Theories

By itself, this passage and its central message contain few explicit connections between Schumacher's theory and either the biological theory of autopoiesis or to Luhmann's *hybrid construction*. Stronger connections along such lines can be drawn via Passage 1.a in Section 4.1.1, however. Passage 1.a leans on Luhmann's theory and proclaims a dependency of the systemic unity of architecture on "architectural theory," describing the latter as the "regulative mechanism" that maintains the (figurative) *boundary* of the discipline of architecture.

More specifically, Passage 1.b approaches the autopoiesis of architecture as an "autopoietic function system" similar to other functionally differentiated subsystems within society as described by Luhmann (1982, p. 135). Yet, at the same time, this passage deviates from both Maturana's and Luhmann's theories by declaring autopoiesis in architecture to be dependent on theory. Neither Maturana et al. nor Luhmann describe dependencies of the autopoietic phenomena described by their respective theories on theory.

References to Maturana et al.'s biological theory can be detected in Passage 1.b, both implicitly – considering Luhmann's *hybrid construction* – and explicitly – given the above-mentioned dependence on Passage 1.a. Biological as well as cybernetic references are furthermore present in evocative word choices such as "components," "self-steering autopoietic function" and "societal evolution."

Schumacher's use of the term "component" and his description of a "self-steering autopoietic function system" that "accelerate[s] societal evolution" echo Luhmann's (1982, p. 131) concept of *components* as defined by a recursive process of self-production of *events* that determines the functioning of each subsystem within society. Figure 4.3 on page 128 shows my visual interpretation of this description.

#### 4.1.2.2 Language Use and Merits

Passage 1.b can be interpreted in terms of multiple possible (both literal and figurative) uses of language. The term "components" (also referred to in this passage with the synonym "ingredient[s]"), together with the prefix "self," and the use of the term *autopoiesis* itself suggest connections between all three – Schumacher's, Maturana et al.'s, and Luhmann's – theories of autopoiesis. From Schumacher's ostensible

theoretical position of **literally** elucidating a subset of the social communication systems described by Luhmann, Schumacher offers an **explanation** (in Ostwald's terms; see Ostwald, 1999, p. 66) of the "functional" (see Luhmann, 2000, p. 133) dependency of architecture on architectural theory. While framed as addressing a subset of Luhmann's *hybrid construction*, this portrayal does not fully resonate with either Luhmann's or Maturana et al.'s theories, neither of which claims a dependency of their subjects on theory.

While the claims that "innovation [...] requires an argument" and "innovation requires theory" can be assumed to be informed by Schumacher's lived experience and observations, they rely in essence on assertions of "truth through *self-evidence*" (Lawlor and Nale, 2014, p. 517) rather than on the presentation of some underpinning reasoning, empirical data or traceable references. To the extent that self-evidence is implied, Ostwald's merits of legitimisation and obfuscation can be identified.

In the first and last sentences of the passage, Schumacher seems to portray architectural theory as being (like) biological autopoietic systems. With the syntactical *metaphorical* construction 'A (the tenor) *is* B (the vehicle)' in the sentence "theoretical treatises are essential components of the autopoiesis of architecture" and the *simile* construction 'A *as (or is like)* B' in the sentence "theory as a necessary ingredient of a self-steering autopoietic function system," I read Schumacher's main claims in Passage 1.b as grounded in figurative (**metaphorical/simile**) appropriations of observable, physical elements of the living cell via Luhmann's theory.

Implying self-evidence and with figurative references to preceding theories of autopoiesis, Schumacher essentially legitimises his assertion that "architecture in contrast to mere buildings is marked by radical innovation and theoretical arguments." Given that architecture is commonly understood as the practice of designing and constructing buildings, Schumacher's portrayal of "architecture" as distinct from "mere buildings" is unusual, if not controversial. The distinction between the discipline and building construction is rhetorically emphasised by using the adjective "mere" to disqualify vernacular architecture, whereas the verb *mark* to describe "architecture" suggests *pedigree* (using Rudofsky's terms; see Rudofsky, 1964, p. 2). With this approach, Schumacher demarcates from my observation of the relationship between vernacular architecture in the form of street markets or workforce settlements in the city and biological autopoiesis. Yet, he emphasises the existence of



some *pedigree* architecture within the built environment emerging from “radical innovation and theoretical argument” sustained as if an “autopoietic function system.”

With the word “evolution” as well as the prefix “self” in the word “self-steering,” Schumacher ostensibly alludes to biological **metaphors**. The use of the prefix “self” in the word “self-steering” further refers to a fundamental cybernetic principle involving the circular arrangement of feedback mechanisms. It also hints at the word “autopoiesis” in itself (i.e., “self-production”) (Maturana and Varela, 1980, p. 101), which suggests that the discipline of architecture, analogous to an autonomous living system (yet subordinate to social communications systems) can determine its own path towards a desired direction. Schumacher thus characterises the discipline as being generated and governed autonomously from within itself. This characterisation can be seen as an *appeal to nature* and thus as a **legitimation** of Schumacher’s ascertainment that theory “accelerate[s] societal evolution.” Furthermore, Schumacher’s apparent lack of interest in counteracting these possible figurative references in line with Maturana et al.’s theory of autopoiesis and the built environment may be a symptom of **obfuscating** purely literal readings in line with the proclaimed Luhmannian framework.

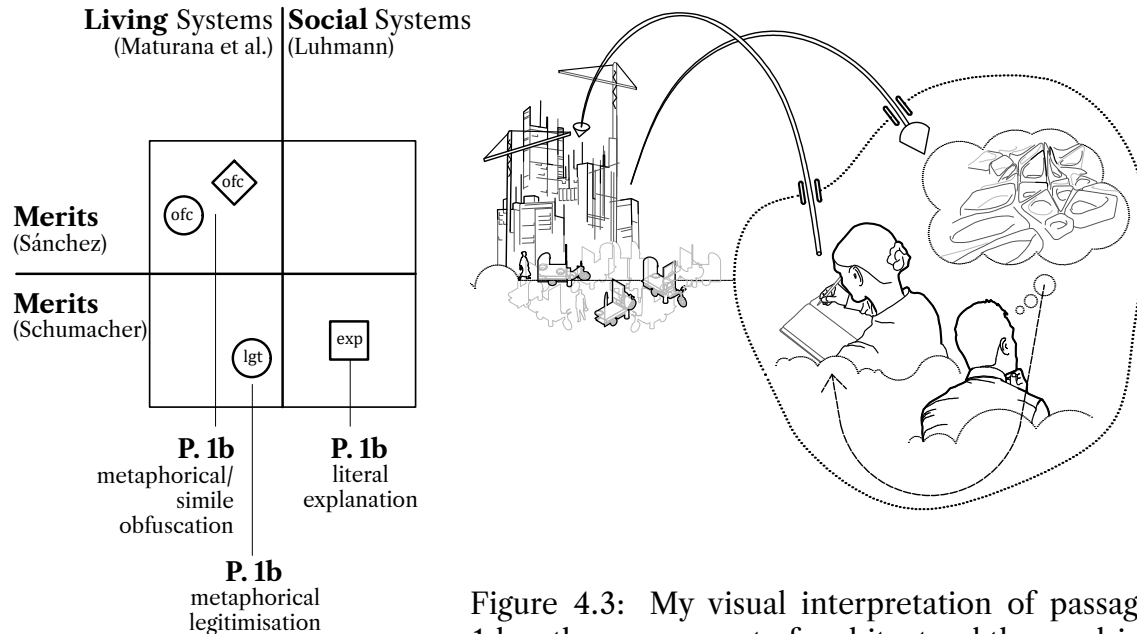


Figure 4.3: My visual interpretation of passage 1.b – the component of architectural theory driving architecture through its relationship with architectural innovation.

#### 4.1.3 Passage 1.c. – Avant-garde vs Mainstream

The following passage is a quote from Section 2.3 “Avant-garde vs Mainstream” in Chapter 2 of Schumacher’s Volume I entitled “The Historical Emergence of Architecture” (Schumacher, 2011, pp. 89–132). In this section, Schumacher (*ibid.*, 2011, p. 35) presents his *Thesis 7* in which he postulates the following *central message*: “The distinction between avant-garde and mainstream is constitutive of architecture’s evolution (autopoiesis). Only by differentiating the avant-garde as specific sub-system can contemporary architecture actively participate in the evolution of society.”

In this *thesis*’s central message, Schumacher further develops his “unified theory of architecture” (Schumacher, 2011, p. 59) as a subset of Luhmann’s figurative appropriation of autopoiesis. In Luhmann’s view (1982, p. 135), the evolution of society

is subordinated to the evolutionary process at the level of the functional subsystems of society. The discipline of architecture, postulated to be “one of the function systems of modern society” (Schumacher, 2011, p. 13), contributes to the “evolution of society” by way of its own evolution (i.e., “autopoiesis”). In Schumacher’s view, this internal evolution can only be achieved by distinguishing between *mainstream* and *avant-garde* architecture. While mainstream architecture addresses “urgent needs of society,” the avant-garde architecture as a subsystem of the discipline “is set free to explore new paths that might enable the discipline to meet upcoming societal challenges in the future” (Schumacher, 2011, p. 95). This passage presents avant-garde architecture as an *autonomous* entity that stands apart from the mainstream within the discipline of architecture.

“Architecture’s self-referential closure has been a precondition for architecture to become one of modern society’s dedicated and authoritative function systems. But, as discussed above, self-referential closure cannot mean hermetic isolation. The distinction between avant-garde and mainstream reproduces the distinction and relation between architecture and society within architecture, and thereby structures the process of adaptation and coevolution. The external boundary between architecture and its societal environment re-appears as internal boundary between the avant-garde and mainstream, with the avant-garde representing the system, and the mainstream representing the environment within the system.” (Schumacher, 2011, p. 99)

#### 4.1.3.1 References to Preceding Theories

With its central message and sampled passage framing the discipline of architecture as being “one of modern society’s dedicated and authoritative function systems,” this passage approaches architecture from the perspective of Luhmann’s theory of social systems. The term “self-referential closure,” around which this paragraph gravitates, alludes to the cybernetic foundation of both biological and sociological theories of autopoiesis. This concept is prominently used within Luhmann’s narrative, wherein he defines social systems as closed (autonomous) in terms of their communicative structure (Luhmann, 1986, pp. 85–86). References to “self-referential closure,”

however, can be traced back to Maturana's early work in which he defines living systems as autonomous through their "circular nature of its organisation" (Maturana, 1969, p. 5). Later Maturana and colleagues referred to this same biological observation as "organizational closure" (see Varela, 1979, pp. 55–56) to distance themselves from inadequate or misleading notions. In Maturana's own words: "I decided not to make any concession to existing notions that I considered inadequate or misleading" (Maturana and Varela, 1980, p. xviii).

Further references to Maturana et al.'s biological theory, while also presented implicitly via Luhmann's approach, can be explicitly distinguished by way of evocative word choices such as "process of adaptation and coevolution," "reproduce" and *external/internal* "boundary." For example, Schumacher's use of the term "adaptation" in conjunction with "coevolution" echoes the biological notion of *structural coupling* and its understanding of *evolution* as a process of systemic adaptation to external perturbances over time (see Maturana, 1980, p. 69; Varela, 1979, p. 36). Figure 4.4 on page 132 shows my visual interpretation of this description.

#### 4.1.3.2 Language Use and Merits

With word choices suggesting connections between Schumacher's, Maturana et al.'s and Luhmann's theories of autopoiesis, Passage 1.c invites interpretations in terms of multiple (both literal and figurative) uses of language. In alignment with Luhmann's perspective that autopoietic closure "does not mean isolation" (Luhmann, 1988, p. 336), Schumacher argues that the closure of architecture "cannot mean hermetic isolation." By incorporating the concept of "self-referential closure" from Luhmann's framework, Schumacher effectively **literally equalises** the discipline of architecture with other subsystems within society. This aligns Schumacher with Luhmann's conceptualisation wherein closure and openness are "no longer [seen] as contradictions but as reciprocal conditions" of and between subsystems of society (Luhmann, 1985, p. 113).

Throughout a syntactical construction based on postulating the "precondition" of architecture to "become one of modern society's dedicated and authoritative function systems," Schumacher suggests appropriating Luhmann's theory as the foundation to develop his own argumentative line of reasoning. From this theoretical foundation, Schumacher legitimises his assertion that avant-garde architecture exists as

an autonomous system distinct from mainstream architecture within the subsystem of the discipline. Furthermore, grounded in the assumption that the discipline of architecture is another social system, Schumacher asserts “architecture” as an authoritative entity, thereby demanding respect and compliance within the system of society.

While building upon Luhmann’s theory, Schumacher’s approach deviates in this passage from portrayals of autopoiesis in both cellular biology and social systems. With a focus on the living cell, Maturana et al. do not proclaim subsystems within the common building block of the vast majority of biological organisms. They (Maturana and Varela, 1987, p. 77; 1980, pp. 110–111), instead, consider multicellular tissues as subordinated to the molecular autopoiesis of individual cells. This biological observation is what they named “second-order autopoiesis.” Even though Luhmann’s theory has faced criticism for neglecting the possibility of understanding social systems as second-order autopoietic systems subordinated thereby to the cellular autopoiesis of living systems (see Mingers, 1995, pp. 148–150), he does not advocate for subsystems within social systems, as suggested by Schumacher in the discipline of architecture. Furthermore, Luhmann does not explicitly discuss the authoritative functions among societal subsystems, but rather recognises their distinct functioning within the broader system of society. Thereby, Schumacher’s reference to Luhmann’s theory appears to bear, at least in part, the hallmark of a *sweeping generalisation* (Engel, 1980, p. 40).

Figurative interpretations along Maturana et al.’s cellular biology also seem tolerated by Schumacher in Passage 1.c. The word “reproduce,” for example, while essential to defining the capacity of living systems to produce itself (autopoiesis), is invoked in this passage to refer to repeated action of distinction. Contrary to Maturana et al.’s interest in avoiding misleading associations, the proactive use of biological terms such as *adaptation*, *(co)evolution*, *boundary* and *environment* evoke further readings that move away from literal interpretations in line with Luhmann’s theory. While those words are also used in Luhmann’s theory they **metaphorically** allude to the biological property of autonomy as consolidated by a physical boundary that demarcates the autopoietic system from an external environment. Their incorporation in this paragraph seems to further **legitimise** Schumacher’s position and argument of differentiating between avant-garde and mainstream architecture within the discipline of architecture. By hinting at Maturana et al.’s autopoiesis,

Schumacher constitutes a rhetorical defence to easily challenge or rebut his argument since any challenge to his claim is also a challenge to Maturana et al.'s theory.

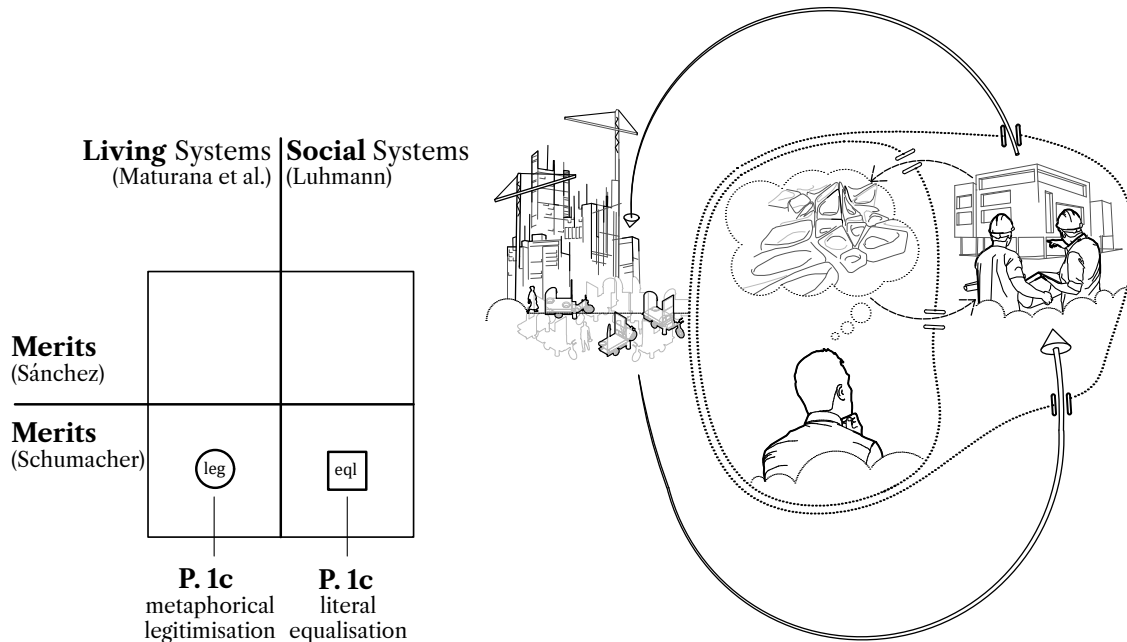


Figure 4.4: My visual interpretation of passage 1.c – the self referentially closed relationship between avant-garde and mainstream architecture *vis-à-vis* the self referentially closed relationship between architecture and the environment.

#### 4.1.4 Passage 1.d. – The Necessity of Demarcation

The following passage is a quote from Section 2.5 “The Necessity of Demarcation” in Chapter 2 of Schumacher’s Volume I entitled “The Historical Emergence of Architecture” (Schumacher, 2011, pp. 144–170). In this section, Schumacher (*ibid.*, 2011, p. 144) presents his *Thesis 9* in which he postulates the following *central message*: “Any attempt to integrate architecture and art, or architecture and science/engineering, in a unified discourse (autopoiesis) is reactionary and bound to fail.”

In this central message, Schumacher refers to Luhmann’s figurative appropriation of autopoiesis, in which social systems are *autonomous* entities within the system of

society (Luhmann, 1982, p. 136). By highlighting what is “bound to fail” and thereby implying a preferred reading, Schumacher asserts the autonomy of architecture as distinct from both art and science/engineering. In distinguishing architecture from art, Schumacher deviates from Luhmann’s perspective, which considers architecture part of the fine arts. With the distinction between science and architecture, Schumacher aligns with the observation that aspects of architecture and design extend beyond the reach of rational academic research (see Glanville, 1999, p. 89). With the claimed autonomy, Schumacher expresses a deliberate interest in expanding the influence of the discipline of architecture into other social systems (see Schumacher, 2011, p. 145). By examining the interplay between the autopoietic system of architecture and art, Schumacher argues for a certain degree of openness that “do not compromise the strict boundary of the separate [...] autopoietic systems.”

“Our conceptual set up even allows that one and the same object or individual communication exists and connects within two or more different systems – albeit differently identified, valued and connected. These overlap items do not compromise the strict boundary of the separate, autonomous, operationally self-enclosed systems of communications that are the different, incommensurable autopoietic systems of art and architecture/design.

The differentiation of art and architecture does not exclude cross-fertilization – via irritation rather than communication. When art, at times, exerts inspirational influence within architecture, it functions in the service of architecture. This can proceed without blurring the discursive boundaries and distinct system references.” (Schumacher, 2011, p. 152)

#### 4.1.4.1 References to Preceding Theories

With its central message describing architecture as an autonomous differentiated entity *vis-à-vis* other subsystems of society, this passage approaches architecture literally from the perspective of Luhmann’s theory of social systems. References to Maturana et al.’s biological theory of autopoiesis are nonetheless explicitly present by way of evocative phrases such as “autonomous, operationally self-enclosed systems,” or “cross-fertilization – via irritation.” The phrase “operationally self-

enclosed systems” aligns with the notion of *organisational closure*, which reflects the observation that living systems are autonomous throughout their “circular nature of its organisation” (Maturana, 1969, p. 5; Varela, 1979, pp. 55–56). Similarly, the phrase “cross-fertilization – via irritation” reflects the biological concept of *structural coupling* as the necessary interaction between the system and its medium (in the form of molecular exchange) to maintain the autopoiesis of the system stable. By emphasising these biological notions and incorporating the words “boundary” and “autopoiesis,” the paragraph calls for the innate autonomy of living systems and underscores Schumacher’s interest in establishing clear boundaries for the discipline of architecture.

Notably, within this passage, the allusions to cellular biology are somewhat overshadowed due to their syntactical association with terms that reaffirm a literal interpretation of the discipline of architecture as a subset of Luhmann’s communication system. For example, the phrase “self-enclosed systems” is promptly followed by “of communications,” or the term “boundary” is preceded by “discursive” which, by definition, encompasses all modes of communication. Figure 4.5 on page 137 shows my visual interpretation of this description.

#### 4.1.4.2 Language Use and Merits

Schumacher opens this Passage 1.d with the argument “that one and the same object or individual communication exists and connects within two or more different systems.” By starting and framing his core argument of this passage as enabled by a “conceptual set up,” Schumacher shields it from the immediate requirement of empirical substantiation, presenting it instead as grounded in his own ideas and principles. This rhetorical move allows the postulation of further statements informed by Schumacher’s lived experience and observations of the discipline, thus appearing to be, at least in part, based on arguments from authority (Knight and Collins, 2005, p. 189).

Schumacher’s reference to Luhmann’s appropriation of autopoiesis is ostensibly present through word choices that connect Luhmann’s theory with Maturana et al.’s. I read the combination of the words “self-enclosed system of communications” or “discursive boundary” as a metaphorical accommodation of Luhmann’s theory within Schumacher’s argumentative line of reasoning. The appropriation seems to



serve the purpose of asserting the discipline's autonomy while simultaneously promoting openness towards other social systems – such as, in the case of this passage, the one of art.

However, Schumacher's portrayal of autopoiesis along Luhmannian lines seems to deviate opportunistically from Luhmann's theory. Schumacher argues that the relationship between the subsystems of art and architecture is based on "irritations rather than communications." By employing the adverb "rather" to express a preference for the noun "irritations" over "communications" in this phrase, Schumacher deviates from Luhmann's emphasis on communications (which can indeed be irritating) among autopoietic systems within society (Luhmann, 1991, pp. 1424–1425). Yet, Schumacher's phraseology reinforces the distinction between architecture and art. Furthermore, although Schumacher seems to acknowledge the significance of inspirational influences as a form of divergent thinking in design with the sentence "art, at times, exerts inspirational influence within architecture," his choice of the word "irritation" to define the relationship between art and architecture undermines this potential. The phrase "object or individual communication" also presents an instance in which Schumacher conveniently utilises Luhmann's theory. With it, Schumacher insinuates an account for designed and created objects as a mode of communication within Luhmannian lines rather than just verbal or visual (in the form of architectural drawings) communications. This account is already foreshadowed on the initial pages of Schumacher's (2011, p. 2) *The Autopoiesis of Architecture*, wherein he enumerates "the total mass of communications" within the discipline that constitutes his autopoiesis and includes that of "buildings."

Schumacher highlights a contradiction in the last sentence of the first paragraph and the beginning of the subsequent one, as he advocates for a "cross-fertilization" between disciplines while preserving the "strict boundary" of each distinct "autopoietic system of art and architecture/design." This seeming contradiction can be reconciled when considering Maturana et al.'s observation that, at a cellular scale, a membrane allows for necessary molecular exchanges as well as when Luhmann (1988, p. 341), based on this observation, proposes a figurative communication boundary, permitting a certain degree of openness between closed subsystems of society. With this context, Schumacher's argument legitimates a discourse initially aimed at regarding the discipline of architecture as "not (just) art" or "not (just) science." By using the phrase "not (just)," Schumacher (2011, p. 145) reinforces

his argument that the “protective demarcation of the discipline’s territory does not preclude architecture’s pursuit of its own predatory appetites.” In other words, the delineation of the discipline in terms of independence and, therefore, *closure* from other social systems does not preclude the discipline from extending its relevance within those same social systems. However, relying more on subjective assessments and preferences of the discipline than observable evidence, this approach indicates a personal inclination toward a desired outcome of disciplinary expansion.

The claim for demarcation is reinforced in the concluding sentence of the first paragraph, where Schumacher weaves together the notions of autonomy and organisational closure (analogous to living systems yet subordinate to social communication systems), using the adjectives “separate,” “different,” and “incommensurable.” By employing these descriptive terms that emphasise distinctions, Schumacher underscores the differentiation between the fields of architecture and art, sidestepping the commonly acknowledged shared competencies. These shared competencies are particularly notable when considering the significance of art (in the form of paintings) as a tool for thinking and proposing architectural design ideas for the late Zaha Hadid’s architectural legacy (Kinzler et al., 2016).

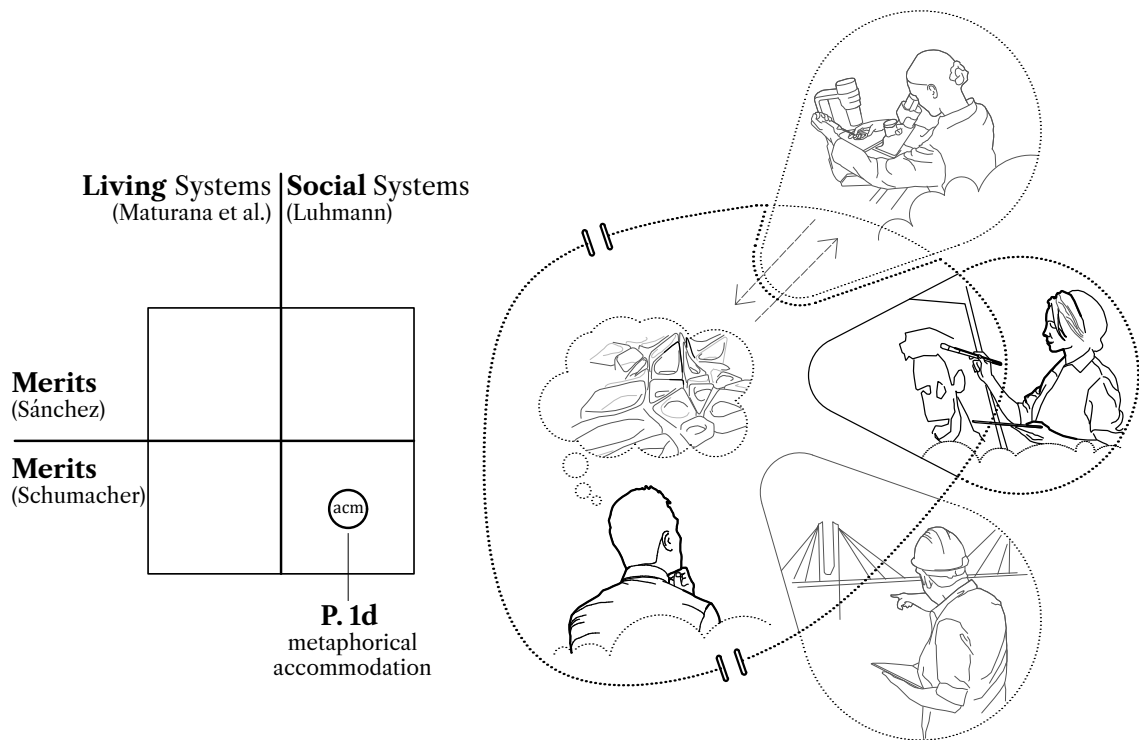


Figure 4.5: My visual interpretation of passage 1.d – the “strict boundary” of the discipline of architecture in relation to (in the case of this passage) the discipline of art.

#### 4.1.5 Passage 1.e. – Architectural Autopoiesis within Functionally Differentiated Society

The following passage is a quote from Section 3.1 “Architectural Autopoiesis within Functionally Differentiated Society” in Chapter 3 of Schumacher’s Volume I entitled “Architecture as Autopoietic System – Operations, Structures and Processes” (Schumacher, 2011, pp. 177–188). In this section, Schumacher (*ibid.*, 2011, p. 177) presents his *Thesis 10* in which he postulates the following *central message*: “In a society without control centre, architecture has to regulate itself and maintain its own mechanisms of evolution that allow it to stay adapted (within the ecology of coevolving societal subsystems).”

I read the title of this Chapter 3, particularly the word “as” in “Architecture as Autopoietic System” as indicative of a figurative connection between “architecture” and the biological theory of autopoiesis. However, in this central message, Schumacher portrays the discipline of architecture in reference to and as a subset of Luhmann’s theory by considering architecture as part of “the ecology of coevolving societal subsystems.” In Luhmann’s view, each subsystem of society is “functionally differentiated” from one another but remains aware of and adapted to social needs (Luhmann, 1982, p. 135). As part of this Luhmanian *autopoietic* functioning of the social system, Schumacher reiterates in this passage the *autonomy* of the discipline of architecture. He further elaborates on the discipline’s internal communicative operations as necessary to maintain the system’s autonomy (Schumacher, 2011, p. 178). This argumentative elaboration originates from Luhmann’s understanding of society as a complex and dynamic entity, devoid of clear hierarchies in values or priorities. In this regard, Schumacher (2011, p. 176) appears to advocate for architecture’s exclusive role in providing a “decisive orientation within the otherwise perplexing, expanding conceptual universe of architectural discourse.”

“There are constant and variable communication structures. It is the continuous evolution of the (variable structures) – set within a stable frame of constant structures – that allows architecture to effectively operate and maintain its autonomy and relevance within society.

This (autonomy) within society does not imply indifference to society. Rather, it is a necessary mode of contributing to society with sufficient flexibility and sophistication. This is one of Luhmann’s primary insights: contemporary society is far too complex and too dynamic to establish clear and fixed hierarchies of values/priorities that would in turn allow the societal division of labour to be conceived as chains of instruction whereby centrally/democratically set purposes are to be fulfilled by the various appointed function systems. Instead each function system appoints itself, defines its own purposes and rules supreme with respect to the appropriate selection of means.” (Schumacher, 2011, p. 178)

#### 4.1.5.1 References to Preceding Theories

With its central message describing architecture as a subsystem of society that “co-evolves” with other societal subsystems and characterising the discipline as needing to “maintain its autonomy and relevance within society,” this passage approaches architecture literally from the perspective of Luhmann’s notion of autopoiesis.

While Schumacher’s central message and sampled passage do not explicitly reference Maturana et al.’s theory of autopoiesis, there is a distinct biological undertone conveyed through Luhmann’s appropriation of the theory of autopoiesis. This is notable not only with the use of the biological terms “ecology” and “coevolution” to describe the interconnectedness of societal subsystems in the central message but also by evocative word choices such as “continuous evolution of the variable structures” and “operate and maintain its autonomy” within this passage. With the phrase “continues evolution of the variable structures,” Schumacher refers to the variation of communicative structures of the discipline of architecture to maintain its autonomy in line with Luhmann’s theory. However, with this sentence and textual context Schumacher does not seem to prohibit allusions to the biological process of structural adjustments necessary for maintaining the living system’s autonomy. Figure 4.6 on page 142 shows my visual interpretation of this description.

#### 4.1.5.2 Language Use and Merits

Key terms to examine in this passage include “evolution,” “structures,” and “autonomy.” Bridging Schumacher’s, Maturana et al.’s and Luhmann’s theory of autopoiesis, these word choices suggest multiple interpretations in terms of literal or figurative use of language.

In the second sentence of the second paragraph of Passage 1.e, Schumacher **literally equalises** his observation of the discipline of architecture with “one of Luhmann’s primary insights.” This equalisation suggests that Luhmann’s description of communication systems validates Schumacher’s theory appropriation, granting **legitimacy** to his reasoning and position. By considering Luhmann’s insights into his own, Schumacher shields his argument against potential challenges, as any critique of his theory would also inevitably extend to Luhmann’s insights.

While most cybernetic approaches, like Varela et al.’s computational model of au-

topoiesis (see section 2.2.5), rely on demonstrated implementations, Luhmann's appropriation of autopoiesis is primarily based on observations without empirical validation. Constructing his theory in close accordance with Luhmann's figurative appropriation, thus limited to lived experiences and observations, Schumacher claims that the evolution of variable communication structures "allows architecture to effectively operate and maintain its autonomy." In the absence of underpinning reasoning, empirical data, or a traceable reference other than an interpretation of Luhmann's figurative appropriation of autopoiesis, I read this claim to be, at least in part, an argument from authority (Knight and Collins, 2005, p. 189).

Schumacher explains in the first sentence of the second paragraph that "this autonomy within society does not imply indifference to society. Rather it is a necessary mode of contributing to society with sufficient flexibility and sophistication." While Schumacher attributes this claim to Luhmann's insights, his emphasis on a unidirectional relationship between the system and its environment deviates from the portrayals of autopoiesis found in both Luhmann's and Maturana et al.'s theories. For instance, Maturana and Varela (1980, p. 9) argue that living systems "cannot be understood independently of the part of the ambience with which they interact, known as the niche, nor can the niche be defined independently of the living system that gives it meaning" which highlights the importance of a relationship between the system and its environment.

Despite its central message and passage intending a literal reading in terms of Luhmann's theory, Schumacher also appears to evoke other figurative interpretations that align with Maturana et al.'s cellular biology. This resonance is particularly noticeable in the use of the term "structure" within the sentence: "It is the continuous evolution of the variable structures – set within a stable frame of constant structures – that allows architecture to effectively operate and maintain its autonomy." While being particularly familiar to architects and engineers, the term structure is pivotal in this passage for claiming the maintenance of the discipline's autonomy. With the biological characterisation of the term structure, Maturana et al. do not distinguish between "variable" and "constant structure," but characterise the system as capable of changing its structure to maintain its autonomy (see section 2.2.1). The use of the term "structure" thus "provide[s] access to" (Gibbs, 1994, pp. 319–320) and **legitimizes** the characterisation of the discipline of architecture as an autonomous entity that evolves over time.

In my reading, this portrayal of the discipline as a whole autonomous system is grounded in figurative language use, particularly **metonymy**, as evident in the use of the terms “structure” and “evolution.” Notably, Varela (2018, p. 43) regards metonymical appropriations of the theory of autopoiesis sceptically, considering them “an abuse of the language” (my translation from the original Spanish phrase: “un abuso del lenguaje”), primarily due to the loss of biological precision.

By drawing apparent inspiration from Maturana and Varela’s (1992, pp. 47–48) concept of autonomy as the ability of a system to “specify its own laws,” Schumacher, building upon Luhmann’s insights, puts forward the notion that the discipline of architecture possesses the capacity to “appoint itself, define its own purpose and rules.” Through his deliberate use of the pronoun “itself” and the determiner “own” prior to the nouns “purpose and rules,” Schumacher establishes a connection between the autonomy of architecture and the spontaneous biological process of self-emergence. This perspective positions the profession as an entity that naturally arises, lending Schumacher’s argument a sense of inherent validity with few (if any) negative meanings (Moore, 1903, p. 94). As a result, Schumacher further seems to legitimate his theory and bolsters his objective of reorienting the architectural discourse.

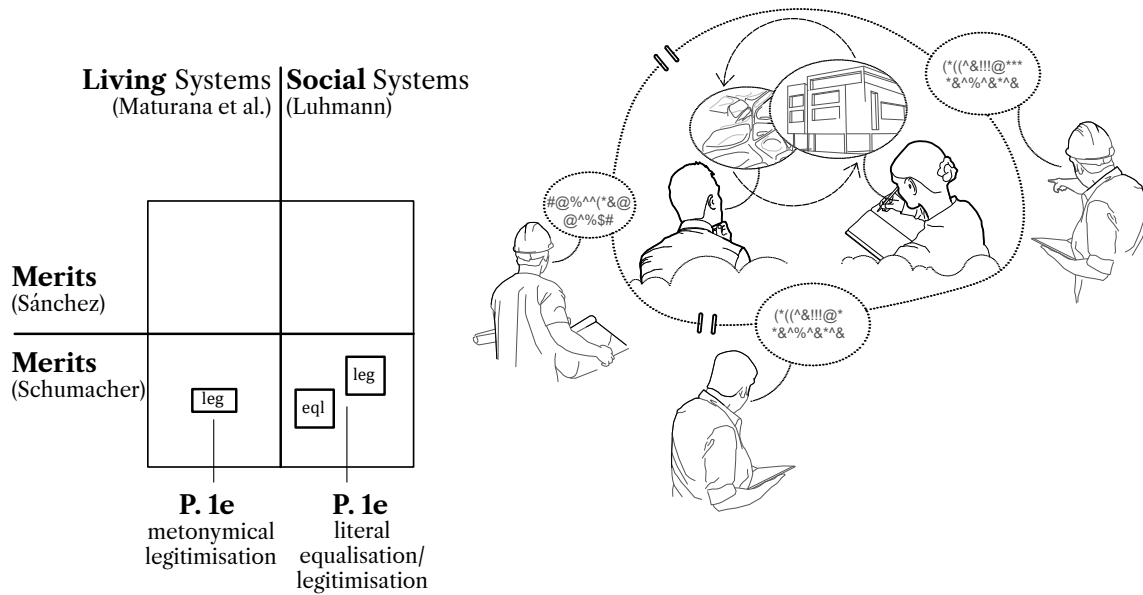


Figure 4.6: My visual interpretation of Passage 1.e – the continuous structural adjustments of communications within a “stable frame of constant structures” to constitute the discipline’s autonomy.

#### 4.1.6 Passage 1.f. – Architectural Style

The following passage is a quote from Section 3.6 “Architectural Style” in Chapter 3 of Schumacher’s Volume I entitled “Architecture as Autopoietic System – Operations, Structures and Processes” (Schumacher, 2011, pp. 241–277). In this section, Schumacher (ibid., 2011, p. 241) presents his *Thesis 15* in which he postulates the following *central message*: “Architecture needs (new) styles to streamline the design decision process and to regulate (anew) the handling of its evaluative criteria (code values).”

Schumacher (2011, p. 241) postulates in this section’s opening sentence that the “defining problem of architecture is the elaboration of designs that give architectural form to social functions.” In this view, by referring to architectural styles in relation to the “design decision process” and the “evaluative criteria” of design, Schumacher alludes in this central message to the physical architectural product that is devel-



oped from within the discipline of architecture. Describing the contribution of architecture as a part of the functioning of the discipline within society, and rejecting existing styles such as Historicism or Modernism, Schumacher calls “for a unified, contemporary style in architecture and design” (Schumacher, 2011, p. 255). From his “super-theoretical” architectural position (ibid., 2011, pp. 58–59) and leaning on his autopoiesis of architecture, Schumacher (ibid., 2011, pp. 244, 245) promotes “the emerging new style” – Parametricism – as a successor to Modernism. That is a new “epochal style” that “gives long-term stability to the development of the built environment” (ibid., 2011, p. 253).

“An observer who is questioning what the supposed beauty and/or utility of a design feature consists in is observing in the mode of second order observation. Such a communication also communicates its awareness that its evaluations are contingent upon its system of distinctions and that other observers can be expected to judge differently on the basis of their distinct criteria of discrimination. Stylistic awareness is thus based on second order observation. What is beautiful for a Minimalist because of the achieved reduction to the utmost simplicity is likely to lack vitality according to the judgement of the Parametricist. According to Parametricism the complexity reduction achieved by Minimalism goes too far and entails the obliteration of vital programmatic and tectonic differences. Such differences could have been taken up by an elegant system of modulation that would have set a rich order against the Minimalist monotony.” (Schumacher, 2011, p. 272, 273)

#### 4.1.6.1 References to Preceding Theories

In this Passage 1.f, Schumacher leans on Luhmann’s concept of “second-order observation,” which involves the observer differentiating between observers and observing them “with a view to that which he cannot see” (Luhmann, 2013, p. 112). Pursuing the unknown stems from acknowledging the potential differences in creating distinctions among individual observers (ibid.). In Schumacher’s autopoiesis of architecture, these distinctions rely on a theoretical frame of reference, i.e., the double code of “beauty and/or utility of a design feature.” Styles, in turn, funnel the

conversations into the same theoretical frame of reference.

With the role of the observer being essential within the (second-order) cybernetic foundation of both biological and sociological theories of autopoiesis (see, for example, von Foerster, 1984; Glanville, 1981), references to the biological theory of autopoiesis are therefore present implicitly by way of Luhmann's theory. This is notable, despite Luhmann's (2013, p. 100) claim that he does not "intend to adopt Maturana's conception [of the observer] wholeheartedly" but instead radicalise it in a way that the theory of autopoiesis is formulated in general terms.

References to Maturana et al. become apparent when Schumacher characterises the observer as having the ability to create "distinctions" and expects them to "judge differently based on their specific criteria of discrimination." This perspective aligns with Maturana et al.'s assertion widely acknowledged in and beyond second-order cybernetics: "Anything said is said by an observer" (Maturana and Varela, 1980, p. 8; Maturana, 1975, p. 315). With it, Maturana et al. imply that the observation, description and explanation of any phenomena are contingent upon the observer's choices and purposes (Maturana, 1980, pp. 46–47; Mingers, 1995, pp. 13–14). Figure 4.7 on page 146 shows my visual interpretation of this description.

#### 4.1.6.2 Language Use and Merits

The historical connection among Schumacher, Maturana et al., and Luhmann, in their understanding of the observer, establishes the foundation for interpreting both literal and figurative language use while also serving to identify various potential beneficiaries of Schumacher's theory appropriation. By positioning architecture as a subset of social communication systems, wherein the system communicates using the mode of second-order observation described by Luhmann, Schumacher offers a **literal explanation** for the different "stylistic awareness" observed among observers examining a "design feature." The explanation is further reinforced through an exemplification drawn from Schumacher's extensive experience and observations within the field of architecture. The example illustrates the contrasting stylistic judgments between a Minimalist and a Parametricist designer, where Schumacher suggests that "what is beautiful for a Minimalist because achieved deduction to the utmost simplicity is likely to lack vitality according to the judgement of the Parametricist." He continues by arguing that, "according to Parametricism the complex-

ity reduction achieved by Minimalism goes too far and entails the obliteration of vital programmatic and tectonic differences.”

Using value-laden language such as “to lack vitality,” “obliteration,” in the given example, and “monotony” in the final sentence of the passage, Schumacher conveys a disdain towards the style of Modernism. Despite the assertion to present a “unified theory of architecture” (Schumacher, 2011, p. 4), this use of language seems to engage a particular readership, thereby fostering a discourse within a specific group of sympathisers. The opening sentence of the passage sets the stage for this targeted approach in which Schumacher prescribes the observer’s question due to the assumption that the reader is following through with his lead distinction of form and function as well as his double code of utility and beauty (see Schumacher, 2011, pp. 258–261). The last sentence of the passage also reveals an interest in targeting his theory towards a particular segment of architectural readers. In it, Schumacher postulates his ideological position by offering his personal opinion regarding the potential enhancements that precursor figures of the Minimalist style could have made to alleviate “the Minimalist monotony.”

In my reading, Schumacher’s appropriation of Luhmann’s *hybrid construction* thus **legitimizes** a discourse that aims to promote the style of Parametricism as guidance from where observers can competently evaluate their own and others’ architectural design. However, as Samalavičius (2011, pp. 359–360) points out, despite Schumacher’s attempt to transcend Modernism with the style of Parametricism, “his perception of how aesthetic judgements are adopted remains stuck in the typically Modernist dogmatism [...]. The role of an expert as the “high priest of value” was institutionalized in and by Modernist discourse” (ibid.).

Approaching the discipline of architecture through the lens of Luhmann’s theory, Schumacher does not appear to counteract possible figurative interpretations of Passage 1.f along the lines that brought me to formulate the research question I investigate in this thesis. Schumacher’s use of the term “design feature” in relation to both the built environment and the design process reinforces the possibility of such figurative associations. With references to the beauty and utility of the built environment in connection with Maturana et al.’s observer-dependency, Passage 1.f, in my reading, evokes figurative associations, particularly of an **analogical** nature. In this view, the way the built environment is observed under the mode of observation described within the theory of autopoiesis enables the **theorisation** (in Ostwald’s

terms; see Ostwald, 1999, p. 66) of the role of the observer in architecture. Notably, Schumacher's description of the role of the observer also diverges from Maturana et al.'s theory of autopoiesis and my own interpretation of autopoietic processes within the city. By purportedly delineating two distinct entities, i.e., the built environment and the autopoietic system of the discipline of architecture, Schumacher suggests a reference to subjectivity in perceiving the architectural product and the built environment rather than taking the observer into account the observation as commonly conceived in second-order cybernetics.

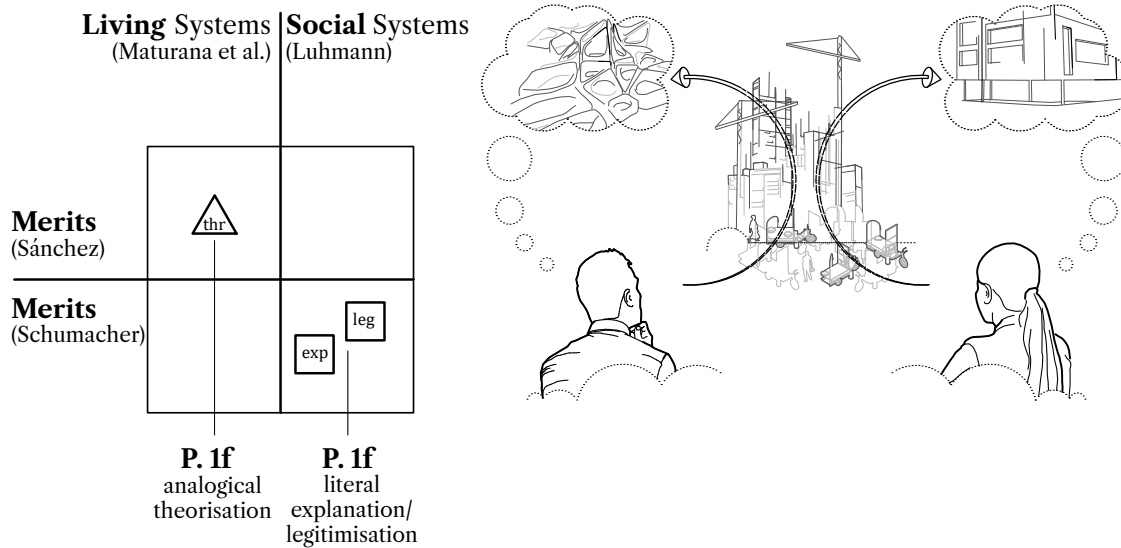


Figure 4.7: My visual interpretation of Passage 1.f – the “stylistic awareness” and subsequent design evaluation based on the observer-dependent observation.

#### 4.1.7 Passage 1.g. – The Medium and the Time Structure of the Design Process

The following passage is a quote from Section 4.2 “The Medium and the Time Structure of the Design Process” in Chapter 4 of Schumacher’s Volume I entitled “The Medium of Architecture” (Schumacher, 2011, pp. 342–362). In this section, Schumacher (ibid., 2011, p. 342) presents his *Thesis 20* in which he postulates the following *central message*: “The evolution of architecture’s autopoiesis involves the evolution of its specific medium. The introduction of the medium established the capacity to progress the architectural project while maintaining reversibility. Each further step in the development of the medium increased this crucial capacity to combine design progress with the preservation of adaptive malleability.”

This central message alludes to Luhmann’s concept of the medium of communication within social systems. Luhmann (2013, pp. 22–23) posits that money serves as the medium of communication in the economic system, while power fulfils this role in the political system. Likewise, within the domain of architecture and related design disciplines, Schumacher (2011, p. 330) proposes drawing/modelling as the medium of communication. According to Luhmann (2013, p. 19), the medium plays a “decisive role in the differentiation of the system” within society, implicitly allowing Schumacher to further consolidate the demarcation of the discipline of architecture within Luhmann’s theory of social systems. While echoing early discussions on *occupational closure* in which “closure” refers to the given system isolating itself from the external environment (Weeden, 2002, p. 59), Schumacher’s central message and passage also align with the systems and cybernetics understanding of “closure” as also referring to the existence of a loop by which a given system’s output can re-enter as its input (see Fischer, 2019, pp. 376–377). Schumacher specifically highlights the evolution of the architectural medium, such as the evolution from tracing paper to computing, to emphasise “the capacity to progress the architectural project while maintaining reversibility.” In this passage, Schumacher portrays the design process as inherently self-referential, relying thus on a circularly-causal functioning through which systems maintain their integrity and identity. This autopoietic approach to the design process resonates with previous depictions of designers’ actions in such processes: they “create the conditions in which the design outcome can come into being and continue to generate itself” (Glanville, 2019, p. 49).

“The various mental acts and associations have no bearing on the meaning unless they have an impact on the ongoing production of drawings out of drawings, or of digital models out of digital models. The design process is a (self-referential, autopoietic process) that (recursively defines itself and constitutes its (elemental meaning components); the individual drawings as (elements) of the ongoing design process. What counts as an (elemental) architectural communication, ie, what is one versus another particular design decision, architectural idea, or feature, is not pre-given via an objective, external criterion. Anything that can be – by means of words and/or drawings – attributed to a design decision is an architectural element. But the decision that turns a latent, perhaps hitherto unobserved formal feature into an intended architectural feature or motif, this decision, is not only a mental act, but – and only this is relevant – a communication that explicitly underlines and reinforces the respective feature as intended and architecturally valuable.”

(Schumacher, 2011, p. 344)

#### 4.1.7.1 References to Preceding Theories

With its central message describing the relevance of the medium of communication of architecture in the design process and further elaborating on such observations in this passage, Schumacher approaches his autopoiesis of architecture in line with Luhmann’s theory of social systems. According to Luhmann (2013, p. 165), the communications of every social system take place in the medium of words, which in turn “allow us to form sentences and make meaningful statements.” Accordingly, Schumacher argues that the discipline of architecture meaningfully communicates not only in the medium of words but also in the medium of drawings and digital models. Yet “the various mental acts and associations have no bearing on the meaning” of the communicative act of the discipline of architecture. With this observation, Schumacher further aligns with Luhmann’s differentiation between the psychic system – which reproduces on the basis of thoughts – and the social system – which reproduces on the basis of communications. In Luhmann’s (Luhmann, 1995, pp. 60–64; Seidl, 2004, pp. 5, 8) view, mental acts such as thoughts have no impact and cannot determine what communications come about but rather irritate them.

References to Maturana et al.'s biological theory are nonetheless present implicitly by way of Luhmann's *hybrid construction* as well as explicitly by way of evocative word choices such as "ongoing production of drawings out of drawings" and "self-referential, autopoietic process that recursively defines itself." The use of the term "self-referential" points even further to the cybernetic foundation of both the biological and the sociological theory of autopoiesis in which a system constantly refers to itself in a feedback loop. Figure 4.8 on page 151 shows my visual interpretation of this description.

#### 4.1.7.2 Language Use and Merits

The terms "production," "components" (also referred to in this passage with the synonym "elements"), "self-referential," "recursively," and the use of the term *autopoiesis* itself suggest connections between all three – Schumacher's, Maturana et al.'s and Luhmann's – theories of autopoiesis. Passage 1.g can therefore be interpreted in terms of multiple possible (both literal and figurative) use of language.

In the first part of the second sentence, Schumacher postulates that the "design process is a self-referential, autopoietic process." With the syntactical construction 'A (the tenor) *is* B (the vehicle)' in this sentence, Schumacher, in my reading, **metaphorically** appropriates observable cellular processes to convey (or transmit (using Ostwald's terms; see Ostwald, 1999, p. 66) certain characteristics of the design process. By portraying drawings as the "components" (or "elements") of the "ongoing design process," Schumacher suggests that these processes have the ability to generate their own components in line with Maturana et al.'s cellular autopoiesis. Glanville (2019, pp. 49–50) argues that "the process of designing can go on in principle forever, and, in essence, when we choose to stop designing is generally a personal and arbitrary decision." Yet he (Glanville, 2019, p. 50) doubts "whether the progress by which the autopoietic system generates itself is in a manner similar to the progress of the design process."

Schumacher's allusion to Maturana et al.'s autopoiesis, is however subordinated to Luhmann's theory. This is suggested by his demarcation between "mental acts" and "the ongoing production of drawings" in line with Luhmann's differentiation between the psychic and the social system. Schumacher explicitly refers to "design decision, architectural idea, or feature" as "elemental architectural communi-

cations,” further suggesting his alignment with Luhmann’s social communication systems. Moreover, Schumacher seems to demarcate his theory from possible interpretations along Maturana et al.’s autopoiesis since, in addition to the recursive interplay of components that produce themselves, Maturana et al. also present the need for a system to maintain such processes from within a defined space so it can be called autopoietic (see Varela, 1979, pp. 12–13; Maturana, 1980, pp. 52–53). In the absence of a clearly defined boundary, Schumacher defines the system of architecture based on Luhmann’s vaguely defined boundary in terms of meaningful communications (Luhmann, 1982, p. 132). Approaching the architectural design process through the lens of Luhmann’s theory, Schumacher, however, does not appear to counteract possible figurative interpretations in line with biological systems. The evocation of metaphorical associations with living systems and architectural design process may undermine and hence **obfuscate** Schumacher’s ostensibly purely literal reading in terms of Luhmann’s theory.

In the opening sentence of Passage 1.g, Schumacher presents the designer’s “mental acts and associations” in a design process devoid of meaning, which appears to eliminate or diminish the human element from the process. The exclusion of the designer as an integral part of the system is particularly unusual, if not controversial. However, Schumacher clarifies that only the mental acts and associations that impact the continual production of drawings or digital models hold significance. By doing so, he implicitly suggests the presence of structural coupling, as defined by Luhmann, between the psychic and social systems, albeit without full acknowledgement. Notably, this perspective brings forth Maturana et al.’s critique of Luhmann’s theory for failing to consider human agency (Maturana and Poerksen, 2011, p. 106). While it is commonly recognised that designers and architects communicate through drawings and words, and that design decisions lead to the formalisation of design outcomes, Schumacher’s position of **literally** elucidating a subset of Luhmann’s social communication systems enables him to make the design process **theoretical**. Yet, Schumacher’s theoretical formulation lacks substantial empirical data necessary for rigorous testing and scrutiny, as is typically expected in academic theories. Instead, he provides a theoretical description of the design process primarily based on his personal experience within the discipline that seems to serve the consolidation of his theoretical edifice rather than potentially informing members of the architectural discipline.



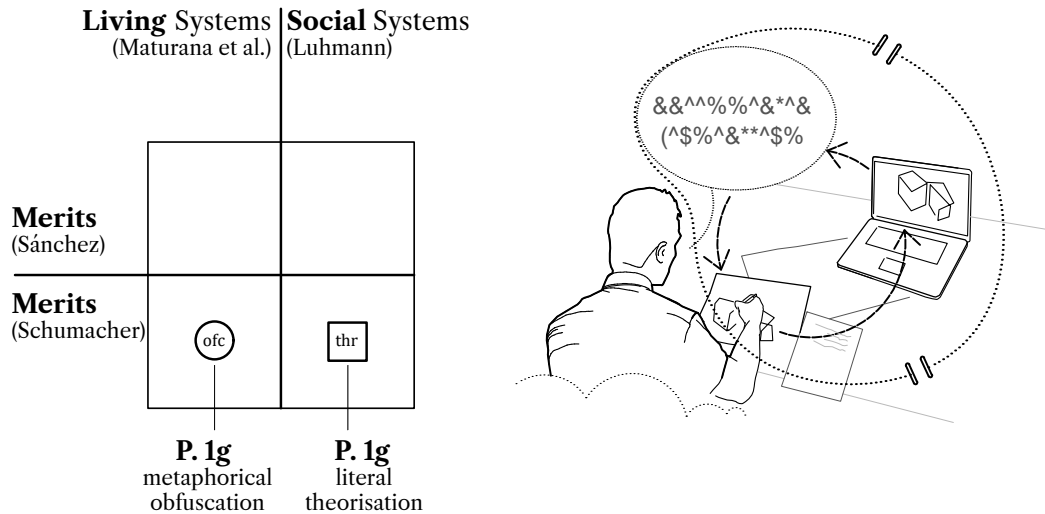


Figure 4.8: My visual interpretation of Passage 1.g – the “ongoing production” of drawings as constitutive of the system’s autopoiesis.

#### 4.1.8 Passage 1.h. – Architecture as Societal Function System

The following passage is a quote from Section 5.1 “Architecture as Societal Function System” in Chapter 5 of Schumacher’s Volume I entitled “The Societal Function of Architecture” (Schumacher, 2011, pp. 364–391). In this section, Schumacher (*ibid.*, 2011, p. 364) presents his *Thesis 21* in which he postulates the following *central message*: “All social communication requires institutions. All institutions require architectural frames. The societal function of architecture is to order/adapt society via the continuous provision and innovation of the built environment as a system of frames.”

With the title “Architecture as Societal Function System” of this section, Schumacher establishes a connection between “architecture” and Luhmann’s theory of social communications. Given this context, and taking into account Luhmann’s (Luhmann, 2000, pp. 131, 135) perspective that social systems possess functional

autonomy, setting them apart from other subsystems of society, this passage can be approached within the framework of Luhmann's theory of autopoiesis. While in Luhmann's view, architecture is not a social system in its own right (see Luhmann, 2000, pp. 45, 160), to Schumacher (2011, p. 264), "architecture is a major autopoietic function system within modern world society." It is because "there is no human society without a constructed spatial environment" (ibid. 2011, p. 371). Through the *organisation* and *articulation* of the spatial (built) environment, architecture frames the communications of each subsystem of society. In this context, the role of architecture in framing communications can be interpreted as providing structures for human activity. However, an alternative perspective also suggests that architecture serves as a communication control mechanism, aligning with Foucault's understanding of social control. According to Foucault (Foucault, 1982, p. 781), power acts upon and through individual subjects within society, giving them little (if any) self-defining capacities.

"Framing is itself a form of communication. It is an important type of communication. It determines a general set of constraining premises for all further communications that are to take place within the communicated frame. Buildings, or, to be more precise, the spaces (territories) around and within buildings, thus constitute important communications. They are communications that are generated within the (autopoiesis of architecture) but at the same time they cross architecture's (system boundary) to enter other social communication systems as their framing devices. Architectural spaces are the final architectural communications delivered into society as architecture's service to society. They are priming the participants of an ensuing communicative encounter by setting the scene, by pre-constraining the range of possible communicative scenarios and by conjuring up anticipations about what is likely to be expected from the participants." (Schumacher, 2011, p. 364, 365)

#### 4.1.8.1 References to Preceding Theories

The opening sentence of the preceding paragraph of the sampled passage claims that Schumacher's work "theorizes architecture in parallel to Luhmann's account

of the great function systems of modern society.” With this claim and its central message suggesting a discipline of architecture as a functionally differentiated subsystem within society similar to other subsystems, this passage can be assumed to be approaching “architecture” from Luhmann’s notion of autopoiesis.

References to Maturana et al.’s biological theory can nonetheless be drawn implicitly considering Luhmann’s *hybrid construction*. Although the term “framing” is presented as “a form of communication” and thus along Luhmannian lines, it deviates from portrayals of autopoiesis in social systems. Luhmann does not physically frame communications in terms of “buildings, or to be more precise, the spaces (territories) around and within buildings.” With a physical characterisation and being something that is “generated within the autopoiesis of architecture,” the term framing evokes, in my reading, the biological understanding of a living cell membrane as an instance of the notion of boundary. This possible reading does not seem to be prohibited, yet somewhat reinforced by Schumacher’s agreement with Georg Simmel’s definition of framing as the boundary that shapes society (see Simmel, 1995, p. 141 cited in Schumacher, 2011, p. 381). Figure 4.9 on page 155 shows my visual interpretation of this description.

#### 4.1.8.2 Language Use and Merits

With word choices such as “generated within the autopoiesis of architecture,” “cross architecture’s system boundary,” or even “framing devices” bridging Schumacher’s theory of autopoiesis and its predecessors, Passage 1.h can be interpreted as encompassing both literal and figurative use of language.

From Schumacher’s theoretical position of **literally** elucidating the functioning of “architecture” within the scope of other social systems functioning within society, Schumacher **legitimises** his reasoning and position. Schumacher’s appropriation of Luhmann’s theory enables him to describe the built environment as a “framing” device of communication that “determines a general set of constraining premises for all further communications [...] by pre-constraining the range of possible communicative scenarios and by conjuring up anticipations about what is likely to be expected from the participants.” With the phrase “constrained premises” embedded in this sentence, Schumacher proclaims architecture to limit and control every other communication. Furthermore, phrases such as “pre-constraining” and “conjuring

up anticipations” enhance the portrayal of the built environment as a mechanism for societal behavioural control, exerting power over other social communication systems by organising and articulating spatial relations. This advocacy of describing architecture as an institution of power “makes individuals subjects” in the sense that “imposes a law of truth on [them] which [they] must recognize and which others have to recognize in [them]” (Foucault, 1982, p. 781).

The invocation of Luhmann’s theory further legitimises Schumacher’s apparent purpose of presenting architecture as a dominant force over other social communications systems as it shields his argument from potential criticism. This perspective is articulated by an emphasis on the “importance” of the built environment, thereby presenting it as a necessary (or great value) mechanism to frame communications of other social systems. With this rhetorical move, Schumacher predisposes readers to approach his reasoning as convincing and theoretically valid. Furthermore, the word “service” in the sentence “architectural spaces are the final architectural communications delivered into society as architecture’s service to society” serves as a powerful rhetorical tool. By employing a word with few (if any) negative meanings, Schumacher conveys a sense of moral rightness, posing a formidable challenge to opposing his argument. Given the absence of negative interpretations associated with the idea of giving service to society within the realm of social communication systems, his viewpoint becomes even more impervious to refutation.

The postulation that “there are communications that are generated within the autopoiesis of architecture, but at the same time, they cross architecture’s system boundary to enter other social communication systems as their framing devices” seems to draw upon Luhmann’s theory to describe the interactions between architects and various stakeholders, including clients, constructors or engineers. However, word choices such as “generated within the autopoiesis of architecture,” “cross architecture’s system boundary,” or even “framing devices” in this sentence evoke **metaphorical** associations between cellular autopoiesis and the built environment. In my reading, it alludes to Maturana et al.’s notion of *second-order autopoiesis* in which multiple living cells interact, forming multicellular patterns of organisation while remaining subordinate to the autopoiesis of individual cells (see Maturana and Varela, 1980, pp. 110–111; 1987, pp. 74–90). With sentences hinting at Maturana et al.’s cellular biology and word choices such as “territory,” “buildings,” “spaces [...] around buildings,” “architectural spaces,” and “boundary” referencing the built

environment, Schumacher does not seem to preclude readings along the lines that brought me to formulate the research question I investigate in this thesis. Particularly to the associations I drew between the built environment and living systems, including the societal interactions that consolidate an ever-changing built environment. These possible other readings may **obfuscate** readings in terms of Luhmann’s theory, particularly acknowledging that members of the architectural discipline are, by virtue of the creative and epistemic demands of the profession, particularly open to figurative references.

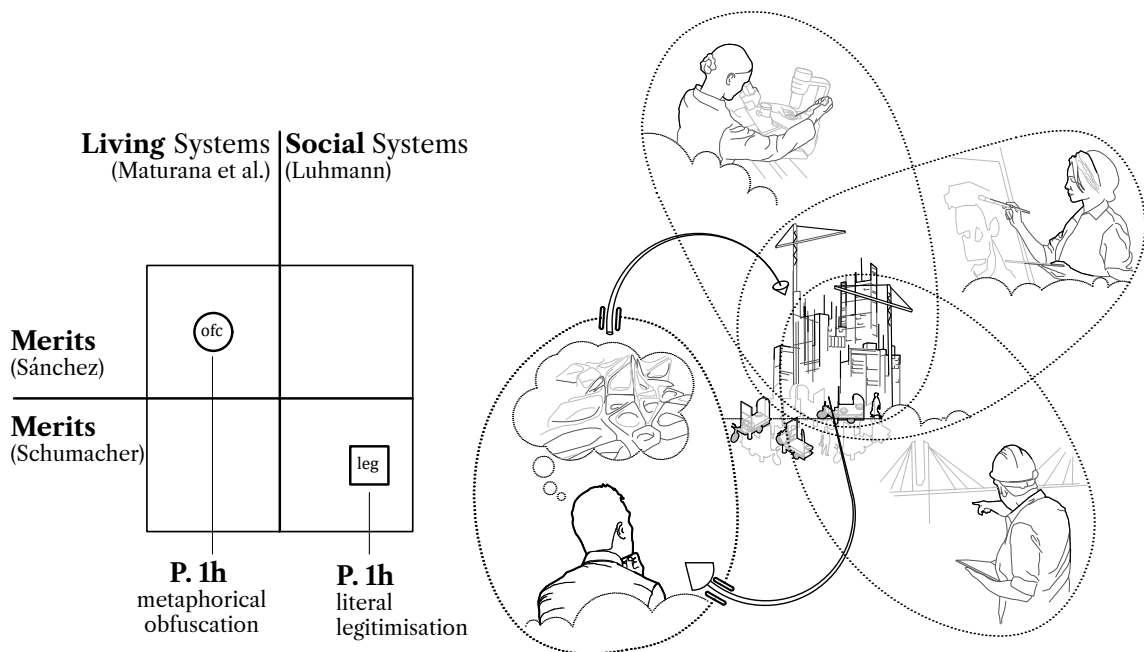


Figure 4.9: My visual interpretation of Passage 1.h – the “framing” of others’ systems of society as generated within and expelled out by the architectural domain.

#### 4.1.9 Passage 1.i. – Key Innovations: Place, Space, Field

The following passage is a quote from Section 5.4 “Key Innovations: Place, Space, Field” in Chapter 5 of Schumacher’s Volume I entitled “The Societal Function of

Architecture” (Schumacher, 2011, pp. 411–433). In this section, Schumacher (ibid., 2011, p. 411) presents his *Thesis 24* in which he postulates the following *central message*: “The concept of space was the conceptual mainspring of Modernism. It is now being superseded by the concept of “field” as one of the conceptual mainsprings of Parametricism.”

“Key concepts of this kind are important discursive structures. They define the essential goal of the discourse and practice for all participants, and therefore give a particular perspective and drift to all communications. This section takes the concept of space as an important example – perhaps the most important example – of a cycle of innovation in the conceptual apparatus of the discipline. The section tries to show how this cycle of conceptual innovation was stirred by external stimuli (perturbations) and drew on imported conceptual resources to respond to the external challenges. The attempt is made to trace how the new conceptual focal point enhanced the discipline’s handling of its new tasks within new societal conditions.” (Schumacher, 2011, p. 411, 412)

By itself, the central message contains few (if any) explicit connections between Schumacher’s theory and either the biological theory of autopoiesis or Luhmann’s *hybrid construction*. Stronger connections along Luhmann’s self-referential system of communications, can be drawn via the sampled passage in which Schumacher characterises architectural “concepts” to “give a particular perspective and drift to all communications.” He argues that the architectural “concepts” undergo a continual “cycle of innovation” and asserts that the concept of “space” is “superseded by the concept of field” within his central message. By considering the architectural concept of space the “mainspring of Modernism,” Schumacher promotes the style of Parametricism, attributing autopoietic dynamics of the discipline of architecture to its associated concept of “field”. Yet, this view deviates from portrayals of autopoiesis in cellular biology and social systems, neither of which proclaim dependency of the autopoietic phenomena they described on the existence of “key concepts.”

#### 4.1.9.1 References to Preceding Theories

Despite the fact that Luhmann does not proclaim dependencies of the autopoietic phenomena he described on the existence of “concepts,” Schumacher seems to rely on Luhmann’s social communication systems to underscore the significance of the term. According to Schumacher these “concepts” are “important discursive structures” that “give a particular perspective and drift to all communications” within the discipline of architecture. By claiming so, Schumacher alludes to the internal autopoietic dynamics of communicative operations within the system. Moreover, I read the last sentence, particularly the phrase “new tasks within new societal conditions” as drawing references to the functioning of architecture within an ever-changing society.

References to Maturana et al.’s biological theory of autopoiesis are nonetheless present explicitly by way of evocative word choices such as “external stimuli (perturbations)” and “cycle of innovation.” In the context of this passage where Schumacher claims that “conceptual innovation was stirred by external stimuli (perturbations) and drew on imported conceptual resources to respond to the external challenges,” Schumacher’s reference to an architectural conceptual “cycle” appears to bear, in my reading, a possible resemblance to the living cell cycle. This is particularly so given the context and, notably, Schumacher’s use of the word “perturbation,” echoing the biological autopoietic concept of *structural coupling*. With this notion, Maturana et al. (1980, pp. xx–xxi; Maturana, 1980, p. 54) reflect the observation that living systems undergo internal structural changes and adaptations in response to external disruptions. Figure 4.10 on page 159 shows my visual interpretation of this description.

#### 4.1.9.2 Language Use and Merits

With word choices that suggest references to both Maturana et al.’s and Luhmann’s theory of autopoiesis, Passage 1.i can be interpreted in terms of multiple possible (both literal and figurative) use of language. From Schumacher’s ostensible theoretical position of **literally** elucidating a subset of the social communication systems described by Luhmann, Schumacher offers an **explanation** of the dependency of the “discourse and practice” for all participants within the discipline on “key con-

cepts.” Although the word “practice” is commonly associated with the practice of architecture in relation to the built environment, in this context, it seems to pertain to the necessary communicative operations between designers in the design process in line with Luhmann’s social communications theory.

While framed as addressing a subset of Luhmann’s *hybrid construction*, portrayals of autopoiesis in this context do not fully resonate with either Luhmann’s or Maturana et al.’s theory, neither of which claims a dependency of their subjects on “concepts.” However, by alluding to Luhmann’s framework, Schumacher **legitimises** the characterisation of “concepts” as being responsible for “the drift of all communications.”

In this view, and by claiming the existence of a “cycle of conceptual innovation,” Schumacher introduces the concept of “field” *vis-à-vis* the one of “space” in this section and its associated central message. By claiming that the concept of “field” supersedes that of “space,” Schumacher implies that both concepts bear, at least, the same relevance. The implication that “what is true under certain conditions must be true under all conditions” (Engel, 1980, p. 40) can be read as a *sweeping generalisation* (ibid.). With this rhetorical move and positioning the concept of “field” as “the conceptual mainsprings of Parametricism,” he establishes the style of Parametricism as the “way forward for the global autopoiesis of architecture in its perennial” (Schumacher, 2011, p. 433). Therefore, through the appropriation of autopoiesis, Schumacher lays the theoretical foundation that makes his own theoretical and professional agenda possible. This rather convenient appropriation is already anticipated in this *Thesis 24* since explicit and implicit references to either Luhmann’s or Maturana et al.’s theory gradually diminish as the section unfolds.

Based on his own observation, lived experience and historical knowledge of the profession, Schumacher describes the emergence of new styles and their associated concepts as inherently natural, unfolding within cycles of innovation ignited by external “perturbances.” He notices that this rather biologically-informed process appears to solve “a lot of stored up problems suppressed by the previous paradigm” (Schumacher, 2011, p. 416). In the absence of empirical substantiation other than Schumacher’s own interest in considering “the concept of space as an important example,” and with Schumacher being a leading representative of the system his theory describes, his claim appears to rely on, at least in part, an argument from authority, thereby suggesting its inherent truthfulness (Knight and Collins, 2005, p. 189).



In this view, I read Schumacher’s use of the word “perturbation” in the sentence “stirred by external stimuli (perturbations)” as a **metaphorical** claim that seems to relate (or at least do not preclude relating) to autopoietic dynamics of living organisms via Luhmann’s theory. By seemingly incorporating this biologically-informed mechanism, Schumacher further **legitimises** his theoretical position, advocating for replacing the concept of “space” with the concept of “field”. This merit of theory appropriation is strengthened by Schumacher’s use of value-laden words such as “essential,” “important,” and “enhance.” With these words, Schumacher predisposed readers to approach his argumentative line of reasoning as theoretically valid.

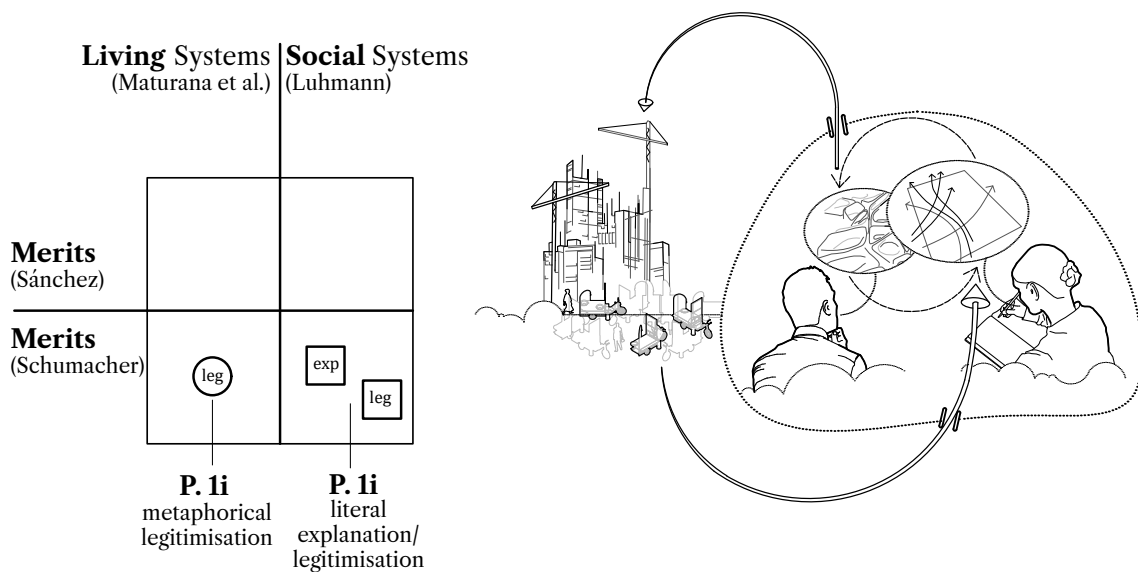


Figure 4.10: My visual interpretation of Passage 1.i – Changes of “key concepts” within “the conceptual apparatus of the discipline” of architecture due to external “perturbations.”

## 4.2 *The Autopoiesis of Architecture* – Volume II

This section presents the analysis of seven passages sampled from Volume II of Schumacher's *The Autopoiesis of Architecture*, based on the methodological approach introduced in Chapter 3.

### 4.2.1 Passage 2.a. – Organization

The following passage is a quote from Section 6.3 “Organization” in Chapter 6 of Schumacher's Volume II entitled “The Task of Architecture” (Schumacher, 2012, pp. 70–87). In this section, Schumacher (*ibid.*, 2012, p. 70) presents his *Thesis 27* in which he postulates the following *central message*: “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.”

Schumacher's second volume marks a shift from framing a theoretical body of work towards the definition of an architectural agenda (Schumacher, 2012, p. 2). With this context, this central message claims the need for “a system of abstract mediating concepts” to gain “proficiency in establishing compelling new form-function relationships.” In light of Schumacher's proclamation in Passage 1.i (see section 4.1.9) that the architectural “concept” of “space” has been superseded by the one of “field” in his autopoiesis of architecture, Schumacher, in this central message, presents his own theory and position as a guide for “the correlation of spatial with social patterns.” In this view, architects can only acquire the aforementioned desired proficiency by aligning with his perspective. Highlighting the interaction between the spatial organisation, arrangement, and distribution of physical elements in the built environment and the “social patterns” of society, Schumacher seems to present his theory and description of architecture as an essential part of the functioning of society along Luhmannian lines. However, this passage deviates, to some extent, from portrayals of autopoiesis in social systems by focusing on the relationship between architectural systems (such as the “structural system” or the “circulation system”) rather than on communications among participants within the discipline of architecture. In line with earlier discussions on systems theory and cybernetics, Schumacher advocates in this passage for a built environment where the systematic interdependence of its components forms a cohesive and functional unity.

“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, ie, each part impacts all other parts and is impacted by all other parts, directly or indirectly.” (Schumacher, 2012, p. 81)

#### 4.2.1.1 References to Preceding Theories

On its own, this passage contains few explicit connections between Schumacher’s theory and either the biological theory of autopoiesis or Luhmann’s *hybrid construction*. Stronger connections along such lines can be drawn given the implicit reference to the cybernetic foundation that underlies both biological and sociological theories of autopoiesis, as well as systems theory in general. This theoretical foundation becomes apparent through Schumacher’s intention to “sharpen and regulate” the use of the term “systems” in architecture.

In this passage, Schumacher establishes the “minimum requirement” to consider architecture and urbanism a system. That is that “their parts (elements or subsystems) are *functionally interdependent*” consolidating a “functional unity.” This perspective aligns with the cybernetic understanding of a system, which defines it as “a set of components together with the relations connecting them to form a whole unity” (Krippendorff, 1986, p. 73). With the term “unity” and “collaborative unities” in this passage, Schumacher does not seem to prohibit relating to Maturana and Varela’s (1980, p. xix) concept of whole and composite unity. A whole unity involves an observer distinguishing an entity from its surroundings, and a composite unity delves deeper into the observation and distinction of a system’s components and relations.

Schumacher's use of the word "functional" preceding "unity," as well as the adverb "functionally" before "interdependent," also suggests a reference to Luhmann's (1982, p. 135) theory. By highlighting its distinctive functioning within society, Schumacher differentiates the autopoietic unit of architecture from other societal subsystems. Figure 4.11 on page 164 shows my visual interpretation of this description.

#### 4.2.1.2 Language Use and Merits

Key terms to examine in this passage are the combination of words "functional unit," "collaborative unities," and "functionally interdependent" as they syntactically bridge Schumacher's, Maturana et al.'s, and Luhmann's theories. While Schumacher's theoretical stance focuses on framing architecture within Luhmann's theory of social communication systems, this passage notably deviates from Luhmann's primary emphasis on communication processes. As a result, I interpret any potential allusions to Luhmann's work in this passage without establishing a direct literal association with his concept of autopoiesis. Considering the cybernetic foundation and understanding of systems underlying this passage, readers can nonetheless observe figurative connections along Luhmann's and Maturana et al.'s theory of autopoiesis.

In the first exemplification of Schumacher's argument, he postulates that "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 unity that warrants their qualification as system." With the opening phrase, "it is a fact," Schumacher suggests that his qualification of architecture as a system is grounded in tested observations, similar to scientific validation. To illustrate his argumentation further, Schumacher provides a testable example where a building's envelope depends on its component functions, forming a "functional unit." He explains that "a breach at any point compromises the performance of the whole envelope." By aligning his claim with empirical and validated observations of systems found not only in Maturana et al.'s theory of autopoiesis but more generally in cybernetic studies, Schumacher **legitimises** his generalised qualification of architecture and urbanism as a system. This is especially so since, with these two examples, Schumacher seems to imply that what is based on facts under certain conditions "must be true under all conditions" (Engel, 1980, p. 40).

While Schumacher characterises architecture and urbanism as “*collaborative unities*,” I interpret the verb ‘to be’ in the statement “architectural and urban systems are *collaborative unities*” not in its literal sense, but somewhat figuratively, aligning with Maturana et al.’s and Luhmann’s theory of autopoiesis. More specifically, I read this statement with the syntactical **metaphorical** construction ‘A (the tenor) *is* B (the vehicle)’ in which Schumacher postulates that these architectural and urban *unities* are “*functionally interdependent*” as if autopoietic. In this view, this passage echoes the biological term “organization,” which refers to the system’s ability to maintain a circular relationship between its components and the process they undergo (see Maturana, 1975, p. 315; Maturana and Varela, 1980, p. 81). The use of the adverb “functionally” in this context also seems to reflect Luhmann’s differentiation between subsystems. Similarly, Schumacher’s definition of architecture and urbanism as collaborative unities may correspond to Luhmann’s view that a system is “not a unity but rather a difference” due to the distinction between the system and its environment. With this possible other reading, I also interpret Schumacher’s argument metaphorically in line with Luhmann’s appropriation of autopoiesis.

By referring to the “structural system” in terms of “all members of a structure,” the “circulation system” in terms of “all the paths of a path-network,” as well as to “a building’s outer envelope” to exemplify his argument, Schumacher seems to align with what brought me to formulate the research question I investigate in this thesis. In my reading, this interest in the built environment and systems evoke associations with living systems more than associations with social communication systems. Either way, by drawing on the systemic approach of autopoiesis from social and biological theories, Schumacher positions his theory as the definitive framework that refines and governs the usage of the term “system.” In this view, systemic observations of architecture are necessarily subordinated to Schumacher’s theory, thereby suggesting an appropriation of the theory of autopoiesis for the purpose of gaining authority (using Ostwald’s terms; see Ostwald, 1999, p. 66) over other systematic approaches to architecture.

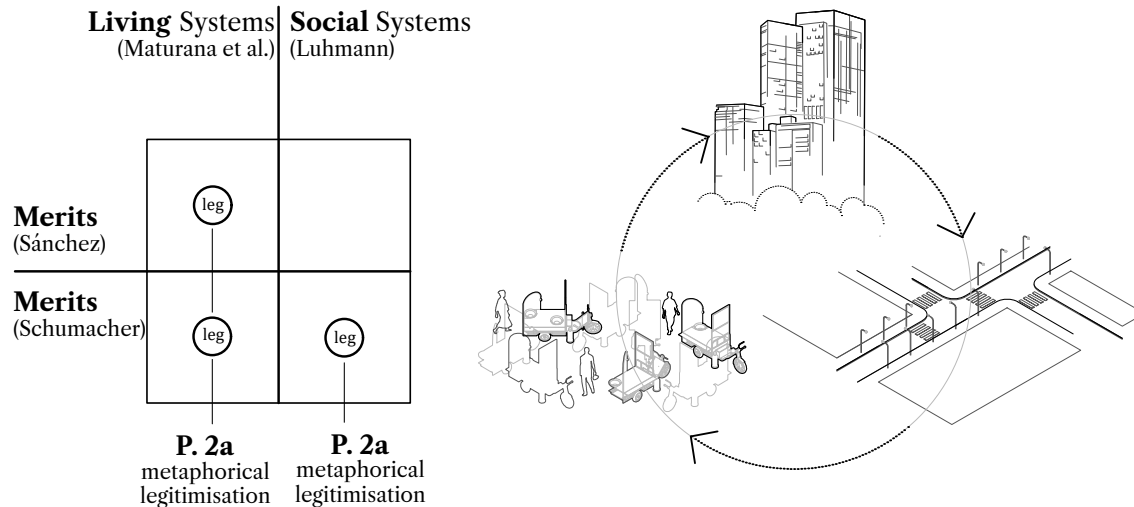


Figure 4.11: My visual interpretation of Passage 2.a – The “collaborative unities” of the system of architecture and urbanism.

#### 4.2.2 Passage 2.b. – The Design Process as Problem-solving Process

The following passage is a quote from Section 7.3 “The Design Process as Problem-solving Process” in Chapter 7 of Schumacher’s Volume II entitled “The Design Process” (Schumacher, 2012, pp. 263–310). In this section, Schumacher (ibid., 2012, p. 263) presents his *Thesis 37* in which he postulates the following *central message*: “Within a design process theory that intends to probe and enhance the rationality of design, the design process must be theorized as problem-solving process. Problem solving – especially at the level of such a complex endeavour as designing the built environment – can only be adequately theorized as accomplishment of an autopoietic communication system, geared up with its whole panoply of communication structures.”

In this central message, Schumacher begins with the premise that the design process, particularly in his and any other architectural theories that aims to enhance

the “rationality of design,” “must be theorized as problem-solving process.” He proclaims that this “problem solving [...] can only be adequately theorized as accomplishment of an autopoietic communication system, geared up with its whole panoply of communication structures.” In this context, Luhmann’s theory serves as the broader theoretical framework to explore the design process as a problem-solving process. By doing so, Schumacher unifies two seemingly unrelated positions: Allen Newell’s and Herbert Simon’s understanding of (design) problem-solving with, and as a subset of, Luhmann’s theory of autopoiesis.

In their work, Newell and Simon (1972, pp. 71–72) describe the design process as a problem-solving endeavour where designers search for solutions within a bounded space. This approach to design requires careful planning of various solutions to evaluate and determine the most optimal or satisfactory one. Krippendorff (2006, p. 26) regards this process as a demonstration of Simon’s “technical rationality in action,” highlighting its effectiveness when “problems are clearly defined, and the solution space is finite, which often is the case in engineering.” However, this (scientifically linear and) rational approach to design processes was not without criticism. Rittel and Webber (1973) highlighted the limitations of conventional problem-solving approaches when applied to complex real-world design problems, which they referred to as “wicked problems.” These design problems defy simplistic solution attempts due to their unique characteristics that make them inherently difficult to solve. Similarly, Schön (1983, p. 47) critiques Simon’s technical rationality and posits that professional design practice deals with “messy problematic situations.” Schön (*ibid.*, 1983, p. 49) proposes instead to search for “an epistemology of practice implicit in the artistic, intuitive processes which some practitioners do bring to situations of uncertainty, instability, uniqueness, and value conflict,” which he characterised as “reflective practice.” In Cross’s (2001, p. 52) view, “Schön appeared to be more prepared than his positivist predecessors to put trust in the abilities displayed by competent practitioners, and to try to explicate those competencies rather than to supplant them.”

Despite this already well-developed discourse, Schumacher uses Newell’s and Simon’s linear approach to theorise design processes, particularly their Information Processing System (IPS) as a framework for analysing the cognitive processes inherent in problem-solving behaviour. Schumacher describes this framework as crucial for facilitating the autopoietic re-production of architectural communications.

“The concept of autopoiesis is also fundamental for theorizing how a given task environment is transcoded into the IPS’s problem space. The task environment ‘itself’ (Ding an sich) is an empty, asymptotic concept. It vanishes in the uncontainable infinity of its potential representations. There are only problem spaces and their (observed) relations. An (observer) might attempt to construct mappings between various (observed) attributed or postulated problem spaces.

In the case of modern and contemporary design processes, the (organism as observer) must be substituted by the social communication system as (observer). The IPS that is being modelled here must be interpreted as such a social communication system. Niklas Luhmann has transposed the centre of reference for the (concept of autopoiesis) from organic to social systems. The theory of architectural (autopoiesis) follows this lead. This is also relevant and pertinent here in the context of a theory of the design process. Problem representation and problem solving – especially on the level of such a complex endeavour as designing the built environment – can only be adequately theorized as accomplishment of an autopoietic communication system, geared up with its whole panoply of communication structures.” (Schumacher, 2012, p. 281)

#### 4.2.2.1 References to Preceding Theories

With its central message framing the theorisation of the design process as only plausible under the “accomplishment of an autopoietic communication system” and claiming that “the theory of architectural autopoiesis follows this [Niklas Luhmann’s] lead,” Passage 2.b approaches architecture from the perspective of Luhmann’s notion of autopoiesis.

Considering the dependency on Luhmann’s theory, implicit references to Maturana et al.’s biological theory become noticeable, particularly in relation to the observer’s role within the system. Like in Luhmann’s theory, Schumacher replaces the organism with the social communication system as the observer. Yet Schumacher seems to also reflect upon the observer-dependent approach that underlies the original biological theory of autopoiesis in this Passage 2.b (see Maturana, 1975, p. 315; Maturana and Varela, 1980, p. 8). According to Schumacher, the observer engages in



the creation of “mappings between various observed, attributed or postulated problem spaces.” This process of creating distinctions inherently relies on the observer’s “choice and purposes,” as highlighted by Maturana (1980, pp. 46–47; Mingers, 1995, pp. 13–14). Figure 4.12 on page 169 shows my visual interpretation of this description.

#### 4.2.2.2 Language Use and Merits

Passage 2.b can be interpreted as showing different kinds of literal or figurative relationships within and among the three theories of autopoiesis. Terms and concepts such as the one of the “observer” and the use of the word autopoiesis itself bridge, once again, Schumacher’s, Maturana et al.’s and Luhmann’s theory of autopoiesis. By substituting “the organism as observer” with “the social communication system as observer” and, more generally, asserting a shift in “the centre of reference for the concept of autopoiesis from organic to social systems,” Schumacher positions the discipline of architecture within the scope of Luhmann’s theory and thereby **literally equalises** the discipline of architecture to social (communications) systems. From this perspective, Schumacher legitimises his line of reasoning and position by shielding it from challenges since any challenge to his theory is necessarily also a challenge to Luhmann’s.

Assuming that Schumacher literally approaches “architecture” through Luhmann’s theory, I interpret the word “as” in the sentence “the social communication system as observer” as indicative of a figurative connection between Schumacher’s theory and Maturana et al.’s autopoiesis. Given the syntactical construction ‘A (the tenor) *as* (or *is like*) B (the vehicle),’ I particularly read Schumacher’s claim as a **simile** that links the inherent feature of observation in a living system via Luhmann’s theory with the role of the observer in the realm of architecture. Drawing from Maturana et al.’s insights into the nature of the observer, Glanville (2012, p. 176) noted that “the observer is included through his frame of reference and his motion relative to the objects and events under consideration,” thus underpinning a fundamental circular relationship between observer and observed. While Luhmann’s (2013, p. 112) social communication system implies this circularity through second-order observation, its application within the context of this passage presents challenges. Despite claiming that “the IPS that is being modelled here

must be interpreted as such a social communication system,” Schumacher seems to deviate from depictions of the observer found in cellular biology and social systems. Schumacher’s incorporation of Simon’s problem-solving theory appears to overlook the observer-observed relationship in favour of emphasising the act of observation as a means to identify and address (design) problems subsequently.

Despite the theory of autopoiesis being explicitly presented as “fundamental for theorizing,” its use within this context seems to primarily serve the purpose of **accommodating** Newell’s and Simon’s understanding of (design) problem-solving as a subset within Schumacher’s architectural theory and the autopoietic functioning it entails. While Newell’s and Simon’s position met with criticism – chiefly from Rittel and Webber (1973) as well as Schön (1983) – Schumacher does not seem to counteract or even acknowledge previous discussions on the issue of problem-solving in design in this passage and thesis. This omission of references to preceding discourse suggests, at least in part, an attempt at guiding the contemporary architectural agenda towards a “technology-centered” design which “thrives on hierarchical organizations of responsibilities and nourishes the kind of functionalist society that emerged during the industrial era” instead of a “human-centered” design (using Krippendorff’s distinction and terms; Krippendorff, 2006, p. 26). In this view, the accommodation of Simon’s approach conveniently **legitimises** Schumacher’s theoretical position and practice.

By drawing upon Simon’s theory and explicitly mentioning Luhmann’s stance on appropriating autopoiesis to justify his own appropriation, Schumacher appeals to authority “in proof of a position” (Engel, 1980, p. 149). This position is characterised by statements that express obligation or requirement through the modal verb “must” in sentences such as “the organism as observer must be substituted by the social communication system” or “the IPS that is being modelled here must be interpreted as such a social communication system.” Informed by Schumacher’s lived experience and observations, these claims can be assumed to rely, in essence, on assertions of “truth through *self-evidence*” (Lawlor and Nale, 2014, p. 517) rather than on the presentation of some underpinning reasoning or empirical data. This appeal to authority is foreshadowed in the opening of the passage, where Schumacher introduces Kant’s philosophy with the German phrase “*Ding an sich*” (thing-in-itself) to depict the isolation of a “task environment.”

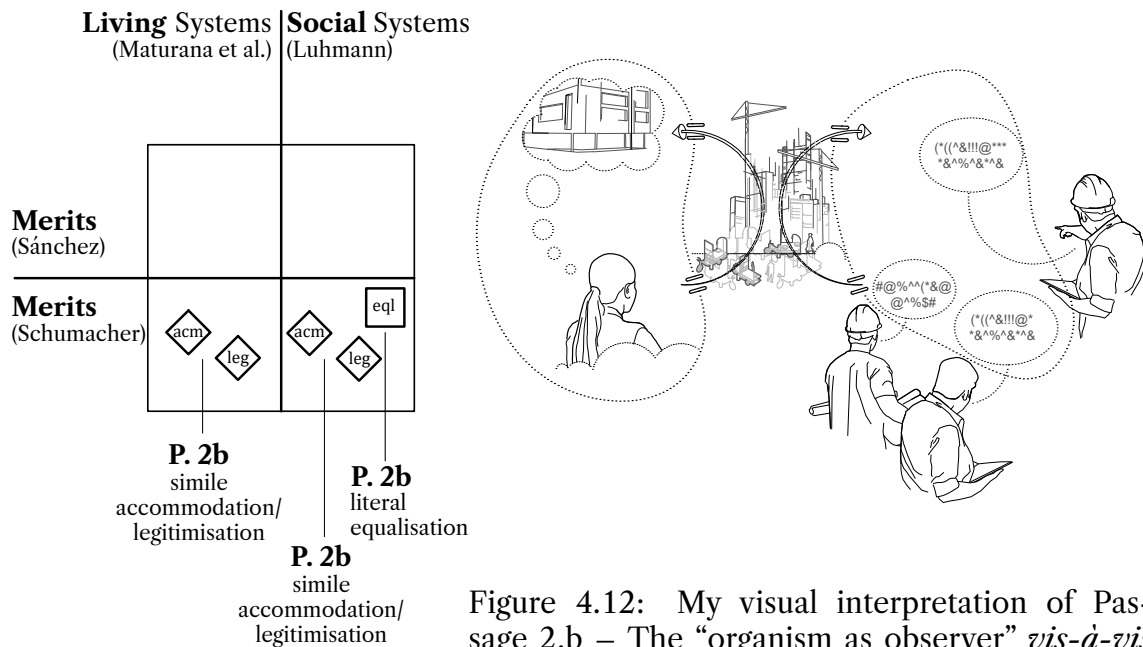


Figure 4.12: My visual interpretation of Passage 2.b – The “organism as observer” *vis-à-vis* the “social communication as observer.”

### 4.2.3 Passage 2.c. – The Problem Definition and Problem Structure

The following passage is a quote from Section 7.5 “Problem Definition and Problem Structure” in Chapter 7 of Schumacher’s Volume II entitled “The Design Process” (Schumacher, 2012, pp. 318–336). In this section, Schumacher (*ibid.*, 2012, p. 318) presents his *Thesis 39* in which he postulates the following *central message*: “The architectural design process is self-determined. There are only very few, very general constraints that are accepted in advance. The design process then proceeds by continuous self-stimulation on the basis of its own intermediate states. This self-determination is a correlate of the autonomy of architecture as autopoietic subsystem of society.”

In this central message, Schumacher further examines the design process within the architectural discipline. He argues that the architectural design process can stimulate and direct itself without external assistance. This self-determination is,

as Schumacher claims, a form of autonomy that corresponds with “the autonomy of architecture as autopoietic subsystem of society.” In this view, Schumacher relates the design process with Luhmann’s autopoiesis of social communication systems and asserts the independence of the discipline of architecture. Within Schumacher’s proclaimed (autopoietic) system, this passage describes part of the “very few, very general constraints that are accepted in advance” that subsequently lead to the said self-determined design process. Given that “the demand for internal coherence (consistency of criteria) [in the design process] is violated all the time,” Schumacher, at the same time, proposes a formula which builds upon the existence of “a certain degree of circularity between the problem and its solution” (Schumacher, 2012, p. 332). While asserting closure in terms of the circular process between problem and solution within the design process, Schumacher not only contradicts his perspective when emphasising design as a rational, goal-oriented process in Passage 2.b (see Section 4.2.2) but also highlights a contrast with his proclaimed independence of the design profession, as conveyed in both its central message and sampled passage.

“The same lack of determinate constraints can be observed with respect to architectural design tasks. As Simon points out: ‘The more distinguished the architect, the less expectation that the client should provide the constraints.’ We might add here that in the case of architectural design competitions, in particular in the case of international, high-profile competitions, there are even less determinate constraints than in any direct commission. In general one can say that the presence or absence of determinate constraints correlates with the distinction between avant-garde versus mainstream architecture. The avant-garde design process is in many ways marked by a strong sense of self-determination. This sense of self-determination is a direct correlate of the autonomy of architecture as autopoietic subsystem of society. One of the major open decisions that permeate the overall character of the design resides in the choice of the style within which the design is to be developed. This decision is usually not prefigured or constrained.” (Schumacher, 2012, p. 328)

### 4.2.3.1 References to Preceding Theories

This passage contains few explicit connections between Schumacher's theory and either the biological theory of autopoiesis or Luhmann's *hybrid construction*. However, stronger connections along such lines can be drawn via Passage 1.c in Section 4.1.3. In Passage 1.c, Schumacher draws on Luhmann's notion of "self-referential closure" (Luhmann, 1986, pp. 85–86), which is tied to and derived from Maturana et al.'s notion of "organizational closure" (Varela, 1979, pp. 55–56). Within this context, Schumacher characterises the differentiation between avant-garde and mainstream architecture. More specifically, Passage 2.c approaches this distinction based on the autopoietic dynamics described by Luhmann to characterise the most notable "absence of determinate constraints" in the design process. By framing architecture as an "autopoietic subsystem of society" in this passage and central message, Schumacher literally approaches the discipline from Luhmann's notion of autopoiesis.

References to Maturana et al.'s biological theory of autopoiesis can be implicitly detected in Passage 2.c given Luhmann's appropriation of autopoiesis and the above-mentioned dependence on Passage 1.c. Schumacher's utilisation of the term "autonomy" in conjunction with the discipline's "self-determination" further resonates with Maturana and Varela's (1992, pp. 47–48) perspective, wherein an autonomous system exists "if it can specify its own laws." This connection becomes particularly pronounced given Schumacher's (2012, p. 414) conception of the profession as self-governed. Associated with the autonomy of the system, Schumacher further alludes to the term *closure*, particularly when referring to the circularity between problem and solution that is brought about by previous discussions on design theory in his theory (see Schumacher, 2012, pp. 263, 263–332). Notably, however, the allusion to cellular autonomy in the sentence: "this sense of self-determination is a direct correlate of the autonomy of architecture as autopoietic subsystem of society," is overshadowed by its syntactical and direct association with Luhmann's theory of social systems. Figure 4.13 on page 174 shows my visual interpretation of this description.

#### 4.2.3.2 Language Use and Merits

Despite the apparent allusion to Maturana et al.'s autopoiesis, particularly with the word "autonomy," I read the word "as" in the sentence "the autonomy of architecture as autopoietic subsystem of society," not as indicating figurative speech but in the literal sense of considering architecture alongside other subsystems of society. Characterising the discipline of architecture as a **literal** subset of the social communication systems described by Luhmann, Schumacher **explains** the design process as independent from "determinate constraints" and asserts the independence of the discipline in general and of the "distinguished" avant-garde architect in particular.

Along with Luhmann's reference, Schumacher presents his explanation with the underpinning reasoning of his previously claimed differentiation between avant-garde and mainstream architecture (see the analysis of Passage 1.c in section 4.1.3). With this rhetorical move, Schumacher seems to accomplish multiple purposes.

Firstly, by repeating what was said, Schumacher affirms his argumentative distinction between avant-garde and mainstream architecture while implying or believing its validation. Instead of relying on empirical substantiation, Schumacher appeals to the rationalisation of the design process based on his "personal experience [...] as participant, leader or critic of many design processes, both in professional and academic arenas" (Schumacher, 2012, p. 331). As a result, his explanation in this passage appears to rely, at least in part, on an argument from authority, suggesting its inherent validity (Knight and Collins, 2005, p. 189). The implication that the point at issue is assumed instead of proven bears the hallmarks of *begging the question* (Engel, 1980, p. 54).

Secondly, by restating previously introduced concepts rooted in autopoietic dynamics, Schumacher reinforces the legitimacy of his explanation concerning "the presence or absence of determinate constraints" in the design process. This proclamation of disciplinary closure, in terms of autonomy and decision-making and the framing of design as "not prefigured or constrained" along the lines of the notion of occupational closure, is, at least, debatable. Arguably, political influence is exercised even on high-profile projects by external decisions such as by implementing and enforcing building regulations, through invitations of practices to participate in and submit proposals to design competitions, and through the selection and funding of winning designs. In any case, Schumacher appears to interpret the notion of "sys-

temic closure” as “isolated from external influence.” He moves on – apparently to **legitimise** the rejection of external influence – by explaining the design process in terms of the interpretation of “systemic closure” as proposed by Maturana and Varela (1992, p. 89) and appropriated later by Luhmann (1995, p. 118), which describes systems whose out-puts affect them as inputs, resulting in circularly causal feedback loops by which systems may respond to effects of their own (past) actions, i.e., self-regulate. For instance, Schumacher refers to “a certain degree of circularity between the problem and its solution” (Schumacher, 2012, p. 332). In essence, Schumacher uses the circular relationship between problem and solution in the design process to then put forward an argument for the independence of (the avant-garde of) the architectural profession – a transition between two interpretations of the term *closure* (see Section 2.2.1.4).

In the preceding sentences of the sampled passage as well as the opening sentence of Passage 2.c, Schumacher draws a parallel between the “lack of determinate constraints” in architecture and the creative process of musical composition. According to Walter Reitman (1966, p. 196 cited in Schumacher, 2012, p. 328), music composition (despite its complexity) has minimal inherent constraints, with the primary one being the final product. In the architectural domain, Schumacher quotes Herbert Simon’s (1973, p. 189) dictum whereby “the more distinguished the architect, the less expectation that the client should provide the constraints.” By advocating for the absence of constraints in the design process, Schumacher, with this quote, not only reinforces his line of reasoning but also aligns himself (along with a limited number of architects) as “distinguished” practitioner. Furthermore, Schumacher argues that “in the case of international, high-profile competitions, there are even less determinate constraints than in any direct commission.” With this observation, Schumacher further scopes his autopoiesis of architecture towards designers and (st)architects participating in “high-profile competitions.” Given that most of these design competitions exclusively invite “distinguished” architects for participation, Schumacher suggests that his autopoiesis of architecture is directed towards a specific segment of the profession.

In this context, Schumacher seems to be, at least in part, romanticising the discipline. Although he claims to provide an “all-encompassing systematization of architecture, coherently embedded with Luhmann’s all-encompassing theory of social systems” (Schumacher, 2011, p. 19), Schumacher fails to resonate with the vast

majority of professionals in the field. Schumacher’s architectural theory seems to disregard architects who are not considered “distinguished” or who are unable to participate in high-profile design competitions. Conversely, Luhmann presents his autopoiesis as a macro-level theory of society (Scott, 2021, p. 63), encompassing “the entire range of deviance, of deviant behaviour, of criminality and of dysfunction” (Luhmann, 2013, pp. 3–4). Therefore, Schumacher’s view deviates from portrayals of autopoiesis in social systems in that Luhmann produces a metalanguage that neutrally allows talking about social processes at large instead of propagating his own conception of such processes.

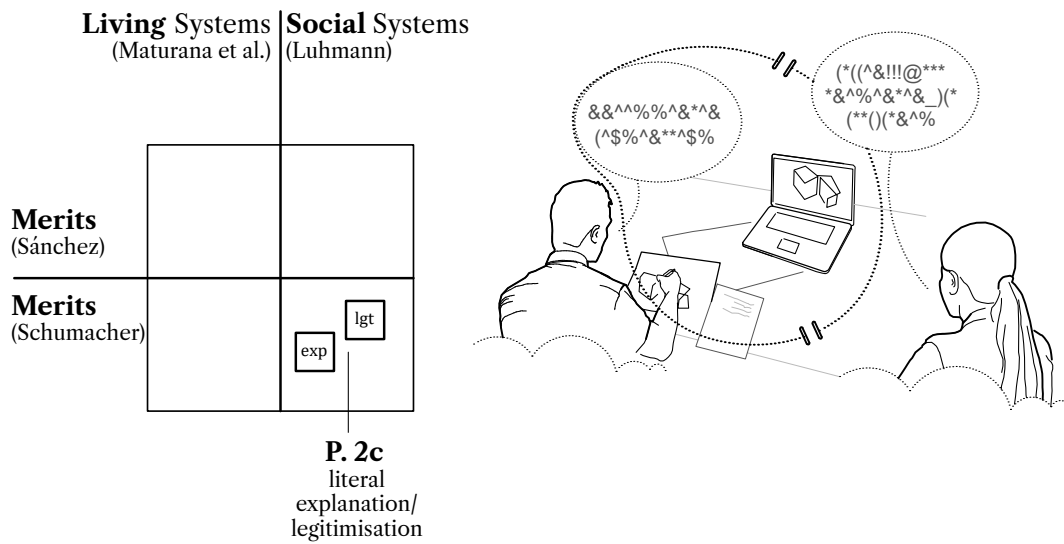


Figure 4.13: My visual interpretation of Passage 2.c – The “self-determination” of the design process regardless given constrains.



#### 4.2.4 Passage 2.d. – Autonomy vs Authority

The following passage is a quote from Section 8.2 “Autonomy vs Authority” in Chapter 8 of Schumacher’s Volume II entitled “Architecture and Society” (Schumacher, 2012, pp. 385–390). In this section, Schumacher (ibid., 2012, p. 385) presents his *Thesis 43* in which he postulates the following *central message*: “The autonomy of architecture implies its discursive authority but lacks the power to impose its authority. Within a polycontextual societal environment architecture needs to sustain its autonomy precisely to be able to respond to all the disparate challenges of the different societal subsystems. However, its proposed solutions are no longer backed up by power.”

“Niklas Luhmann has observed the peculiar fact that scientific knowledge must simultaneously ‘stand its ground and take itself back; it must continue to produce new achievements and, at the same time, it must refrain from defining the world for society.’ Luhmann continues: ‘To be sure, no one seriously doubts the descriptions of the world furnished by science, insofar as science itself trusts them. Nonetheless, the effect is virtually non-binding as far as other systems of communication are concerned.’

The same ambivalent status might be observed with respect to advanced architecture. Even though architecture has an exclusive and (autonomous) hold over its disciplinary domain – (it does not submit to any outside dictates) – it has in turn no chance to force itself upon society at large. As a specialized societal function system, architecture does indeed enjoy a certain privilege (and responsibility) of ‘first bidding’ in respect of the proposition and promotion of innovations. However, this privilege does not entail the absolute exclusivity of a guaranteed monopoly. The tendencies that gain the upper hand within the intense exchanges of avant-garde communications usually find enough early adopters to press forward towards the mainstream, but there can be no guarantee of society-wide success. In turn, sustained innovations might indeed crystallize

outside and against architecture – and are discovered, sublimated and recuperated into architecture only later by means of retroactive manifestos. Such efforts at recuperation are important (adaptations) – important for the ongoing vitality of architecture and ultimately for its survival, precisely because architecture has lost its authority to impose its achievements onto society at large.” (Schumacher, 2012, p. 387, 388)

In this central message as well as the passage itself, Schumacher presents architecture as an autonomous disciplinary entity that operates within “a policontextual societal environment.” By stating so, Schumacher implicitly refers to Luhmann’s appropriation of the biological theory of autopoiesis, wherein religion, science, art, education, and politics are autonomous autopoietic subsystems within the societal environment (see Luhmann, 2000, p. 2). With the sentence “the autonomy of architecture implies its discursive authority,” Schumacher further alludes in its central message to Luhmann’s understanding of the functioning of “authority” within the self-referential nature of society. According to Luhmann (2013, pp. 224–225), authority acts as a form of “simplification that makes it possible to continue with communications,” serving as both the “precondition of continued autopoiesis and the precondition of connecting operations.” Given the pivotal role of architectural theory in fostering discourses and its integration into the autopoiesis of architecture (see Passage 1.b in section 4.1.2), it appears that Schumacher’s theory of architecture aims to regulate and control the discourse within the discipline. While distinguishing “architecture” from societal processes at large, Schumacher describes the discipline in the sampled passage with a co-determining effect on society. Amongst other influencing factors, “architecture” enjoys a privileged position that is, by no means, the only factor that determines the evolution of society.

#### 4.2.4.1 References to Preceding Theories

With its central message framing “architecture” “within a polycontextual societal environment” and describing it in this passage “as a specialized societal function system,” Passage 2.d seems to approach architecture from the perspective of Luhmann’s social communication systems.

Nonetheless, word choices such as “autonomous” and “adaptations” do not seem to prohibit implicit references to Maturana et al.’s biological theory. The use of the word “autonomous” to state that the discipline of architecture “does not submit to any outside dictates,” and the use of the phrase “important adaptations” echo, in my reading, Maturana et al.’s notion of structural coupling. In Maturana and Varela’s (1980, pp. xx–xxi; 1992, p. 75) view, living cells recurrently adapt to external (environmental) perturbances while maintaining their internal organisation. At the same time, however, Schumacher demarcates from Maturana et al.’s autopoiesis by presenting “architecture” as a separate entity from – yet instrumental in – the ongoing innovation of the built environment. Unlike Schumacher, Maturana et al.’s describe autopoiesis as a spontaneous entity undergoing processes of production that emerge from and within the system itself.

Moreover, the above-mentioned word choices point even further to the cybernetic foundation of both biological and sociological theories of autopoiesis. The term adaptation does so in the Singerian sense, in which the physical environment is adapted to human-social needs (Krippendorff, 1986, p. 1) and, the term autonomy, is used to characterise an organisationally closed system (ibid., 1986, p. 5). Figure 4.14 on page 180 shows my visual interpretation of this description.

#### 4.2.4.2 Language Use and Merits

With word choices suggesting connections between all three – Schumacher’s, Maturana et al.’s, and Luhmann’s – theory of autopoiesis, Passage 2.d provides a basis in which literal and figurative language use can be identified.

Schumacher opens this passage by drawing a parallel between Luhmann’s observations of the dynamics within the scientific subsystem and his observations within the subsystem of architecture. In Luhmann’s and Behnke’s (1994, p. 11 cited in Schumacher, 2012, p. 388) view, scientific knowledge “must continue to produce new achievements and, at the same time, it must refrain from defining the world society.” Building upon this observation, Schumacher then postulates that “the same ambivalent status might be observed with respect to advanced architecture.” By asserting that both domains share “the same [...] status,” Schumacher **literally equalises** his observed process of the discipline of architecture with those in science as per Luhmann’s observations. This literal equivalence of dynamics

between science and architecture can be more accurately illustrated by employing Maturana's concept of *isophor*, which involves the (literal) transfer of dynamics or processes (instead of meaning) from one domain to another (see Ison, 2022, p. 151).

The implication that “what is true under certain conditions must be true under all conditions” (Engel, 1980, p. 40) bears the hallmarks of a *sweeping generalisation* (ibid.). Nonetheless, it **legitimises** Schumacher's reasoning and position by shielding it from challenges since “no one seriously doubts the description of the world furnished by science” (Luhmann and Behnke, 1994, p. 11 cited in Schumacher, 2012, p. 388). Furthermore, leaning on Luhmann's observations further shields his position since any challenge to his observation is necessarily also a challenge to Luhmann's.

While purportedly approaching the discipline of architecture through Luhmann's lens, Schumacher's portrayal of the profession does not fully resonate with Luhmann's description of social systems. Luhmann's approach highlights the impartiality and equal significance of various societal subsystems, including science, art, and politics, all of which contribute to the overall functioning of society. In contrast, Schumacher's portrayal of architecture relies on value-laden words such as “exclusive,” with “privilege,” and “upper hand,” implying a position of superiority over other social systems in respect of the “proposition and promotion of innovations” of the built environment. This suggests a perspective that positions “architecture” as an autonomous authoritative force, subjugating other subsystems within society. Notably, however, Schumacher notes that the discipline of architecture neither possesses “absolute exclusivity of a guaranteed monopoly” nor the proposed built environment can guarantee a “society-wide success.”

In the last part of the paragraph, Schumacher suggests that the communicative exchange between avant-garde and mainstream architecture materialises in “sustained innovations” of the built environment. These innovations are also recuperated into the discipline of architecture “by means of retroactive manifestos. Such efforts at recuperation are important adaptations – important for the ongoing vitality of architecture and ultimately for its survival.” With this last sentence, Schumacher does not appear to counteract possible figurative, particularly **metaphorical**, readings along Maturanian lines. I read the words “adaptations” along with “ongoing vitality” and “survival,” as carrying biological connotations in line with Maturana et al.'s theory of autopoiesis. Together with the word “innovation,” which refers,

in this paragraph, to the innovation of the physical product of architecture, Schumacher evokes, in my reading, associations between the built environment as well as with living systems. Notably, Schumacher's assertion of the discipline's autonomy in relation to the built environment and society at large diverges from Maturana et al.'s theory of autopoiesis. In contrast to Schumacher, who asserts the existence of two distinct entities where the renewal of one (the built environment) is brought about by the other (the discipline of architecture), Maturana and Varela conceptualise autopoiesis as an integrated unity of interdependent elements from which renewal emerges spontaneously.

Schumacher's metaphorical allusion to Maturana et al.'s autopoietic processes thus **legitimises** his apparent advocacy towards an intentional piloting function of architecture in consolidating the social and built environment. With this context, Schumacher claims for the recuperation of the architectural "authority to impose its achievements onto society at large."

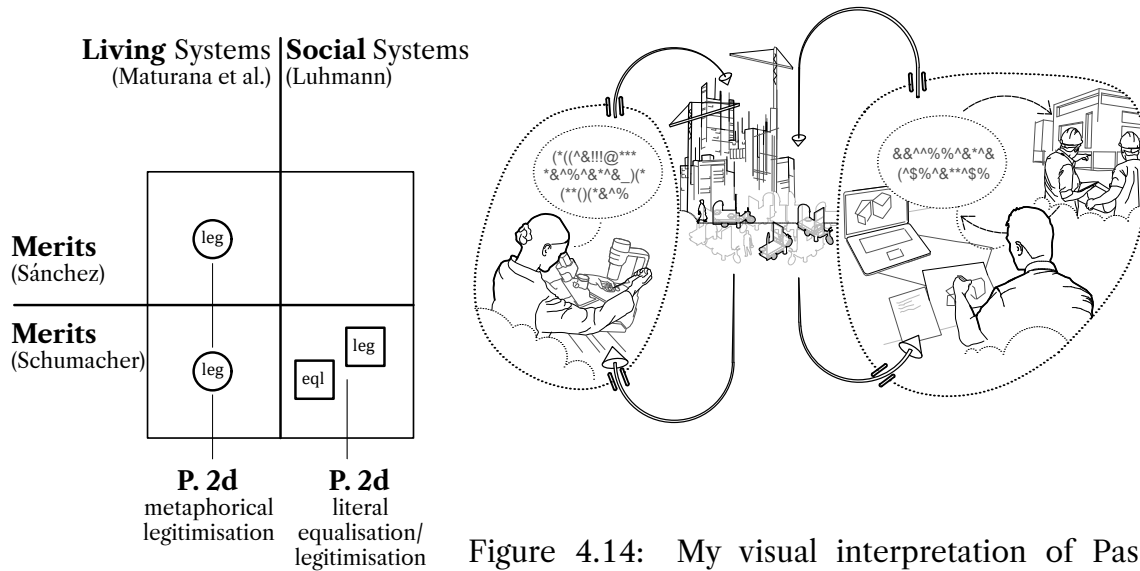


Figure 4.14: My visual interpretation of Passage 2.d – The autonomy and adaptability of the architectural knowledge *vis-à-vis* the functioning of scientific knowledge in society.

#### 4.2.5 Passage 2.e. – Architecture in Relation to Other Societal Subsystems

The following passage is a quote from Section 8.4 “Architecture in Relation to Other Societal Subsystems” in Chapter 8 of Schumacher’s Volume II entitled “Architecture and Society” (Schumacher, 2012, pp. 398–410). In this section, Schumacher (*ibid.*, 2012, p. 398) presents his *Thesis 45* in which he postulates the following *central message*: “Architecture coevolves with all the other major autopoietic subsystems of society in relations of mutual facilitation and irritation.”

In this central message, Schumacher refers to Luhmann’s appropriation of the biological theory of autopoiesis, in which social systems are autonomous autopoietic subsystems of society (Luhmann, 1982, p. 131). Schumacher does so by portraying the discipline of architecture as being part and thus mutually constitutive of the process and evolution of “all the other major autopoietic subsystems of society.” This

interconnectedness is facilitated through the biological analogy of *coevolution* and is fostered through a dynamic interplay of “mutual facilitation and irritation” among the societal subsystems. Schumacher (2012, pp. 399–400) observes that architecture assumes a pivotal societal role that transcends its conventional function as a mere provider of “physical provision of shelter or an external shell containing the workings of the various social institutions.” To Schumacher, it also plays a fundamental role in “organizing logic and articulation of those complex social processes.” Acknowledging that the built environment encompasses dimensions and achievements that have yet to be fully integrated into the existing body of architectural knowledge, Schumacher proposes a “retooled architectural theory” with the capability to “identify, trace and systematize” these often-overlooked achievements within his autopoiesis of architecture (ibid.).

“Irritations are always co-constituted by environment and system. What registers as (irritation) depends upon the system’s general constitution as well as on its current state. In order to be at all (irritated by certain environmental changes,) the system needs to have a (respective general sensitivity.) For instance, architecture is sensitive to changes in society’s mode and intensity of social differentiation. It is less sensitive to changes in the relation between the sexes (as witnessed in the second half of the 20th century). Architecture is also highly sensitive to advances in construction technology. It is less sensitive to advances in medicine or aviation. Architecture’s current state might heighten or blunt its particular sensitivities. For instance, whether a certain (change in the environment irritates the system) depends on whether the change in question had been ignored for a long time so that (pressure to adapt) had been building up, or whether a fairly recent response to a similar change has provided a reserve capacity that can now absorb the new (otherwise (irritating)) environmental changes. Failure to adapt and satisfy societal demands will lead to criticism, and ultimately to abandonment.” (Schumacher, 2012, p. 405)

#### 4.2.5.1 References to Preceding Theories

This passage approaches the discipline of architecture as being “sensitive to changes in society’s mode” and with the need to “satisfy societal demands.” Given Schumacher’s central message and theoretical claim of being architecture a subset of Luhmann’s societal system, these phrases, in my reading, underscore the functional dependency of architecture on these social subsystems and vice versa.

References to Maturana et al.’s theory of autopoiesis can be detected both implicitly – giving Schumacher’s reference to Luhmann’s *hybrid construction* in his central message – and explicitly – by way of evocative word choices such as “irritated by certain environmental changes,” “respective general sensitivity,” and “pressure to adapt.” The sentence “failure to adapt and satisfy societal demands will lead to criticism, and ultimately to abandonment” further echoes Maturana et al.’s understanding of the living system’s loss of structural coupling with its environment and the subsequent decline of its autopoiesis (see Maturana and Varela, 1980, p. 81). Figure 4.15 on page 184 shows my visual interpretation of this description.

#### 4.2.5.2 Language Use and Merits

Passage 2.e can be interpreted in terms of multiple possible (both literal and figurative) uses of language. Word choices such as “adapt” and “irritation” tie to the notion of structural coupling in the context of this passage suggest a connection between Schumacher’s, Maturana et al.’s, and Luhmann’s theories. Schumacher posits his theory as **literally** describing a subset of Luhmannian communication systems. Like Luhmann, he then presents the “general sensitivity” of the discipline of architecture to its environment, thereby **theorising** (i.e., the “attempt to make architecture theoretical” – see Linder, 1992, p. 167) the functional relationship between “architecture” and its societal environment (see Schumacher, 2012, p. 400).

Schumacher’s two main claims in this passage and accompanying examples accomplished considerable rhetorical work. By stating that “in order to be at all irritated by certain environmental changes, the system needs to have a respective general sensitivity” and that “architecture’s current state might heighten or blunt its particular sensitivities,” Schumacher portrays the discipline of architecture as an autonomous entity that depending on its “current state,” can naturally adapt its sensi-



tivity to “certain environmental changes.” With this claim, Schumacher does not seem to present any empirical data, traceable reference, or underpinning reasoning aside from his examples of the discipline’s varying levels of sensitivity. Assumed to be informed by Schumacher’s lived experience and observations of the discipline at large, these claims rely, in essence, on assertions of “truth through *self-evidence*” (Lawlor and Nale, 2014, p. 517).

Notwithstanding, Schumacher seems to strike a biological chord evoking **metaphorical** associations to processes that occur naturally from within a system due to its interactions with the environment. By approaching the discipline of architecture as an entity that naturally manifests itself, Schumacher provides an argument with a sense of inherent validity as it might have few (if any) negative meanings (Moore, 1903, p. 94). As a result, Schumacher’s apparent evocation of biological phenomena seems to **legitimise** his line of reasoning and position. While his claims echo Maturana et al.’s autopoiesis via Luhmann’s appropriation, it also brings forth one of Luhmann’s primary criticisms: namely its failure to account for human agency as subordinated to their molecular autopoiesis. In essence, the discipline of architecture, yet portrayed as an autonomous entity capable to self-adaptation, is ultimately formed by people who “can think and choose to leave, to disobey, to innovate, etc.” delineating thus the sensitivity to environmental changes (see Bunnell in appendix B; Maturana and Poerksen, 2011, pp. 106–107). In this view, autopoiesis is a human decision rather than an automatic reaction of molecules within a living organism, as initially proposed by Maturana et al. (see section 2.3.2).

Schumacher exemplifies his argument with the case of the high degree of sensitivity of the discipline to “the changes in society’s mode and intensity of social differentiation” *vis-à-vis* the lack of sensitivity to “the relation between sexes.” As well as the high degree of sensitivity to “advances in construction technology” *vis-à-vis* the lack of sensitivity to “advances in medicine or aviation.” With these examples, Schumacher claims what needs to be considered within the discipline of architecture over other possible appreciations. Notably, he seems to consciously overlook crucial contemporary issues such as inequality in the relationship between genders or sustainable construction in architecture. In this context, I read Schumacher’s appropriation of autopoiesis as a means to further legitimise his theoretical position and architectural practice agenda.

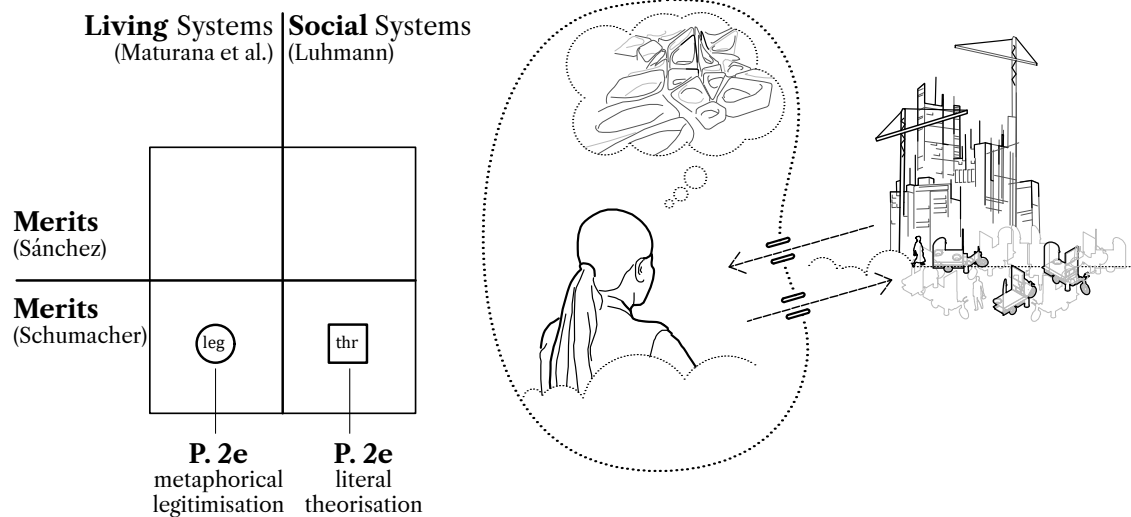


Figure 4.15: My visual interpretation of Passage 2.e – The mutually constitutive “irritations” between the system of architecture and its environment.

#### 4.2.6 Passage 2.f. – Theorizing the Relationship between Architecture and Politics

The following passage is a quote from Section 9.2 “Theorizing the Relationship between Architecture and Politics” in Chapter 9 of Schumacher’s Volume II entitled “Architecture and Politics” (Schumacher, 2012, pp. 448–469). In this section, Schumacher (ibid., 2012, p. 448) presents his *Thesis 49* in which he postulates the following *central message*: “To respond to hegemonic political trends is a vital capacity of architecture. It has no capacity to resolve political controversy. Political debate within architecture overburdens the discipline. The autopoiesis of architecture consumes itself in the attempt to substitute itself for the political system.”

“The code is thus the touchstone of the system’s differentiated identity. All supposedly political communications can be queried with respect to their alignment on the *left vs right* dimension, or on the *affirmative vs oppositional* dimension. Communications that refuse such alignments cannot be regarded as political communications. All supposedly architectural communications must relate to both the code of beauty and the code of utility, ie, all concretely design-related communications can be queried with respect to their position on the functionality and formal resolution of the design in question, and all more general communications (like communications within architectural theory) can be queried about the import of their pronouncement with respect to the general criteria of functionality and beauty. This means that the autopoiesis of architecture cannot enter into political arguments. It can only relate to given political agendas as (irritating) premises for its own architectural thinking. These premises are merely (irritating) premises, rather than regular, logical premises, because there is no ingrained logic within architectural thinking that would allow architects or architectural theorists to draw regular conclusions from those premises.”

(Schumacher, 2012, p. 449)

In this central message and passage, Schumacher examines the “interpenetration of discursive domains” among subsystems of society, particularly between the political and architectural subsystems (Schumacher, 2012, p. 454). In this context, Schumacher approaches “architecture” as a self-referentially closed system of communications within society, akin to Luhmann’s portrayal of the system of politics. In other words, “architecture” is considered an autonomous, singular, and distinguishable entity with “no capacity to resolve political controversy.” This observation of the discipline of architecture echoes early discussions of *occupational closure* in which professions “construct and defend social and legal boundaries that, in turn, affect the rewards of their members” (Weeden, 2002, p. 59). Schumacher elaborates in this passage upon the criterion that upholds the distinction between the two societal subsystems, politics and architecture, while simultaneously “irritating” one another. He further observes that “the autopoiesis of architecture consumes itself in the attempt to substitute itself for the political system,” implying a decline in the system’s

autopoiesis. This theoretical view leads Schumacher (2012, p. 458) to claim that the task of “the avant-garde segment of architecture, supported by architectural theory, [is] to continuously innovate the disciplinary resources in line with the demands of society.” With this claim, Schumacher presents architectural theory and, thus, his autopoiesis of architecture as an essential prerequisite for the continuous innovation of disciplinary resources. In turn, these innovations delineate the development and innovation of the built environment.

#### 4.2.6.1 References to Preceding Theories

With its central message pointing towards the relationship between the autonomous autopoietic systems of politics and architecture and further elaborating on this relationship by highlighting the different system’s identities through their binary code (i.e., for example, “*left vs right*” for politics), Passage 2.f can be interpreted as approaching architecture literally from the perspective of Luhmann’s notion of autopoiesis. Schumacher conceives the notion of “code” in line with Luhmann’s (1991, pp. 1427–1428), i.e., as a simple “rule of attribution and connection” that enables the categorisation of communications as belonging to one or other subsystem of society. However, the use of the term “identity” in the phrase “the code is thus the touchstone of the system’s differentiated identity” could potentially evoke further readings along Maturana et al.’s biological theory, particularly to their conception of the system’s organisation.

In Maturana and Varela’s view (1980, p. xx), the “organization of a system [...] specifies the class identity of a system.” It is when “the structure of the system changes so that its organization cannot anymore be realized, [that] the system loses its identity, and the entity becomes something else.” These structural changes are triggered by environmental perturbations, establishing an ongoing interaction called *structural coupling* between the system and its environment. In Schumacher’s passage, the term “irritating” appears to refer to this biological process, potentially leading to “the autopoiesis of architecture consum[ing] itself” (as highlighted in Schumacher’s central message) and thus its loss of identity. Figure 4.16 on page 189 shows my visual interpretation of this description.

#### 4.2.6.2 Language Use and Merits

Bridging Schumacher's, Maturana et al.'s and Luhmann's theories, "differentiated identity" and "irritation" are key terms in this passage. With different kinds of relationships within and among the three instances of autopoiesis, Passage 2.f can be interpreted in terms of literal and figurative language uses.

Schumacher posits his theory as literally describing a subset of Luhmannian communication systems. Similarly to Luhmann's description of the subsystem of politics, he then postulates the existence of a binary code as the "touchstone" for defining the differentiated identity of the discipline of architecture. Schumacher presents his argument through the use of a syntactical repetition – he employs the opening sentence "all supposedly political communications," and seamlessly extends it to architecture, stating "all supposedly architectural communications." I read this syntactical move as facilitating a **literal accommodation** of Luhmann's theory in Schumacher's autopoiesis of architecture. By bringing forth Luhmann's code of "*left vs right*" and "*affirmative vs oppositional*" of the subsystem of politics, Schumacher conveniently reiterates his postulation of the "code of beauty and the code of utility" as the governing principles within the discipline of architecture.

By accommodating Luhmann's theory, Schumacher offers an **explanation** of the rule of attributions and connections between conversations within the discipline. Based on the binary codes of autopoietic subsystems, Schumacher presents the theoretical frame required to categorise and differentiate conversations from politics and architecture. With this theoretical framework, Schumacher explains why "the autopoiesis of architecture cannot enter into political arguments" but can "relate to given political agendas as 'irritating' premises for its own architectural thinking." In this context, Schumacher further seems to rely on other systems theories that view the traditional distinction between open and closed systems as no longer rigid but as a dynamic "relationship of intensification. Using boundaries, systems can open and close at the same time, separating internal interdependencies from system/environment interdependencies and relating both to each other" (Luhmann, 1995, p. 30). By alluding to certain systemic processes, Schumacher not only perpetuates the understanding of architecture as an independent and self-sufficient discipline in its decision-making but also appears complicit in justifying the presence of political agendas within the discipline of architecture his theory portrays.

Subordinated to literal readings in terms of Luhmannian communication systems, however, word choices such as “irritation” and “differentiated identity” in this passage do not seem to prohibit potential figurative associations along Maturanian lines. This is particularly so given that members of the architectural discipline (the core readership of Schumacher’s thesis) are, by virtue of the creative and epistemic demands of the design process, particularly open to figurative references. Alluding to the biological process of structural coupling by way of the relationship between the discipline of architecture and the system of politics, Schumacher **legitimises** his claim that “all supposedly architectural communications must relate to both the code of beauty and the code of utility.” That is “all concretely design-related communications can be queried with respect to their position on the functionality and formal resolution of the design in question, and all more general communications (like communications within architectural theory) can be queried about the import of their pronouncement with respect to the general criteria of functionality and beauty.”

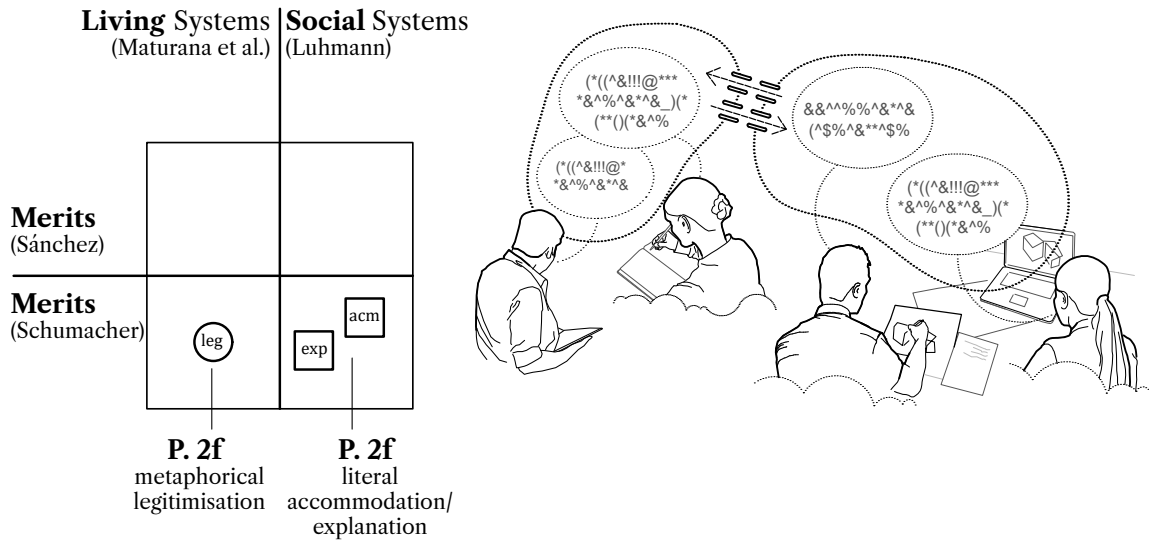


Figure 4.16: My visual interpretation of Passage 2.f – The “differentiate identity” and relationship between the autopoietic system of politics and architecture while being mutually ‘irritated’.

### 4.2.7 Passage 2.g. – Theoretical Underpinnings

The following passage is a quote from Section 10.1 “Theoretical Underpinnings” in Chapter 10 of Schumacher’s Volume II entitled “The Self-descriptions of Architecture” (Schumacher, 2012, pp. 485–496). In this section, Schumacher (ibid., 2012, p. 485) presents his *Thesis 52* in which he postulates the following *central message*: “Architecture, as a self-reflective system of communications, is trying to steer itself via theoretical self-descriptions that attempt to theorize and define architecture’s role within society. The complexity and sophistication of the contemporary societal environment demand increasingly complex and sophisticated architectural self-explanations. Convincing autological self-inclusion is now one of the indispensable conditions that any serious candidate for architectural self-description must fulfil.”

In this central message, Schumacher portrays the discipline of architecture as a “self-reflective system of communications” that describes itself through ar-

chitectural theory. This self-description represents the discipline's endeavour to steer (by theorising and defining) its "role within society." Given that "a reflective self-description is a special, advanced form of self-reference" (Schumacher, 2012, p. 489), this central message (implicitly) refers to Luhmann's figurative appropriation of autopoiesis (see Scott, 2012, p. 32; Whitaker, 2012, p. 32). In Luhmann's (1995, p. 32) view, social systems are "self-referentially closed systems" of communications "in the sense that they produce their own elements and thus their own structural changes." By describing the autopoietic dynamics of the discipline of architecture as dependent on architectural theory, Schumacher, however, deviates from portrayals of autopoiesis in both cellular biology and social systems. These two preceding theories, as discussed in the analysis of Passage 1.b (see section 4.1.2), do not assert that the existence of theory is a prerequisite for the autopoietic phenomena they describe. Under the context that "the complexity and sophistication of the contemporary societal environment demand increasingly complex and sophisticated architectural self-explications," Schumacher's own theory claims a "super-theoretical" position "*within* the autopoiesis of architecture." He positions his theory of architecture as "a (temporary) point of culmination in the ongoing, historical chain of successive self-descriptions" (Schumacher, 2012, pp. 486, 488).

"Architecture is a self-reflective system of communications that, at any time, is able to reflect (communicate about) itself as a unitary discourse or *system* of communications.<sup>30</sup> Reflectivity facilitates (adaptive) innovation, in dialectic interplay with the stabilization of a coherent (identity.) Reflectivity is also an important moment in the consolidation of an avant-garde movement leading to the formation of a new style. To succeed a style has to give itself a name and reflect its distinctiveness within a competitive environment." (Schumacher, 2012, p. 495, 496)

#### 4.2.7.1 References to Preceding Theories

With its central message and passage describing architecture as a self-reflective system of communication that "at any time, is able to reflect (communicate about) itself as a unitary discourse or *system* of communications," Passage 2.g can be interpreted as approaching architecture literally from the perspective of Luhmann's theory of



autopoiesis. I read the word “as” in the central message sentence: “architecture, as a self-reflective system of communications, is trying to steer itself via theoretical self-descriptions” not as indicating figurative speech but in its literal sense of characterising architecture as being a self-reflective system of communications. In this context, the syntactical formulation provides a Luhmannian lens through which to approach Schumacher’s claim. This literal reading that derives from Schumacher’s central message becomes apparent, especially in the first sentence of the sampled passage. Here, Schumacher articulates the same characterisation of architecture without the conjunction “as” (“architecture is a self-reflective system of communications”), thereby eliminating the possibility of a figurative reading.

With this characterisation of “architecture,” Schumacher not only evokes references to Luhmann’s theory but also to the cybernetic foundation of biological and sociological autopoiesis theories. Specifically, Schumacher appears to allude to the concept of self-reference, where the establishment of circular causal, interpersonal, or instrumental relationships fosters a cohesive unity. Figure 4.17 on page 193 shows my visual interpretation of this description. By alluding to the notion of self-reference, this passage can be loosely interpreted as drawing upon the definition of living systems proposed by Maturana and Varela (1980, p. 57). However, there are few (if any) references in Passage 2.g along such lines.

#### 4.2.7.2 Language Use and Merits

In this passage, Schumacher appends a footnote to the first sentence, stating, “It is interesting to note here that if one observes this most advanced form of self-reference, i.e., the occurrence of statements such as ‘*the essence of architecture is..., true architecture requires..., this is a milestone within the history of architecture, because...*’ etc, one usually observes the oscillation between functional and formal concerns.” Through this footnote and its accompanying examples of self-referential statements, which Schumacher associates exclusively with the “most advanced” segment of the architectural discipline, he presents his argument as grounded in his own firsthand experience and observations. In lieu of empirical substantiation, and with Schumacher being a leading representative of the system his theory describes, this postulation appears to be, at least in part, an argument from authority, suggesting its inherent truthfulness (Knight and Collins, 2005, p. 189).

By highlighting the significance of the self-reflective process within the discipline of architecture, Schumacher **accommodates** (using Ostwald's terms; see Ostwald, 1999, p. 66) in this passage Luhmann's theory of autopoiesis to his own theoretical wave. The accommodation of Luhmann's theory enables Schumacher to conveniently claim that reflectivity "facilitates adaptive innovation, in dialectic interplay with the stabilization of a coherent identity," and that it "is also an important moment in the consolidation of an avant-garde movement leading to the formation of a new style." The utilisation of the phrases "dialectic interplay" and "coherent identity" within the second sentence of the sampled passage accomplishes considerable rhetorical work. By employing the term "dialectic," Schumacher implies the existence of a continuous discussion between individuals holding diverse viewpoints yet aiming to establish a shared and "coherent identity" for the discipline through reasoned argumentation. In this view, Schumacher positions at the centre of his argumentative reasoning words, which have few (if any) negative meanings, thereby conveying a moral rightness that is very difficult to rebut. With this rhetorical move coupled with value-leaden words such as "facilitates," "important," and "interesting," Schumacher **legitimises** his advocacy for adaptive innovation through self-reflection within his autopoiesis of architecture.

With the sentence "architecture [...] is able to reflect (communicate about) itself," Schumacher attributes human capabilities to the discipline of architecture. However, in doing so, he overlooks the essential role of the human being who essentially underpins these communication processes. Consequently, he suggests that the "adaptive innovation," "the stabilization of a coherent identity," and the "consolidation of an avant-garde movement leading to the formation of a new style" (i.e., Parametricism (see Schumacher, 2012, p. 598)) emerge spontaneously as a result of a naturally occurring process of self-production.

Despite the criticism of Luhmann's theory for neglecting human agency (see, for example, Maturana and Poerksen, 2011, p. 107), the utilisation of natural autopoietic processes – which bear resemblance to living systems but operate within the realm of social communication systems – serves to strengthen the legitimacy of Schumacher's theory. It establishes the significance of architectural theory and positions Schumacher's theory as the driving force behind defining the "architecture's role within society." This self-centred position persists despite advocating for a "dialectic interplay" among practitioners in the field. Given the foundational premise

in his central message that the “complexity and sophistication of the contemporary social environment demands increasingly complex and sophisticated architectural self-explications,” Schumacher’s argumentative reasoning concerning the self-description through architectural theory and the self-reflectivity of the discipline appears justifiable nonetheless.

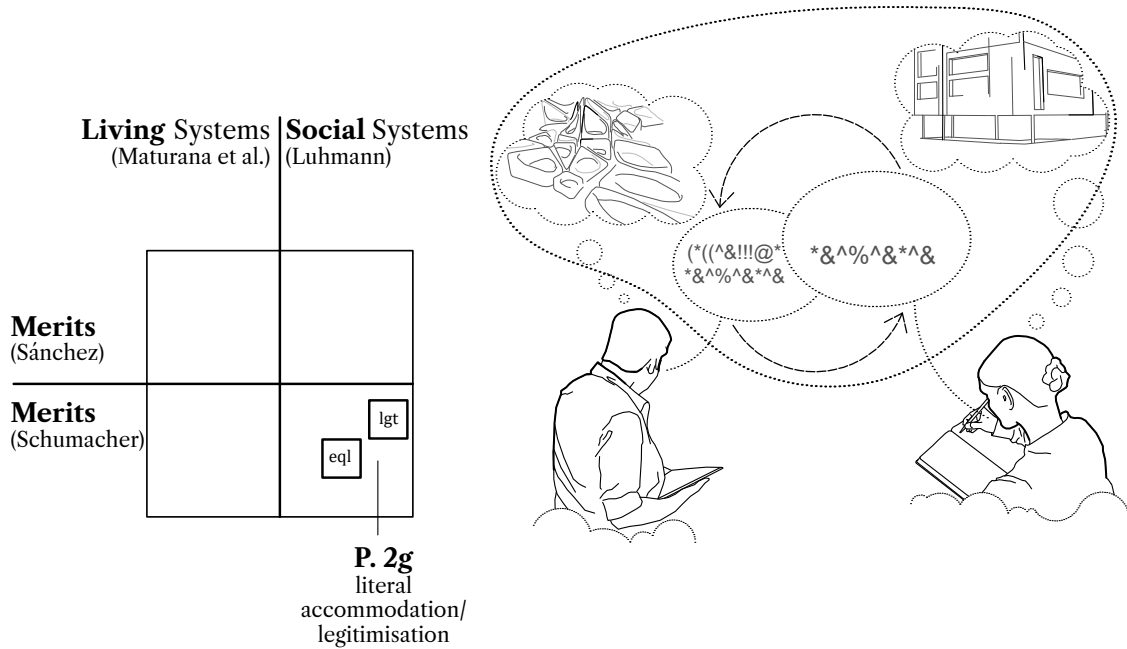


Figure 4.17: My visual interpretation of Passage 2.g – The self-reflectiveness of the discipline of architecture as “a unitary discourse or *system*.”



## Chapter 5

# Discussion and Conclusion

This concluding chapter consolidates the outcomes of this thesis, offering answers to the research questions posed at the end of Chapter 2, alongside related reflections and contextualising observations. It consists of four sections. Section 5.1 recaps the objectives and outcomes of the work presented in this thesis. Subsection 5.1.1 consolidates key findings of the analysis discussed in the previous Chapter 4, and presents them in the form of a textual narrative, a tabular summary of findings, and a unified diagrammatic summary. Subsection 5.1.2 presents observations and reflections on the findings presented in the preceding section. Section 5.2 discusses the implications and contributions to knowledge put forward in this thesis in the context of architectural research and beyond. Section 5.3 discusses the limitations of the work presented in this thesis. Section 5.4 concludes the chapter by outlining future research by which the findings presented here may be extended.

## 5.1 Summary of Findings

I embarked on this research project with a background in architectural studio education and practice – a background that prepared me to draw on inspirations from a broad range of fields in appreciating and shaping the built environment. However, this background offered me little preparation for abstract theoretical reflection and rigorous academic research. Having found myself as a participant in and observer of fast-developing urban centres in China with this design studio perspective, I found strangely obvious-yet-vague connections between my urban surroundings and biological systems. These perceived connections intrigued me, and, as outlined in detail in Chapter 1, motivated me to conduct this project, with an initial ambition to investigate the street-level production and use of temporal and informal structures. Aiming to better understand the connections between urban and biological dynamics, I read Schumacher's *The Autopoiesis of Architecture*. Yet, instead of finding the connections between the two domains explained, I found a considerable discrepancy between my expectations towards the two volumes and what they deliver. Looking for either a discourse or critiques that *The Autopoiesis of Architecture* might have stimulated, I found little in the way of either, which further compounded my questions about Schumacher's theory. Instead of answers, in other words, I found more questions, which allowed me to re-orient my research from the field to the desk when this was required. This thesis presents the results of the resulting investigation.

My literature review, presented in Chapter 2, covers three broad areas: The appropriation of theory from other domains in architecture, the development of the theory of autopoiesis in the biological context, and the cross-disciplinary appropriation of the theory of autopoiesis. Three instances of the theory of autopoiesis have been put forward over the course of the past half-century. The first instance, developed by the neuro-biologists Humberto Maturana, Francisco Varela, and Ricardo Uribe, explains the self-regenerative processes that sustain living systems in general and biological cells in particular. The second instance, proposed by the sociologist Niklas Luhmann, appropriates the first instance to explain the self-reproduction of communication systems. The third instance, proposed by the architect Patrik Schumacher, appropriates the second instance to explain "architecture." Based on this

literature review, and sensing that I was unlikely to be alone with my questions *vis-à-vis* the merits of Schumacher's theory appropriation, I raised the following two research questions:

1. What are the merits of Schumacher's appropriation of the theory of autopoiesis from the perspective of academic architectural research?
2. How literally is this theory of autopoiesis to be taken, and to what ends?

To address these questions, I developed and subsequently applied a purpose-designed approach, drawing primarily on methods developed earlier in the field of discourse analysis but also incorporating previously-proposed categorisations of language use and merits of theory appropriation into a unified methodological framework. The development of this framework is presented in Chapter 3. Applying this methodological framework, I sampled relevant passages in *The Autopoiesis of Architecture*, followed by a close reading and coding of said passages. Finally, I interpreted these passages by way of inference to the respective best explanations with regard to modes of language use, merits, and respective beneficiaries of theory appropriation. This analysis, presented in Chapter 4, yielded qualitative/textual, visual/interpretative, and quantitative/diagrammatic results, which are summarised below.

This enquiry resulted in insights extending across two different levels: The immediate findings from the analysis of sampled passages from *The Autopoiesis of Architecture*, and broader observations and reflections based on these analytical findings – the latter being the level at which my research questions are answered. The insights across these two different levels are outlined in the following two sections, respectively.

### 5.1.1 Summary of the Analysis of Sampled Passages

This section offers a brief review of the findings presented in Chapter 4, highlighting key connections between architecture and autopoiesis identified in Schumacher's architectural theory with a focus on language uses, merits, and respective beneficiaries of theory appropriation. The analytical categories of language use and merits of theory appropriation present in each sampled passage are emphasised in italics in this section. For the sake of clarity and conciseness, this section follows a

thematic sequence rather than the order in which the analysed passages appear in Schumacher's two volumes and in Chapter 4 of this thesis.

In Passage 1.a, Schumacher claims that (the discipline of) "architecture" exists as a singular, distinguishable entity constituted by the re-production of disciplinary communications. Schumacher positions the discipline of architecture as a subset of autopoietic communication systems at large, thereby *equalising* his appropriated notion of autopoiesis *literally* to that of Luhmann. Yet, at the same time, some of his phraseology suggests (or, at least, does not dispel) *metaphorical* interpretations of the autopoiesis of architecture in terms of living systems, aligning thereby with my interest in understanding the connection between architecture and autopoietic processes in biological tissues. This alternative interpretation of the text appears to *obfuscate* the relatively limited scope of application permitted by the Luhmannian notion of autopoiesis, and suggests a *legitimising* of Schumacher's theory through a broader biological grounding.

In Passage 2.g, Schumacher describes "architecture" similarly, emphasising the self-reflective communicative capabilities by which the discipline exhibits a stable and coherent identity through theoretical self-description. Describing this reflectivity as important in the consolidation of an avant-garde movement leading to the formation of a new style (such as Schumacher's own Parametricism), Passage 2.g, like other passages sampled from the second volume of *The Autopoiesis of Architecture*, extends beyond a mere theoretical description of "architecture" to also propound an architectural agenda. Within this context, Schumacher *accommodates* Luhmann's theory of autopoiesis as a vehicle to *legitimise* his claim of the discipline of architecture being self-reflective. This self-reflectivity is depicted as being performed independently from human agency, suggesting a spontaneous and naturally occurring process that facilitates the adaptive innovation of the discipline and consolidates Schumacher's own Parametricism as "the candidate to become the unified, epochal style for the 21st century" (Schumacher, 2012, pp. 1, 495).

In Passage 1.b, Schumacher describes the discipline of architecture *literally* as a subset of the social communication systems described by Luhmann, and *explains* the dependency of "architecture" on architectural theory. This stands in some contrast to both Luhmann's and Maturana et al.'s theories, neither one of which claims a dependency on the autopoietic phenomena they describe on theory. By *metaphorically* evoking Maturana et al.'s autopoiesis, Schumacher *legitimises* his portrayal of



the built environment (“mere buildings” in contrast to “architecture”) as being driven by the innovative powers of the discipline of architecture, whose autopoietic dynamics, in turn, are described as being dependent on architectural theory. Furthermore, Schumacher’s not-counteracting these possible figurative interpretations *obfuscate* a purely literal interpretation of his proclaimed Luhmannian framework, thereby broadening its scope to encompass also the biological interpretation of autopoiesis. With this theoretical context, Schumacher’s own theory claims a “super-theoretical” (Schumacher, 2011, pp. 58–59) position among architectural theories despite relying, however, on self-evident assertions rather than on the presentation of some underpinning reasoning, empirical data, or traceable reference.

In Passage 1.c, Schumacher presents the discipline of architecture as an autonomous self-referentially closed system of communications, *literally equalising* his theory to Luhmann’s theory of autopoiesis. Schumacher claims that the evolution of society is contingent upon the evolutionary process of the discipline of architecture, suggesting thus a relationship between the autopoietic system of the discipline and its societal environment. With this understanding of closure along Luhmannian lines but without precluding *metaphorical* references to Maturana et al.’s theory of cellular autopoiesis, Schumacher *legitimises* his claimed distinction between autonomous disciplinary subsystems, namely those of avant-garde and mainstream architecture within the system of architecture. This theoretical position sets Schumacher’s own avant-garde practice apart from conventional architectural practices.

In Passage 1.h, Schumacher further elaborates on the discipline’s autonomy along the lines of Luhmann’s (2000, pp. 131, 135) theory, according to which functional autonomy sets social systems apart from other systems within society. Within this context in which social systems are portrayed as isolated entities, Schumacher *legitimises* the discipline’s role in framing communications via the built environment. While architecture, in this role, can be seen as a mechanism that structures human activity, this passage suggests a different perspective in which architecture serves as a mechanism to control society, in accordance with Foucault’s (1982, p. 781) understanding of social control. At the same time, however, Schumacher figuratively evokes associations between urban dynamics and autopoietic processes in biological cells along the lines that brought me to formulate the research question I investigate in this thesis. Assuming a general openness towards *metaphorical* references within

the architectural discipline, Schumacher's writing in this passage *obfuscates* the relatively limited applicability permitted by Luhmann's theory of autopoiesis.

In Passage 1.e, Schumacher elaborates on the internal communicative operations required to consolidate the autonomy of the discipline. With Schumacher *equalising* his observations of the discipline of architecture *literally* to Luhmann's insights on social systems, Schumacher validates his argumentative line of reasoning and position. Yet, at the same time, he does not seem to avoid *metonymical* allusions to biological processes that further *legitimise* his characterisation of the discipline of architecture as an autonomous entity undergoing evolutionary changes over time independently from its environment.

In Passage 1.g, Schumacher argues that the discipline of architecture communicates in the medium of (digital) drawings and (digital) models. By characterising the design process as an autonomous and self-referential autopoietic process capable of generating its own components (drawings and models), Schumacher appears to draw *metaphorical* inspiration from Maturana et al.'s theory of autopoiesis. Although this allusion is subordinated to Luhmann's autopoiesis, it undermines and hence *obfuscates* purely literal readings along Luhmannian lines. In turn, Schumacher's appropriation of Luhmann's theory enables him to *theorise* about the design process. However, Schumacher's theoretical formulation lacks the substantial empirical data necessary for rigorous testing and scrutiny, as is typically expected in academic theories. Instead, he offers a description of the design process primarily drawn from his personal experience within the discipline, serving the consolidation of his theoretical edifice rather than potentially informing members of the architectural discipline.

In Passage 2.b, building upon Luhmann's theoretical framework, Schumacher further elaborates on the description of the design process as a problem-solving endeavour. Through the appropriation of autopoiesis, Schumacher *accommodates* Newell's and Simon's (1972) description of design as a problem-solving process within his theory of architecture. Ignoring previous criticisms of Newell's and Simon's rational position towards designing, Schumacher seems to be guiding the contemporary architectural agenda towards a "technology-centered" design (Krippendorff, 2006, p. 26). This approach favours "hierarchical organizations of responsibilities and nourishes the kind of functionalist society that emerged during the industrial era." It diverges, however, from a "human-centered" design that

“derives its criteria from a community of users whose worlds designed artifacts may have to find a place together with their users, bystanders, instructors, and critics” (ibid.). In this view, the accommodation of Simon’s approach through Schumacher’s appropriation of the theory of autopoiesis seems to *legitimises* his own professional agenda.

In Passage 2.c, Schumacher advocates for the autonomy of the design process. With the autopoietic notion of *autonomy*, its associated notion of *organisational closure* and a valid summary of well-developed design theory, Schumacher claims a circular relationship between problem and solution within the design process. With this context, Schumacher’s stance not only contradicts his emphasis on a rational, goal-oriented design process but also highlights a divergence from his proclaimed independence of the profession as a self-sufficient entity in its decision-making. Although intertwined and not clearly delineated from the closure in terms of process dynamics, this isolated-based closure of the profession is brought about by presenting the limited constraints that could restrict the design process, such as clients or competition briefs. By limiting his argument to high-profile competitions and those constraints imposed upon renowned architects, Schumacher suggests an autopoiesis of architecture tailored for a particular segment within the community of architectural practitioners. By alluding to the autopoietic closure described by Luhmann, Schumacher not only *explains* his perception of the discipline but also *legitimises* his line of reasoning and position. Given Schumacher’s reliance on personal experience and the lack of empirical data that might substantiate his theory appropriation and position, his arguments and assertions in this passage seem to rely on his role as an authoritative agent of the profession.

In Passage 1.f, Schumacher addresses one of the most contentious issues in design studio education and practice – the observation and evaluation of design outcomes. Reaching back to fundamental principles of second-order cybernetics, particularly that of the role of the observer, Schumacher implicitly bridges both Maturana et al.’s and Luhmann’s theories of autopoiesis. Leaning *literally* on Luhmann’s (2013, p. 112) concept of “second-order observation,” Schumacher establishes a theoretical frame of reference based on the double code of beauty and utility. Architectural styles, in turn, funnel the conversations into the same theoretical frame of reference. With this theoretical position, Schumacher *explains* the existence of different types of “stylistic awareness,” and *legitimises* his “style of Parametricism”

as a guiding principle to competently evaluate design outcomes. This new “epochal style” thus “gives long-term stability to the development of the built environment” (Schumacher, 2011, p. 253). Also alluding to Maturana et al.’s (Maturana and Varela, 1980, p. 8; Maturana, 1975, p. 315) insights regarding the observer’s capacity to process distinctions through their own actions and understanding (thoughts) recursively, Schumacher prompts a connection between this theoretical perspective and my personal experience of fast-development urban centres in China. This *analogical* association wherein the observer is observing the observed built environment along the mode of observation described within the theory of autopoiesis enables the *theorisation* of the role of the observer in architecture. Notably, rather than taking the observer into account of the observation, Schumacher suggests a reference to subjectivity in observing the architectural product and the built environment.

In Passage 2.a, Schumacher diverges from the conventional (Luhmannian) portrayal of autopoiesis in social communication systems by focusing on the interplay between architectural systems (such as structural or circulation systems). In the same context, he also evokes *metaphorical* associations to the circular dynamics between components observed within living cells. Aligning his notion of autopoiesis with Maturana et al.’s observations of living systems, Schumacher not only evokes associations with living systems along the lines that brought me to formulate the research question I investigate in this thesis but also *legitimises* his characterisation of the discipline of architecture as an autopoietic system. Notably, by positioning his theory as the definitive framework that refines and governs the usage of the term “system,” Schumacher hints at an appropriation of theory to gain authority rather than aim for a clearer understanding of the discipline for the reader.

In Passage 2.d, Schumacher again postulates the existence of architecture as an autonomous discipline that operates within a complex societal environment, providing an innovative built environment. By describing a continuous interaction involving adaptation and ongoing vitality between the discipline of architecture and the built environment, Schumacher does not appear to counteract possible figurative, particularly *metaphorical*, interpretations along with Maturana et al.’s autopoiesis. Assuming that members of the architectural discipline (the core readership of Schumacher’s thesis) are, by virtue of the creative and epistemic demands of the design process, particularly open to figurative references, the metaphorical interpretation of Schumacher’s passage offers insights into the connection between the construc-

tion of the built environment and living systems. Yet by distinguishing between “architecture” and the built environment as two distinct entities where the renewal of one is brought about by the other, Schumacher diverges from Maturana et al.’s theory, which conceptualises autopoiesis as an integrated unity of interdependent elements from which renewal emerges spontaneously. Nonetheless, Schumacher’s metaphorical reference to autopoiesis seems to *legitimise* his advocacy towards an intentional piloting function of architecture in consolidating the social and built environment.

In Passage 2.e, by building upon Luhmann’s autopoiesis, Schumacher *theorises* the functional relationship between the discipline of architecture and its societal context. Specifically, Schumacher explores this relationship in terms of the discipline’s sensitivity to environmental changes while overlooking crucial contemporary issues in architecture, such as gender inequality or sustainable construction. At the same time, Schumacher employs *metaphorical* language that evokes processes of adaptation and decline commonly observed in living systems. By presenting “architecture” as an entity that naturally emerges, adapts, and potentially declines, Schumacher constructs an argument that carries an inherent sense of validity, thereby bolstering the *legitimacy* of his theoretical position and professional agenda.

In Passage 2.f, Schumacher further elaborates on the relationship between subsystems of society, particularly between architecture and politics. By categorising communications as belonging to one or another subsystem through the notion of binary code, Schumacher *accommodates* Luhmann’s social systems theory within his own theory. Furthermore, with this appropriation, Schumacher *explains* why “the autopoiesis of architecture cannot enter into political arguments” but can “relate to given political agendas as ‘irritating’ premises for its own architectural thinking.” In this view, Schumacher perpetuates the understanding of the discipline of architecture as an independent and self-sufficient discipline in its decision-making while justifying the presence of political agendas within the field. Yet subordinated to literal readings along Luhmannian communication systems, Schumacher does not seem to preclude the possibility of figurative associations that align with Maturana et al.’s autopoiesis. Alluding to biological processes of structural coupling, Schumacher *legitimises* his claim that all architectural communications must relate to only the code of beauty and the code of utility, thereby further legitimising the independence of the discipline.

To present a concise overview of the outcomes from the analysis of passages sampled from both volumes of *The Autopoiesis of Architecture*, the following table 5.1 shows a compiled version of the findings, comprising the possible modes of language use, merits, and respective beneficiaries of theory appropriation for each sampled passage. Supplementing the table, figure 5.2 superimposes a code of each sampled reference to the theory of autopoiesis in a single two-by-two matrix that establishes an aggregate pattern of language use, merits, and respective beneficiaries of theory appropriation across all samples taken from Schumacher's two volumes. Observations and reflections resulting from the table and superimposition of passages are discussed and contextualised in the following Section 5.1.2.

PASSAGES	LANGUAGE USE	PROBABLE MERITS	BENEFICIARIES OF THEORY APPROPRIATION	REFERENCES TO PRIOR INSTANCES OF AUTOPOIESIS
P.1a	Literal	Equalisation	Schumacher	Social Systems
	Metaphorical	Legitimation		
	Metaphorical	Obfuscation	Sánchez	Living Systems
P.1b	Literal	Explanation	Schumacher	Social Systems
	Metaphorical	Legitimation	Schumacher	Living Systems
	Similised/ Metaphorical	Obfuscation	Sánchez	Living Systems
P.1c	Literal	Equalisation	Schumacher	Social Systems
	Metaphorical	Legitimation	Schumacher	Living Systems
P.1e	Literal	Equalisation/ Legitimation	Schumacher	Social Systems
	Metonymical	Legitimation	Schumacher	Living Systems
P.1f	Literal	Explanation/ Legitimation	Schumacher	Social Systems
	Analogical	Theorisation	Sánchez	Living Systems
P.1g	Literal	Theorisation	Schumacher	Social Systems
	Metaphorical	Obfuscation	Schumacher	Living Systems
P.1h	Literal	Legitimation	Schumacher	Social Systems
	Metaphorical	Obfuscation	Sánchez	Living Systems
P.2a	Metaphorical	Legitimation	Sánchez/ Schumacher	Living Systems
P.2b	Literal	Equalisation	Schumacher	Social Systems
	Similised	Accommodation /Legitimation	Schumacher	Living Systems
P.2c	Literal	Explanation/ Legitimation	Schumacher	Social Systems
P.2d	Metaphorical	Legitimation	Sánchez/ Schumacher	Living Systems
P.2e	Literal	Theorisation	Schumacher	Social Systems
	Metaphorical	Legitimation	Schumacher	Living Systems
P.2f	Literal	Accommodation /Explanation	Schumacher	Social Systems
	Metaphorical	Legitimation	Schumacher	Living Systems
P.2g	Literal	Accommodation /Legitimation	Schumacher	Social Systems

Figure 5.1: Summary of findings of each sampled passage.

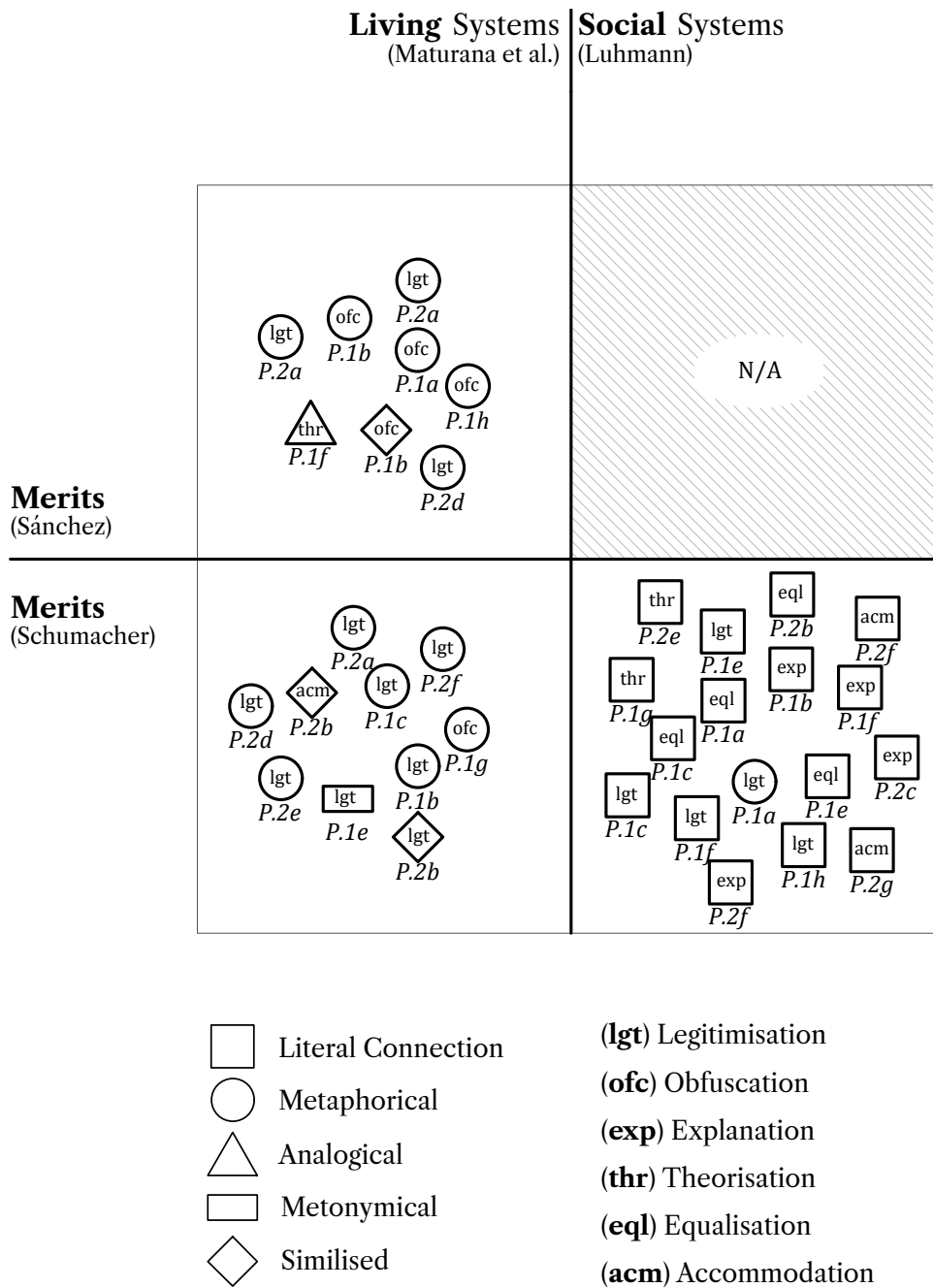


Figure 5.2: Superimposition of findings in a single two-by-two matrix.



### 5.1.2 Observations and Reflections

As discussed above, this project was prompted by the discrepancy between my expectations towards *The Autopoiesis of Architecture* and what the two volumes deliver. Following my analysis of 16 passages sampled from the two volumes, I am in a position to explain this discrepancy in this section. In this explanation, the above-mentioned discrepancy continues to feature prominently – not only as an initial motivation but also as a potential challenge to its credibility and trustworthiness and as a key aspect of its findings. The credibility and trustworthiness of a text analysis depend largely on the degree to which the perspectives of the author of the analysed text, the analysing researcher, and the readers of the analysis are aligned. I acknowledge possible limitations arising from my perspective on *The Autopoiesis of Architecture* in section 5.3 below. The alignment of the perspectives of author and reader, however, also requires clarity on the part of the author. In this regard, I find *The Autopoiesis of Architecture* somewhat unclear.

In my reading, the two volumes do not commit to a clear professional and creative practice, or academic research.<sup>1</sup> In its explicitly stated motivations, its rhetoric, theoretical foundation, and literary format *The Autopoiesis of Architecture* appears to be grounded in *academic research*, setting out at the beginning of Volume I to develop “a comprehensive discourse analysis of the discipline [of architecture...in] an effort towards theoretical systematization” (Schumacher, 2011, p. xi). Eventually, *The Autopoiesis of Architecture* emerges as a part of an agenda set for a community of *architectural practitioners*, concluding towards the end of Volume II with a call to “join Parametricism’s drive to conquer the mainstream of world architecture!” (Schumacher, 2012, pp. 735–736). Transitioning gradually between the theoretical description of the architectural profession and a value-laden agenda-setting for the profession of architecture, *The Autopoiesis of Architecture* demands the open-mindedness and tolerance with which *creative designers* (including myself in my previous role as a practising architect) approach and embrace potential inspiration. In my reading, in other words, *The Autopoiesis of Architecture* speaks the language of academic research while serving the professional agenda of its author and appearing

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<sup>1</sup>This perception was further reinforced in my mind by the meandering answer Schumacher offered to my question: “Is your use of the concept of autopoiesis scientifically formal, or designerly informal?” (see Appendix A).

most likely to be appreciated by designers who forego critical rigour in open-minded pursuits of creative stimulation. To exemplify how Schumacher performs this transition, I focus here on three key instances in which I find ambiguity and equivocation to be at play in *The Autopoiesis of Architecture*. Specifically, I focus in the following paragraphs on my reading of Schumacher's use of the terms of *architecture*, *theory*, and *closure*.

The first of three terms I found ambiguous in *The Autopoiesis of Architecture* is the term *architecture*. Generally, the term may refer to physical objects and building structures, the process of designing such objects and structures, and the profession engaged in this process. In *The Autopoiesis of Architecture* and elsewhere, Schumacher uses the term *architecture* primarily in accordance with the latter interpretation. Based on his adoption of Luhmann's theory of autopoiesis, he uses it to refer to the social subsystem of architecture and, more specifically, to "The total mass of communications that constitutes this autopoiesis compris[ing] diverse items such as sketches, drawings, CAD files, renderings, buildings and photographs of buildings that all circulate as communications" (Schumacher, 2011, pp. 2–3). While Schumacher (Schumacher 2011, p. 35) explicitly distinguishes this interpretation of architecture from "mere building," somewhat confusingly, "buildings" (i.e., physical objects and building structures) are included in this list of communication media, provided that their production is "marked by radical innovation and theoretical argument," whereas vernacular architecture is explicitly excluded (Schumacher, 2011, pp. 3, 35). Schumacher clarifies his use of the term architecture repeatedly. Yet, given the wealth of earlier appropriations of natural-scientific theory to describe aspects of (design processes underlying) the built environment – using terms such as *metabolism*, *symbiosis*, *catalysis*, *homeostasis*, *co-evolution* and *autopoiesis* – see Section 2.1.1 – readers approaching *The Autopoiesis of Architecture* can be expected to anticipate a treatment along similar "weak biomimicry" lines. I, for one, expected a biological explanation of the dynamics of the (vernacular) urban environment.

As discussed in Section 1.2, the distinction between these two interpretations of *architecture* can be seen as a reflection of the emergence of the architectural profession in the transition from the Middle Ages to the Renaissance. Before the formation of the architectural profession, master builders relied on verbal communication and full-scale on-site layouts rather than on models and drawings to communicate their design intentions to their construction workforces. This approach required the

constant presence and involvement of the master builder in the construction process (Barrow, 2001, T1.2.). Innovations in perspective representation and orthographic drawing in the Renaissance, however, allowed architects to communicate their designs effectively on paper and to detach themselves from the construction process (Porter, 1997, pp. 18–19), resulting in “the crystallization of the architectural profession as a scholarly, gentlemanly occupation that could be detached from the practicalities of building” (Koutamanis, 2001, p. 60).

The second of three terms I found ambiguous in *The Autopoiesis of Architecture* is the term *theory*. Ostensibly, Schumacher puts forward a “unified,” “all-encompassing,” “theoretical systematization” of (the discipline of) architecture, “as [a] general theory of architecture with the ambition to become available as self-description of architecture within architecture” (Schumacher, 2011, pp. xi, 4, 59). By adopting Luhmann’s theory of communication systems, Schumacher positions *The Autopoiesis of Architecture* in the context of academic theory development. He does so in scholarly, academic prose, describing his approach as a “comprehensive discourse analysis,” suggesting a correspondingly rigorous, value-free theoretical description of the discipline with broad applicability.

The three instances of autopoiesis theory, moving from a natural-scientific to a sociological, and, based on that, a disciplinary focus, have successively drifted away from narrow scope definitions and empirical grounding. While Maturana and Varela (1978) limit the scope of their theory of living systems to a single biological cell, Schumacher, does not delineate the “discipline of architecture” (say geographically or culturally) and instead describes the scope of his theory as “universal.” Maturana and Varela (1980, pp. 90–93; 1992) link the cycle of cellular autopoiesis to verifiable physiological evidence, and Varela et al. (1974, pp. 189–191) illustrate the autopoietic process with a demonstrable computational model, *showing* how their theoretical description corresponds with the process dynamics it describes. In doing so, they took an approach that is not unlike the use of models in the reconstruction of a traffic accident noted by Wittgenstein (see page 104) and which has been taken by several theorists of self-reproducing systems, some of whom I discussed in Section 2.2.4. Schumacher, by contrast, does not show correspondences between his theory and observable phenomena. Instead, he puts his theory forward to shape and structure what is perceived: “Theory is no reflection of the given order of the world. Rather, it is a designed apparatus to give order to the phenomena we experience”

(Schumacher, 2011, p. 5).

Accordingly, Schumacher offers little in the way of verifiable samples of the “discourse” he claims to analyse. On the contrary, he states that “the ‘empirical basis’ offered [in *The Autopoiesis of Architecture*] has the status of an invitation to the reader to test the proposed concepts and theorems against his/her own immediate observations and experiences within the field of architecture. The actual ‘empirical’ origin of the theory stems from the author’s [Schumacher’s] own accumulated observations and browsing journeys into this reservoir” (Schumacher, 2012, p. 5). As a line of reasoning, in my view, this statement resembles both an appeal to trust as well as an argument from authority. As an approach to empirical substantiation, it appears to seek agreement more than it seeks improved understanding or improved practice. In any case, this approach leaves Schumacher’s theory difficult to refute. Its labelling as a discourse analysis – an approach that relies on material manifestations of discourse in the medium of text – seems admissible only with the use of quotation marks, when uttered from a position of notable power, when uttered to a particularly open-minded audience, or in the presence of some combination of these. Luhmann’s earlier adoption of the biological theory of autopoiesis had met with criticism by Maturana, one of the authors whose theory Luhmann had adopted. Maturana rejected Luhmann’s adoption for failing to account for the role of human agency in social communication systems (see Section 2.3.2). Schumacher’s theory neither addresses Maturana’s criticism of Luhmann, nor does it account for the role of human agency in the autopoieses of architectural communication systems. In this sense, Schumacher’s contextualisation of *The Autopoiesis of Architecture* in the preceding systems science discourse is limited.

Some of the above criticism may similarly be leveraged against Luhmann’s theory. In contrast to Luhmann’s theory, however, *The Autopoiesis of Architecture* appears to have no more than a moderate application value, as its limited use by others indicates. Yet more notably, Schumacher’s theory deviates from its Luhmannian predecessor by putting forward an agenda for the architectural profession. This agenda is necessarily based on aesthetic, professional, political and economic values, which appear to be those of Schumacher and his practice. Having published *The Autopoiesis of Architecture* in the wake of his *Parametricist Manifesto*, positioning it in relation to other architectural manifestos, and concluding with a rallying cry for *Parametricism*, Schumacher’s use of the word *theory* deviates from its academic

interpretation (descriptive, explanatory, or predictive abstraction of observable phenomena) and assumes an interpretation sometimes encountered in the architectural field (normative agenda-setting by authoritative agents of the profession). Towards the end of Volume II, then, the utility of the theory is limited to creative inspiration: “such a theory is perhaps comparable to a computer, ie, it is a general purpose machine, a tool with an attached invitation to be put to many creative uses” (Schumacher, 2012, p. 736).

The third term I found ambiguous in *The Autopoiesis of Architecture* is the term *closure*. According to Maturana and Varela (1992, p. 89), a system is organisationally closed when its output affects the system as an input, resulting in a circularly-causal feedback loop by which systems may respond to effects of their own (past) actions, i.e., self-regulate. As I explained in Section 2.2.1.4 of this thesis, however, the term “closure” is sometimes misunderstood as describing isolating effects of systemic boundaries that (supposedly) prohibit systems from interacting with their environments and render them independent from their contexts. This misunderstanding has been clarified by multiple authors, including Varela and Goguen (1978, p. 294), and Fischer (2019, pp. 376–377). Schumacher conflates these two understandings. In multiple places, he describes the closure of the architectural profession both consistently with its systems-theoretical definition as responsive to its own outputs. In other places, Schumacher describes this closure inconsistently with its systems-theoretical definition and more aligned with Weeden’s (2002, p. 59) notion of *occupational closure* as independent from external influences. My visual interpretation of these two understandings of the term *closure* in Schumacher’s theory is shown in Figure 5.3.

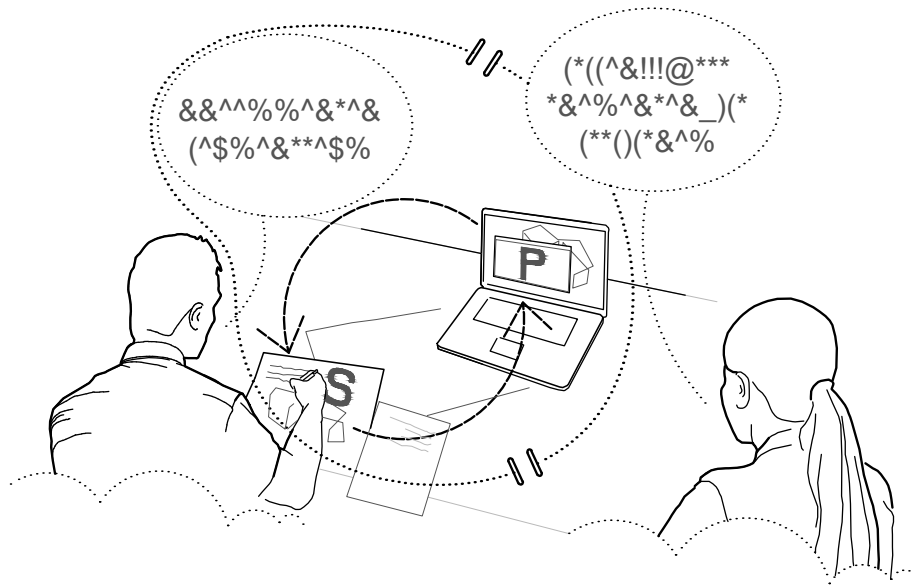


Figure 5.3: My visual interpretation of the two interpretations of the term *closure*.

Passage 2.c, for example, transitions between both understandings of the term closure. Schumacher discusses it first in terms of the circular relationship between problem and solution in the design process to then put forward an argument for the independence of (the avant-garde of) the architectural profession – a transition which may coincide in particular instances without necessarily being causally connected. With this transition, Schumacher switches again from offering a descriptive theory (describing observable phenomena) to offering a prescriptive theory (putting forward value-laden assertions).

The superimposition of references to autopoiesis in the sampled passages shown in Figure 5.2 indicates that the connections Schumacher draws between architecture and autopoiesis do not adhere to a uniform use of language. Instead, the use of language in the sampled passages ranges across literal, metaphorical, analogical, similitised, and metonymical modes. (Figure 4.1 on page 121 shows the different kinds of (literal or figurative) relationships within and among the three instances of autopoiesis). This mix of figurative and literal use of language, evocative and inspiring from a creative point of view, is challenging to grasp from a more formal academic viewpoint. While Maturana et al.'s biological systems refer literally to observable bi-

ological phenomena, Luhmann's description of communication systems via biological systems figuratively describes communication systems as behaving *like* biological cells. Schumacher's description of "architecture" as autopoietic, in turn, is literal when read along Luhmannian lines (given that Schumacher positions his theory as a subset of Luhmann's), and figurative when read along Maturanian lines (describing architectural discourse to be *like* biological cells). The merits of Schumacher's references to autopoiesis, likewise, range across the full spectrum of motivations for theory appropriation proposed by Ostwald (1997). Yet, in my reading, a considerable portion of these merits fall into the *obfuscating*, *legitimising*, and *equalising* categories, of which Ostwald (1999, p. 67), building upon Sokal and Bricmont's (2003, pp. 178–182), stated: "nothing productive can result from appropriations motivated for these reasons." Appropriations of these kinds tend to benefit the author rather than clarity of understanding on the part of the reader. Cautionary warnings against sweeping generalisation, or unjustified biological interpretation of the autopoietic characterisation of professional communications in the architectural profession are absent from the two volumes. While Schumacher relies explicitly on Luhmann's theory, Figure 5.2 also shows that a considerable portion of the connections drawn between architecture and autopoiesis appear to relate, or at least do not preclude relating to, biological systems rather than exclusively aligning with social systems.

## 5.2 Implications and Contributions

With the analysis of Schumacher's *The Autopoiesis of Architecture* presented in this thesis, I condensed a theory of architecture based on earlier theories of biology and communications, along with its model of language use and their associated merits, put forward across two volumes totalling well above 1,100 pages, in a single diagram. This work resulted in findings with relevance and implications for design practitioners and academics in general, and for architectural designers coming to terms with figurative and evocative language in the context of rigorous academic research in particular. I hope these findings may serve as signposts for others seeking to engage with Schumacher's theory appropriation or theory appropriation in architecture more generally.

This study presents a compact review of the biological theory of autopoiesis and its two subsequent appropriations in social science and architecture – most notably in sociology by Luhmann and, based on that, in architecture by Schumacher. This review may benefit others who wish to grasp this development. Given this development, it is evident that theory appropriations can be concatenated. The particular theory appropriation examined in this thesis demonstrates the usefulness of Ostwald's (1999, p. 66) theoretical categorisation of *motivations* (which I refer to as *merits*) for theory appropriations in architecture. I have extended Ostwald's framework by also considering modes of language use, showing the multiple and multi-layered language uses and merits of theory adoption that can be at play in theory appropriations. For example, Schumacher may *literally* lean on Luhmann's theory of autopoiesis to *explain* some features of the discipline of architecture while at the same time alluding to Maturana et al.'s theory of autopoiesis, which can implicitly *legitimate* his argument through *metaphorical* allusions. This study thus builds on prior work on theory appropriation to further develop and interrogate Schumacher's theory appropriation as well as the methodological means available for such purposes.

To this end, the work presented in this thesis also contributes an approach to using illustration in discourse analysis and theory appropriation. Research in this area is based heavily on *this-is-like-that*-connections between different contexts and ideas, which, as Wittgenstein notes, can not be described but *shown*. Utilising a part of my architectural training, I am showing my interpretations of such connections throughout the analysis presented in this thesis. This approach may be applicable in other investigations involving discourse analysis and theory appropriation.

Another substantive contribution of this study is its purpose-designed methodology. This mixed-method text analysis approach expands on – and differs from – previous methods established in social science by combining methods developed earlier in discourse analysis while also incorporating categorisations of language use and merits of theory appropriation proposed elsewhere. The findings obtained from the analysis of the sampled passages of *The Autopoiesis of Architecture* are necessarily limited to my interpretation of Schumacher's appropriation of autopoiesis and, by extension, to the linguistic specificity and the discursive context of Schumacher's theory of architecture. However, the analytical framework proposed here might help to understand other theory appropriations from academic architectural



research perspectives equally unclear in architecture. For example, it could be utilised to examine the appropriation of the biological concept of *metabolism* by Japanese architects Kisho Kurokawa, Kiyonory Kikutake, and Arata Isozaki, offering a novel perspective on a well-known period in architectural history. Similarly, it could be employed to explore appropriations that extend beyond natural science and draw from philosophy, such as the appropriation of Chomsky's notion of *deep structure* and Derrida's concept of *trace*, among other theories, to elucidate entire architectural design ideas of the architect Peter Eisenman. Likewise, the adoption of the mathematical concept of *fractals* informs the design proposals of the architect Jean Nouvel. Further research on the consequences of such appropriations beyond superficial narratives of creative inspirations appears, in my opinion, necessary. The analytical approach presented here is thus offered to the field of architecture – while also being potentially extendable to other creative disciplines – for scrutiny, potential adoption, application, or further development by others (including myself in future work – see Section 5.4).

Finally, the analysis of Schumacher's theory appropriation presented in this thesis sheds light on the relationship between the domain of architectural practice and the domain of architectural academia. Specifically, it shows that patterns of reasoning and language use by which architectural academia may inform architectural practice, and vice versa, are subject to asymmetrical in-principle limitations.

As discussed in Section 2.1, architecture constantly appropriates concepts from other fields, particularly from natural science (Ostwald, 1999, p. 53). Such appropriations include terminology, methods, and theories. Cross-disciplinary appropriations of scientific knowledge often occur as a matter of course, gravitate towards biological concepts and theories, and provide stimuli for the creative development of architectural ideas as well as for the development of the architectural discipline as a whole. Utilising such “unauthorized jargon” (Scruton, 1983, p. 26–27, cited in Johnson, 1994, p. 44), architects thus establish a “metalanguage” for the proactive exploration of new conceptual connections, thereby enabling the formulation of design proposals and theories. Consequently, the appropriation of natural-scientific theory is integral to the creative and intellectual cross-pollination of architecture in both its practice and its academic sub-domains. Notably, these sub-domains of the discipline are asymmetrical. Academic research is characterised by and evaluated in terms of systemic rigour, transparent, and communicable processes that ‘ought’ to be

validated and repeated. In contrast, the principles by which the professional practice of architecture is evaluated depend on uncontrolled, varied, ill-defined or “wicked” (Rittel and Webber, 1973, p. 160) and often conflicting factors, ambitions, problems, and requirements. Unlike the objective and explicit knowledge typically produced through rational analysis in academic research, professional practice activities, such as dealing with clients, project briefs, and design proposals, are characterised by subjective and implicit knowledge. Although not grounded in empirical data, this *tacit knowledge* serves as the foundation for informed and vital professional decision-making, especially in the case of designers (Schön, 1983, pp. 21–22; van de Weijer et al., 2014, p. 21).

Despite the noticeable contrast between the modes of reasoning with which practice and academia claim authority and are held to scrutiny, they have the potential to mutually inspire and enrich each other. For example, Nigel Cross (2006, p. 95) argues that architectural practice has been susceptible to influence from modes of academic research to construct new design proposals, and Michael Polanyi (1966, p. 20) points out that academic research relies as much on skills based on *tacit knowledge* as on *explicit knowledge*. In order to enable potential new ideas to emerge within both the professional and academic realms of the discipline, it is thus essential that knowledge cross-pollinates between them. This dualistic nature of the discipline fosters mutual enrichment, ultimately benefiting the field of architecture as a whole.

Some architectural practitioners and architectural firms have acknowledged the advantages of the exchange of knowledge between subjective design practices and objective research-based principles. As a result, they move back-and-forth between both sides of the discipline rather than remaining committed to the construction and material manifestation of architecture. Some leading architectural firms have expanded their practice to include research branches. These include *AMO*, a mirror image of the architectural office OMA or *The Why Factory*, an architectural research office created by the architectural practice MVRDV. The same applies to Patrik Schumacher, who, as the principal of *Zaha Hadid Architects*, is active and prominent in both architectural practice and architectural academia. With architectural practitioners bringing their reasoning into the academic domain through (commonly) architectural theories, those committed to operating in the rigorous and objective research realm of the discipline face challenges relating to informal reasoning. This

is due to the above-mentioned distinct standards by which academic research and architectural practice are scrutinised and given authority. When natural-scientific theories, for example, are brought into the domain of architecture to inform designerly reasoning, these challenges intensify further. While incoming ideas help to rework the discipline's identity (Galison, 1999, p. 2; Gerber, 2013, p. 19), they introduce different frames of interpretation (both literal and figurative) that expand the possibilities of scientifically formal or designerly informal interpretations. Figure 5.4 illustrates this dual character of the discipline in analogy to the two sides of a coin.

In short, the single, most fundamental insight I gained in this study is that the relationship between professional practice and creative studio design, on the one hand, and rigorous academic research, on the other hand, is asymmetrical regarding the possibilities of mutual theoretical enrichment. Concepts of formal research, including natural-scientific theories, can enter and contribute to professional and creative endeavours with relative ease. Vague, ambiguous and informal concepts of professional and creative practice, however, cannot enrich or be evaluated on formal academic grounds with similar ease. I now wish I had the clarity of this insight early on in this project, and I hope that my thesis will help other researchers, especially those with studio design backgrounds and those at the beginning of their academic research careers, appreciate the asymmetry between both sides of our discipline. In particular, it may help such researchers to contextualise, evaluate, and appreciate the extent to which figurative, designerly reasoning of architectural practice and literal, rational reasoning of academic research may (or may not) justifiably inform and enrich each other.

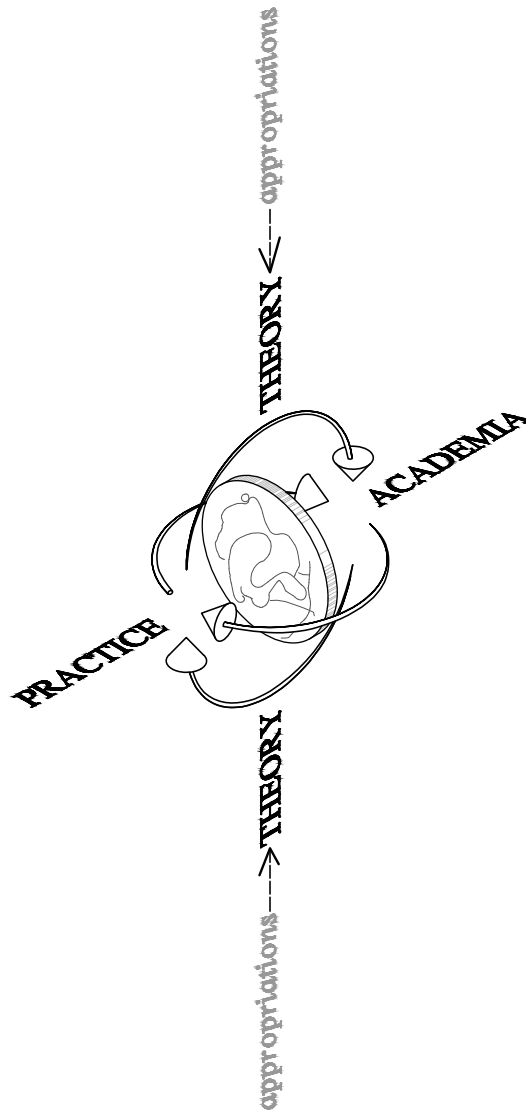


Figure 5.4: My visual interpretation of the dual character of the discipline.

### 5.3 Limitations

I embarked on the project described in this thesis with a background in architectural studio design and architectural practice. Aiming initially to investigate the street-level production and use of these temporal and informal structures in Chinese urban

spaces through participatory research, I soon found myself pondering the merits of theory appropriation in architecture. Having done my best to address this challenge over the course of this project, I acknowledge my lack of prior preparation in this area as a limitation of this study.

Having conducted this study as a Ph.D. research project, I have positioned it in the context of academic architectural research and approached it accordingly. As I have shown in this thesis, Schumacher's *The Autopoiesis of Architecture* straddles the domains of professional and creative practice as well as academic research. In principle, this permits an evaluation of the merits of this body of work from each of these vantage points, possibly leading to significantly different results. I have approached this work primarily from the perspective of academic architectural research, with only limited consideration of the professional practice and creative design perspectives.

Furthermore, much of the methodological toolkit I depended upon in this research relies on subjective interpretation and personal judgements. This applies especially to my reliance on discourse analysis. While discourse analysts encourage researchers who employ this method to approach the material under study with a reasonable degree of scepticism in order to minimise its inherent subjectivity (Gill, 2000, p. 178), it is ultimately a method based on “an *interpretation*, warranted by detailed argument and attention to the material being studied” (ibid., 2000, p. 188). Centred around analytical procedures of discourse analysis, the purpose-designed methodology of this study – which encompasses the procedures of *close reading*, *coding*, and *inferring the best explanation* – is not immune to this limitation. Although Wittgenstein's ‘early’ work in his *Picture Theory of Language* (1922) provides some insights that are further developed in his ‘later’ work on *Language Games* (1958) to explain the subjective limitation at multiple levels put forward in this study, the analysis of Schumacher's architectural theory appropriation is, ultimately, based on my (subjective) judgement. As Griffin (2004, p. 4) points out, “research can never be totally value-free or objective, although we can always strive to be rigorous.” The mixed-method text analysis approach conducted in this study produces rigorous interpretations that by no means attempt to prescribe a single unitary reality from the analysis of the appropriation of autopoiesis in Schumacher's architectural theory, nor does it attempt to invalidate any other interpretations. On the contrary, the analysis and subsequent findings I put forward in this thesis are available for other

researchers to scrutinise and challenge, allowing others to corroborate or refute my interpretations, as ought to be expected from any academic research (Phillips and Hardy, 2002, p. 16).

Finally, as a textually-oriented study of two consecutive appropriations of the theory of autopoiesis across multiple different languages, this research is also limited by possible shortcomings of translations of and between relevant previous works. While the initial theory of autopoiesis was predominantly published by Maturana et al. in my mother tongue (Spanish) and my second language (English), the appropriation of autopoiesis in social systems described by Luhmann was, at least initially, published predominantly in German, which I can neither read nor speak. As according to Forty (2000, p. 16), “the problem of translation is simply another manifestation of the transitoriness of meaning,” which is central to the act of appropriating itself, and thus an inevitable limitation for this thesis.

## 5.4 Future Research

With this study, I contribute an addition to the existing knowledge on cross-disciplinary appropriations in architecture, further enhancing the field’s understanding of the relationship between the domain of architectural practice and the domain of architectural academia. The development and testing of this understanding do not stop at the end of this thesis. Instead, I hope that academic architectural researchers (including myself) will explore the following opportunities I see for related future work:

This study is limited to the analysis of Schumacher’s appropriation of the biological theory of autopoiesis, based primarily on questions that arose from my unfulfilled expectation that this body of work might offer insights into strangely obvious-yet-vague connections between urban architectural environment and biological systems. As I suggested in section 5.2, further research is necessary to generalise the purpose-designed methodology employed to analyse Schumacher’s theory appropriation from a rigorous academic design research perspective. Examining the applicability and potential limitations of the proposed methodology beyond the scope of this thesis may provide insights into what to make of other appropriations that are equally unclear in architecture. Unfolding further the limitations of this common act

of appropriating may assist and further enrich our understanding of the mechanisms through which knowledge is shared across disciplines and, more specifically, how it constitutes the discipline of architecture as a whole.

As a next step, others may take what I wrote in this thesis, make their own meaning, construct their own understanding and judge whether my interpretations of the appropriation of autopoiesis in architecture align with their own. Subjecting my analytical interpretations and observations of Schumacher's theory appropriation to scrutiny, modification, extension, acceptance, or rejection may lead to further development at two levels: Firstly, it may lead to a discursive development on the extent to which the biological theory of autopoiesis is an appropriate cross-disciplinary appropriation in the design context. Secondly, it may stimulate a broader discourse in our field on the extent to which academic reasoning may inform and enrich architectural practice and creative design, and vice versa, when borrowing knowledge from non-architectural theory.





# Appendices



# Appendix A

## Question-and-answer with Patrik Schumacher

On the evening of the 5th of March 2020, Patrik Schumacher's delivered a lecture entitled *Architecture Communication as Human Universal* in Madrid. As a member of the audience, I asked Patrik Schumacher a question about *The Autopoiesis of Architecture* during question-and-answer session that followed the lecture. This appendix contains a transcript<sup>1</sup> of my (G.S.) question and Patrik Schumacher's (P.Sch.) response.

- **Lecture title:** Architectural Communication as Human Universal.
- **Lecturer:** Patrik Schumacher (Principal *Zaha Hadid Architects*).
- **Date:** Thursday, March 5th, 2020, 19:30 h.
- **Venue:** Universidad Nebrija, Campus Madrid-Princesa, C/ Sta. Cruz de Mercedado, 27 – Madrid, Salón de Actos.
- **Media partner:** ELLE DECOR

**G.S.:** [...] My question is related to your use of the concept of autopoiesis. Is your use of this biological concept scientifically formal or designerly informal? And do you think your readers know?

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<sup>1</sup>This is my transcript of an audio recording with subpar quality, and it represents my best effort to approximate Schumacher's answer despite the challenging audio conditions.

**P.Sch.:** OK, Well...I mean... The way it [autopoiesis] comes into my theory where I got the books *The Autopoiesis of Architecture*. The book is actually... the books are some kind of discourse analysis of the discipline. So, what I am looking here in the two parts, and I am working on a third part, is what happened since the Renaissance [unintelligible] an increasingly complex and sophisticated expertise and disciplinary academic theoretical part is something which is a function system of society – in terms of Luhmann – so, it is a little bit complex, but I get there, give me two minutes...

So, what... the original biological concept of autopoiesis is about self-making, self-organisation, self-referential closure, the way that an organism sets itself off from the environment and has internal processes, the way it sees [its] environment and [unintelligible]. Luhmann does something similar in sociology and Francis Mallgrave call 'Architectural Theory', and my architectural theory is actually embedded in Luhmann's theory of systems, which is a comprehensive theory of social systems and society. Because what I believe as architects and architectural theorists, we need to comprehend the societal context within [which] we operate so that we can fit our all innovations into overall progressive trajectories of societal development. So we need to have some kind of basic theory of society and to understand where we fit in the overall societal division of labour. Luhmann has been arguing this quite right. He saw that we have a living division of labour in the sense of the different function systems, which have their own internal, their own specific repertoires and responsibilities. So, the political systems, the economic systems, the legal systems, the educational systems... each of these are experts' discourses. It's very important to understand that there is economic theory guiding the economic system, there is pedagogy [theory] guiding the education system, there is political theory guiding the political system, there is jurisprudence scholarship and loyalty guiding the legal system, there is architectural and the build environment design, which has architectural theory. These are expert discourses which are – and that's the interesting thing, and that's where autopoiesis comes in – self-referentially closed. They have a particular perspective on the world; we look at everything in respect of what does it spatially? How could this pan out... let's say... architecture and design? And I can almost look at the same problem in terms of how this is profitable and cash out? But not in terms of politicians, which involves political agenda and dangerous opportunities with every project is then a mission. So, that is the autopoiesis of architecture; it is self-generated, self-referential, it is [where] all the architects participate.

What it is also important to realise is that we generate something quite sophisticated and particular that we, in the end, need to export. And people who grow up in this export is thus to be responsible for that. They can't let the client decide, they can't let the populous demand, because when they demand or call for something, the client is aiming for a particular thing that doesn't have a process, doesn't have the repertoire, values, and criteria to make a really sustainable and valuable position. So that is where the autopoiesis of architecture comes in.

So that was the general framing; I look at particulars of the discipline – the way they work, the way they use distinction or function, the way the medium of architecture comes in with the particular drawing and the values and static validations – and I do make sense of all of this. I am using this, but in this lecture, I reflect on that kinda meta-discourse of how the discipline is constantly... and moves forward. But I am kind of validating the way the architecture has historically evolved. In a sense, for instance, when I am looking back and discussing certain theories of architecture like – and discussions of – form and content, form and function, structure and ornament, and the interesting expressiveness and so on... I am rationalising this, and I am bringing it into. For instance, the semiological project ties in all the traditions and discussions in architectural theory. An interest in ornament wasn't maybe that explicit, and some things get forgotten, but for instance, in the 70s came back with an interest in semiology. And then, I am analysing why it didn't work out. And they're very much embedded in the history of the discipline; the way its categories evolved, the way... and most of the positive valuation and milieu [unintelligible]. I am not someone who is kind of saying; "parametricism arrives and trash the whole history of architecture," certainly not the kind of categories values and distinction, but of course, we have to realise that each state of history has an additional set of progress and also an understanding of each era and style of architecture was delivering new resources, well adapted to new conditions. The way I discussed modernism is well adapted to the forces of society of the 1920s; mass reproduction, mass social democracy, the way it brought the symmetry and proportion and was able to have a much better diversity of constructs and more adapted. So I am validating this. So, sometimes you will be ending realise that [by] validating modernism what I am saying is "in it's time." And then I show [unintelligible] that it is no longer registered in a new level of complexity and dynamism and value...

So, these books... and this autopoiesis, meaning that it is us, us being all the

architects – and I am including the other designers such as interior designers, fashion designers, product designers... – we collectively have exclusive and universal competency with respect to the totality of the built environment. So there is nothing you ever encounter physically and phenomenally – phenomenally in particular which touch our field – which isn't our responsibility... that wasn't designed by a colleague; this [referring to an object on the table] was designed by a colleague, this [referring to another object on the table] was designed by a colleague. But also all the ordinary occasions, all [are] designed by different designers, our space, everything, the landscape design... and you will find nothing that was not designed. Of course, there are zones that are not engineered, like agriculture fields that are not designerly, but all other spaces and gardens and landscapes and interiors and products and fashion... and that is important to realise. Any new idea coming up is instantly disseminated and relevant to everybody. So everything which was created was created by a colleague, and only a different colleague [who] knows us, knows their significant contribution – you know... there is not a single piece created in the second half of the twenty century that somebody wasn't aware [was designed by] Le Corbusier for instance. And that is the part we also have. Now I am saying that [unintelligible] and Le Corbusier, these characters totally remake the whole totality of physiognomy of the built environment – all the way from this palace design, to this palace design, to this palace design..., and everything – this needs to remake again. That's the kind of power of the discipline. As I said, it is a universal responsibility, we are not encountering anything that has not been. You should also recognise that all the media communications are done by colleagues... So graphic design, interaction design... So even if we transform less physical spaces – which are always designed by colleagues – we mainly communicate on Facebook or other media, that are usually done by our colleagues, [unintelligible], so that also comes out of this. We, all these colleagues together, are the autopoiesis of architecture, and this is the function system which has universal and exclusive competency of anything anyone has ever touched, felt or encountered in the world [Schumacher ends up this sentence and respond punching the table]. So, that was the idea of autopoiesis.

## Appendix B

# Varying Scales of Application of Autopoiesis Theory

This appendix contains a partial transcript of the email conversation<sup>1</sup> on the subject of “varying scales of autopoiesis discourse” that occurred between Pille Bunnell and myself on 25th of March 2021. For many years, Bunnell has worked alongside Humberto Maturana. Together, they have engaged in extensive reflections and conversations related to cybernetics and biology, co-authored multiple papers, and worked closely on editing much of Maturana’s work. To her, Maturana was not only a friend but her mentor. Given her familiarity with Maturana and his work on the theory of autopoiesis in particular, I asked her: “how is it possible, that Humberto Maturana himself appears to apply the theory of autopoiesis across different (cellular and molecular) scales, while criticising Niklas Luhmann for applying autopoiesis at the scale of society? I wonder whether there is a clear limit to the application of autopoiesis theory across scales and, if so, where, and why? Do you have any insight into this?”. Pille Bunnell responded:

“I have however asked your question, concerning the use of the notion of autopoiesis in contexts other than “the organization of the living” as Maturana coined it. I fortunately had the opportunity to ask Humberto directly, though not from the same perspective as you are addressing your con-

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<sup>1</sup>The transcript is edited for brevity. Pille Bunnell has kindly agreed with the partial transcription presented in this appendix.

cerns. This would have been well over a decade ago. Humberto replied that what he has done is to abstract the process that we call “life” and give that process the name autopoiesis. By abstract he didn’t mean the notion of an abstract concept, but rather the education, or drawing forth of what is a basic commonality for all situations that we call “life”.

There are other circular self-propagating mechanisms. What is particular about the self-generative process of life is the recursive production of the network of productions that produces that network of productions. Note that replication as in sexual or asexual reproduction of another entity, is not the fundamental to autopoiesis. However, reproduction does provide for both a continuance of a species and is relevant for creating a variety of species. Note also that the recursive molecular process of autopoiesis also inherently have a limit as to what is included, thus effectively creating an edge or membrane that confines the productions as a system. I want to emphasize that this happens at the molecular level. As you point out, given that a membrane is entailed, also at the cellular level. The salient point is that autopoiesis in Maturana’s original conception happens as a consequence of the structural dynamics of the relations between components. They do what they do as that is how they are structured, not because they choose to do so.

When I asked Humberto why autopoiesis does not also pertain at the level of a social organization, as Luhmann proposed, he answered that people have a choice. People can think and choose to leave, to disobey, to innovate, etc. Humans are not robots.

However, I can’t recall how many years ago now, definitely after either of the publications you mention, there was a conference on Autopoiesis in Santiago, and Maturana was of course invited. After that conference he realized that the notion of self-sustaining self-creation had taken on value as a concept with wider application. I think he realized that his word “autopoiesis” had inevitably been generalized. His solution was “I am claiming that the process of life is molecular autopoiesis”.



## Appendix C

# Table of Sampled Text Passages

This appendix presents the complete table of sampled text passages from Schumacher's two-volume theoretical treatise, *The Autopoiesis of Architecture*. This table comprises each of the 60 *theses* (24 in Volume I and 36 in Volume II) and their associated *central messages* to guide the selection of passages for analysis in accordance with the criteria outlined in the subsection 3.1.4.4.1.

SCHUMACHER'S THESIS	SCHUMACHER'S CENTRAL MESSAGE	MENTIONS AND USE OF AUTOPOIETIC CONCEPTS	AUTOPOIESIS AND ARCHITECTURE	name of selected passage
THESIS 1	The phenomenon of architecture can be most adequately grasped if it is analyzed as an autonomous network ( <b>autopoietic system</b> ) of communications.	<b>XX</b> autonomy	The autonomy of autopoietic systems as the autonomy of the network of communications in architecture.	
THESIS 2	There exists a single, unified system of communications that calls itself architecture: World Architecture (the <b>autopoiesis</b> of architecture).	<b>XX</b> unity	Architecture as a unified distinguishable entity.	Passage 1.a (P.1a)
THESIS 3	Architectural theory effects an immense acceleration of architecture's evolution.			
THESIS 4	Architectural theory is integral to architecture in general and to all architectural styles in particular: there is no architecture without theory.	<b>X</b> components	Theoretical treatises as essential components of the autopoiesis of architecture.	Passage 1.b (P.1b)
THESIS 5	Architecture observes and constitutes itself as a distinct domain within modern (functionally differentiated) society, claiming exclusive and universal competency with respect to the built environment. This demarcation is ultra-stable.			
THESIS 6	The emergence of architecture over and above building constitutes a significant evolutionary gain that elevates society's self-transformative capacity to a new level. Resolute autonomy (self-referential closure) is a prerequisite for architecture's effectiveness within an increasingly complex and dynamic societal environment.	autonomy		
THESIS 7	The distinction between avant-garde and mainstream is constitutive of architecture's evolution ( <b>autopoiesis</b> ). Only by differentiating the avant-garde as specific subsystem can contemporary architecture actively participate in the evolution of society.	<b>XX</b> organisational closure	The autonomy of avant-garde architecture within the organisational closure of the discipline of architecture.	Passage 1.c (P.1c)
THESIS 8	The avant-garde segment of architecture functions as the subsystem within the autopoiesis of architecture that takes on the necessary task of architectural research by converting both architectural commissions and educational institutions into substitute vehicles of research.	<b>XX</b>		
THESIS 9	Any attempt to integrate architecture and art, or architecture and science/engineering, in a unified discourse ( <b>autopoiesis</b> ) is reactionary and bound to fail.	<b>X</b> autonomy	The autonomy of architecture as consolidated by a figurative boundary.	Passage 1.d (P.1d)
THESIS 10	In a society without control centre, architecture has to regulate itself and maintain its own mechanisms of evolution that allow it to stay adapted (within the ecology of coevolving societal subsystems).	<b>X</b> self-maintenance	The internal communicative operations of the discipline of architecture as the structural adaptations of an autopoietic system.	Passage 1.e (P.1e)
THESIS 11	There can be no external determination imposed upon architecture – neither by political bodies, nor by paying clients – except in the negative/trivial sense of disruption.	autonomy	The autonomy of architecture as an autopoietic functionally differentiated system of architecture.	

THESIS 12	The self-determination ( <b>autopoiesis</b> ) of architecture must provide credible criteria and processes that can absorb the risk of communicating design decisions that project into an uncertain future.	<b>XX</b>		
THESIS 13	The lead-distinction of form vs function defines the discipline and has universal relevance with respect to all communications within architecture. As the difference between architectural self-reference and architectural world-reference, it represents the difference between system and environment within the system.	autonomy		
THESIS 14	All design decisions are evaluated along two dimensions: utility and beauty.	X		
THESIS 15	Architecture needs (new) styles to streamline the design decision process and to regulate (anew) the handling of its evaluative criteria (code values).	X the observer	The observer dependent approach as a way to construct a commonplace framework for “stylistic awareness.”	Passage 1.f (P.1f)
THESIS 16	Avant-garde styles are design research programmes. They start as progressive research programmes, mature to become productive dogmas, and end as degenerate dogmas.	X		
THESIS 17	Aesthetic values encapsulate condensed, collective experiences within useful dogmas. Their inherent inertia implies that they progress via revolution rather than evolution.			
THESIS 18	All architectural communications must contribute to both themes and projects. This indispensable double connectivity of architectural communications is a hallmark of architecture as a practice steered by theory.	X		
THESIS 19	Architecture depends upon its medium – the drawing/digital model – in the same way that the economy depends on money and politics depends on power. It sustains a new plane of communication that relies on the credibility of the medium and remains inherently vulnerable to inflationary tendencies.	X		
THESIS 20	The evolution of architecture’s autopoiesis involves the evolution of its specific medium. The introduction of the medium established the capacity to progress the architectural project while maintaining reversibility. Each further step in the development of the medium increased this crucial capacity to combine design progress with the preservation of adaptive malleability.	X self-production	The design process as being constantly regenerating itself.	Passage 1.g (P.1g)

THESIS 21	All social communication requires institutions. All institutions require architectural frames. The societal function of architecture is to order/adapt society via the continuous provision and innovation of the built environment as a system of frames.	X baudary	Social control through the consolidation of "framing devices" (boundaries in my reading) of the built environment.	Passage 1.h (P.1h)
THESIS 22	Everything in architecture's communicative constitution is geared towards innovation: its elemental form of communicative operation, its elaborate communication structures and its specialized medium of communication.			
THESIS 23	Radical innovation presupposes newness. Newness is otherness. The new is produced by blind mechanisms rather than creative thought. Strategic selection is required to secure communicative continuity and adaptive pertinence.	X		
THESIS 24	The concept of space was the conceptual mainspring of Modernism. It is now being superseded by the concept of field as one of the conceptual mainsprings of Parametricism.	X structural coupling	The structural coupling between the discipline of architecture and its environment as being the pre-requisite for innovative conceptual cycles within the discipline.	Passage 1.i (P.1i)
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.	X		
THESIS 26	Architectural order is symbiotic with social order and its effective realization requires organization and articulation as crucial registers of the design effort.	X		
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.	X organisation	The functionally interdependent organisation of the system of architecture and urbanism.	Passage 2.a (P.2a)
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.	organisation		
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.			
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.	X		

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.			
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.	X		
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'.	X		
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.	X		
THESIS 35	Design process theories (with rationalizing methodological ambitions) make sense only during the cumulative periods of disciplinary advancement, under the auspices of a hegemonic style. The time has come for a new theoretical investment in design process theory with the aim of advancing contemporary design methodology under the auspices of Parametricism.	X		
THESIS 36	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'.	X		
THESIS 37	Within a design process theory that intends to probe and enhance the rationality of design, the design process must be theorized as problem-solving process. Problem solving – especially at the level of such a complex endeavour like designing the built environment – can only be adequately theorized as accomplishment of an <b>autopoietic</b> communication system, geared up with its whole panoply of communication structures.	<b>XX</b> re-production	From the re-production of molecular components to the re-production of communications as a problem-solving process.	Passage 2.b (P.2b)

THESIS 38	Design via scripted rules is replacing design via the direct manipulation of individual forms. Scripts can uniquely enhance both the design process's generative power and its analytical power. The ability to combine the explorative potential for surprise discoveries with the guaranteed adherence to key criteria is the unique advantage of the new computational techniques. Through these techniques the design process simultaneously gains breadth and depth.			
THESIS 39	The architectural design process is self-determined. There are only very few, very general constraints that are accepted in advance. The design process then proceeds by continuous self-stimulation on the basis of its own intermediate states. This self-determination is a correlate of the autonomy of architecture as autopoietic subsystem of society.	X closure	The design process as an autonomous self-referential process.	Passage 2.c (P.2c)
THESIS 40	The rationality of the specific characteristics, affordances and limitations of the various, radically different problem spaces a project typically moves through can be broadly aligned with the three fundamental dimensions of architecture's task: the organizational, the phenomenological and the semiological dimension.	X		
THESIS 41	A historically well-adapted style is a necessary precondition of any credible design process rationality.	X		
THESIS 42	Contemporary architecture exists as a single, unified world architecture.	X autonomy		
THESIS 43	The autonomy of architecture implies its discursive authority but lacks the power to impose its authority. Within a polycontextual societal environment, architecture needs to sustain its autonomy precisely to be able to respond to all the disparate challenges of the different societal subsystems. However, its proposed solutions are no longer backed up by power.	X autonomy and structural coupling	The autonomy and adaptability of the architectural knowledge as an autopoietic system.	Passage 2.d (P.2d)
THESIS 44	Architecture must periodically adapt and upgrade its internal representation of society. To do this it must draw on external theoretical resources.	X circularity and structural coupling	The circularity of autopoiesis between the environment and the cell as the relationship between the environment and the system of architecture.	
THESIS 45	Architecture coevolves with all the other major <b>autopoietic</b> subsystems of society in relations of mutual facilitation and irritation.	XX structural coupling	The structural coupling between the discipline of architecture and its environment as being the theoretical way forward for the articulation of complex social processes.	Passage 2.e (P.2e)

THESIS 46	Architecture no longer tolerates that the bearer of architectural reputation has any outside ambitions.	X		
THESIS 47	Architectural figures offer the archetypical paradigm of any concept or order. The emergence and stabilization of any social order require that the spatial traces of social interactions ossify into a sedimented social memory that acts both as an organizing framework and as system of signification.	X organisation		
THESIS 48	The notion of a political architecture has transformed from a tautology to an oxymoron.	X		
THESIS 49	To respond to hegemonic political trends is a vital capacity of architecture. It has no capacity to resolve political controversy. Political debate within architecture overburdens the discipline. The <b>autopoiesis</b> of architecture consumes itself in the attempt to substitute itself for the political system.	X structural coupling	The relationship between the self-referentially closed system of architecture and politics as being an example of a relationship between autopoietic systems.	Passage 2.f (P.2f)
THESIS 50	Architecture responds to resolved and thus depoliticized politics. To bind architectural positions to an ongoing political polemic is counterproductive. The intransigence of political positions operating in the medium of power leads to communicative dysfunction within the architectural discourse.	X circularity and structural coupling	The relationship between the environment and the autopoietic system as the relationship between politics and architecture.	
THESIS 51	The vitality of architecture depends on its ability to register and address the political agendas empowered within the political system. Those forms of theoretical politics that are merely be desired or hoped for cannot become productive within architecture.			
THESIS 52	Architecture, as a self-reflective system of communications, is trying to steer itself via theoretical self-descriptions that attempt to theorize and define architecture's role within society. The complexity and sophistication of the contemporary societal environment demand increasingly complex and sophisticated architectural self-explications. Convincing autological self-inclusion is now one of the indispensable conditions that any serious candidate for architectural self-description must fulfil.	X unity	The unity of the discipline of architecture through theoretical self-description as a way to theoretically drive the built environment towards adaptive innovation and the stabilisation of a coherent (formal architectural) identity.	Passage 2.g (P.2g)

THESIS 53	Like all other great function systems, architecture tries to unify and orient itself via self-descriptions that reflect/define its <i>raison d'être</i> and identify/define its tasks within its societal environment. Although necessary, these self-descriptions, like all descriptions, are fallible and risky self-simplifications. The fact that these descriptions might become influential, and thus might indeed seem to shape the reality of what they describe, does not vitiate the prior fact that the reality of architecture's <b>autopoiesis</b> always already exceeds its simplified descriptions.	XX unity and <i>self</i>		
THESIS 54	All classics of architectural theory are self-descriptions. Only this theory type explicitly addresses and interprets the general, underlying, permanent problematic of architecture. The continued relevance of the classics of architectural theory is based on this stability of their underlying problematic even when the more particularly historical problems/solutions that have been formulated within these theories are no longer applicable.	X		
THESIS 55	Architectural historiography is always committed historiography. It is an integral part of architecture's self-description. It is a reflection theory rather than a science. Its organizing principle and coherence can only be derived from a principle that identifies a particular historical problematic and task for contemporary architecture.	X		
THESIS 56	Architectural criticism provides the interface (structural coupling) between architecture and the mass media. The results of architecture's internal evaluation processes are supplied with a new set of reasons satisfying the values and criteria of mass media communication. Therefore architectural criticism can neither share in nor convey architectural intelligence. Instead it can productively irritate this intelligence.	X structural coupling	Structural coupling as the relation between the system of architecture and the mass media.	
THESIS 57	Avant-garde architecture and urbanism engage in an ongoing cycle of innovative adaptation – retooling the discipline in order to elaborate its capacity to adapt the architectural/urban environment to the demands of the socio-economic era of Post-Fordism.	X self-maintenance	The process of maintenance due to the environment as the process of adaptation of architecture and urbanism under socio-economic demands.	



THESIS 58	The eventual success of grand, unifying schemes in science relies on the underlying coherence of reality. The rationality of a style's claim to universality lies in the advantage of a coherent built environment. Modernism did achieve universality during the course of the 20th century. Parametricism aims for an equivalent achievement in the 21st century.			
THESIS 59	The work of Frei Otto is the only true precursor of Parametricism.			
THESIS 60	Elegance is the aesthetic expression of complex order.	X		



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