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## **What to Make of the Appropriation of Autopoiesis in Architecture?**

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We investigate cross-disciplinary appropriations of natural scientific theory in architecture with a focus on the theory of autopoiesis, developed by the Chilean neuro-biologists Humberto Maturana, Francisco Varela, and Ricardo Uribe in the early 1970s. Since its inception, this theory has been applied to phenomena beyond biology, most notably in sociology by Niklas Luhmann and, based on that, in architecture by Patrick Schumacher. So far, Schumacher's appropriation of the theory of autopoiesis in architecture has led neither to a broader, structured discourse nor to a coherent critique, begging the question: What are the merits of Patrick Schumacher's appropriation of the theory of autopoiesis from the perspective of academic architectural research? To address this question, we employ the method of discourse analysis as well as a purpose-developed analytical framework, aiming to show patterns of language use, merits, and respective benefactors of natural-scientific theory appropriation in architecture and design. We are particularly interested in the extent to which reasoning and language use of academic research may inform architectural practice and vice versa, and we hope that our findings are also applicable in other contexts where strangely obvious-yet-vague connections between design and natural-scientific theory are drawn.

KEYWORDS: autopoiesis, appropriation, purpose, discourse, discourse analysis.

RSD TOPIC(S): Architecture & Planning, General, Methods & Methodology, Methods and the worlds they make.

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## **Presentation summary**

This study is motivated by the main investigator's experience as a participant in, and as an observer of, fast-developing urban centres in China—the city of Suzhou in particular. Compared to other cities, Suzhou's recent growth has been much faster and affecting larger areas of space, thus lending itself to observations of significant developmental processes over short periods of time and at broad spatial scales. The growth of the city's urban environment manifests itself 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 the greater part of this study, improvised pandemic control facilities. These large-scale high-rise and street-level dynamics are highly interdependent. The development of new residential estates, for example, depends on construction workforces which, in turn, are 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. The interrelations between manifestations of urban life at different scales are thus characterised by the kind of systemic closure and interdependency that also characterise the interrelation between chicken and egg. Arising from this relationship, the growth of the city, once initiated, is a continual process of self-development and self-maintenance.

With biological terms such as growth, development, self-maintenance, and self-reproduction entering our thinking about our observations of such urban processes emerged the idea that architectural development may be approached via an understanding of biological development. Alongside, then, emerged a desire to scrutinise this promise by examining the strangely obvious-yet-vague connection between urban architectural spaces and biological systems more closely.

Cross-disciplinary appropriation of knowledge, particularly from natural science, is not uncommon in architecture (Collins, 1998; Forty, 1999, 2000; Steadman, 2008). This is, in part, due to a view of architecture as a limitless and multifaceted domain (Linder, 1992). Often performed as a matter of course, this cross-disciplinary knowledge appropriation seems to be essential to the creative development of many architectural ideas and projects as well as for the development of the discipline as a whole. It facilitates the development of a 'metalanguage' for the proactive exploration of new conceptual connections, thereby enabling the formulation of design proposals, theories and discourse. Biomimicry, for example, finds inspiration in and imitates the characteristics of those biological systems to enable nature-based innovations such as recyclable and biodegradable materials. Critical analysis has shown, however, that major philosophical and ethical issues remain to be resolved in this approach (Blok and Gremmen, 2016).

Such challenges notwithstanding, 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 its academic sub-domains. Yet, architects rarely explore the mechanics and consequences of such adoptions beyond vague and superficial narratives of creative inspiration. What do we mean, and what do we gain when we say that bones are like the structure of buildings? 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 currency do such appropriations of biological notions have in rigorous design research? Do they help 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 underpins such adoptions to render them justifiable? This study is the result of our attempt to shed light on these questions, with a specific focus on the biological theory of autopoiesis.

### **Cross-disciplinary appropriations of autopoiesis**

The theory of autopoiesis is among the various and numerous natural-scientific theories that have been appropriated in architecture. Originally 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 theory focuses on the living cell as a representative exemplar and an essential common building block of the vast majority of biological organisms. In its autopoietic process, according to the theory, the cell's constituent molecular elements continually interplay with each other and their environment (Rose, 1970). 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 production of these very constituent elements and 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 1975; Maturana and Varela, 1980).

After Maturana and Varela formulated the theory of autopoiesis at the University of Chile in Santiago de Chile, and before they published it in writing (Varela, Maturana and Uribe, 1974), they were joined by Uribe, then based at the Biological Computer Laboratory at the University of Illinois, to implement a computer-based demonstration of their theory, based on a cellular analogy (Varela, 1996). The resulting computational model of the biological theory of autopoiesis, referred to by the team as Protobe (*ibid*, p. 413), implements autopoiesis as a two-dimensional cellular automata system. It illustrates a simple but cogent autopoietic system that served its originators as a test that confirmed 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, counter-acting their simultaneous decomposition (*ibid.*).

Since its inception in biology, the theory of autopoiesis has been used to describe a range of phenomena beyond biology. Most prominent among these appropriations is Niklas Luhmann's use of autopoiesis to describe social processes of communication (Luhmann, 1988). Luhmann (*ibid.*; 1995) characterises social systems such as art, science, or politics as autopoietic closed systems of self-referential communications that re-constitute and reproduce themselves. Luhmann's appropriation was widely adopted but also met with criticism – chiefly from the originators of biological autopoiesis theory. Maturana notes that in biological autopoiesis, "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.”, Luhmann’s theory, according to Maturana, fails to account for this human agency (Maturana and Poerksen, 2011, pp. 107).

Resonating with our ambition to examine strangely obvious-yet-vague connections between the built environment and living systems, the notion of autopoiesis has recently been appropriated in architecture by Patrick Schumacher – the principal architect of the architectural firm Zaha Hadid Architects, writer, and educator at multiple architecture schools. In 2011 and 2012, Schumacher published his self-proclaimed ‘opus magnum’, a two-volume treatise titled *The Autopoiesis of Architecture* (Schumacher, 2011; 2012). In it, Schumacher positions his theory as a subset of Luhmann’s appropriation of autopoiesis, thereby describing architecture as a systemically closed, self-referential communication system between society and the environment.

Schumacher’s appropriation of the theory of autopoiesis in architecture, however, has led neither to a broader, structured discourse nor to a coherent critique, begging a question – a question in which our academic interest in the connections between the built environment and living systems found a focus: What are the merits of Schumacher’s appropriation of the theory of autopoiesis from the perspective of academic architectural research? How literally is this theory of autopoiesis to be taken, and to what ends?

## **Research method**

To enquire into the merits of Schumacher’s theory appropriation, we conduct a discourse analysis – a linguistically and contextually sensitive, textually-oriented analysis of *The Autopoiesis of Architecture*. Bridging the gap between the micro-linguistic analysis and the macro impact of the text, this method takes a constructivist approach to language (Potter and Wetherell, 1987; Fairclough, 1989). It furthermore approaches language as a vehicle to produce knowledge that is not just influenced by but also has an influence on our social environment. We then locate key passages of Schumacher’s text in a unified analytical framework comprising possible references to two preceding

instances of autopoiesis theory, different possible modes of language use, as well as different possible merits of theory appropriation.

The two volumes of *The Autopoiesis of Architecture* put forward 60 theses – 24 theses in Volume 1 and 36 in Volume 2. Each thesis presents a core idea as its “central message” (Schumacher, 2011, p. xiii). From those theses, we sample key passages whose central messages draw explicit or implicit connections between autopoiesis and architecture (with the exception of those that merely re-iterate connections already drawn in earlier samples). In our reading, a total of 16 theses meet this criterion – nine in Volume 1 and seven in Volume 2. Employing close reading and inference to the best explanation, we analyse and code these samples systematically and locate their references to autopoiesis in a 2x2 matrix formed by two overall distinctions. Firstly, we distinguish references to two previous instances of autopoiesis theory:

- 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, we take these references to autopoiesis to be literal.
- 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 above), we take these references to autopoiesis to be figurative. We 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, we distinguish between two possible benefactors of Schumacher’s appropriation of the theory of autopoiesis in this context:

- The first author and main investigator of this study (GS), seeking to understand connections between the built environment and living systems.
- Patrick Schumacher (PS), putting forward a theory of architecture.

After placing the sampled references to autopoiesis theory within the 2x2 matrix formed by these two overall distinctions, we further qualify them based on a

categorisation of motivations (which we refer to as merits) of theory appropriation in architecture put forward by Ostwald (1999). This categorisation comprises the merits of legitimisation, obfuscation, explanation, transmission, theorisation, equalisation, occupation, and accommodation. We substituted Ostwald's term motivation with the term merit to emphasise the benefits a theory appropriation may offer its readers rather than the possible intentions of its authors and acknowledging von Foerster's categorising the author], who determines the meaning of an utterance [i.e., a text]". Besides categorising and placing sampled references to autopoiesis theory in the 2x2 matrix described above, we also associate each reference with a type of language use as well as with one or more of Ostwald's categories. In this analysis, a reference to autopoiesis may be categorised, for example, as a metaphorical obfuscation or a literal equalisation.

In addition to this analysis, we also visualise each sample with a diagrammatic representation of the first author's understanding of the relationships described in the given sample. Finally, after evaluating each instance at a micro level, we superimpose the locations of all samples in a single 2x2 matrix to establish an aggregate macro pattern of language uses and merits across all samples.

### **An analytical instance**

Within the limited scope of this work-in-progress discussion, this section presents the analysis of an indicative sample, namely Thesis 2, presented by Schumacher (2011, pp. 29–32). The central message of Thesis 2 (Schumacher, 2011, p. 29) postulates the existence of architecture as "a single, unified system of communications that calls itself architecture: World Architecture (the autopoiesis of architecture)". In the same sample, Schumacher (2011, p. 31) points out 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. Figure 1 shows the first author's visual interpretation of this description.

The central message of Thesis 2 (implicitly) refers to Luhmann's figurative appropriation of autopoiesis, according to which social systems are constituted by communications (Luhmann, 1982). References to Maturana et al.'s biological theory are nonetheless



present implicitly in the development of this idea by way of Luhmann's appropriation, as well as explicitly by way of evocative word choices such as "boundary maintenance" and "unsustainable overextension [...] into alien territory" (Schumacher, 2011, p. 31).

This can be interpreted in terms of multiple possible (both literal and figurative) modes of language use. 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 other than a reference to the existence of outsiders (engineers and artists) (see Schumacher, 2011, p. 31), we read this claim as a metaphorical appropriation of properties of the living cell membrane via the vaguely defined boundary of social systems proclaimed by Luhmann. Schumacher hence appears to refer to the concept of systemic boundaries to legitimise his characterisation of architecture as a "single unified system of communications" (Schumacher, 2011, p. 29) rather than to offer an empirical substantiation of his theory. He establishes "architecture" as an entity with a systemic unity and a boundary (analogous to a living system, subordinate to social communication systems) as a rhetorical basis for subsequently presented theses. With its central message describing architecture as a system of communication and framing it "like all the other subsystems of society" (Schumacher, 2011, p. 31), 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.

Purportedly approaching the discipline of architecture through the lens of Luhmann's theory, Schumacher does not appear to counteract possible figurative interpretations of Thesis 2. Word choices such as territory, (un)sustainability and boundary, in our reading, evoke metaphorical associations with the built environment and 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, due to 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.

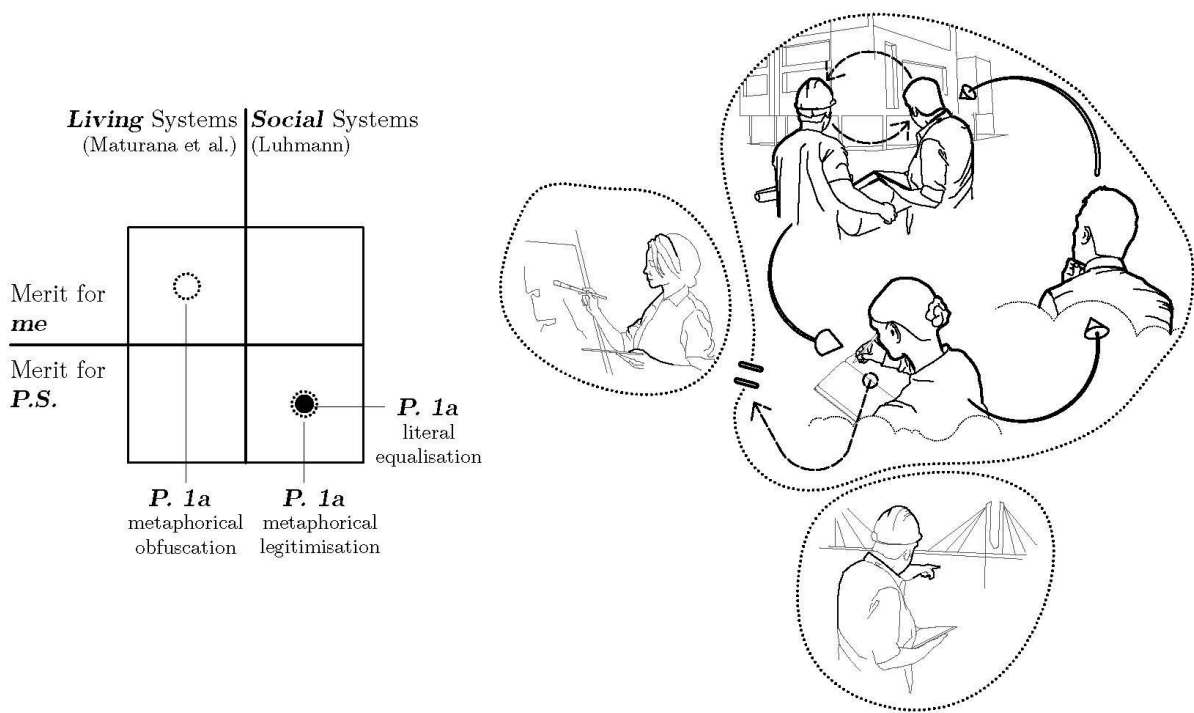


Figure 1. Our visual interpretation of the Thesis 2 sample— the unity of the discipline of architecture through “boundary management”.

## Preliminary findings and expected contributions

In this paper, we present a snapshot of an ongoing investigation into the strategies and merits of the appropriation of autopoiesis theory in architecture. The title of Schumacher’s two-volume work promises a theoretical framework to approach architectural and urban development via an understanding of biological development. However, much of Schumacher’s theory appropriation equivocates the dynamics of social communication (previously examined by Luhmann in terms of biological dynamics) with the social self-assertion and the self-distinction of (some pockets of) the architectural profession. Where we expected biologically-informed explanations of urban dynamics, we find legitimisation of the profession and of the theory appropriation itself, as well as apparent obfuscations of the underlying motives. This raises new questions. Taking *The Autopoiesis of Architecture* as a theoretical extension of Schumacher’s architectural practice, for example, the question arises whether the

equivocation of high-profile and high-powered professional agency with decentralised biological self-regeneration may be convenient. In any case, the limited explanatory merits of Schumacher's theory appropriation may account for its failure so far to inspire either a structured discourse or a coherent critique.

Cross-domain concept appropriations and ambiguous, non-literal language use are fostered and harnessed in design practice as sources of creative divergence. The Autopoiesis of Architecture enjoys the benefit of this well-justified designerly openness towards novelty and ambiguity. Dressed as scholarly theory, however, The Autopoiesis of Architecture promises explanatory convergence, potentially presenting academic architectural researchers with a puzzling challenge.

We expect the superimposition of analyses of all samples in the described 2x2 matrix, once completed, to show a macro pattern of modes of language use, merits, and respective benefactors of theory appropriation in the case of Schumacher's The Autopoiesis of Architecture. We hope that this work will help academic design researchers seeking to understand strangely obvious-yet-vague connections between urban architectural spaces and biological systems 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.

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