

**Inhabiting a finite world:  
Towards a regenerative architecture**

**Research**

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*It matters what matters we use to think other matters with; it matters what stories we tell to tell other stories with; it matters what knots knot knots, what thoughts think thoughts, what descriptions describe descriptions, what ties tie ties. It matters what stories make worlds, what worlds make stories.<sup>1</sup>*

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1 Haraway, D.J. (2016). *Staying with the Trouble* . Duke University Press. p.12

## 1.0 GLOSSARY\_ KEY TERMINOLOGY

### *ecoliteracy*

'understanding how nature sustains life...understanding the basic principles of ecology, or principles of sustainability, and living accordingly.'<sup>2</sup>

### *system*

'an integrated whole whose essential properties arise from the relationships between its parts'; 'denotes living organisms, social systems, ecological systems'<sup>3</sup>

### *(living) systems thinking*

'A way of thinking...in terms of connectedness, relationships, context...the properties of the parts can be understood only from the organization of the whole. Accordingly, systems thinking concentrates not on basic building blocks, but on basic principles of organization...systems thinking means putting it into the context of a larger whole.'<sup>4</sup>

### *to understand things systemically*

'to put them into a context, to establish the nature of their relationships'<sup>5</sup>

### *network*

'inseparable patterns of relationships'<sup>6</sup>

### *web of life*

'living systems (networks) interacting in network fashion with other systems (networks)'; 'flexible, ever-fluctuating network'<sup>7</sup>

### *living system*

'integrated wholes whose essential properties arise from the interactions and interdependence of their parts; three kinds of living systems: organisms, parts of organisms and communities of organisms'<sup>8</sup>

### *autopoiesis*

'self-making'<sup>9</sup>

### *ecology*

'the science of relations between the organism and the surrounding world'<sup>10</sup>

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2 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.447  
3 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.93  
4 Capra, F. (1996). *The Web of Life*. Anchor Books, Doubleday. pp. 29-30  
5 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.93  
6 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.11  
7 Capra, F. (1996). *The Web of Life*. Anchor Books, Doubleday. pp. 48;302  
8 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.96  
9 Capra, F. (1996). *The Web of Life*. Anchor Books, Doubleday. p.97  
10 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.95

**ecosystem**

'a community of organisms and their physical environment interacting as an ecological unit'<sup>11</sup>

**ecological community**

'an assemblage of organisms, bound into a functional whole by their mutual relationships; organisms linked together in network fashion through feeding relations'<sup>12</sup>

**nature**

'complex web of relationships between the various parts of a unified whole; networks nesting within other networks'<sup>13</sup>

**sustainable architecture**

an act of building that does not interfere with nature's inherent ability to sustain life

**regenerative design**

'...relates to approaches that support the co-evolution of human and natural systems in a partnered relationship. It is not the building that is 'regenerated' in the same sense as the self-healing and self-organizing attributes of a living system, but by the ways that the act of building can be a catalyst for positive change within the unique 'place' in which it is situated.'<sup>14</sup>

**regenerative development**

'Built projects, stakeholder processes and inhabitation are collectively focused on enhancing life in all its manifestations - human, other species, ecological systems - through an enduring responsibility of stewardship.'<sup>15</sup>

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11 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.95

12 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.96

13 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.97

14 Cole, R. J. (2012). Regenerative design and development: current theory and practice. *Building Research & Information*, 40(1), p.1

15 Cole, R. J. (2012). Regenerative design and development: current theory and practice. *Building Research & Information*, 40(1), p.7

## 2.0 INTRODUCTION\_ INHABITING A FINITE WORLD

I got deeply fascinated by the plan of a friend of mine (a western woman) to permanently settle on a small 'uninhabited' island in the least developed part of Indonesia, next to the coast of North Maluku. *Permanently, settle, uninhabited, least developed*. These words intrigued me because they pose the very questions of living in direct relation to nature. *Least developed* suggests that far away there is still more of what we call 'nature' than of human. *Uninhabited* reminded me of our human-centric world, where non-human living organisms and their habitat are too often not considered inhabitants, and therefore we call an island without humans 'uninhabited'. *Settle*, in fact, made me feel uncomfortable. How will one's settling on a foreign piece of land affect the local humans, non-humans and their environment? Lastly, *permanently*. How can one sustain himself/herself in an isolated small area for a long time? The need for a self-sufficient system in such a place surely requires a more regenerative logic, considering the limited resources on a finite piece of land.

This self-sufficient regenerative logic needed to inhabit an island is very different from the capitalistic model of inhabiting the world. A model that has created a world of constant economic growth, a growth that requires increasing territorial expansion beyond defined geopolitical borders in the search for continuous exploitation of resources. This transformation that comes with the rapid urbanization and industrialization of the globe over the past century has depleted the world to a critical point, endangering and eradicating diversity in the forms of life it sustains.<sup>16</sup>

Inhabiting a world that is increasingly nearing the limits of growth<sup>17</sup>, a limit manifesting itself in the impending collapse of this system, where humans can no longer be considered 'nature's outside'<sup>18</sup>, we are in critical need to ask: How could we arrive at a new logic of environmental production in which we reconsider the world as also being a finite island, an environment that increasingly needs to shift towards a self-sufficient and more regenerative model?

*How does this line of thought manifest itself in the field of architecture?*

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Donna Haraway has more sharply critiqued the nature/culture opposition that entails a radical break of connection to place by homogenizing the world and enslaving nature as flexible for disposal by culture.<sup>19</sup> Anna Tsing similarly critiques the resulting conception of man-made landscapes that create impoverishing worlds, reducing diversity in the name of reproducing the same hierarchical 'Architecture of Western Man'.<sup>20</sup> For the reason that culture has been elevated above nature, the latter is now being integrated into the built environment. By contrast, I am trying to bring architecture back down, similarly as Bruno Latour invites us to 'land on Earth' and 'become terrestrial'.<sup>21</sup>

I argue that the current state of the discipline of architecture - struggling to offer sustainable environments so urgently needed in an Anthropocene age<sup>22</sup> - does not stem from the impossibility of built forms to be sustainable or to offer truly sustainable solutions. Instead, it appears to be a result of the incapability of the architect to understand and apply the underlying principles of sustainability from an ecological and biological perspective. Moreover, it seems as if there is a lack of awareness among architects about the complexity, interconnectedness, and the process of continuous change of the environment, which is not surprisingly one for human and non-human. As Peg Rawes comments in her related anthology 'Relational Ecologies of Architecture', this necessary shift in thinking and making built environments requires a new understanding of "how the 'habitats', 'natural milieus', 'places' or 'shelters' that construct architectural ecologies are composed of complex material, spatial, social, political and economic concerns."<sup>23</sup>

One discourse that proposes such a deeper understanding of ecological interdependencies centres on the notion of regenerative design and development.

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16 Tsing, A. L., Swanson, H. A., Gan, E., & Bubandt, N. (2017). *Arts of Living on a Damaged Planet: Ghosts and Monsters of the Anthropocene*. University of Minnesota Press.

17 Tsing, A. (2016). *Earth Stalked by Man*. *The Cambridge Journal of Anthropology*, 34(1), p.8

18 Yusoff, K. (2016). *Anthropogenesis: Origins and Endings in the Anthropocene*. *Theory, Culture & Society*, 33(2), p.16

19 Haraway, D. (1988). *Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective*. *Feminist Studies*, 14(3), p.592

20 Tsing, A. (2016). *Earth Stalked by Man*. *The Cambridge Journal of Anthropology*, 34(1), p.8

21 Bruno, L. (2020). *Critical Zones*.

22 Haraway, D. J. (2016). *Staying with the Trouble*. Duke University Press. p.35

23 Rawes, P. (2013). Introduction. In P. Rawes (Ed.), *Relational architectural ecologies* (1st ed.). Routledge.

### 3.0 REGENERATIVE DESIGN AND DEVELOPMENT\_ A BRIEF SUMMARY

Central to the regenerative theory is 'the concept of place and humanity's role in it'<sup>24</sup> and it is often referred to by critical thinkers as a paradigm shift 'emerging out of the transition from a 'mechanistic' to an 'ecological' or living systems worldview.'<sup>25</sup>

As du Plessis describes it, the approach attempts to 'address the dysfunctional human-nature relationship by entering into a co-creative partnership with nature' through design practices 'rooted in the context and its social-ecological narratives.'<sup>26</sup> Similarly, J. Cole argues that 'it is not the building that is 'regenerated' in the same sense as the self-healing and self-organizing attributes of a living system, but by the ways that the act of building can be a catalyst for positive change within the unique 'place' in which it is situated.'<sup>27</sup> He further specifies that 'built projects, stakeholder processes and inhabitation are collectively focused on enhancing life in all its manifestations – human, other species, ecological systems – through an enduring responsibility of stewardship.'<sup>28</sup>

Within the regenerative theory, the notion of place, the story of a place, the potential of a place and therefore, place-making are tightly linked. As defined by Mang and Reed, place is a 'unique multi-layered network of living systems within a geographic region that results from the complex interactions, through time, of the natural ecology...and culture...', where 'humans, human developments, social structures and cultural concerns are an inherent part of ecosystems', making humans integral, and particularly influential participants in the health and destiny of the earth's web of living systems.'<sup>29</sup> The story of the place then gives 'the ability to convey 'who' a place is, and how to be part of it – the whole relationship between human settlement and the systems of life that are continually making the place.'<sup>30</sup> Understanding the story of the place is the precondition of discovering the potential of the place and thus the role of the project within it. Time and scale become essential to thinking regeneratively as the place, and its story are seen as continuously evolving, while the project 'works to integrate the flows and structures of the built and natural world across multiple levels of scale, reflecting the influence of larger scales on smaller scales and smaller on larger.'<sup>31</sup>

In this manner, J. Cole argues that (living) systems thinking, community engagement and respect for place become the core tenets of regenerative thinking. Mang and Reed likewise suggest that the (living) systems thinking is guided by eco-literacy (understanding how natural systems work) and pattern-literacy as crucial components, where 'pattern is the language of relationship, and regenerative development and design in a living system is a process of patterning human communities to align with the energetic patterns of a place in a way that both humans and the place co-evolve.'<sup>32</sup>

While the theory of regenerative design and development offers a precise understanding of what the role of architecture should be within the ecologies of a place and what an architectural design should achieve in order to be regenerative, it struggles to provide an understanding about how can one's thinking become ecological, nor about how precisely can one think, design and make regenerative architecture. What, in fact, makes an architecture ecological or not? Moreover, if regenerative architecture is inherently contextual, can there be a conceptual framework of design principles for regenerative architecture that can be applied to any design question?

In exploring these questions, my goal is to figure out: *How can a (socio-ecologic) systemic way of understanding relationships between humans, architecture and nature enable thinking and making built environments with a more regenerative logic?*

Engaging critically with the complexity of this question, I further define the following sub-questions:

*What does it mean to understand the relationship between humans and nature in a systemic way?*

*What is the meaning, position and role of architecture within the relationship between humans and nature?*

*What does it mean to think architecture with a more regenerative logic?*

*What does it mean to make architecture with a more regenerative logic?*

By investigating these 'deeper' questions, my research objective is to foster a discussion about an alternative way of architectural production that challenges the discipline of architecture and the role of the architect within it from a *more-than-human perspective*. Such *more-than-human perspective*, I believe, is what can open up the creative potential of architecture to be truly ecological and so demands the expansion of the conception of architecture as being relational, process-driven and open-ended.

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24 Zhang, X. (2014). Toward a regenerative sustainability paradigm for the built environment: from vision to reality. *Journal of Cleaner Production*, 65, pp. 3–6  
25 Mang, P., & Reed, B. (2012). Designing from place: a regenerative framework and methodology. *Building Research & Information*, 40(1), pp. 23–38  
26 du Plessis, C. (2012). Towards a regenerative paradigm for the built environment. *Building Research & Information*, 40(1), pp. 7–22  
27 Cole, R. J. (2012). Regenerative design and development: current theory and practice. *Building Research & Information*, 40(1), pp. 1–6  
28 Cole, R. J. (2012). Regenerative design and development: current theory and practice. *Building Research & Information*, 40(1), pp. 1–6  
29 Mang, P., & Reed, B. (2012). Designing from place: a regenerative framework and methodology. *Building Research & Information*, 40(1), pp. 23–38  
30 Mang, P., & Reed, B. (2012). Designing from place: a regenerative framework and methodology. *Building Research & Information*, 40(1), pp. 23–38  
31 Mang, P., & Reed, B. (2013). Regenerative Development and Design. In *Sustainable Built Environments* (pp. 478–501). Springer New York. p.16  
32 Mang, P., & Reed, B. (2013). Regenerative Development and Design. In *Sustainable Built Environments* (pp. 478–501). Springer New York. p.21

*Re-think*



## 4.0 RE-THINKING NATURE AS A SYSTEM\_ UNDERSTANDING RELATIONSHIPS: HUMAN-NATURE

To understand the relationship between humans and nature, it is fundamental to first examine the principles underlying life from a biological and cognitive perspective. To do so, I turn to Capra's conceptual framework of the theory of living systems.

To understand the nature of life from a systemic point of view, he argues, means to understand the essential characteristics of living systems and be able to identify the set of general criteria for sustaining life, distinguishing them from non-living systems. These essential characteristics of living systems are defined by Capra as the three criteria of pattern, structure and process.<sup>33</sup>

Pattern of organization means the configuration of relationships that determines the system's essential characteristics. Structure is the physical embodiment of the system's pattern of organization and process – as the activity involved in the continual embodiment of the system's pattern of organization.<sup>34</sup> 'The pattern of organization can be recognized only if it is embodied in a physical structure, and in living systems this embodiment is an ongoing process. Thus...one could say that the three criteria - pattern, structure, and process - are three different but inseparable perspectives on the phenomenon of life.'<sup>35</sup>

In his comprehensive conceptual framework of the trilogy of life Capra further defines autopoiesis as the pattern of life (pattern of organization of living systems) – represented by the autopoietic unit, dissipative structure as the structure of living systems – represented by the environment and cognition as the process of life – represented by cognition<sup>36</sup> [fig.1].

In other words - the living being, he argues, interacts with the environment through cognition. Life is then the synergy of the three domains, interdependent of one another.

What exactly does this synergy mean?

The living being is seen as an autopoietic unit that constantly produces itself, and so it is characterised by biological autonomy. At the same time, it is strictly dependent upon the external medium for its survival. So, to stay alive and maintain order, the living organism interacts with the environment by the continuous flow of air, water and food. Lastly, the interactions of a living organism within its environment are cognitive or mental interactions, where cognition is seen as the process of knowing – thinking, perception, emotion, and action.<sup>37</sup>

The principles underlying life are the same at all levels – from the simplest microorganisms to the higher forms of life.<sup>38</sup> Thus, all living organisms sustain life by interacting with the environment through cognition. Therefore, the principles of organization are the same for human and non-human living beings.

So there is no human and nature. Human is nature. And human is not more or less natural than a non-human.

This ecological view requires seeing the world as an integrated whole, and therefore 'deep ecological awareness recognizes the fundamental interdependence of all phenomena and the fact that, as individuals and societies, we are all embedded in (and ultimately dependent on) the cyclical processes of nature.'<sup>39</sup> Accordingly, humans – or anything else – cannot be separated from the natural environment, and so the value of all living beings becomes intrinsic. Humans are not nature's outside but instead 'just one particular strand in the web of life'.<sup>40</sup> 'All living beings are members of ecological communities bound together in a network of interdependencies.'<sup>41</sup> 'Nature and the self are one.'<sup>42</sup>

If a living being is able to sustain life only through the interaction with the environment, so the relations with the environment are fundamental for understanding the living organism. Then based on the conceptual framework of the trilogy of life:

How precisely does a living organism interact with the environment?

*'[T]here is no "environment" in some independent and abstract sense. Just as there is no organism without an environment, there is no environment without an organism. Organisms do not experience environments. They create them. They construct their own environments out of the bits and pieces of the physical and biological world, and they do so by their own activities.'*<sup>43</sup>

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33 Capra, F. (1996). The Web of Life. Anchor Books, Doubleday. p.161  
34 Capra, F. (1996). The Web of Life. Anchor Books, Doubleday. p.161  
35 Capra, F. (1996). The Web of Life. Anchor Books, Doubleday. p.161  
36 Capra, F. (1996). The Web of Life. Anchor Books, Doubleday. p.160  
37 Capra, F., & Luisi, P. L. (2014). The Systems View of Life. Cambridge University Press. p.178  
38 Capra, F., & Luisi, P. L. (2014). The Systems View of Life. Cambridge University Press. p.181  
39 Capra, F. (1996). The Web of Life. Anchor Books, Doubleday. p.6  
40 Capra, F. (1996). The Web of Life. Anchor Books, Doubleday. p.7  
41 Capra, F. (1996). The Web of Life. Anchor Books, Doubleday. p.10  
42 Capra, F. (1996). The Web of Life. Anchor Books, Doubleday. p.12  
43 Capra, F., & Luisi, P. L. (2014). The Systems View of Life. Cambridge University Press. p.178

Capra explains this interaction by the primary mechanism of acts of cognition and mutual co-emergence with the familiar environment. Cognition is understood not as perception coming from the external world but in terms of the internal structure of the organism, and therefore, as closely linked to its autopoietic system. This means that the cognitive interaction with the environment is determined by the internal organization of the living organism and so can be described as a structurally determined interaction. Consecutively, the structural determination of each organism is a result of biological evolution, and so we can define the environment and the living organism as co-evolving. In other words, 'the environment is 'created' by the living organism through a series of recursive interactions, which in turn have been produced during mutual co-evolution.'<sup>44</sup>

It is essential to notice that despite the difference in the sensorium's sophistication in human beings, similarly to all other living organisms, 'the environment is created by the organism, and this creation permits the existence of the living organism.'<sup>45</sup> Capra showcases this by noting that the woody construction of the beaver and the cities constructed by mankind similarly modify the structure of their environments. This also means that 'the term "environment" can represent quite different things, depending on the levels of life we consider: it can be the milieu in which cells swim, or the habitat where animals live, or the urban environment of humans. In all cases, as in the case of the bio-logic of life, there is a conceptual similarity: the interaction between the living organism and the environment is a dynamic one based on co-emergence, where the living organism and the environment become one through cognitive interactions.'

The autopoietic aspect of the living organism and the interaction with the environment together form a network of metabolic processes, resulting in a system far from equilibrium. This system remains nevertheless stable over long periods of time, maintaining the same overall structure in spite of the ongoing flow and change of components. In this way, living forms combine the stability of structure with the fluidity of change resulting in a dynamic balance. They are organizationally closed and energetically open systems. And the combined effects of non-equilibrium, irreversibility, feedback loops and instability<sup>46</sup> result in the self-organization and the spontaneous emergence of order.

So nature, the human and the non-human, can be described as unpredictable, sensitive to the surrounding world and influenced by small fluctuations, and this uncertainty is precisely the heart of nature's creativity.

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As mentioned earlier, the systems view of life implies looking at an organism in its totality of mutual interactions.<sup>47</sup> Now that I have examined the relationship between the living organism and the environment, it is crucial to consider the living organism in terms of its relation to other living organisms, as no organism exists in isolation and creating one environment means influencing all other environments at all levels of life.

To provide this understanding, Capra introduces the concept of network and community. Organisms are considered as networks of cells, organs and organ systems eventually forming an organism. The metabolic pathways through organisms are then continued by the flows of matter and energy through ecosystems. The ecosystem is then a network with a few nodes, each node representing an organism. As defined by Capra, an ecosystem is 'a community of organisms and their physical environment interacting as an ecological unit', and an ecological community is 'an assemblage of organisms, bound into a functional whole by their mutual relationships'.<sup>48</sup> In this way, we can understand the web of life as consisting of 'networks within networks. At each scale...the nodes of the network reveal themselves as smaller networks'.<sup>49</sup>

All three kinds of living systems – organisms, parts of organisms and communities of organisms then form 'multileveled structures of systems within systems. Each of these forms a whole with respect to its parts while at the same time being part of a larger whole.'<sup>50</sup> The double role of living systems as parts and wholes requires the interplay of two opposite tendencies: an integrative tendency to function as part of a larger whole and a self-assertive or self-organizing tendency to preserve individual autonomy<sup>51</sup> According to Capra, this multileveled network of systems within systems suggests that each organism exists within social systems and ecosystems. Social systems represent the relationship between an individual organism and the other organisms from the same family, while ecosystems represent the relationship between an organism and the other organisms from the ecological community and the relationship between the organism and the abiotic environment.

If we consider that the human living being interacts with the environment the same way as a non-human living being interacts with the environment, and so the human and the non-human are no different, and nature and the self are one, it would mean that the human living being exists within social- and ecosystems the same way that a non-human being does. Humans are similarly dependent on other living organisms to sustain life and so take part in the food webs within an ecological community. Here it is important to realise that humans are part of the ecosystems the same way non-humans are.

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44 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.178

45 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.179

46 Capra, F. (1996). *The Web of Life*. Anchor Books, Doubleday. p.192

47 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.163

48 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.96

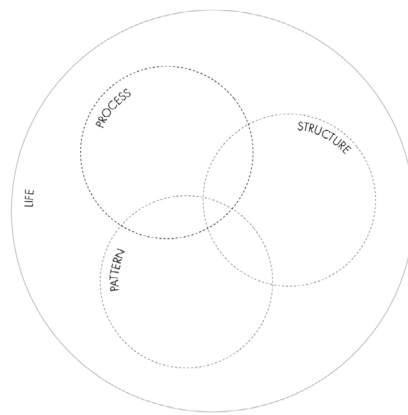
49 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.96

50 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.93

51 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.93

Examining the relationships between a living organism and the environment and between a living organism and other living organisms from the perspective of the living systems theory provides the understanding needed to eliminate the dichotomy between humans and nature. Humans and non-humans are no different as they both exist in the same way through the act of cognition and mutual co-emergence with the environment. Humans and nature, the self and the other are one. The multileveled network of systems within systems suggests that humans are part of social- and ecosystems the same way that non-human living beings are.

Viewing the world and nature as such a complex network representing life at all levels also suggests the entanglement, interconnectedness, the interdependence between all living systems and the ever-widening impact of a perturbation in one single point in the system, as each interaction depends on all others. This, in turn, means that as each living organism constructs its environment, it modifies the environment of all other living organisms. This critical realization raises the question about the meaning, position, impact and role of architecture within this complex system, it being the physical embodiment of how humans construct and modify the environment, an environment that is as much human as it is non-human.



[fig.1] Capra's conceptual framework of the trilogy of life

## 5.0 RE-THINKING ARCHITECTURE\_ POSITIONING ARCHITECTURE WITHIN THE SYSTEM:

### HUMAN-NATURE-ARCHITECTURE

In the previous chapter, I have followed Capra and Luisi's conceptual framework of the theory of living systems to understand the complex relationship between humans and nature 'integrating life's biological, cognitive, social and ecological dimensions.'<sup>52</sup> In my goal to re-position the discipline of architecture and the role of the architect within this complex system of relationships between human, non-human and the abiotic environment, I will explore the notion of architecture from a systemic point of view, extending Capra's and Luisi's conceptual framework to the architectural dimension.

Understanding architecture from a systemic point of view, analogically, implies looking at it in its totality of mutual interactions. To do so means to examine architecture and its role and position within the context of the larger whole, namely the complex network of relationships between humans, non-humans and the abiotic environment.

Within an ecosystem, a living organism interacts with other living organisms but also with the abiotic environment. One way of interacting with the abiotic environment is the creation of shelter. All living beings, human and non-human, seek in this way protection from the climate or from danger. From this point of view, I argue that architecture constructed by mankind has the same meaning within the ecological dimension as the bird's nest as it provides the exact relation between the human being and the abiotic environment as it does between the non-human living being and the environment. Consequently, the physical environment constructed by humans can be described as shelter, while the bird's nest can also be called architecture and the other way around. With this notion of architecture, I intend to continue to discontinue the dichotomy between humans and nature, so apparent in the way the discipline of architecture operates. Despite the different meaning I give to architecture in the context of this written work, I choose to keep using the term 'architecture' as both a 'mere shelter' and a 'human art' to consciously avoid a distinction between the two - reminding myself and others that this separation is precisely the root of the current struggle of architecture to be ecological.

If architecture is understood as the physical manifestation of the relation between the living organism and the abiotic world, then I argue, architecture can be positioned within the ecological dimension, namely as being part of the ecosystem. [fig.2]

This different notion and position of architecture within the complex system of the web of life implies not only a shift in the understanding of what architecture is but also one in the understanding of what architecture does. Architects seem to me, tend to imagine and design buildings by focusing on conveying a (human) meaning, rooted in their time but also with the hope of it transcending beyond the architect's lifetime. The building is then placed within an immediate (human) context and influencing immediate (human) relations and therefore having a restricted (human) impact. As Pallasmaa describes it: 'Human architecture is always more dictated by cultural, metaphysical and aesthetic aims than by pure functionality and reason.'<sup>53</sup>

However, is this precisely what architecture does?

In order to understand the impact of architecture from an ecological perspective, I turn back to the understanding of the interaction between a living being and the environment from the perspective of the living systems theory. Since all living organisms are continuously changing and co-evolving, all creations of shelters similarly modify the environment, which in turn has implications for all future interactions with the environment, human and non-human. Architecture then intrinsically embodies a change of the environment created by a human or non-human through a cognitive interaction. So architecture, as part of the ecosystem, is not having a restricted and immediate impact bound to the human dimension, but rather an ever-widening one, contributing to the continuous change of the environment, directly and indirectly influencing all.

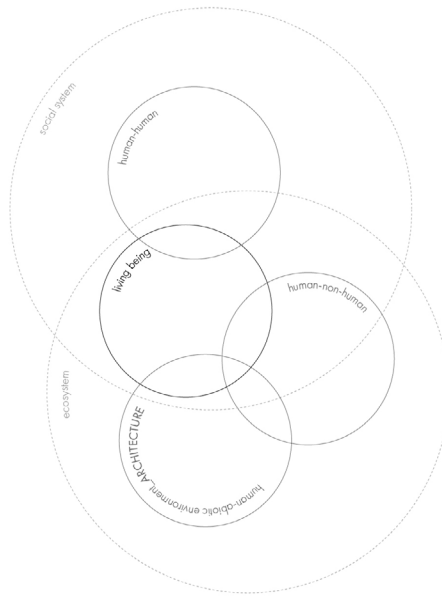
So architecture is not positioned in the environment in the abstract sense, but rather is a physical change of the environment. The architect then is not creating simply an experience of the environment but instead is creating and changing the environment.

Realizing that the act of building is namely a continuous change of the environment, and therefore negotiates the existence of human and non-human and so influences their co-emergence and co-evolution, illustrates the root of the unsustainability of current architectural practices and at the same time raises the question about the potential and limitations of architecture to be sustainable and regenerative.

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52 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.12

53 Pallasmaa, J. (2010). *Architecture Of The Essential: Ecological Functionalism Of Animal Constructions*.



[fig.2] Positioning architecture within the complex system of the web of life

## 5.1 ARCHITECTURE AS A LIVING SYSTEM: TOWARDS THINKING AND MAKING REGENERATIVE ARCHITECTURE

To explore the potential and limitations of architecture to be regenerative/ecological, I turn to Capra and Luisi's theory about the fundamental unity of life, namely that 'different living systems exhibit similar patterns of organization.'<sup>54</sup> Capra and Luisi suggest that the network pattern as the basic pattern of organization of living systems can be found at all levels of life. In other words, the metabolic networks of the cells find their extension in the food webs in ecosystems, and so the 'components and processes of living systems are interlinked in network fashion.'<sup>55</sup> Analogically, they suggest that the systemic understanding of life can be extended from the biological and cognitive to the social domain, meaning that social reality can be understood by applying the knowledge of life's basic patterns and principles of organization. In other words, all living systems – living beings, ecosystems and social systems – exhibit similar principles of organization.

If we position architecture, from a systemic point of view, within the ecosystem and therefore is part of the interconnected networks of the web of life, this would mean that it can also be understood as an extension of the network of living systems. In this way, if architecture is another system within the complex network of systems within systems, then we can apply the knowledge of life's basic patterns and principles of organization to architecture. Now, if we combine the systemic understanding of architecture with the knowledge that the essence of living systems is to sustain life and their pattern of organization has developed through evolution to maximize sustainability<sup>56</sup> then I suggest that the potential of architecture to be regenerative/sustainable/ecological lies in considering architecture as a living system.

If we consider architecture as a living system, then it can also be described by the three essential characteristics of living systems – pattern, structure and process. [fig.3] The pattern of architecture is the configuration of relationships that determines the system's essential characteristics. The structure of architecture is the physical embodiment of its pattern of organization – the building itself, while the process of architecture is the architect's cognitive process of design. Analogically, architecture then is the synergy of the three domains, interdependent of one another.

## 5.2 POTENTIAL AND LIMITATIONS OF REGENERATIVE ARCHITECTURE (PART 1)

It is important to note once again that, as J. Cole argues, 'it is not the building that is 'regenerated' in the same sense as the self-healing and self-organizing attributes of a living system, but by the ways that the act of building can be a catalyst for positive change within the unique 'place' in which it is situated.'<sup>57</sup>

The potential and limitations of architecture to be regenerative will therefore depend on its underlying pattern of organization and the architect's mental process of design. In other words, the preconditions for regenerative architecture become the ecological awareness of the designer and whether the underlying pattern of organization, namely the design principles, are sustainable or not.

54 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.384

55 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.384

56 Capra, F. (1996). *The Web of Life*. Anchor Books, Doubleday. p.298

57 Cole, R. J. (2012). Regenerative design and development: current theory and practice. *Building Research & Information*, 40(1), 1–6.

Ecological/regenerative design is then not a precise physical form of architecture, but one that is based on a sustainable pattern of organization and on the mental process of the designer that is being ecologically literate.

So what does it mean to think architecture with a more regenerative logic?

### **5.3 THINKING ARCHITECTURE WITH A MORE REGENERATIVE LOGIC**

From the exploration of the theory of living systems and so re-thinking the relationship between humans and nature and consequently extending the theory to the architectural domain and re-thinking architecture as a living system, I synthesize the following conditions for thinking architecture with a more regenerative logic:

#### **1. More-than-human perspective**

Move beyond human-centric views and simplified ecologies by studying human and non-human interrelations and hence include non-humans in thinking and making architecture as there are always directly or indirectly affected by it.

#### **2. Embrace complexity (time and scale)**

Consider simultaneously the entangling of multiple (conflicting) scales and systems with their connections and disconnections and the importance of the temporal aspect by thinking of the environment as continuous dynamic state changes rather than a state.

#### **3. Think in terms of relationships, patterns and networks**

Think of living beings, human and non-human, as 'symbiotic assemblages...which are knots of diverse intra-active relations in dynamic complex systems.'<sup>58</sup> Therefore, consider the human and non-human entanglements, reflecting the influence of larger scales on smaller scales and smaller on larger.<sup>59</sup>

#### **4. Process-driven (rather than product-driven)**

Render the invisible, visible by mapping movement and flows (and what brings the flow), cycles and rhythms, rather than envisioning states. Focus on the process of design and, therefore, the pattern of organization of architecture rather than of the building as a product.

#### **5. Open to change and shifts**

The spatial intervention should become part of the evolving story of a place, while its role can only be determined as a consequence of reading the environment and understanding the story of a place. Simultaneously, embrace uncertainty by considering a spatial intervention as open-ended and as part of an environment subject to continuous changes and shifts. Focus on long-term spatial effects rather than on immediate problem-solving. Change brings resilience.

#### **6. Embrace contradictions and conflicts (dynamic balance)**

Seek a dynamic balance by accepting the constant negotiation between human and non-human. Just like in nature, architecture needs both stability and change, order and freedom, tradition and innovation.

#### **7. Pursue contextual innovation**

If architecture is inherently contextual, different contexts will require different solutions. The same pattern of organization of regenerative architecture can therefore result in different physical embodiments of architecture depending on the context.

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58 Haraway, D. J. (2016). *Staying with the Trouble*. Duke University Press. p.60

59 Mang, P., & Reed, B. (2013). *Regenerative Development and Design*. In *Sustainable Built Environments* (pp. 478–501). Springer New York. p.16

The remaining question then is: How can architecture have a sustainable pattern of organization?

Once again, I turn to Capra's conceptual framework of the basic principles of ecology, based on the understanding of the pattern of organization of living systems. He argues that the understanding of ecosystems as sustainable ecological communities can be used as a set of guidelines for creating sustainable human communities. In turn, I will extend the conceptual framework to architecture to find out how the principles of organization of ecological communities can be translated to a pattern of organization of architecture with a more regenerative logic.

According to Capra, the basic principles of ecology are the following: interdependence, recycling, partnership, flexibility and diversity. Altogether, they result in sustainability and resilience.

The first three aspects of the pattern of organization of ecological communities ensure its sustainability. Interdependence means that the success of the whole community depends on the success of its individual members, while the success of each member depends on the success of the community as a whole. The principle of recycling implies that waste for one is food for the other, and so the cycle results in a system with no net waste. Partnership suggests that the cyclical exchanges of energy and resources in an ecosystem are sustained by pervasive cooperation, meaning that both partners continuously learn and change, or in other words, they co-evolve.<sup>60</sup> The aspects of flexibility and diversity, in turn, provide the resilience of the system. Flexibility is a consequence of its multiple feedback loops, which tend to bring the system back into balance whenever there is a deviation from the norm due to changing environmental conditions. Lastly, a diverse ecosystem will also be resilient because it contains many species with overlapping ecological functions that can partially replace each other. Therefore, the more complex the network is, the more complex its pattern of interconnections and the more resilient it will be.<sup>61</sup>

Altogether, these five different aspects of the same pattern of organization of ecological communities enable ecosystems to survive disturbances and adapt to changing conditions.<sup>62</sup> I then argue that the closer the pattern of organization of architecture is to the five basic principles of ecology, the bigger its regenerative potential and resilience to changing conditions.

Furthermore, it is important to understand that the contradictions and conflicts within an ecological community are the very essence of its being. In nature, they contribute to the system's viability.<sup>63</sup> Unlike the predominant problem-solving approach within human communities – seeking rigid decisions – ecological communities resolve conflicts by establishing a dynamic balance. An example of dynamic balance within an ecosystem is that the community simultaneously needs stability and change, order and freedom, tradition and innovation.<sup>64</sup>

This, in turn, suggests that similarly in architecture, where the act of building is always a negotiation between human and non-human living beings, the concept of building with a more regenerative logic does not mean having a positive impact on both in terms of all possible aspects at the same time, but instead seeking a dynamic balance, sometimes acting in favor of the human and sometimes in favor of the non-human living beings and so allowing the co-evolution of both.



[fig.3] Architecture as a living system

60 Capra, F. (1996). *The Web of Life*. Anchor Books, Doubleday.  
61 Capra, F. (1996). *The Web of Life*. Anchor Books, Doubleday.  
62 Capra, F. (1996). *The Web of Life*. Anchor Books, Doubleday.  
63 Capra, F. (1996). *The Web of Life*. Anchor Books, Doubleday.  
64 Capra, F. (1996). *The Web of Life*. Anchor Books, Doubleday.

*Re-map*



## 6.0 (COUNTER)MAPPING SYSTEMS OF ENVIRONMENTAL PRODUCTION

While the extension of the theory of living systems to the architectural domain offers a different understanding of the position and the role of architecture and the architect within the entanglement of human, non-human and the abiotic environment and simultaneously provides a conceptual framework for the potential and limitations of architecture to be regenerative, it does not give precise examples of what exactly the underlying principles and therefore sustainable patterns of organization might mean in terms of the material aspect of architecture. In order to provide this missing link between the material and immaterial aspects of regenerative architecture, between theory and practice, I turn to the examination of three case studies of different forms of inhabitation, visualizing different (sustainable and less sustainable) patterns of organization of human communities living with nature. The understanding of the similarities and differences between the three patterns, in turn, gives practical examples of more regenerative material forms of architecture that can be in turn translated into general design principles.

The chosen site of the province of North Maluku, Indonesia, offers such various forms of human habitation with different degrees of connection to the local ecosystems - from indigenous semi-nomadic human communities to rural and emerging urban settlements. The city of Ternate, as the urban case, showcases a system based on exploiting environments in the pursuit of generating stable growth (metastasis). The semi-nomadic case of the Tobelo Dalam forest people offers an opportunity to counter map a system that maintains regenerative relations in which things change to remain the same (metastability). Lastly, the study of the rural indigenous community of the Bajau Laut sea gypsies, as an in-between form of habitation, helps to avoid creating a false dichotomy and classification between modern versus vernacular techniques and instead demonstrates the transitions and relations between the different forms of habitational dynamics.

### 6.1 METHODOLOGY

To map the three case studies and understand their corresponding functional or dysfunctional relationship between humans and the-rest-of-nature, I extend the conceptual framework, previously explained diagrammatically in [fig.2] to include more detailed examples of the various aspects of the social- and ecosystems within which the human communities and their architecture exist. Each aspect is, in turn, further specified with practical examples specific to the given case study. The resulting maps of the habitational patterns of the Tobelo Dalam forest people, the Bajau Laut sea gypsies and the people of Ternate can be seen in detail in [appendix 1;2;3]. Consequently, for each case study, I re-map the mapped information into the same five categories that comprise the pattern of organization of ecological communities discussed earlier [appendix 1;2;3], based on Capra and Luisi's theory that all living systems exhibit similar patterns of organization.<sup>65</sup> Analysing how the aspects relate or deviate from each principle gives a clue about the reason behind the sustainable or unsustainable pattern of organization of human habitation and the corresponding sustainable or unsustainable architecture. Lastly, by learning from the principles of architecture of the more sustainable human communities, I comprise practical examples to each one of the five categories, which together form a conceptual framework for a pattern of organization of architecture with a more regenerative logic.

### 6.2 LIMITATIONS OF RESEARCH METHOD

Prior to proceeding with the analysis and synthesis of learnings that the case studies offer, it is essential to note the two limitations of the above-mentioned mapping method. Firstly, from the systemic perspective described in the previous chapters, it is clear that the conceptual framework, shown in [fig.2], can be infinitely extended with further details of the given aspects of the social and ecological systems. For example, if we take the aspect of shelter, it can be extended into several other aspects, one of which is the material resources used for building. Instead of stopping at exploring the most common materials used, this aspect can be further extended into more aspects such as the location of the given material, the production method, the treatment of the material, the way of building and so forth. The way of building can be extended to the suitable construction method, the transport of the material, the connections between the building elements and others. In other words, the infinite expansion potential of this mapping method suggests that the level of detail will depend on the specific goal of the study. In this case, I am looking for a broad understanding of the relationship between humans and the-rest-of-nature and the corresponding pattern of organization of the different human communities, which does not require an intensive amount of detail. This method of consciously mapping approximate knowledges<sup>66</sup>, within the context of this study, is precisely what enables focusing on the understanding of relationships rather than objects from a systemic point of view.<sup>67</sup>

The second limitation includes the realization that human communities, and therefore, architecture do not exist within social- and ecosystems only, but rather they are embedded in the complex network of social, ecological, political, economic systems and so forth. This means that for a comprehensive understanding of the pattern of organization of human communities and their architecture, the characteristics of all other systems will need to be mapped, and thus the resulting mapping diagram will also extend into a bigger, more complex version. For the goal of this study, however, namely the understanding of the relationship between humans, nature and architecture from a socio-ecologic systemic perspective, the conceptual framework of [fig.2] provides the necessary focus and therefore also limitations.

65 Capra, F. (1996). *The Web of Life*. Anchor Books, Doubleday.

66 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press.

67 Capra, F., & Luisi, P. L. (2014). *The Systems View of Life*. Cambridge University Press. p.108

### 6.3 CASE STUDY 1\_ TOBELO DALAM FOREST PEOPLE

The Tobelo Dalam forest people are semi-nomadic indigenous communities that inhabit the tropical jungles of north and central Halmahera, the North Maluku's mainland. They usually build several settlements along river banks, and move monthly between them along the river, consisting of a small number of families living closely together and sustaining themselves by partnering with each other and the rest of the local terrestrial ecosystem. Their primary food supply comes from the sago palm and from the collective practice of hunting pigs and fish from the rivers, and therefore, their daily routine and monthly relocation are finely tuned to the regeneration cycle of the nature around. The daily catch is divided among the members of the community when individual needs are met. These practices are a reflection of the Tobelo Dalam's belief system, which is based on their close relationship with the forest and includes not only collective values but also environmental laws, such as the ban on hunting the 'cuscus' animal, which is considered to be the ancestor of the Tobelo people. The act of building shelters is a collective practice, entirely based on the availability of natural materials found in the jungle. These characteristics of the Tobelo Dalam forest people demonstrate the direct interdependence between the individual and the community and the rest of the local terrestrial ecosystem.

The organic food waste is thrown away from the house straight in the jungle, providing food for smaller land species and therefore making the process cyclical with no waste going into the terrestrial ecosystem. In terms of building waste, the Tobelo people construct their shelters from natural materials such as wood, bamboo and palm leaves that gradually disintegrate, producing no waste at the end of the building's life. These ways of waste treatment from food and building materials exemplify the recycling practices of the Tobelo Dalam community.

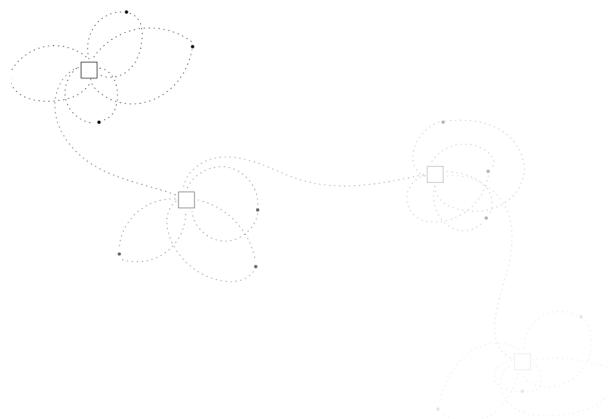
The recycling of the organic waste in combination with some of the elements of the forest people's houses showcase the partnership between humans and the terrestrial species living around. For example, when the community relocates monthly on different spots along the river, the roof of their shelter can be inhabited by birds, while the underside of the floor can become a shelter for tiny crawling beings. These species, in turn, attract predators to the area, stimulating the regeneration of the ecosystem after it has been temporarily depleted by the hunting practices of the Tobelo people.

Several aspects of the building and hunting practices of the Tobelo community exhibit a pattern of flexibility. The building is constructed in a way such that the different components can be easily modified or replaced yearly when the people return to their previous shelters. Flexibility can also be found in the movement of the Tobelo people during hunting. On the one hand, the community relocates monthly along the river, triggered by the exhaustion of animals in a particular area. On the other hand, the diverse types of animals eaten by the Tobelo result in diverse hunting locations – from fishing in the nearby river to hunting in the deep forests.

The different animal species and the sago palm used as a primary food source, the choice of natural building materials based on the availability around the forest and the monthly relocation along the river bed are all signs of the pattern of diversity of Tobelo's ways of sustaining life.

[Appendix 1] provides the complete mapping of the habitational pattern of the Tobelo Dalam forest people, while [fig.4] provides a summary of their pattern of organization. The abstract representation shows that the community sustains life through the main principles of movement and diversity. The people rely on diverse animal species and the sago palm as a primary food source and therefore relocate their place of habitation monthly once an area has been depleted from food sources, ultimately aiding regeneration by giving time to the local ecosystem to recover. The corresponding shelters of the Tobelo people are temporary and easily adaptable to the changing locations of habitation. In this way, by adapting habits, the Tobelo Dalam maintain a functional relationship with nature that benefits their co-evolution.

The way the Tobelo Dalam forest people sustain themselves as a community is closely aligned with the underlying principles of ecology, resulting in a sustainable pattern of organization. These same principles reflected in their act of building, therefore showcase a form of architecture with a more regenerative logic.



[fig.4] Tobelo Dalam pattern of organization



## 6.4 CASE STUDY 2\_ BAJAU LAUT SEA GYPSIES

The Bajau Laut sea gypsies are indigenous communities of people that inhabit a few rural areas along the coastline of North Maluku. They usually form small villages, built in the shallow waters above reefs, consisting of a few families living closely together and sustaining themselves by partnering with each other and the rest of the living beings of the local marine ecosystem. Their primary food supply comes from the collective practice of fishing, and therefore, their daily routine is precisely tuned to the daily tides and the monthly moon cycles. The collected fish is shared within the community when individual needs are satisfied. These practices are a reflection of the Bajau's belief system that is based on their close relationship with the ocean and includes not only collective values but also environmental laws, such as banning the fishing of small fish for a certain period of time to avoid depletion. The act of building shelters is also a collective practice, including sharing and reusing materials within the community. These characteristics of the Bajau Laut community demonstrate the direct interdependence between the individual and the community and between the community and the rest of the local marine ecosystem.

The organic food waste is thrown away from the verandas of the houses straight in the water, providing food for other marine species and therefore making the process cyclical with no net waste going into the marine ecosystem. In terms of building waste, the Bajau construct their houses in a way that allows the reuse of materials during the use of the building. At the end of the building's life, the natural materials can disintegrate with time, avoiding pollution of the marine ecosystem. These ways of treating waste from food and building materials are an example of the recycling practices of the Bajau community.

The recycling of organic waste, together with some of the elements of the sea gypsies' houses, illustrate the partnership between humans and the marine species living directly under the houses. For example, the building's stilts in the water provide the condition for a fish nursery, which in turn provides food for the Bajau right under their homes.

Several aspects of the building and fishing practices of the Bajau community exhibit a pattern of flexibility. The building is constructed in a way such that the different components can be easily disassembled, replaced if needed and reused either for the same purpose in another building or for a new purpose after some modification. In terms of size, the individual house, as well as the village, grow gradually according to the needs – when children are born, or new members join the community. Flexibility can also be found in the movement of the Bajau people during fishing. On the one hand, the fishermen choose different times and locations depending on the daily cycles of the tides and the monthly cycles of the moon. On the other hand, the diverse types of fish eaten by the community corresponds to diverse fishing locations – from picking fish in the shallow waters to fishing in the deep ocean.

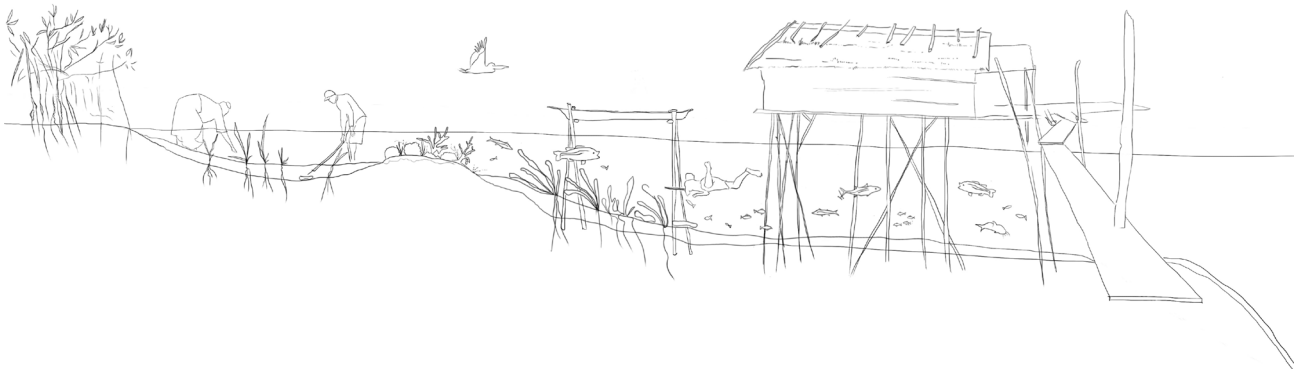
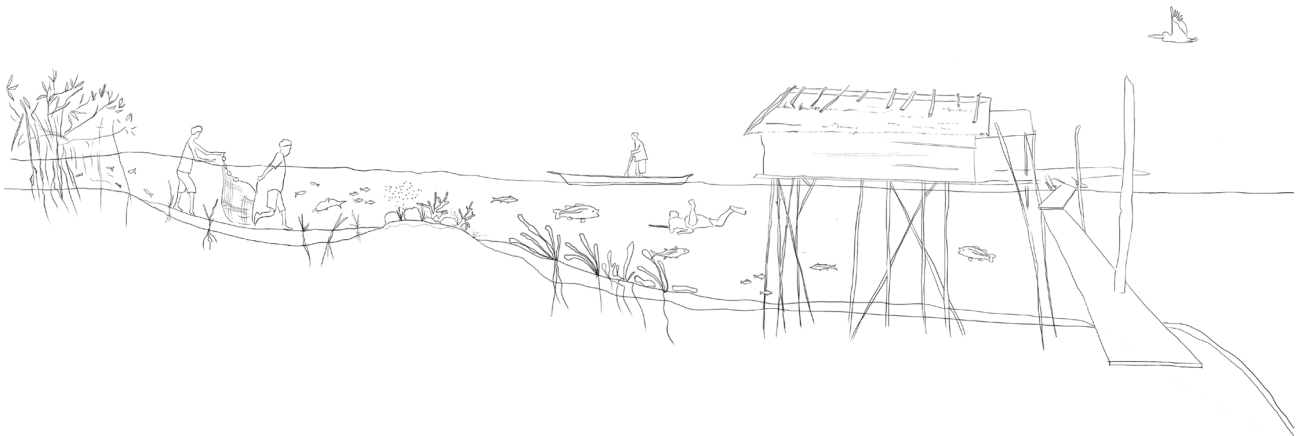
The different fish species used as a primary food source and the choice of natural building materials based on the availability in the area are signs of the pattern of diversity of Bajau's ways of sustaining life.

[Appendix 2] provides the complete mapping of the habitational pattern of the Bajau Laut sea gypsies, while [fig.5] provides a summary of their pattern of organization. The abstract representation shows that the community sustains life through the main principles of movement and diversity. Despite having a fixed shelter, the people rely on diverse fish species as a primary food source and therefore move daily to different fishing locations avoiding the depletion and ultimately aiding the regeneration of the local marine ecosystem by spreading the impact around more but smaller locations. In this way, by adapting habits, the Bajau Laut maintain a functional relationship with nature that benefits their co-evolution.

The way the Bajau Laut sea gypsies sustain themselves as a community is closely aligned with the underlying principles of ecology, resulting in a sustainable pattern of organization. These same principles reflected in their act of building, therefore showcase a form of architecture with a more regenerative logic. It is important to note that despite the regenerative logic of the Bajau's way of life, the size of the community poses a limit to its regenerative potential. If the community becomes too big, the organic waste cannot be recycled on time by the rest of the ecosystem and the village becomes gradually polluted, impacting both the people and the local marine species negatively.



[fig.5] Bajau Laut pattern of organization



### 6.5 CASE STUDY 3\_ PEOPLE OF TERNATE

The people of the city of Ternate inhabit the most densely populated area of the province of North Maluku, located off the west coast of the mainland of Halmahera. The people live in urban districts, built densely with individual houses, sustaining themselves mainly by the trade of goods, which is the main economic activity of the city. Their primary food supply comes from the import of packaged goods from surrounding Indonesian islands and from the import of local produce from the mainland of Halmahera. Despite living physically close to each other, the people of Ternate rely on participating in the economic system to sustain themselves rather than on each other as a community. The relationship between the individuals is then a choice rather than a necessity. These practices are a reflection of the people's religious system that connects the individuals in a community in the abstract sense, focusing on their relationship with each other rather than on their connection to nature. These characteristics of the People of Ternate suggest the indirect interdependence between the individual and the community and between the community and the rest of the local ecosystems.

The food waste, organic and inorganic, is collected and transported to landfills with limited recycling, therefore making the process linear resulting in the gradual accumulation of waste and increased pollution of the local ecosystems. In terms of building waste, the people of Ternate construct their houses in a way that hardly allows the reuse of materials during the use of the building. The buildings are often made out of man-made materials unable to disintegrate at the end of the building's life and so further polluting the local ecosystems in the long term. In addition, instead of giving back to the local ecosystems, the industrial production of energy for cooling, electricity, the production and transport of goods is based on non-renewable resources leading to the continuous negative impact on them, including the human community. These ways of treating waste from food and building waste in combination with the use of non-renewable resources of energy demonstrate a linear pattern that creates a disconnection between human habitation and the cyclical processes of recycling of the ecosystems around.

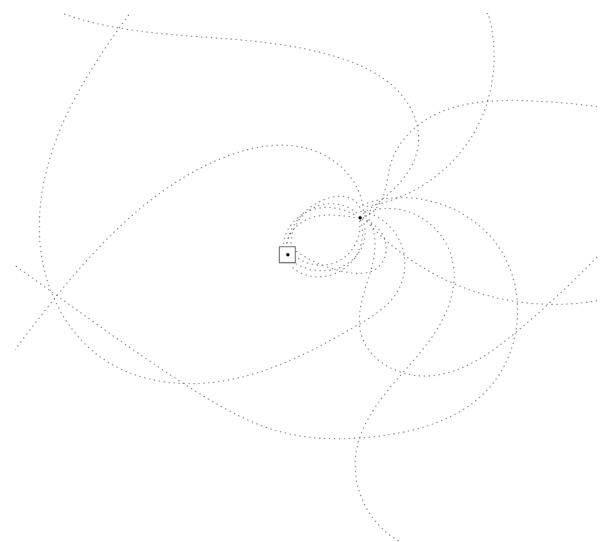
The majority of buildings in Ternate are built from man-made materials like concrete, metal, plastic or other synthetic materials that are unfamiliar to other non-human living beings and often are surrounded by infrastructure that further removes their habitat, instead of providing one leading to no partnership between human and non-human living beings. Many species tend to adapt to the man-made/urban environments created by humans, but often out of lack of surrounding habitat leading to an unintended partnership.

The Ternate people often construct their buildings to be as permanent as possible in ways that do not allow the easy reuse of building components if some maintenance or adaptation is needed resulting in more waste and use of more materials in the long term. In terms of size, often bigger houses are constructed based on predictions of future needs and the buildings are therefore also often planned based on standards rather than on individual needs. The practice of gathering food is based on the stationary position of the individual and the short movement to several points in the area when they can get enough food for several days at once, resulting in interdependence on the import of goods to the nearby supermarkets and the local fresh food markets. These aspects of building and of ensuring food exhibit the pursuit of a pattern of stability and permanence rather than one of flexibility.

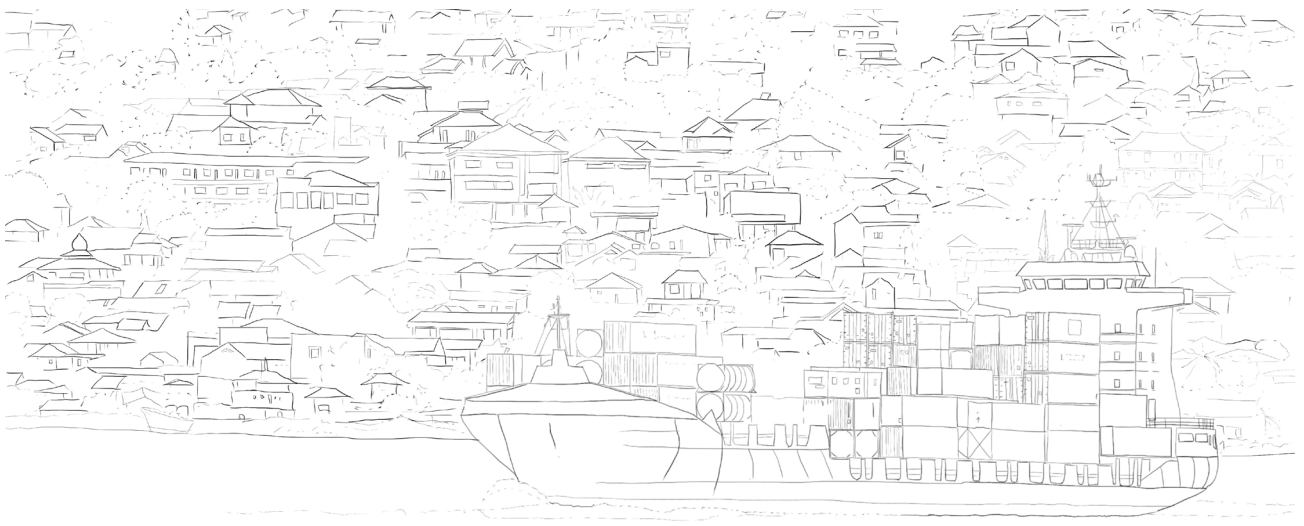
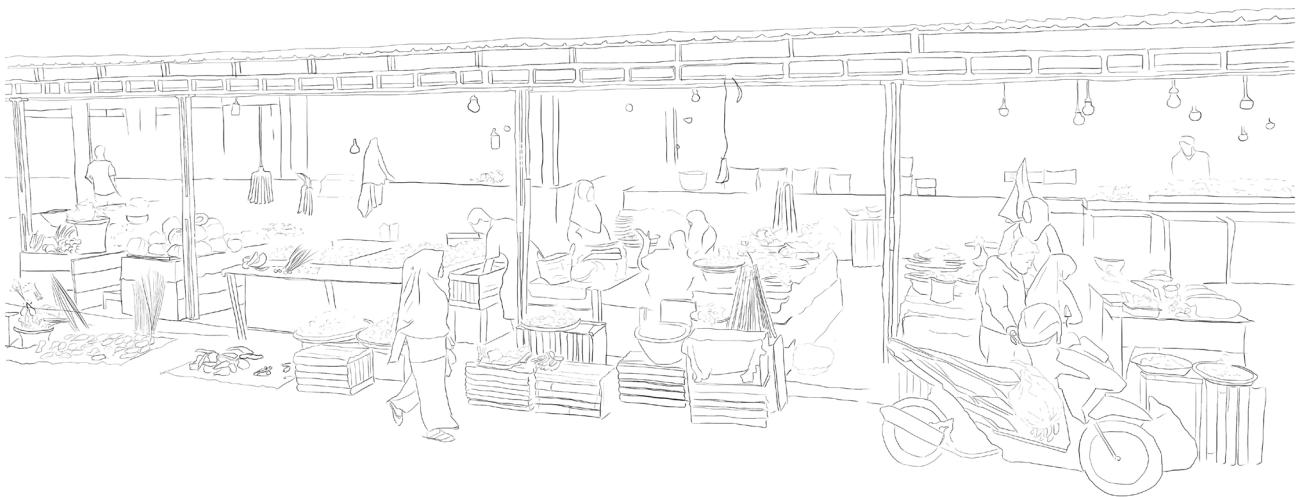
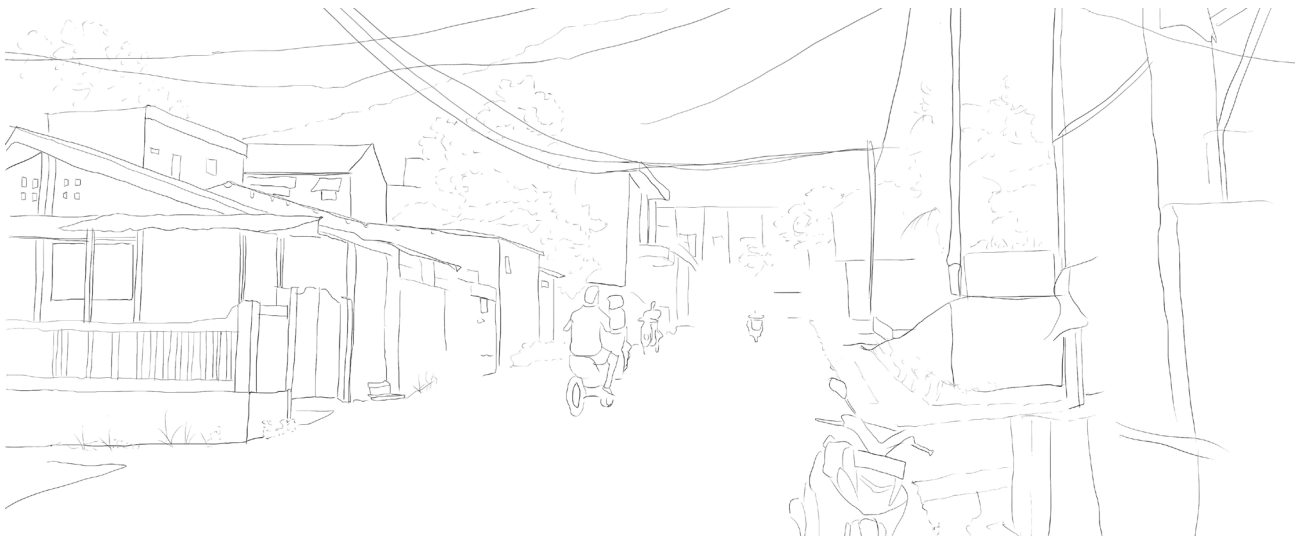
The increased diversity of food supply is not based on the diversity of the local food sources but on the import and export of goods, some of which are processed and packaged to last longer – resulting in abundance and excess of food and therefore bigger environmental impact, rather than on tuning with the local natural cycles. Similarly, the increased diversity of building materials is not based on the diversity of the available local building materials but on the import of materials from faraway places resulting again in abundance and excess, but also in more significant environmental impact that is faraway, therefore invisible and resulting in more and more excessive use. In this way, the visible pattern of diversity of Ternate's people way of sustaining life is 'invisibly' based on ecologically destructive practices.

[Appendix 3] provides the complete mapping of the habitational pattern of the people of the city of Ternate, while [fig.6] provides a summary of their pattern of organization. The abstract representation shows that the individuals sustain life through the main principles of movement of goods, rather than of people and diversity imported goods available at a glance rather than avoiding depletion and pollution and ultimately inhibiting regeneration of close and far ecosystems. In this way, by adapting habitat, the people of the city of Ternate maintain a dysfunctional relationship with nature that obstructs their co-evolution.

The way the people of the city of Ternate sustain themselves as individuals moves away from the underlying principles of ecology, resulting in less sustainable patterns of organization. These same principles reflected in their act of building, therefore showcase a form of architecture with a less regenerative logic. It is important to note that the decreased regenerative potential of city dwellers' way of life, however, comes in exchange for increased well-being and comfort and thus an easier human life.



[fig.6] People of Ternate pattern of organization



## 6.6 COMPARATIVE ANALYSIS

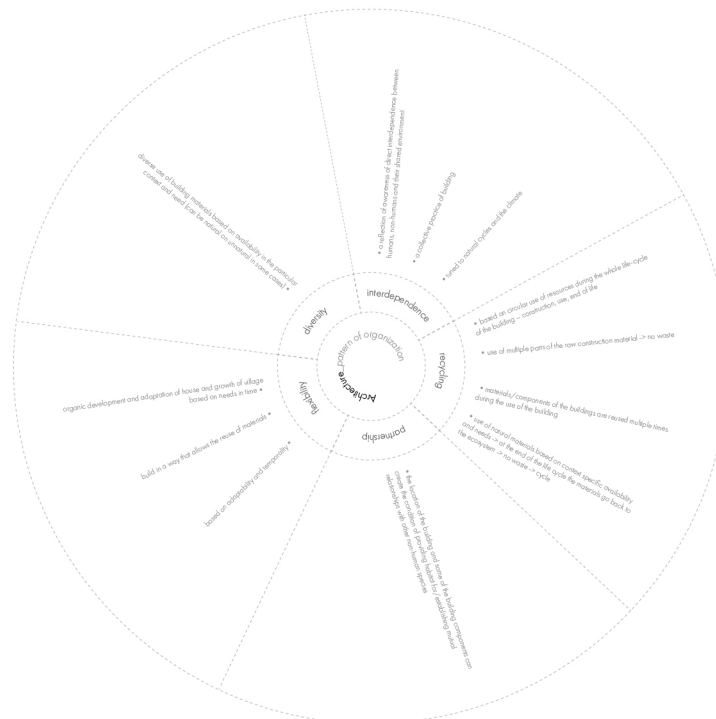
The critical examination of the three patterns of organization demonstrates that the further away a human community goes from the underlying principles of ecology, the smaller its regenerative potential becomes and thus the smaller the regenerative potential of its architecture. In the more regenerative cases of the communities of the Tobelo Dalam forest people and the Bajau Laut sea gypsies, the connection between humans and the rest-of-nature is based on direct interdependence between the individual, the community and the rest of the local ecosystem and therefore on the awareness of their mutual relationships and the direct feedback loops of the system. In turn, adapting habits - movement and diversity to avoid depletion or movement and relocation to ensure time for regeneration - creates a dynamic balance between the stability of structure and the fluidity of change. Precisely that ensures the sustainability and resilience of the community and its architecture to the continuous changes of the environment. By contrast, in the less regenerative case of the people of Ternate, the disconnection between humans and nature is based on the indirect interdependence between the individual and the local ecosystem, and therefore, on the unawareness of the mutual relationships and the indirect and often invisible feedback loops of the system. In this way, adapting habitat - in terms of the increased dependence of natural resources extending beyond the capacity of the place and the impossibility of the individual to trace the impact and change of environments, near and far - creates a dynamic imbalance: transitioning from the stability of structure and fluidity of change to seeking permanence, resulting in the long-term instability of structure and decreased sustainability and therefore also decreased resilience to the continuous changes of the environment.

It is important to note that the comparison between different human forms of habitation based on a functional or dysfunctional relationship between the humans and the environment is neither a classification of modern versus vernacular architectural techniques nor a juxtaposition between economy and ecology. Instead, it is a critical examination that demonstrates how the constant negotiation between sustainability and increased living standard and quality of human life leads to sustainable and less sustainable principles of organization of human communities, and therefore, architecture.

So what does it mean to make architecture with a more regenerative logic?

## 6.7 MAKING ARCHITECTURE WITH A MORE REGENERATIVE LOGIC

Based on the learnings from the principles of architecture of the more sustainable communities of the Tobelo Dalam forest people and the Bajau Laut sea gypsies, [fig.7] shows a synthesis of design principles with practical examples to each one of the five categories, which together form a conceptual framework for a general pattern of organization of architecture with a more regenerative logic.



[fig.7] Synthesis of design principles for regenerative architecture



**1. Interdependence** means that the act of building is a reflection of the awareness of the direct interdependence between humans, non-humans and their shared environment. The building practice is often collective and depends on the involvement of the community. The building itself is based on principles tuned to the local natural cycles and the specific climate.

**2. Recycling** indicates that buildings require a circular use of materials during their whole life-cycle - construction, use and end of life. During the construction phase, the use of all parts of the raw building material ensures a cyclical process producing the least amount of waste. In terms of the construction method, the building elements should be assembled in a way that allows the easy reuse or maintenance of the components during the whole use phase of the building. At the end of the building's life-cycle, the materials can disintegrate and go back to the local ecosystem if natural materials have been used, based on context-specific availability and needs.

**3. Partnership** suggests that the specific location and orientation of the building and some of the building components can create the conditions for providing habitat for/establishing mutual relationships with other non-human species.

**4. Flexibility** implies that the building should be based on adaptability and temporality. This means that the construction method should allow and encourage the reuse of materials, in line with the development or adaptation of the house, the village or the city based on short- and long-term needs.

**5.** Lastly, **diversity** means a diverse use of building materials based on need and availability in the particular context. This can mean the use of both natural and man-made materials in some cases.

## 6.8 POTENTIAL AND LIMITATIONS OF REGENERATIVE ARCHITECTURE (PART 2)

The closer the pattern of organization of architecture is to the principles of interdependence, recycling, partnership, flexibility and diversity, the higher its regenerative potential is and its resilience to changing conditions.

Scale and time, in turn, comprise the main limitations of architecture to be regenerative. The bigger the scale of the human population in an area, the more indirect the relations between the individual and the community and between the individual and the local ecosystems. This, in turn, results in an architecture based on a need for excessive use of materials, natural and unnatural, in a short amount of time, often exceeding the capacity of the place and ultimately inhibiting regeneration and so decreasing the potential for sustainability and resilience of both architecture, the human community and the non-human communities as a whole. The regenerative pattern of organization of architecture is therefore dependent not only on the basic principles of ecology but also on the relationship between scale, time and the specific regenerative capacity of a place.

It is essential to realize that just like in the rest of the natural world, the same pattern of organization can result in very different physical structures. This means that considering architecture as a living system does not provide precise solutions about the material aspect of architecture and what a regenerative building will be or might look like but instead provides the immaterial framework for a design process and design principles that act as a precondition for regenerative design. This also implies that regenerative architecture is intrinsically contextual. The same pattern of organization applied to designing within an urban environment will result in a very different physical embodiment of architecture than one applied to designing within a more rural setting. The same applies to designing for different climates, social, political, economic contexts and so forth. The material aspect of architecture is therefore strictly dependent on the specific context of systems within systems within a specific place.

## 6.9 THE NOTION OF DYNAMIC BALANCE

Here, the notion of dynamic balance comes back one more time in the discussion between technological and more nature-based solutions to building environments with a more regenerative logic. Based on the living systems theory and its translation to architecture, I argue that the regenerative potential of the built environment can be found in a unified approach that relies on the dynamic combination of both. It is a contextual approach, one of situated knowledges<sup>68</sup>, where different situations require different solutions, always a negotiation between scientific and non-scientific – indigenous ones. This need for dynamic balance stems from the constant negotiation between humans and the-rest-of-nature, between an increased quality of human life and a true partnership with nature. The continuous human progress, increasing human population and higher living standard bring further and further new requirements and meaning to the way humans inhabit places, impossible to be achieved by returning to more primitive ways of being. At the same time, technology-based solutions alone struggle to provide answers to the ecological challenges of our time. So, constructing environments with a more regenerative logic perhaps implies what Pallasmaa describes as a paradoxical task for architecture:

*'Today...I cannot imagine any other desirable view of the future than an ecologically adapted form of life where architecture returns to early Functionalist ideas derived from biology. Architecture will again take root in its cultural and regional soil. This architecture could be called Ecological Functionalism...this view implies a paradoxical task for architecture. It must become more primitive in terms of meeting the most fundamental human needs with an economy of expression and mediating man's relationship with the world...and more sophisticated in the sense of adapting to the cyclic systems of nature in terms of both matter and energy. Ecological architecture also implies a view of building more as a process rather than a product. And it suggests a new awareness in terms of recycling and responsibility exceeding the scope of life. It also seems that the architect's role between the polarities of craft and art has to be redefined...After the decades of affluence and abundance, architecture is likely to return to the aesthetics of necessity in which elements of metaphorical expression and practical craft fuse into each other again; utility and beauty again united.'*<sup>69</sup>

68  
69

Haraway, D. (1988). Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. *Feminist Studies*, 14(3), pp. 575–599  
Pallasmaa, J. (1993). From Metaphorical to Ecological Functionalism (pp. 74–79). *The Architectural Review*.

*(re-think(re-map(re-make)))*

## 7.0 SYNTHESIS\_ A MULTILEVELED NETWORK OF DESIGN PRINCIPLES

My research synthesis evolves into a multileveled network of systems within systems of design principles with the purpose to serve as a design tool for thinking and making built environments with a more regenerative logic [fig.8]. The multileveled network is simultaneously a unified conceptual framework for understanding relationships between humans, nature and architecture.

The first system of principles – *re-think* – corresponds to the process of cognition of architecture, namely the mental process of design of the architect. The seven principles of thought: more-than-human perspective; embracing complexity; thinking in terms of relationships, patterns and networks; process-driven; open to change and shifts; embracing contradictions and conflicts; and pursuing contextual innovation, become a necessary pre-condition for thinking architecture with a more regenerative logic and for the understanding of the other two levels of design principles.

The second system of design principles - *re-map* – constitutes the second aspect of the process of cognition of architecture. It provides the mapping method needed to understand architecture in the context of the socio-ecological practices of a place.

The third system of design principles – *re-make* – corresponds to the pattern of organization of architecture, namely the underlying design principles of architecture. The practical examples for each of the five principles: interdependence, recycling, partnership, flexibility and diversity [fig.7], give clues about what a regenerative pattern of organization of architecture might mean in terms of its material forms.

Together, the three systems of design principles form the precondition for any regenerative design by providing a conceptual framework for the two immaterial aspects (process and pattern) of the synergy of the three domains of architecture as a living system. If applied to the process of design, the multileveled network ensures the regenerative potential of the material aspect of architecture (structure) – the building itself - as the embodiment of the system's pattern of organization.

Lastly, the network pattern of the unified conceptual framework suggests continuous feedback loops during the design process, encouraging the designer to embrace the inherent complexity of the systemic approach to architecture.

## 8.0 CONCLUSION AND DISCUSSION

Based on the extension of the theory of living systems to the built environment and the definition of architecture as the synergy of its process, pattern and structure [fig.3], the multileveled network of design principles [fig.8] can be applied to any design question. The physical structure of architecture will then look different depending on the place it is situated in, and the regenerative solutions will therefore also vary. This alternative direction of architecture suggests the need for contextual innovation. Thus, regenerative design does not imply the need for precise solutions but instead opens up the potential of architecture to respond to current ecological challenges by seeking a dynamic balance. The dynamic balance can mean stability and change, order and freedom, tradition and innovation, but also a combination of scientific and non-scientific, technological and nature-based solutions to sustainability and regeneration.

Such paradoxical task for architecture to become simultaneously more primitive and more sophisticated; to combine the stability of structure with the fluidity of change embodies the complexity of the constant negotiation, co-emergence and co-evolution between human, non-human and their shared environment. In this way, embracing contradictions in the design process becomes the very essence of both the potential and limitations of architecture to be more ecological by allowing creative evolution similar to the one observed in living systems. In turn, seeking continuous transformation, impermanence and instability in architecture become a form of sustainability and resilience.

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Perhaps eco-literacy and ecological design are not about *becoming* ecological but rather about realizing that we are inherently ecological<sup>70</sup> and so are the built environments we create. It is about architecture as human art *and* as shelter, *and* as merely a change of environment.

Perhaps, thinking and making built environments with a more regenerative logic means thinking 'ecology without nature'<sup>71</sup> and 'architecture without architects.'<sup>72</sup> Or rather an architecture with a different kind of architects doing a more-than-human kind of architecture. An architecture of care. One that is relational, process-driven, open-ended, and thus creating conditions for constant negotiation between human and non-human, allowing their co-evolution with the mutual environment.

70 Morton, T. (2018). *Being Ecological*. Penguin UK.

71 Morton, T. (2007). *Ecology without Nature*. Harvard University Press.

72 Rudofsky, B. (1964). *Architecture without Architects*. The Museum of Modern Art.



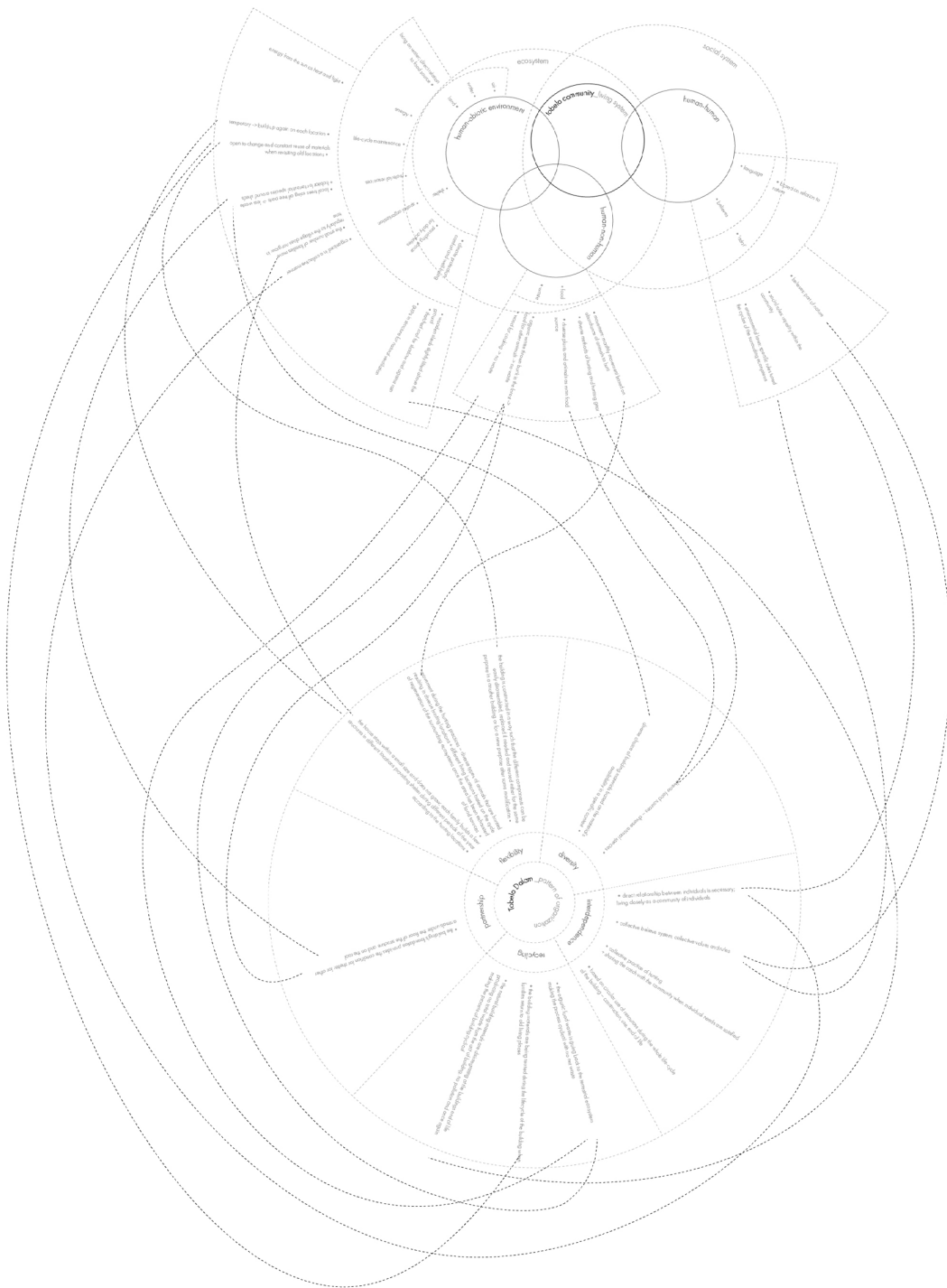
**[fig. 8]** Thesis synthesis: a multileveled network of design principles for thinking and making regenerative architecture

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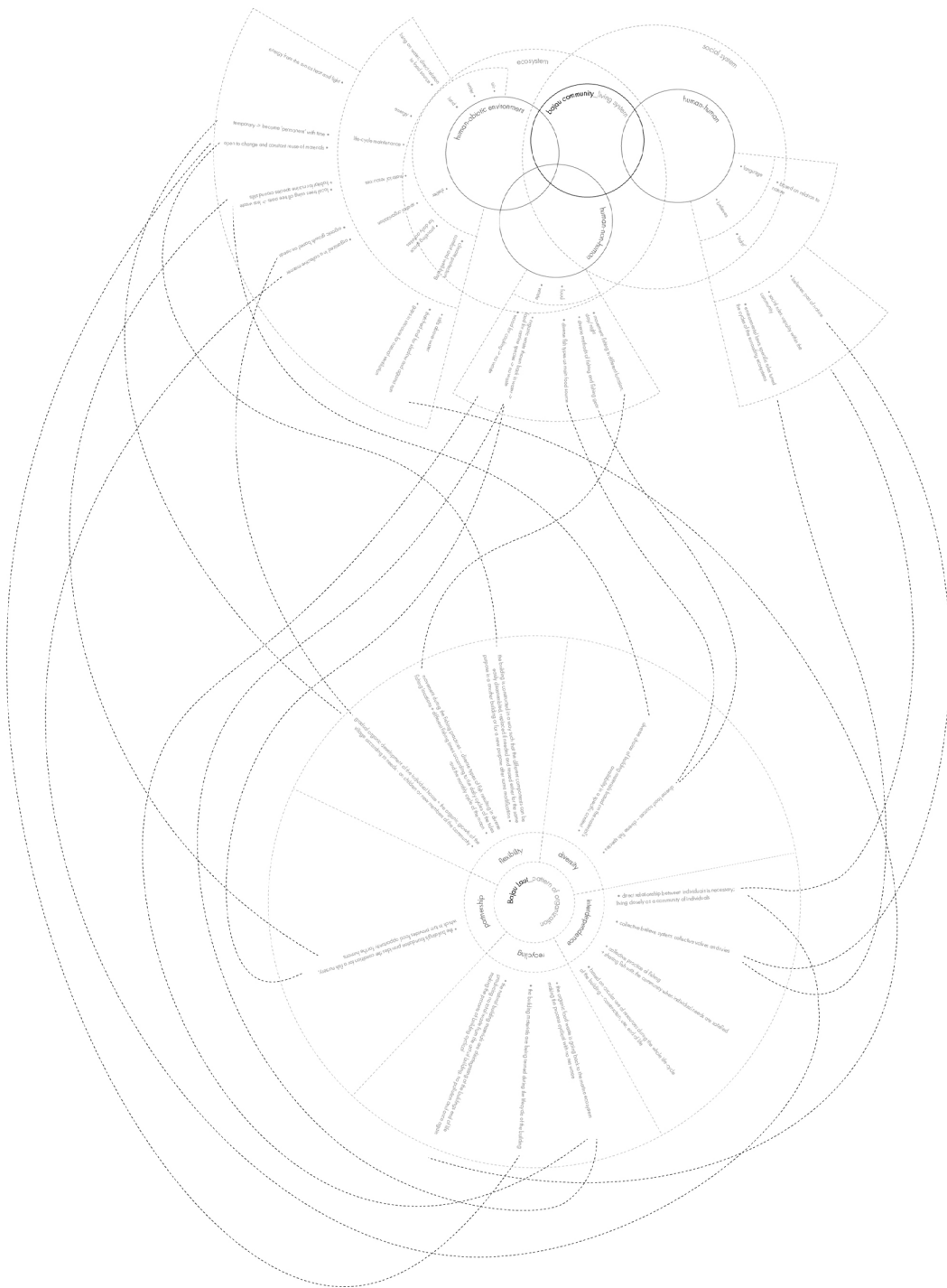
# APPENDIX 1

## CASE STUDY 1\_ TOBELO DALAM PEOPLE



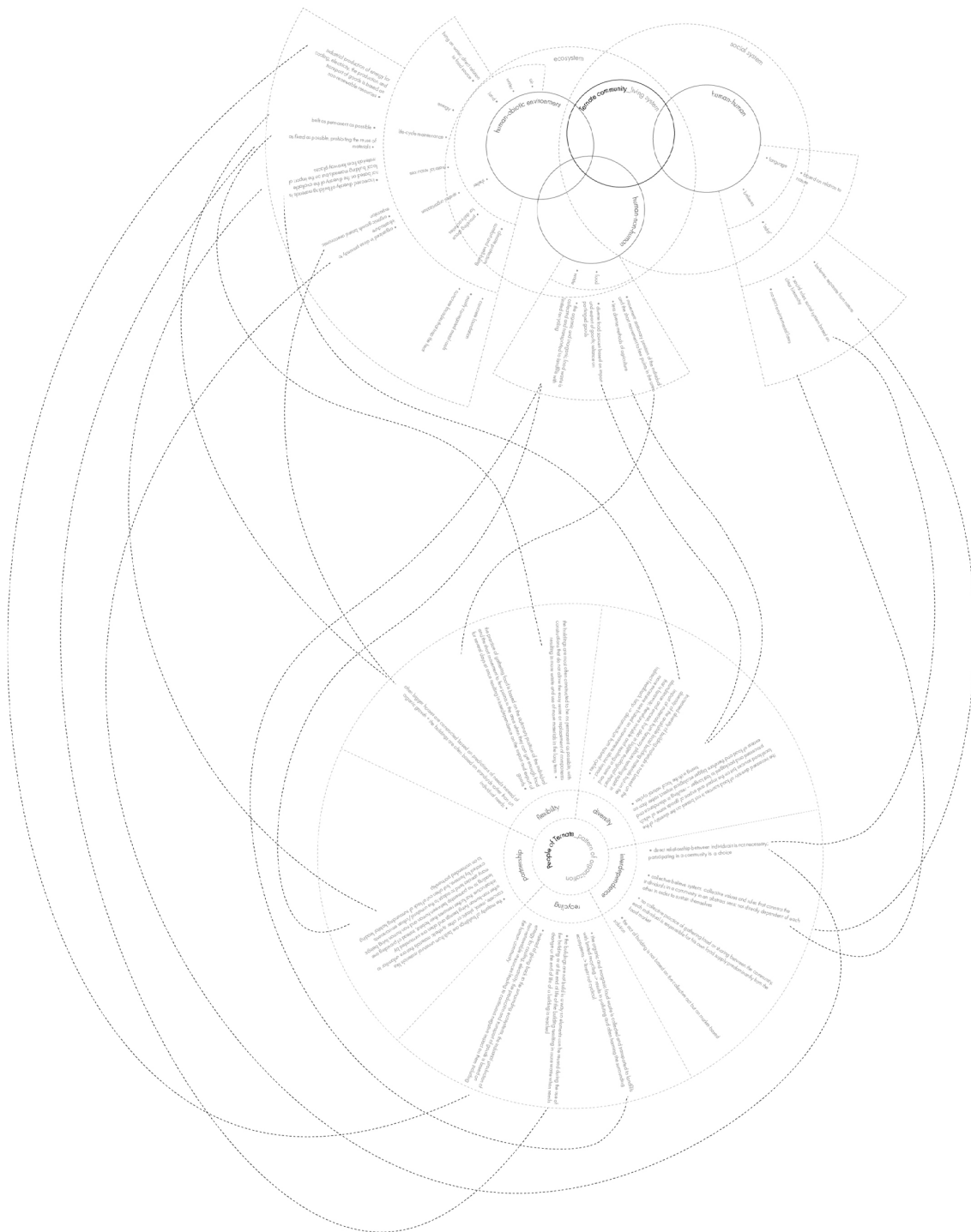
## APPENDIX 2

### CASE STUDY 2\_ BAJAU LAUT SEA GYPSIES



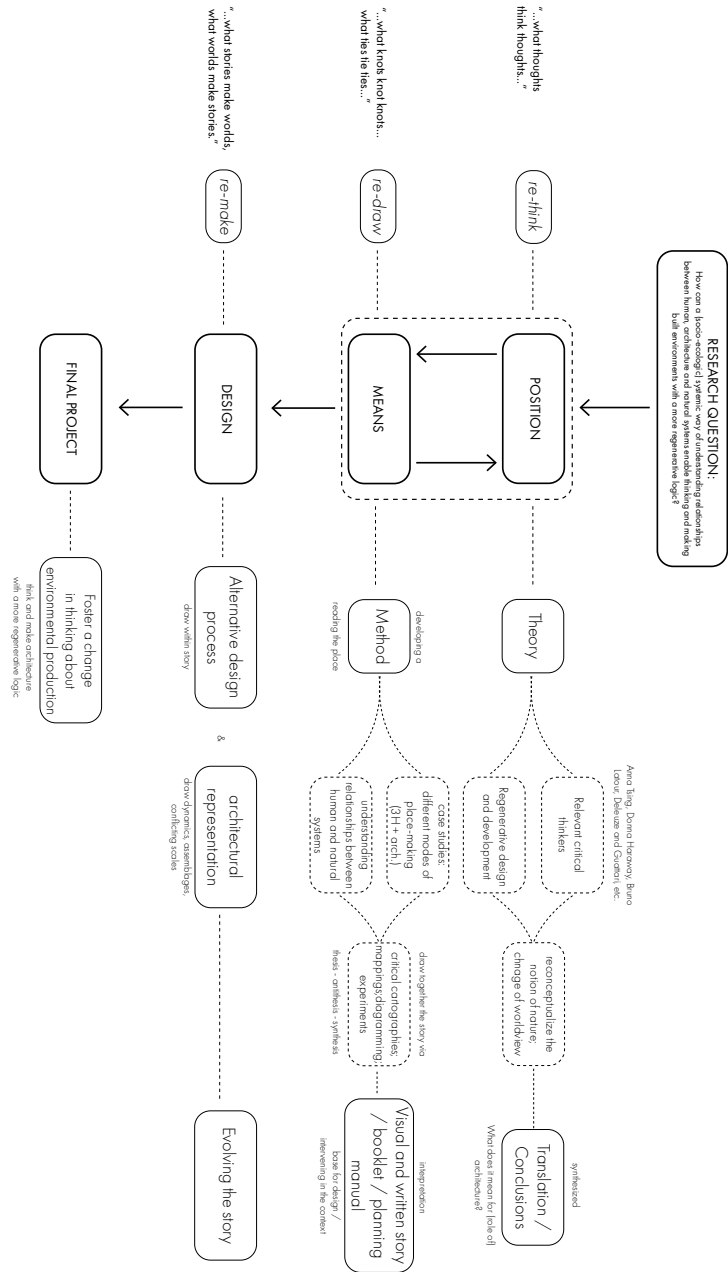
# APPENDIX 3

## CASE STUDY 3\_ PEOPLE OF TERNATE



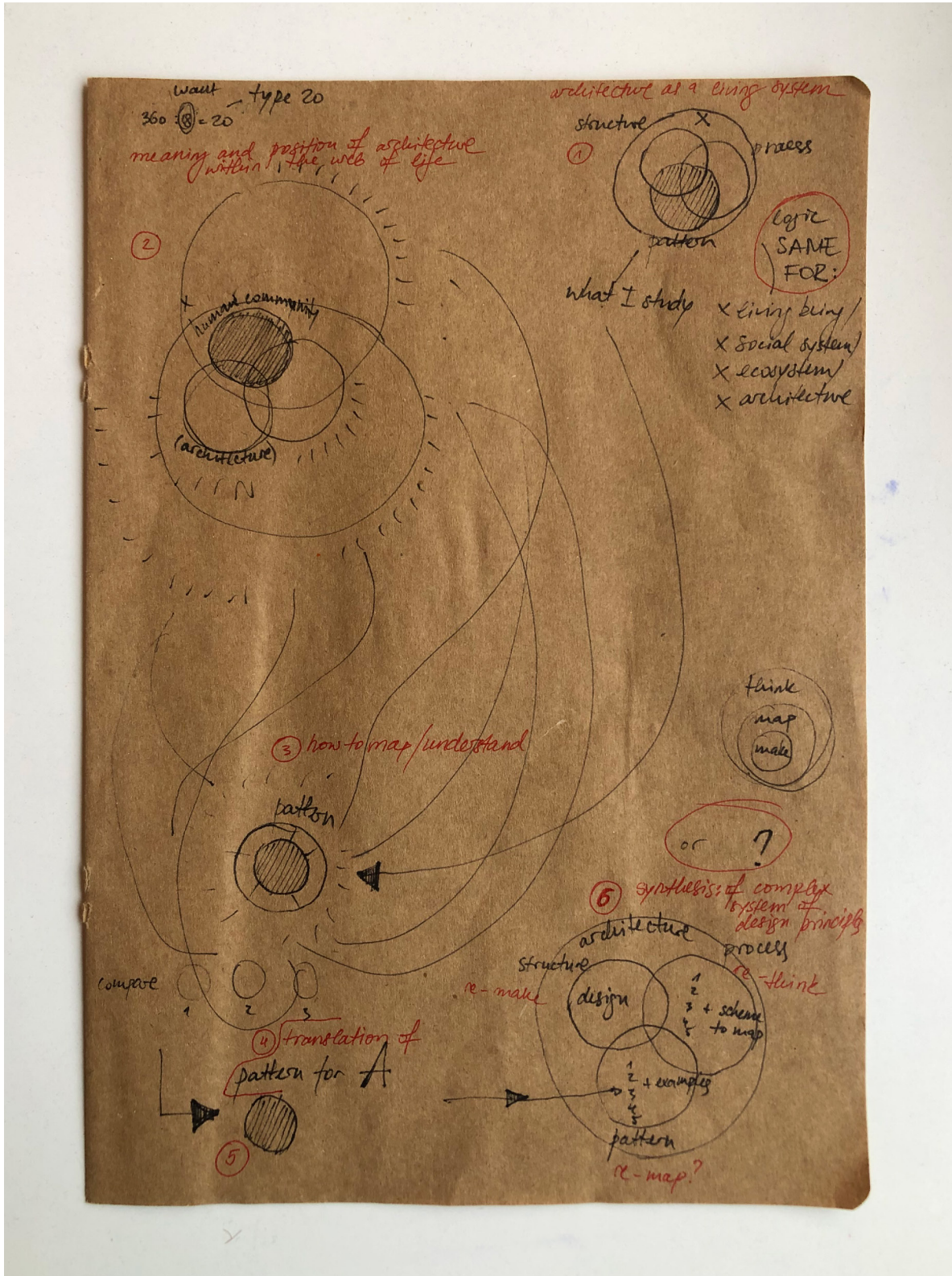


# APPENDIX 4 RESEARCH DIAGRAM



APPENDIX 5

RESEARCH PROCESS\_ AN ONGOING RE-THINKING THROUGH DIAGRAMS





Case studies

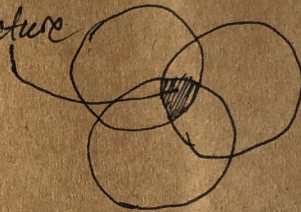
- intro need to study indiv.
- intro case studies (brief description)
- how I may them explain extension & diagram + limitations
- results:
  - comparison of basic pattern (12 diagrams)? + appendix?
  - conclusional connection - disconnection
  - translation to principles for architecture
- conclusion about limitations → dynamic balance ... pallasmaa

Conclusion

synthesis

DA

Architecture



Architecture

