

# Designing resilient creative communities through biomimetic service design

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## ABSTRACT

Creative communities are grassroots, bottom-up initiatives of people who through their diffuse design capacity propose new, desirable service futures that address the problems of everyday life. These creative communities exist within a transition from modernity towards sustainment, their adversarial character embodying alternative values such as conviviality, solidarity, and openness and shifting the focus from growth to flourishing. The sociotechnical system that is a creative community creating social innovation faces constant threats due to the collapse of traditional support structures and their disruptive, adversarial character, and so, identifying strategies to increase its resilience is necessary. We turn to nature for inspiration and mentoring. Biomimicry is a framework that designs solutions inspired by biological systems. We argue that permaculture, provides an interesting direction for development and research in the context of social innovation.

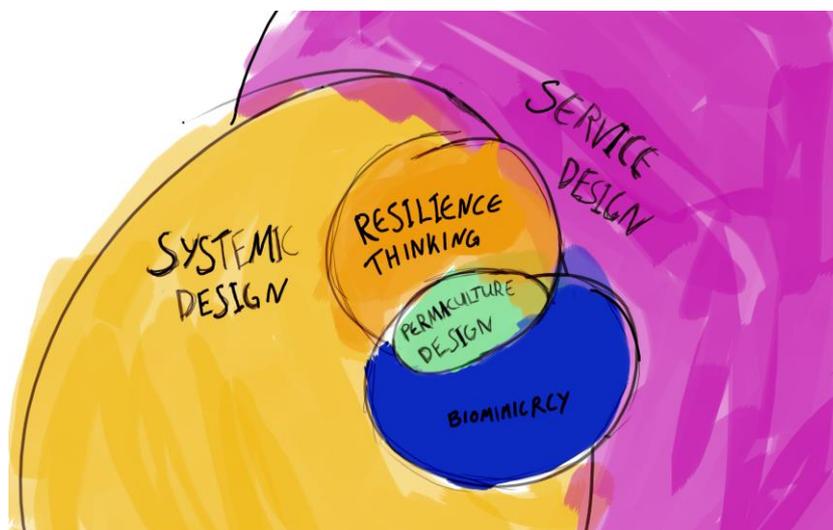
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## INTRODUCTION

This paper aims to support the idea that increasing the resilience of creative communities by fostering the emergence of greater diffuse capacity on a local level can act as a successful exit strategy for service design. To achieve this goal, we turn to Biomimicry, the study of biological systems, to translate their principles into sociotechnical ones. Applying these through design can provide a way to reconstitute the domains of everyday life (Kossoff, 2015) and transition towards sustainability in some grassroots, distributed way. At the same time these different ways of looking at the subject provide a direction that seems to offer an answer to many emerging issues in the context of service design within a systems thinking framework. This exploratory case study aims to outline an emerging synthesis of different yet adjacent fields that are connected by their adoption of a systemic design perspective. In addition, most approaches are connected through the transition towards sustainability and their alternative systems of values. One important such shift from modernist values is associated with the relationship between nature, technology and humanity. Most of the

views synthesised in this proposition bring Gaia back to the forefront as the mentor and mother figure, not as a beast to be exploited and tamed to fulfil human ambitions.



**Figure 1. The different fields of this research project**

The paper is divided into six sections. In the second section we position our work in the context of the discourse in the field of service design and social innovation. In the third section we present the systemic perspective of the field of resilience, followed by a brief overview of permaculture, which is a systemic view of agroecological models. In the fifth section we focus on the practice of Biomimicry, a design methodology that looks to natural models for inspiration. In the second to last section the case study of working with the 'Apano Meria' social enterprise on the island of Syros in relation to the research question is presented. The focus of this section is on translating the lessons extracted from biological systems into social systems. In the final sections we present our conclusions. In the figure below an affinity diagram of the different theoretical tools is presented.

In order to explore the application of biological models in the context of social systems a Research Through Design (Frayling 1997) methodology was developed. This practice based research engages in a dialogue between theory and practice, shaping, through fluid and hybrid forms (Redstrom 2017), new assemblies of humans and non-humans. Given the fact that creative communities co-create value producing relational services and evolving their diffuse design capacity research has to be embedded within the organisation while it designs. Research through design allows us to work within the research context and test how new knowledge is generated, shared and communicated. The embeddedness of this approach

allows us to gain insight into the tacit knowledge that is part of the type of distributed design process adopted by creative communities (Bofylatos 2018). This kind of knowledge tends to be a blind spot for design research and finding ways to scale up or duplicate the innovative knowledge created in the field. In a wider methodological context this study is categorised as participatory action research. Given the necessary ontological and methodological shifts needed to transition towards sustainability the rejection of traditional scientific knowledge structures and the application of new methods has the capacity to lead to new ways of designing that address the structural issues of modernist thought.

## 1. SOCIAL INNOVATION

In the last couple of decades service design has emerged as a field with promising potential to minimise the material flows and increase the overall sustainability of human activities on the planet. One of the central reasons for this is the adoption of 'service dominant' logic as opposed to the 'goods dominant' logic of traditional economies. Service dominant logic sees value as dynamic and co-created when a service provider and a client interact (Meroni and Sangiorgi, 2011), whereas goods dominant logic asserts that value is static and embodied in material products. The main shift is that of perspective; products are systems that embody 'value in exchange', whereas services are systems that produce 'value in use' (Edvardsson et al., 2005; Grönroos, 2008). These perspectives shift the focus towards the process of value creation, due to the shift from considering value as embedded in tangible goods to conceiving value as co-created amongst various economic and social actors (Vargo and Lusch, 2008; Meroni and Sangiorgi, 2011). The transition from atoms to bits is one that is conducive to sustainability as it reduces material flows, increases resource efficiency, and reduces consumerism. The interactivist view of value in the context of service systems points to the adoption of a relational ontology (Escobar, 2018) that better supports the emerging scientific paradigm associated with sustainability. Social innovation builds on tools and methods of service design to increase sociality through participation, to strengthen local economies and to create enabling ecosystems for the transition towards sustainability.

According to Manzini (2017), social forms are made possible, durable and, where appropriate, relocatable and scalable through participation in a social ecosystem that hopes to make itself more desirable. Creative communities that use the diffuse design capacity to co-create collaborative services sit at the centre of social innovation and transition studies. This difference between collaborative services and standard services (Cipolla and Manzini, 2009) exemplifies the dichotomy between reducing unsustainability and enabling the

emergence of unsustainability. Collaborative services utilise a higher level of cooperation than that of simply building the service itself.

Today, social innovation and social entrepreneurship have garnered a lot of attention from professional designers and funding agencies (Telalbasic, 2015). Due to the externalities of this approach the social enterprises and creative communities that are structured are not emergent from the bottom up but exist for external reasons. In addition, the designers associated with the project are not embedded in the community and there is rarely special attention given to increasing the diffuse design capacity in the community. In a sense the community becomes dependent on external resources; as such, when these are removed, the community withers because it lacks the capacity to exist without the supporting apparatus. This lack of an 'exit strategy' has been identified as an issue that becomes more and more important in service design discourse. The theoretical model presented and the supporting case study aspires to provide the initial structure of a framework for designing creative communities in a way that increases the odds in favour of a self-sustaining community creating social innovation. However, this process has several shortcomings in relation to spatial and temporal sustainability. If the expert designers engaged in the projects are removed, the diffuse design capacity has not reached a level of maturity that allows the community to continue evolving and flourishing. This field is described as designing 'exit strategies' for the design team. This project aims to present the initial thought process of such an exit strategy, developed in an action format informed by Participatory Action Research methodologies (Fassi *et al.*, 2013).

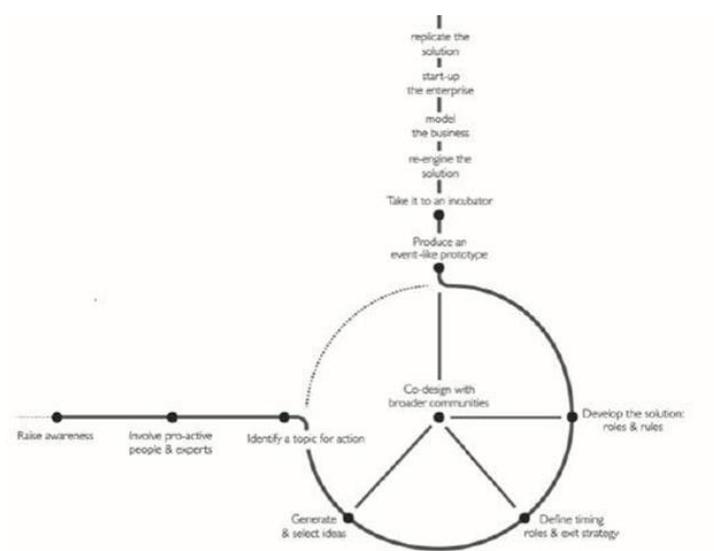


Figure 1. Social innovation journey. Source (Fassi *et al.* 2013)

Within this context the main research proposition emerges. RP1: **“We create a viable exit strategy for designers engaged in social innovation by fostering the diffuse design capacity of the creative community.”** We posit that by applying resilience thinking and biomimetic design methods in the context of a systemic perspective, these ecosystems of creative communities can be enabled and strengthened and can better achieve their goals. Increasing resilience by fostering the diffuse design capacity can be a viable exit strategy in any service development within a community.

## 2. RESILIENCE

Resilience is defined as the capacity of a system to retain its organisational closure while absorbing external perturbations (Walker and Salt, 2012). The sociotechnical system that is a creative community creating social innovation faces constant threats due to the collapse of traditional support structures and their disruptive, adversarial character. Identifying strategies to increase the capacity of any system to resist external forces is necessary to ensure their survival in a time of unprecedented environmental and social pressures, but in the context of the wider transitions towards sustainment and the necessary reconstitution of the domains of everyday life. “Three aspects can help us to achieve resilience: Persistence to withstand shocks or unexpected events, transformability, to move from crisis to innovation, adaptability, or able to understand change” (Rockstrom, 2009). Meadows (2008) explains that once we see the relationship between structure and behaviour, we can begin to understand how systems work and how to shift them into better behaviour patterns. Systems thinking, she adds, can help us to manage, adapt and see the wide range of choices we have before us, to identify root causes of problems and to see new opportunities. So, systems thinking consists of behavioural patterns, and learning to use them along with design can result in the design of resilient strategies to forecast the effect of a design.

Another tool is the notion of the Panarchy which is developed by Gunderson and Holling. This tool attempts to understand the source and role of changes in systems which transform and take place in adaptive systems (Gunderson and Holling, 2001). Based on the study of ecosystems, the researchers describe how nature proceeds through recurring cycles that contain four basic phases: 1) Rapid growth (r); 2) conservation (K); 3) release (omega); and 4) reorganisation (alpha).

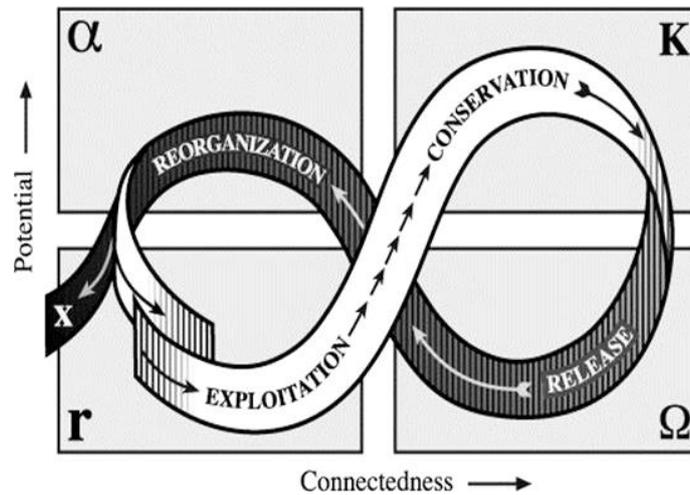


Figure 3. Panarchy, Source: Gunderson and. Holling 2001:

In panarchy, adaptive cycles take place along different scales (global and local) of time and space (gradual and episodic, rapidly and slowly unfolding). Panarchy is explained as the antithesis of hierarchy. In its original meaning it is defined as a set of sacred rules or as a framework of nature's rules. This term is now widely used to visualise systems theory and complexity. The theory of panarchy “rationalizes the interplay between change and persistence, between the predictable and unpredictable and how panarchies represent structures that sustain experiments, test the results, and allow adaptive evolution” (Resilience Alliance, 2015).

The tools above represent a contemporary notion of resilience thinking, which looks at the rhythms of creating, conserving, revolting and finally declining within a continuous cycle. Although it requires deeper study, the idea offers a principle that designers can incorporate into their philosophy of making ecological and social systems (Ruano, 2016). The types of resilience of social systems might be different but the strategies for increasing resilience remain the same. Creative communities go through similar cycles of panarchy. In addition, the interactivist and relational character of service design further supports the distributed system with multiple redundancies, a high degree of interconnectedness, and diversity, similarly to biological systems with high resilience. This further informs our theoretical understanding and leads to RP2: **“The increase of the diffuse design capacity of a creative community leads to increased resilience of the systems.”** One approach to creating such nested, resilient systems within a Systemic Design ethos is the adaptation of permaculture in

the context of social systems. In the next section we discuss the notion of Permaculture within a systemic view.

### 3. PERMACULTURE

We argue that permaculture, an agroecological systemic design tradition (Cassel, 2015), provides an interesting direction for development and research in the context of social innovation. In contrast to monoculture, where only one type of value is the goal of the system, permaculture provides a systemic view that is focused on fostering virtuous cycles and cooperation between different symbiotic systems. Permaculture was introduced by Bill Mollison, a biogeographer, together with his student David Holmgren, as a response to the 1972 book *The Limits to Growth*. The permaculture concept is not simply an environmental protection measure or an organic farming principle, but rather a form of ecosystem design. As Mollison writes: *“This book is about designing sustainable human settlements and preserving and extending natural systems. It covers aspects of designing and maintaining a cultivated ecology in any climate”* (1978).

The 12 permaculture design principles are based on creating and developing patterns. 1) Observe and interact; 2) Catch and store energy; 3) Obtain a yield; 4) Apply self-regulation and accept feedback; 5) Use and value renewable resources and services; 6) Produce no waste; 7) Design from patterns to details; 8) Integrate rather than segregate; 9) Use small and slow solutions; 10) Use and value diversity; 11) Use edges and value the marginal; 12) Creatively use and respond to change. All processes within a system are regulated by these principles, which Mollison refers to as “axioms”. There is overlap between these axioms and the six principles of biomimicry.

Looking at creative communities as an interconnected ecosystem rather than as discrete systems provides a different avenue for increasing their resilience and capability for flourishing by creating positive feedback within a wider ecosystem of bottom-up initiatives on both a local and a global level. All of the basic principles of permaculture are part of the design for social innovation.

In order to draw inspiration, the prairie was selected as the basis for designing an ecosystem of creative communities entangled in virtuous circles, with the aim of increasing the resilience of a bottom-up organisation while increasing the overall flourishing in an insular environment. The example of prairies shows the significance of multiple and different ‘crops’ being required to enable resilience to succeed. This metaphor leads us to the idea that a

social-ecological system requires many and diverse creative communities interacting with each other and applying the principles of community resilience.

Due to the high level of complexity of the systems of polyculture in general and the prairies specifically, they are diverse by their nature and they interact by transferring knowledge and leaving constant feedback, thus ensuring the maximisation of community resilience by the constant creation of new varieties and the emergence of redundancies.

The Prairie metaphor suggests a polycentric model (Benyus, 1995) as well. Classic studies on the sustainable governance of social-ecological systems highlight the importance of so-called 'nested institutions'. These are institutions connected through a set of rules that interact across hierarchies and structures so that problems can be addressed swiftly by the right people at the right time. Nested institutions enable the creation of social engagement rules and collective action that can 'fit' the problem they are meant to address. In contrast to more monocentric strategies, polycentric governance is considered to enhance the resilience of ecosystem services in six ways, which coincide elegantly with other principles aiming to increase the resilience of local creative communities and ecosystems: it provides opportunities for learning and experimentation; it enables broader levels of participation; it improves connectivity; it creates modularity; it improves the potential for response diversity; and it builds redundancy that can minimise and correct errors in governance.

Another reason why polycentric governance is better suited for the governance of social-ecological systems and ecosystem services is that it gives traditional and local knowledge a much better chance of being considered. This, in turn, improves the sharing of knowledge and learning across cultures and scales. This acts in tandem with the Systemic Design approach that permeates this approach as it provides the principles for dealing with the complexity of a sociotechnical system (Jones 2014, Ryan 2014) the production of knowledge within a design project (Sevaldson 2010). This understanding of how polyculture creates more resilient systems leads to RP3: **"Permaculture can be utilised to increase systemic resilience when designing social innovators with creative communities."** This is particularly evident in local and regional water governance, as in watershed management groups in South Africa or the management of large-scale irrigation systems in the Philippines, where polycentric approaches have facilitated participation by a broad range of actors and the incorporation of local, traditional and scientific knowledge (Simonsen et al., 2014).

In order to further incorporate nature's teachings in the design process, we turn to Biomimicry, a trans-disciplinary approach to problem solving which has emerged through the integration of design with other disciplines, such as biology and engineering, and which attempts to translate biological mechanisms into components of socio-technical systems. Biomimicry offers the tools for identifying patterns and mechanisms in the natural world that have evolved to increase the resilience of a system. Translating and adapting these solutions to a social project is the next part of the process.

#### 4. BIOMIMICRY

In order to create the necessary strategies, we turn to nature for inspiration and mentoring. Biomimicry is a framework that designs solutions inspired by biological systems. It opens up possibilities of seeing the way nature works, teaches, and informs arts and sciences (Ruano, 2016). It encourages deeper studies in order to arrive at technologies and strategies that may be achieved through interdisciplinary dialogues. Ecosystems display differing degrees of resilience. Understanding the strategies developed by nature to increase the resilience of ecosystems is a first step. Identifying and reframing these solutions can foster the resilience necessary for creative communities to flourish. The emerging fields of biomimetic design of services can support the evolution of service design (Ivanova, 2014) methods in the context of social innovation and shift the underlying assumptions behind the decisions made. Biomimicry has proven a robust methodology for the development of solutions in the fields of material engineering and product design; applying lessons from nature is a frontier for service design and the creation of resilient organisations.

We can explore the relationship between ecology and social innovation through the lens of a biomimetic idea, namely a generation tool for service design as proposed by Ivanova. This process takes into consideration the ecology metaphor, the fact that service design and ecology share the same level of organisation and lastly, the relation contained in their definition – both terms study interactions of organisms with their environment, in ecology with the natural inhabitants, and in service design with resources, people, organisations, nature and technology (ibid., 2014).

Biomimicry is a tool that can help us find options and can sometimes force the researcher to find answers (Benyus, 1997). Use of a natural pattern does not guarantee that the biomimetic artifact or system will work; for this reason, a prototype (digital or physical mock-up) is required. As the prototype is developed, it will be acquiring features that can be evaluated and modified, if necessary. "How does nature do it...?" is a key question to ask in

the process of implementing biomimetic thinking in design. It suggests new ways of inquiry when designing infrastructure, messages or artefacts using keywords related to natural forms, functions, processes and systems found in nature. The difficulty occurs when the learner must structure this information or validate its accuracy (Ruano, 2016). This action format is incredibly compatible with the massively co-designed approach used in social innovation. The service itself is in a continuous iterative redesign process of evolving and growing.

Ivanova proposes “a conceptual proposition of what biomimetic service design might ‘look like’”, a tool inspired by the TRIZ methodology and the Lotus Blossom tool of Namahn and Design Flanders. It follows these steps: definition of the design challenge and definition of eight design requirements; abstraction of a design principle which needs to define each design requirement in more general terms; searching for a biological analogue to each abstraction; and extraction of the principles behind each biological example. So the last research proposition is shaped as RP4: **“Biomimicry can be used to inform the design of creative communities that aim to be more resilient.”**

In these sections a collection of design related approaches has been presented as elements of an approach that can enable the more robust design of relational services by creative communities. The main conclusion in our view lies in the increased adaptability present in polyculture systems due to their virtuous cycles and the contingencies that can be applied in bottom-up social systems such as creative communities. The four research propositions put forward outline an emerging systemic design approach informed by biology and service design that is spatially aware and responsible and has the capacity to transform into autopoietic systems (Battistoni and Barbero, 2018). In addition, the different levels of everyday life proposed by Kossoff (2015) point to another interesting notion: creative communities exist with a focused and specialised goal at their centre; however, they are connected by adoption of a specific subset of values such as conviviality, participatory decision making, and others (Bofylatos and Telablastic, 2018). By looking at creative communities in a place such as an ecosystem and focusing on their interdependencies and virtuous cycles, a polyculture of social innovation can emerge in a specific space. Increasing the diffuse design capacity within this given territory can be a valid exit strategy for professional designers.

**5. THE 'APANO MERIA' SOCIAL COOPERATIVE AS A RESILIENT SERVICE POLY CULTURE**

In order to elaborate on the recognised strategies, the 'Apano Meria' social enterprise will be analysed with respect to the relationships between different focus groups and how these can increase the overall resilience of the system. The object of this case study is a collection of different creative communities with various interests but connected by a common theme: enabling the flourishing of the island of Syros, Cyclades. The Cyclades is a collection of islands in the middle of the Aegean Sea in Greece. They have been one of the first places in Europe to be settled in early Prehistory. The insular character of island creates a unique context in each island with human activities, microclimate, flora fauna and traditions varying highly from island to island. In order to achieve this goal three main themes have been adopted: the environment, culture and people. Each of these themes is made up of different special interest groups that are interconnected both within the theme and within the wider scope of the community. What brings everything together is conservation, the need to keep the essence of place safe from the homogenising unsustainability of modernity. The breadth of the whole enterprise is visualised in the system map below.

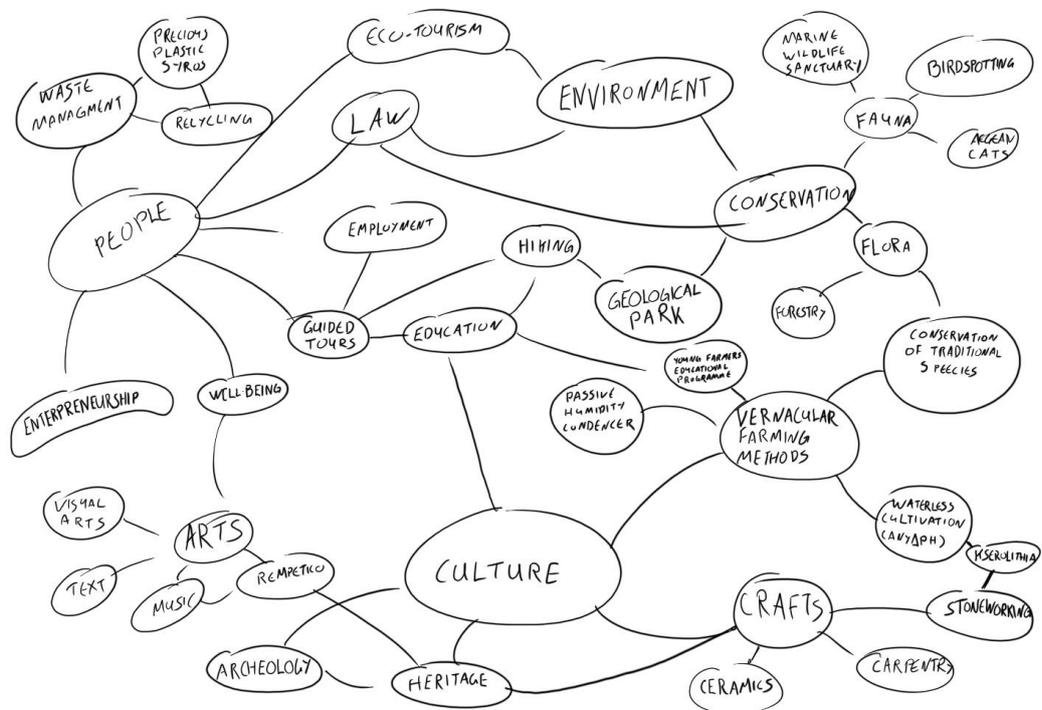


Figure 4. System map of the 'Apano Meria' social cooperative

The 'Apano Meria' social enterprise is a bottom-up initiative of the people of Syros who are interested in working to preserve the essence of place on the island. This creative community aims to act as a hub for existing or emerging active citizens' groups focused on different issues but brought together by an understanding of the need to preserve the character of the island for future generations. A place is made of tangible and intangible parts interconnected in an unending dance. The vernacular crafts and farming methods are deeply embedded in the local context and climate and are an integral part of this territory. In addition to conservation waste management is a modern problem that needs to be translated in a local context to be addressed on a local level. Finally the unique geological features of Syros create the setting for a specific, self aware visitor who requires an authentic experience when visiting a place.

In order to co-create the meta-community that 'Apano Meria' strives to become we adopted the Participatory Action Research framework for Social Innovation developed in Politecnico di Milano (Fassi *et al.*, 2013). In order to build on the idea of biomimicry we used Ivanova's (2014) bioinspired design tool to facilitate the concept development stages of the design process. Given the participatory and cyclical nature of the design process and the fact that the authors are embedded in the local context, it is impossible at this time to reach a finish line design-wise. As such formal evaluation of the project is nearly impossible, what has been adhered to has been the empirical conclusions drawn at the end of each iteration.

The three main thematic areas around which the activities take place in the context of 'Apano Meria' are People, Culture and Environment. The high connectivity between the issues and the cross-pollination between different focus groups increase the overall variety of the whole venture. Some notable attractors within the system are: The designation of the area of 'Apano Meria' as an Environmental and Geological Park, to protect all natural, architectural, geological and marine features, to maintain and restore human-built structures that form the living history of the area and the Cyclades in general, and finally to enable the area to become a centre for sustainable activities, such as walking and geological tourism, climbing, diving, fishing, ecotourism and the promotion of archaeological sites. The goal is the establishment of a geological park in the network of UNESCO Global Geoparks which are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development.

A different issue is associated with the conservation of traditional farming methods and varieties. This touches on environmental aspects (conservation of native species) as well as heritage management and environmental stewardship. The Cyclades region is a very arid

one and as such vernacular methods for cultivation with minimal water use were developed. In order to aid local farmers in transitioning towards such labour-intensive methods, a Passive Humidity Condenser was developed in collaboration with the local university. These types of interconnected relations increase the resilience of the systems and point to the leverage points for further increasing the diffuse design capacity.

All of these teams are in an open dialogue amongst themselves and the goal is to foster the evolution of the diffuse design capacity in a way that creates design redundancies throughout the system. Understanding the flows of information, juxtaposing people in different roles as well as increasing the overall diffuse design capacity of the participants in the social enterprise, form the first step in creating a resilient organisation. Identifying relevant biological models that create virtuous cycles and translating these into design strategies will increase variety, resilience and the contingencies relating different people and communities. Functional redundancy, or the presence of multiple components that can perform the same function, can provide insurance within a system by allowing some components to compensate for the loss or failure of others. Redundancy is even more valuable if the components providing it also react differently to change and disturbance. This response diversity (differences in the size or scale of the components performing a particular function) gives them different strengths and weaknesses, so that a particular disturbance is unlikely to present the same risk to all components at once.

Within a governance system, a variety of organisational forms such as government departments, NGOs and community groups can overlap in function and provide a diversity of responses, because organisations with different sizes, cultures, funding mechanisms and internal structures are likely to respond differently to economic and political changes. Diverse groups of actors with different roles are critical in the resilience of social-ecological systems, as they provide overlapping functions with different strengths. In a well-connected community, where functions overlap and redundancy is present, creativity and adaptability can flourish. In the next section the five lessons from the biological methods analysed are presented. Permaculture was central in the selection of biological metaphors but it was not the only factor. Social insects and hermit crabs were also used as inspiration for the extraction of design principles for the project.

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Figure 5. Bioinspired service design. Adapted from Ivanova 2014

A diversity of users and designers can also safeguard the sustainable use of a resource. The case study of the Mangroves forest, with its mutualism in ant-plant relations, underlines the significance of the collaboration between different species in the same ecosystem which benefits all the participants. It presents a mutual social-ecological interaction – the place can be the shelter for the society, where people can live and build homes, harvest crops, etc., but

the society can be the shelter for the place at the same time, by offering important 'nutrients' through social-ecological interactions. However, in a community of creative entities, the metaphor of mutualism can be related to people's exchange of knowledge and services which, at the same time, 'feed' the whole community with trust and multiple options for responding to change and dealing with uncertainty, thus helping to increase self-reliance. All these 'nutrients' contribute to the resilience of the creative community.

Self-reliance requires connectivity. Connectivity refers to the structure and strength with which resources, species or actors disperse, migrate or interact across patches, habitats or social domains in a social-ecological system. Consider, for example, the epiphytic plants connected in Bromeliads: Bromeliad is the system; the epiphytes are parts of the system. How they are linked together determines how easy it is for an organism to move from one module to another. In every system, connectivity refers to the nature and strength of the interactions between the various components. From a social network perspective, people are individual actors within a system embedded in a web of connections.

Connectivity can influence the resilience of ecosystem services in a range of ways. It may safeguard ecosystem services against a disturbance, either by facilitating recovery or by preventing a disturbance from spreading. The effect on recovery is demonstrated in riparian habitat. Closely situated plant communities with no physical barriers enhance recolonisation of species that may have been lost after disturbances such as floods. The basic mechanism is connection to areas that serve as refuges, which can accelerate the restoration of disturbed areas, thus ensuring the maintenance of functions needed to sustain the habitat and their associated ecosystem services.

Perhaps the most positive effect of epiphytic connectivity is that it can contribute to the maintenance of biodiversity. This is because among well-connected habitat modules local species extinctions may be compensated by the inflow of species from surrounding areas. Local resources form the fourth principle of how nature maintains its high levels of resilience. Looking at desert ecosystems, a process of 'local facilitation' among plants enables the usage of local resources, which enables the whole ecosystem to exist. As Manzini posits, "Within the next few years, we will have to learn to live (and to live better, in the case of most of the inhabitants of this planet) consuming fewer environmental resources. And we will have to do so by establishing new social undertakings at all levels" (2007). The groundwork for great systemic changes, for macro-transformations, is laid by micro-transformations, i.e. by the radical innovations introduced into local systems. Therefore, we can make complexity

and diversity work efficiently through localities which consist of networked people working together with high levels of self-reliance.

The fifth and last principle which arose during the creation of this idea generation tool is the necessity of feedback between the actors. In the study of social insects, we understand that most individuals would be trapped and probably die, without the feedback each one leaves through its pheromones. In discussing resilience we refer to fast and slow variables, whereby drivers (external to the system, or from higher scales) cause change in 'slow' (controlling) variables; as slow variables approach threshold levels, the fast-moving variables in the system fluctuate more in response to environmental and other shocks; and these shocks or directional change in the drivers can push the system across a threshold into an alternative stability regime. Therefore, feedback plays an essential role in complex systems.

## 6. CONCLUSIONS

The possibility of an exit during the post-design process in services is probably the greatest concern of any service designer today. The example of panarchy shows an unending process of creating and maintaining adaptive capability. However, what could happen if this diffuse design capacity of each creative entity could be translated into expertise through the biomimetic model for resilience? Unfortunately, usage of the principles of biomimetic creative communities is a process with a timeframe that makes it impossible for it to lead to concrete data. The very design process adopted in the context of the 'apano meria' social enterprise is similar to panarchy and as such no beginning or end exists, only adaptive cycles between the different phases.

However, combining the early research findings extracted over the last two years, we can assume that the model of biomimetic creative communities creates an optimistic scope for further research. Addressing the community one domain higher provides the opportunity to maximise the diffuse design capacity of the members. The main research proposition is that creating contingent design capacity in a specific territory through the evolution of diffuse design capacity can increase the resilience of a social innovation ecosystem. This means that the designers embedded in this process need to understand and move between the different organisational layers of the local society. Our mapping of the creative communities of Syros showed that these bottom-up initiatives are amorphous and change depending on trends, mitigations, emergencies etc. One important takeaway from this process has been that designing for the internal gratification of the goals of a creative community can be problematic. If the environment in which this creative community exists does not inform the

design process a high volume of wealth and connections is lost. It is those connections that increase the resilience of the system.

Staying with resilience and permaculture, they mark an interesting continuation of the drift of design from the personal to the collective. Co-design, participatory design, and open design are but milestones in the democratisation of design. This shift towards the emergence of a collective diffuse design capacity informed by the local context and global movements in the vein of 'cosmopolitan localism' has the capacity to act as a tool for conviviality which creates value offerings capable of accelerating the transition towards sustainable ways of life tailor-made for every geographical territory. In the context of degrowth such changes are necessary to avoid the collapse of the socio-natural ecosystem.

Although not evidently biomimetic, creative communities exhibit biomimetic elements. During the process of creating the bio-inspired idea generation tool we kept confirming that all the important characteristics of a social-ecological system for resilience thinking leading to a creative community exist in nature. We explored case studies from nature which prove that their resilience is based on these characteristics. Two main takeaways in relation to biomimicry have to do with the epistemology of design and ethics. Firstly, the holistic view associated with approaches that bring nature to the forefront of design exist within an alternative scientific paradigm; the scientific operationalism of modernity is incompatible with the variety of the sociotechnical and natural system. New approaches are needed to navigate these muddy waters and to deal with complexity. The second conclusion on the application of biomimicry in the context of service design is associated with ethics. Naturalistic ethics are natural and apply to living systems, but humans have, for better or worse, gone beyond this 'might is right' ethical worldview. Using natural systems with questionable ethical systems as inspiration provides a very interesting field of open dialogue and introspection on values and worldviews.

One final conclusion is associated with research through design and social innovation. When undertaking action research or some other embedded epistemic approach, the perspective can be skewed, as the biases of the practitioner coexist with those of the researcher. In addition, this embeddedness in the collective creates an imbalance in decision making. The direction in which a collective wants to move can be uninteresting to research and vice versa. Balancing the different perspectives and allowing the movement of a creative community is associated both with the idea of an exit strategy and with the necessary increase in the requisite variety of the system in order to increase its resilience.

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