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## Redesigning Systems Thinking

### Discussions on the Relation between Systemic Design and Aesthetics

#### **Abstract**

*The recent movement of Systemic Design seeks for new synergies between Design and Systems. While the usefulness of systems approaches in design has been fairly obvious, this paper argues that many core concepts in design are beneficial in systems thinking. This seems reasonable when it comes to the concept of Design Thinking. However, as this paper argues, the more practical core concepts of design are equally important. Designerly skills have been regarded as belonging mainly in the realm of traditional commercial design, whereas design thinking has been regarded as useful in strategic management settings. This paper argues against the idea of separating design thinking from design action. The skills and competences of design, such as the composition of the shape and form that are obvious in product design, are central to Systems Oriented Design (SOD). SOD is a version in the emerging pluralistic field of Systemic Design. The Systemic Design movement should recognise the core values of design and integrate them in systems thinking. This integration would contribute to innovation in both Systemic Design and systems thinking. Among the core competences of design discussed in the paper are composition, choreography, orchestration, the notion of the Gesamtkunstwerk and open-ended multi-scalar design strategies that allow for both structural and organic development. The paper provides examples to support its proposal for the use of concrete aesthetic principles to guide Systemic Design processes. This paper expands the working paper entitled “Holistic and dynamic concepts in design: What design brings to systems thinking”, which was presented at the RSD3 symposium (2014).*

*Keywords:* System Oriented Design, Systemic Design, Aesthetics, Designerly ways, Design Thinking, Systems Thinking.

#### **Introduction**

The intensive discussion on the formation of the pluralistic field of Systemic Design (B. Sevaldson, 2013a) has been successful in developing a middle ground between systems and design. The 2014 Relating Systems Thinking and Design Symposium (RSD3) demonstrated that the orientation was toward pragmatism and pluralistic practice rather than building and crystallising an academic discipline. In this phase, such crystallisation would be premature and would necessarily be based on existing theory rather than exploring the possibilities and developing new perspectives through a generative research by design.

According to Collopy, systems approaches to design have largely failed (2009). The main idea of the application of systems in design has been that design needs to learn from systems thinking. However, there seemed to be little need for the systems field to learn from the advanced applications of design. The systems approach has partly failed in design because of the attempt to apply several complex, prescriptive, and analytic theories in a field where generative, adaptive and dynamic design is practised.

The Systemic Design movement aims to counter the previous lack of success. Most voices in the emerging dialogue represent undogmatic, flexible, generous and innovative attitudes and approaches. The shared understanding is that real-life *problematiques*<sup>1</sup> drive the development of Systemic Design. If the models do not fit, or they are too cumbersome to operate, they need to be changed. Models and practices need to be adapted to real life, not vice versa. We therefore have seen many examples of pragmatic application of systems in design.

Examples are in the published proceedings of the RSD symposia (Jones, 2014; B. Sevaldson, 2013b; B. Sevaldson & Jones, 2014; B. Sevaldson & Ryan, 2014).

The Systemic Design Research Network was established in Oslo at the first Relating Systems Thinking and Design Conference in 2012. It was initiated by the author as an integrated part of teaching systems-oriented design (SOD) (B. Sevaldson, 2009) at the Oslo School of Architecture and Design (AHO). The notion of SOD was then used in the emerging field of the systems' renaissance in design. As the field slowly started to expand, it became clear that SOD had to include an increasing number of emerging approaches. The Systemic Design Research Network agreed that the generic name Systemic Design would be used to identify this growing pluralistic field. The term Systemic Design was used previously in different contexts. Amongst these are the Systemic Design group at the University of Torino and Nelson and Stolterman's use of the term in the 2001 edition of their book (2012). SOD could then develop further along its original path as a dialect or version of Systemic Design within a plurality of other dialects and versions (Figure 1). Today, SOD is the most designerly and practice-oriented version of Systemic Design.

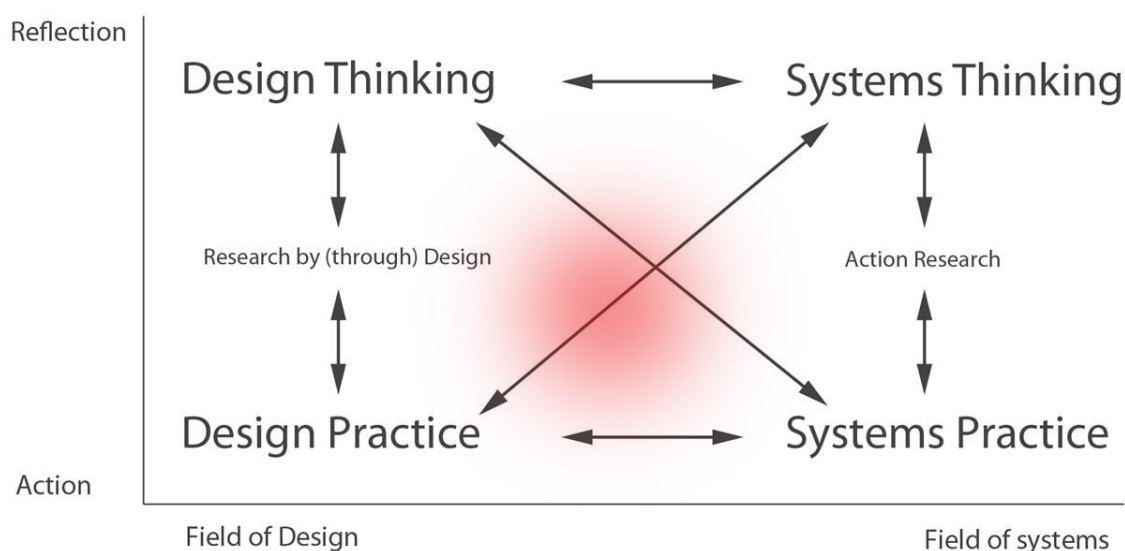


Figure 1: Field of possibilities in Systemic Design. Systems Oriented Design is located at the red dot near design practice (B. Sevaldson, 2013b).

Because of the increasing acceptance of SOD, we could address issues from that perspective and develop the contributions that design could offer systems approaches. SOD had already established its relation to visual thinking and to viewing systems thinking as a design process (B. Sevaldson, 2008, 2011; B. R. Sevaldson, 2013).

The notion of design is used in diverse ways. Indeed, it is tempting to agree with Herbert Simon that “Everyone designs who devise courses of action aimed at changing existing situations into preferred ones” (Simon, 1996).<sup>2</sup> However, the question remains: Is everybody who designs a Designer with a capital D (Kolko, 2007)? The actions of the Designer are based on abilities, skills and competences that can be learned especially for the act of designing. Perhaps most designers are not Designers. This type of thinking ignores the value of design as a practice and its potential for integrating those skills and reflections. I believe that these skills and competences are very useful in Systemic Design and that they could contribute to systems approaches in general. In this paper, I will elaborate this position.

### **Skills, competences and concepts in design**

Art and design are based on long-standing central concepts. Among those concepts are the creation of wholes, the generation of harmonic (or disharmonic) compositions and the synthesis of ideas (i.e. content). These elements have been known and developed for a long time, and they may be considered core concepts in art as well as design.

I propose that some of these core concepts should be central in the developing field of Systemic Design. Potentially, the skills and competences that are at the core of design are used in creating wholes. Although these wholes are sometimes self-referential, in the field of design, and more relevant to our discussion, they might be interrelated with an environment. In this case, designing holistically implies the inclusion and response to external parameters, thus blurring the distinctions between holistic design and Systemic Design. These practices in art and design are unique because they compose, create, plan and enliven system components, actors, choreographies and actions, combining them into holistic *gestalts*. While most other systemic approaches are predominantly descriptive (i.e. understand the system to inform action), SOD is predominantly generative and creative. Hence, in SOD, designs are created to provoke the system in order to imagine how it might react, thus learning about the system from that perspective. We also design and generate creative new states of the system and even entirely new systems. The creative provocation also implies that instead of trying to model true representations of a system, we design complex pictures (i.e. Gigamaps) of the systems, which further implies the blurring of descriptive and generative modes in the design process. The main role of systems-oriented design therefore is to shape design and compose artefacts within systems, as systems and in systemic contexts. The artefacts at stake are material or immaterial, objects or relations, items or processes and political contexts or social contexts.

This article refers to fields, disciplines and concepts in art and design, each of which deserves a deeper and more thorough discussion than is possible within the current frame. Each should be discussed in relation to systems-oriented design. The intention of this article is to raise issues and discuss briefly each relationship and interconnection in order to introduce the concept and to demonstrate the many possible relationships between SOD and the rich landscape of the surrounding world.

### **Current state**

Most previous attempts to integrate systems thinking in design were unsuccessful in becoming accepted in the mainstream profession and design education. Potential reasons for this failure are that systems approaches are alien to designerly ways or systems approaches are too inflexible and dogmatic. However, additional reasons might have been overlooked. I argue that in the field of design, a series of concepts of dealing with complex issues have emerged over a long period. Because some of these ideas and concepts are so basic and embedded in the designerly 'DNA' that they tend to be taken for granted, they were not considered in the context of systems design.

Moreover, there is a move away from design's roots in the arts and craft movement toward a scientific approach. Bruce Archer and others argued that design is a unique discipline with ties to science via technology and to the humanities via the arts (Archer, 1979; Nelson & Stolterman, 2012). This balanced view is now being challenged by educators and researchers who want to move design firmly in the direction of the sciences.<sup>3</sup> In this view, the traditional association with the arts is deemed invalid. Several external concepts and models of knowledge production are being discussed as relevant to design. Sociology, ethnography, statistics and even the natural sciences have been imported into design to increase its scientificity. In addition, interest in the scientific approach is evident in other practice-based fields, such as research in medical practice. For example, the concepts of evidence-based design and problem-based learning<sup>4</sup> have been used in design. Although these external approaches are valuable

contributions to the already extremely interdisciplinary field of design, they are problematic if they replace designerly ways and eradicate existing concepts and traditions from this field.

The move away from the root competencies in arts and crafts has unfortunate consequences. Moreover, this move is not necessary to become 'scientific'. On the contrary, design research should examine the resources in arts and craft and the related research in these fields in order to learn from them.

Unfortunately, the attempts to bring design closer to the sciences have led away from perceiving design as a third unique discipline by reintroducing a dichotomy between art and science. The contradictions between the arts and the sciences are constructed, and they are rooted in the long-standing dichotomy between them. However, this dichotomy at times has been overcome, as we will show in this article. In the design discourse, the arts are often dismissed as being intuitive, creative, based on metaphor and so on. Nevertheless, it could be argued that intuition, creativity and metaphor are all part of science. The dichotomy between art and science should not be taken for granted. There is no logic in the notion that the move away from art will make design more scientific. John Maeda expressed the following:

Art and science. To those who practice neither, they seem like polar opposites, one data-driven, the other driven by emotion. One dominated by technical introverts, the other by expressive eccentrics. For those of us involved in either field today (and many of us have a hand in both), we know that the similarities between how artists and scientists work far outweigh their stereotypical differences. Both are dedicated to asking the big questions placed before us: "What is true? Why does it matter? How can we move society forward?" Both search deeply, and often wanderingly, for these answers. We know that the scientist's laboratory and the artist's studio are two of the last places reserved for open-ended inquiry, for failure to be a welcome part of the process, for learning to occur by a continuous feedback loop between thinking and doing.

(Maeda, 2013)

It is discouraging that the dichotomy between art and design and science is referred to repeatedly. However, I will pay no heed to such references but look forward to see how concepts of art and design could be integrated in Systemic Design. In addition, I intend to show that the increasing need to apply holistic and inclusive perspectives to solve the complex problems of today implies overcoming this dichotomy.

However, first another issue should be addressed. In the wake of what I call the trend to dissolve design as a complete and unique discipline, design thinking has been detached from design and co-opted by business schools, being reduced to different tool sets, heuristics and methods that can be applied by non-designers. This detachment, gaps in understanding and simplification of design were well described by Jon Kolko (2007). This paper makes the case that when design thinking is detached from design practice, the most important parts of design are sacrificed. Both trends, the uncritical move toward the scientification of design and the uncritical detachment of design thinking from design is detrimental to the integrity of design as a unique discipline. Furthermore, it seriously threatens the potential role that design could play in dealing with the complex and systemic challenges of today.

This article argues for maintaining the perspective that design is a unique discipline and for reintroducing the integration of systems thinking and design. This argument does not imply the importation of an alien theory into design but the reinforcement of the inherent systemic nature of design.<sup>5</sup>

Systemic approaches were resisted when they were introduced to the fields of design not only because they did not fit but also because they had to compete with the already embedded and integrated approaches and concepts on which the core concepts of art and design are based. When systems thinking was previously introduced, the designer was implicitly asked to forget his or her training in the core skills and concepts of design and instead focus on systems

analysis. There was an exaggerated belief in the accuracy and efficiency of the modelling and simulation approaches. The terminology was alien, and the application of systems thinking in design was usually technical and theory oriented. It was presented textually rather than visually, and it was developed through good practice. A classic example is Christopher Alexander's (1964) early work on systems. Systems thinking was conceived as providing prescriptions for design in a mainly one-way relationship that subsumed designerly practice.

Subsequently, approaches emerged that were more relevant and more relational to design. The action-oriented approach of soft systems methodology emphasised interpretation, which was less alien to the designerly practice than the hard approaches were (Checkland, 2000). Other important contributions were Rittel's work (Protzen & Harris, 2010), Banathy's educational design (Banathy, 1997), systems architecture (Maier & Rechtin, 2000) and others. Despite their value, none of these approaches were demonstrated in a designerly way but were communicated textually and theoretically. A praxeology of Systemic Design was still missing.

The prescriptive nature of the early systems approaches did not suit design. However, the dogmatic positions and the contradictions between different systems was theoretically overcome through critical systems thinking (Flood & Ulrich, 1990; Jackson, 1990; Midgley, 2000; Ulrich, 1983). Critical systems thinking offers an approach to systems theory that is better suited to the many facets of design. The recent emergence of Systemic Design has been built on these modern and 'soft' perspectives of systems. (This picture is not complete and other references have been influential, such as Maturana, Warfield, Christakis, Churchman and others.) Despite the development of systems toward forms that are much more relevant to design, a breakthrough has not yet happened. The reason might be a missing link, that is, a true amalgamation of systems thinking and design based on the designerly practices of visualisation and visual thinking.

The growing pressure on the design field caused by globalisation and the need for sustainability has changed the design profession in recent decades. Designers need to find ways of becoming capable of meeting these challenges. We suggest that a particularly promising way forward is to reinvestigate the relationship between design and systems thinking. However, this time, we might approach it on an equal basis. Design needs to change, but at the same time, design has some central answers to the difficult questions and challenges that confronted designers today. The implication is that systems thinking and practice also need to change.

The radical potential of Systemic Design is that it might be used to rethink the relation between systems thinking and design. If such rethinking is done properly and thoroughly, the fixed relation between systems thinking and design might be destabilised, and we will start to look for new answers in the amalgamation of the two fields. Creating new ways of relating design and systems thinking does not mean that we as designers should become conversant with systems theories. Perhaps the worst thing a young designer can do is to start by reading about particular systems orthodoxies and specific systems models. In SOD's educational approach to research projects, we intend to start by teaching Systemic Design very early in the process, although many facts about the nature of the systems are still unknown. This approach might be problematic for many cyberneticists or systems analysts, but this paper argues that designing is inherently a systemic way of approaching complexity and that it seamlessly bridges description and synthesis. Understanding the systemic nature of design<sup>6</sup> is important because it serves to avoid repeating previous mistakes. As Systemic Designers, we first need to re-understand the heritage and potential of the design field, which are its core concepts. I propose that these designerly approaches to dealing with complexity and creating holistic solutions are the core of what design brings to systems thinking.

### **Making designerly approaches explicit**

Although design inherently deals with complexity, and at its best demonstrates the ability to solve very complex and systemic problematiques, these crafts and skills have rarely been made explicit. Nonetheless, the long-term relation between systems and design is very promising, and it constitutes a theoretical starting point and a basis for Systemic Design. People such as Alexander, Banathy, Rittel and Ackoff (Ackoff & Sheldon, 2003; Alexander, 1964; Banathy, 1997; Rittel & Webber, 1973) were closely tied to design and designing. Nonetheless, their contributions were expressed as texts, and there was little demonstration of a systemic practice in design. Although they emphasised skills and mind-sets, they failed to demonstrate how to, in a designerly way, internalise these aspects and make explicit Systemic Design skills. They tended to ignore the ‘old’ design skills and competences, among which are the concepts of composition, orchestration, choreography and the ideas of Gestalt<sup>7</sup> and *Gesamtkunstwerk*. The term ‘form-giving’<sup>8</sup> expresses this central aspect of design.

Because form-giving is both an aesthetic and a synthetic activity, it is important in systemic design. Therefore, including aesthetics in the context of systems thinking is important. In remainder of this article, I will discuss aesthetic concepts with particular reference to their importance in Systemic Design. I will start by describing the basic concept of harmony and then move to higher-level concepts of Gestalt, composition and orchestration, before concluding by discussing the notion of *Gesamtkunstwerk* or the total work of art.

### **Holistic designs and the issue of harmony**

One of the central competencies of the designer is the ability to create harmonic wholes. Although design can be intentionally disharmonic, the notion of balance and harmony underlies all design. Confronted by many demands, briefs, parameters and complexities, the designer aims at generating a single holistic response that solves, negotiates or balances some or many of the contradictory inputs in the shape of a more or less aesthetically satisfactory form (i.e. form-giving). The notion of harmony and balance (or disharmony and unbalance) is not assumed but constantly challenged. Harmony is a parameter rather than a goal. There are many ways of composing a whole, the less harmonic of which include solutions that are more complex than others are. Furthermore, the notion of harmony is not necessarily congruent with the notion of the whole; nonetheless, it is a way of expressing an ideal holistic solution.

The notion of harmony (and disharmony) is relevant in discussions between systems and aesthetics. Harmony is an expression of spatial relations between two sides, the foreground and the background or the arrangement of elements. Harmony includes many issues about relationships, which will be discussed in detail in the section on composition. Hence, it could be said that the issue of harmony is inherently systemic and represents the ‘hidden’ link between aesthetics and systems.

### **Gestalt**

Another ‘hidden’ relation between design and systems emerges in the examination of Gestalt theory. It is no wonder that Gestalt psychology has long held a very strong position in the visual arts and design. It is the psychological theory that resonates the most deeply for designers. For example, Rudolf Arnheim connected Gestalt psychology directly to creativity and challenged the distinction between perception and cognition (Arnheim, 1974). Members of the Bauhaus were in close contact with the early Gestalt psychologists and many adopted their theories (Behrens, 1998). Moreover, there are many links between Gestalt psychology and the systems world. Although Gestalt psychology is not directly related to systems thinking, and it is usually not considered part of the systems world, it is closely related to systems thinking. For example, Kurt Lewin is both a Gestalt theorist and a systems thinker (Ramage & Shipp, 2009).

The assertion, “The whole is more (greater) than the sum of its parts”, which is attributed to Aristotle, is often used to describe systems thinking. However, this concept is the central thesis of Gestalt psychology but in a slightly different version: “The whole is other than the sum of its parts”<sup>9</sup> (Figure 2).

Kurt Koffka was precise in stating that the whole was not more than, but different from the sum of its parts. Furthermore, this difference is not quantitative but qualitative, in which the whole changes character compared to the sum of its parts. This statement, which is central to Gestalt psychology, has been expanded to systems thinking. However, in that field, it reverts to “the whole is more than the sum of its parts”, and it is most often discussed in connection with and reference to emergence and synergy. Unfortunately, when this observation was migrated to the systems world, it lost its significance.

In investigating the relations between systems thinking and design, Gestalt psychology provides several avenues for connecting and cross-referencing. In the present discussion, it is useful to return to the original version of the statement as it is used in Gestalt psychology, particularly with regard to qualitative issues. The word Gestalt refers to sensing as an active process in which missing parts are added to create perceived wholes. Therefore, perception is an active composition process.

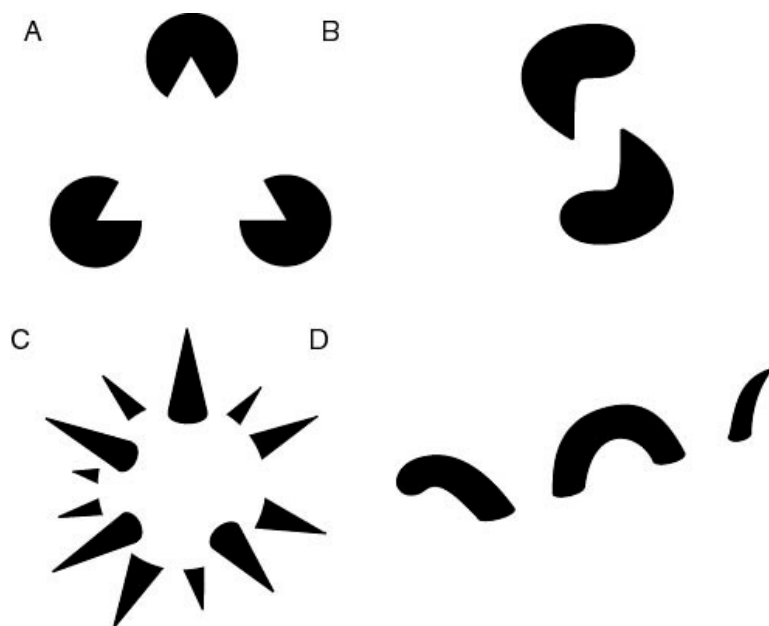


Figure 2: The images demonstrate that perception creates wholes from patterns that actually do not provide any real information about the whole that we perceive. (Wikimedia commons.)

The idea of the whole is central in Gestalt psychology. Regarding perception, it does not make sense to look at singular fragments of perception. Instead, perception is a holistic and actively creative process. Indeed, the purpose and functionality of perception are to generate wholes.

In 1890, Christian von Ehrenfels explained, “A melody is composed of singular notes. The same notes can form many different melodies. But if you do a transition of the melody to another key, the notes would be different but the melody is the same”. The melody generates a recognisable whole across all possible versions of intonations, tonality and interpretations.

Regarding our main discussion on relating systems thinking and design, this concept presents a possibility that is radically different from the abstract, hard and quantitative systems models and analyses that have predominated systems thinking. Even in soft systems, qualitative



approaches, such as soft systems methodology, the perceptions and analyses remain abstract. The objectives of all systems modelling are to understand the interplay between many components and to generate a holistic understanding of myriads of fragments. It is possible to learn the increased capacity to control large numbers of entities and their relations, which was demonstrated through Gigamapping and the rich design space (B. Sevaldson, 2008, 2011). The process of designing plays a central role in the active internalisation of large amounts of data. However, another perspective emerged in the development of extensive gigamaps. This perspective does not require the understanding of every single component or myriads of interactions, but it addresses the creation of the Gestalt of the system. The complexity of a Gigamap might be beyond our ability to maintain an overview of all details. However, it can play the role of a Gestalt by indicating the main structures, layers, diversity and connections rather than fractional information (Figure 3). In this case, the entities are de-emphasised and the pattern of relations is emphasised. Another issue is that the creators of the map will gain much greater insight and more detailed knowledge than a random viewer will. In creating the map, insights and knowledge are developed through the processes of visual thinking.

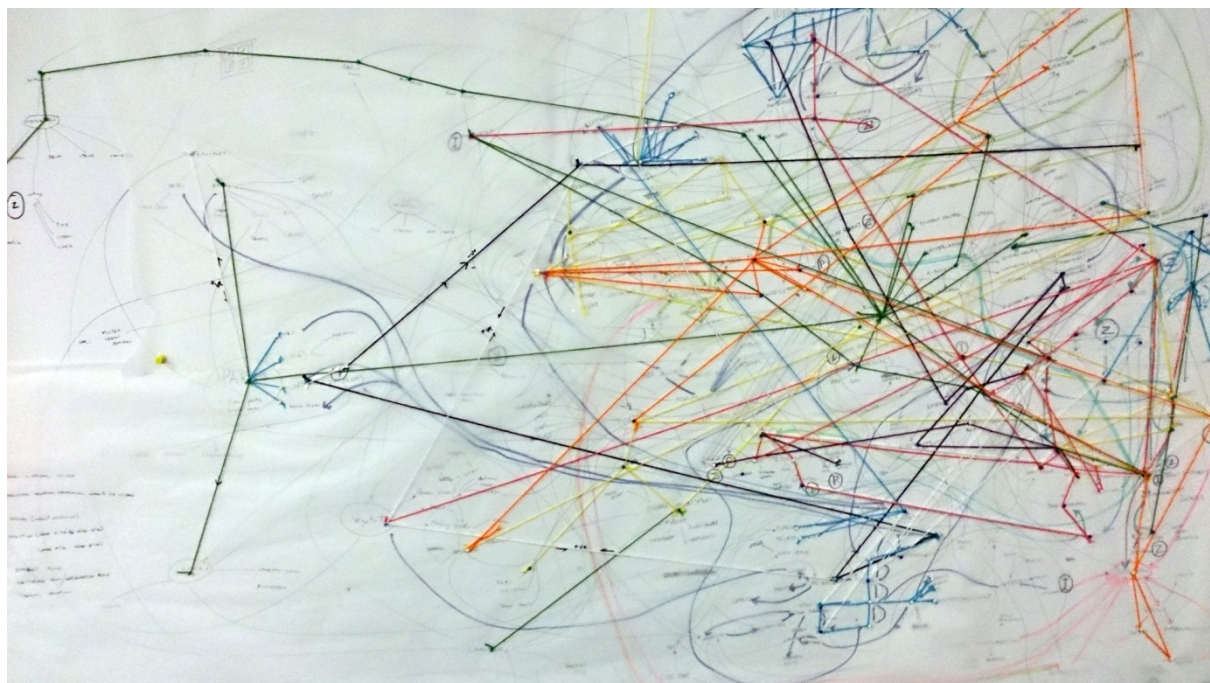


Figure 3: Gigamap with a focus on layers of information and emphasis of relations. The value of such maps is not that they are resolved and logic in all aspects, but that they provide a sense of the system and create its Gestalt. Source: Chalmers School of Architecture (2015). (Photo: Birger Sevaldson.)

Gigamapping shows the limits of the numbers of elements, variables and parameters that could be handled in the design process. In this process, we should go far beyond such limits to filter out the necessary components, features, relations and variables in an informed manner. We manage by zooming in and out constantly and by cross-scalar thinking. However, the overall 'feel' of the system is usually the most valuable result of Gigamapping, that is, the Gestalt of the system.

Zwicky (1969) argued that morphology, the study of shapes of material structures, should include the study of abstract structural interrelations, concepts, ideas and phenomena. Tom Ritchey (1998 p.3) described it as follows:



The first to use the term morphology as an explicitly defined scientific method was J. W. von Goethe (1749–1832), especially in his "comparative morphology" in botany. Today, morphology is associated with a number of scientific disciplines in which formal structure, and not primarily quantity, is a central issue. In linguistics, it is the study of word formation; in biology, it deals with the form and structure of organisms; in geology, it concerns the characteristics, configuration and evolution of rocks and landforms.

Richey added the following:

The term morphology comes from classical Greek (*morphe*) and means the study of **shape** or **form**. It is concerned with the structure and arrangement of parts of an object, and how these conform (i.e. fit together) to create a whole or Gestalt. The "objects" in question can be physical (e.g. an organism or an ecology), social (e.g. an organisation or social system) or mental (e.g. linguistic forms, concepts or systems of ideas).

Zwicky suggested a method for modelling unquantifiable structures, which was called morphological analyses (MA). This method is used to solve the problem of mapping the possible structural relationships between several items. The strength of MA is that it systematically maps every possible relation between the parameters defined in a multi-axial matrix space. However, MA can only handle a limited number of parameters. Zwicky (1969) was aware of this shortcoming: "[W]ithin the final and true world image everything is related to everything, and nothing can be discarded a priori as being unimportant."

From this perspective, Gigamapping is related to a morphological approach but it is generative and designerly rather than analytical (compared to MA). Although starting points are shared, the methods differ. MA is more systematic and rigorous but its capacity is limited even with computer support. Gigamapping is more inclusive, but it is dependent on interpretation.

The transition from descriptions of myriads of objects and relations to creating a shape or Gestalt of the system comprises a shift from the descriptive to the generative. Sensing is generative. When sensing becomes central in the interpretation of complex systems, thinking and designing are integrated. As previously mentioned, Rudolf Arnheim (1969) provided a platform for this transition through his theories on visual thinking. His central argument is that there is no real divide between perception and thought.

This brief description of the relations between systems, aesthetics, visual thinking and design, provides a point of departure for considering specific concepts of art and design in relation to systems practice. Chief among these concepts are composition and *Gesamtkunstwerk*. Because both topics are considerable, this working paper discusses them only briefly. However, we will clarify that these concepts are central to SOD, in which design practice is the main way of learning, understanding, analysing, provoking, generating and synthesising systems.

## Composition

In art, composition is both the goal and the means, and it creates its own logic (*l'art pour art*).<sup>10</sup> In its purest form, composition consists of spatial organisation in painting and sculpture. Composition is concerned with the arrangement of components in space according to notions of balance and imbalance, connectedness and separation, and the unity (harmonious or disharmonious) of the composition. Musical composition (and dynamic media such as film) is also concerned with addressing temporal issues, rhythms, tonalities, dynamics and so on.

In design, all these aspects of composition may be involved. Similar to painting and music, in product design and service design, temporal issues are important. Interaction design and service design combine these aspects. However, in contrast to the arts, in design,

composition is influenced by complex information. In design, composition can be seen as a particular activity leading to the synthesis of shape, not only guided by basic principles but also informed by numerous inputs, requirements, material conditions, and many other parameters such as ergonomics, functionality, pleasure, experience, ethics, cultural contexts, sustainability, technology, trends, markets, politics, social systems and so on. At best, all these issues are incorporated in design solutions in a way that synthesises the whole. This wholeness is also called compositional assembly. The notion of the compositional assembly is described by Nelson and Stolterman (2012, p. 159): “A compositional assembly is not merely patterns of parts: it is an assembled whole that displays emergent qualities that transcend the quality of the elements in isolation or summation”. This definition points toward both Gestalt and systems thinking. The compositional assembly gives a design its sense of integrity (p. 160), which involves issues of symmetry and asymmetry and balance and tension.

A perfect balance can be regarded as a stable or an ideal condition that is preferable. In contrast, the compositional aspects of tension and asymmetry are as important and perhaps as interesting as balance. They express change and dynamism. The tension can be in the form, such as the organisation of a floor plan, or in the system’s composition. Gigamaps often reveal imbalances in the conception or organisation of systems. Imbalances and tensions should be regarded as potential inducers and indicators of change.

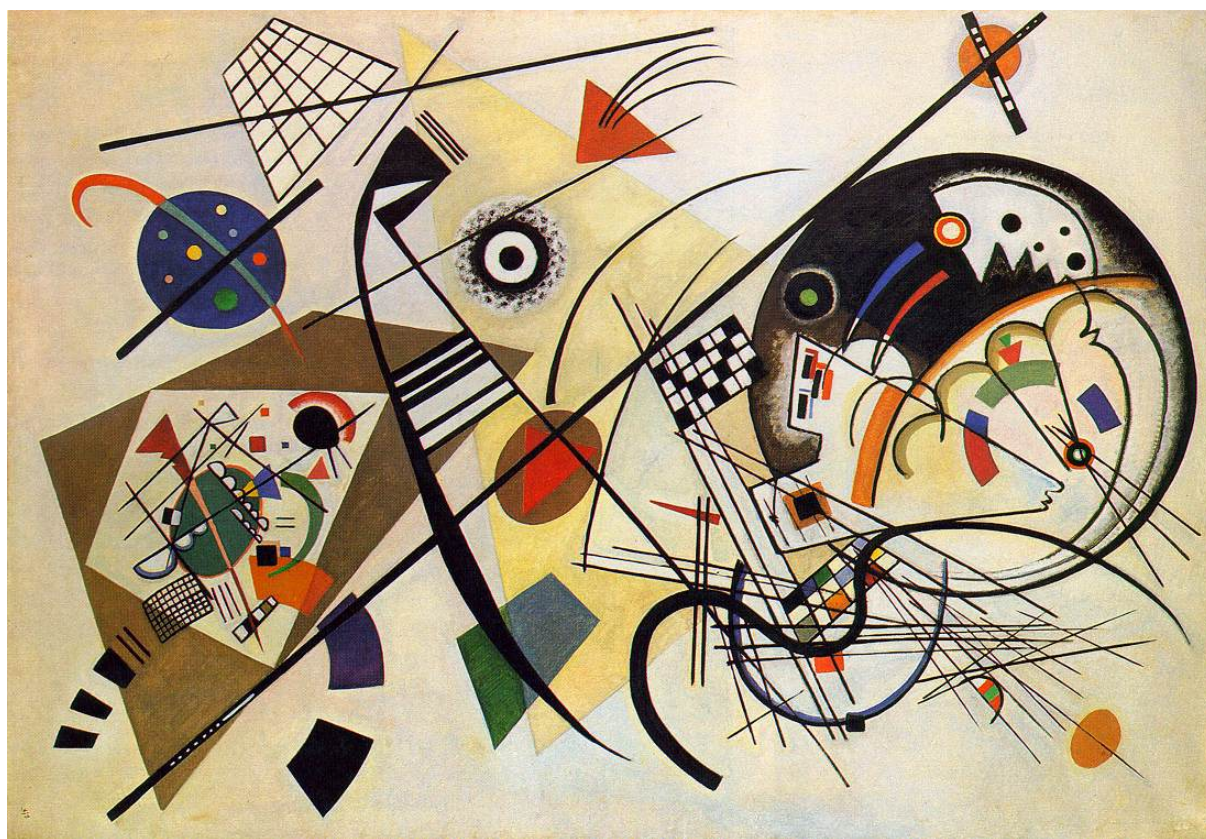


Figure 4: *Transverse Line* by Wassily Kandinsky, 1923 (Public domain).

In the visual arts, composition is defined as the arrangement and placement of visual components in space. In other fields, compositionality and composition systems are similar to those in the visual arts. Their relation to systems thinking is obvious.<sup>11</sup> The following example is from applied mathematics:

Compositionality refers to the evident ability of humans to represent entities as hierarchies of part, with these parts themselves being meaningful entities, and being reusable in a near-infinite assortment of meaningful combinations. Compositionality is generally considered to be fundamental to language (ref to Chomsky), but many believe, as do we, that it is fundamental to all cognition. Objects and scenes, for example, decompose naturally into a hierarchy of meaningful and generic parts. Furthermore, compositions help us to identify parts unambiguously: It is often the case that components can not be correctly interpreted in the absence of the contextual constraints imposed by their incorporation into a larger whole, i.e. a composition. Indeed, such compositions are sometimes called “higher-level” constraints.

(Geman, Potter, & Chi, 2002).

In modern art, there are many examples of expanded composition in which the principles of balance and imbalance, harmony and disharmony are challenged. For example, the work by Kandinsky shown in Figure 4 demonstrates that seemingly unrelated and fragmented elements shape a whole that emerges only in the presence of the components. There are many layers and relations of balance and imbalance across different forms of expression. In Kandinsky's *Transverse Line*, the different elements are balanced. Colour intensities are balanced by the degree of articulation of geometrical shapes, which is the case of the two biggest figures, the round to the right and the edge to the left. Balance is achieved by means of values as well as geometrical shapes, lines, networks, figures and organic forms. Different categories of elements are related to each other through proximity and location in relation to the higher-level constraints, such as the image plane.

Kandinsky also plays with the issues of fields and boundaries, which is shown by the yellow triangle in the background and the careful colouring of the backdrop. The spatial depth is created through overlapping, where lines sometimes configure overlaid boundaries or change the boundaries of objects in the background. The result is an almost un-definable composition of tensions, harmonies and holistic resolution.<sup>12</sup>

### **Gesamtkunstwerk**

Composition leads to higher-level holistic responses to environmental constraints. There exist concepts for such holistic evolutions of complex designs. The most comprehensive concept is that of *Gesamtkunstwerk*.<sup>13</sup> This German term is used in aesthetics and is often translated as the total work of art, ideal work of art, universal artwork, synthesis of the arts, comprehensive artwork and all-embracing art form. The *Gesamtkunstwerk* is a work of art that uses and combines all or many art forms.

In this paper, it is not possible to give justice to this theme because of the extensive discourse and criticism about it. Moreover, the intention of this paper is not to contribute to this discourse but to suggest the usefulness of the concept in the current emergent practice of Systemic Design. Therefore, the theme is treated rather superficially and pragmatically in the present context. However, it might contribute to the renewed discussion of the concepts pertaining to Systemic Design.

The term *Gesamtkunstwerk* is often associated with the German composer Richard Wagner, who sought to unify all works of art in the theatre.<sup>14</sup> Wagner's *Gesamtkunstwerk* combined musical composition and orchestration, spatial composition, theatrical orchestration and choreography into one holistic performance. Wagner presented the idea of *Gesamtkunstwerk* as literally boxed in on the stage, presented to a passive audience, and viewed from the outside. We can recognise the concept of the whole work of art in the movements around the shift of the 19th and 20th century, the Arts and Craft movement, Art Deco, Art Nouveau and the Bauhaus School. In post-war Europe, the term was no longer used because it was associated with fascism and an anti-modern approach to art. Koss (2009)



attempted to recover the original concept of *Gesamtkunstwerk* by detaching it from fascism and emphasising its relation to modernity, its notions of interdisciplinarity and holistic composition, as well as its relevance to audience engagement, co-creation and participation. This conception of the term is fundamental for its use in systemic design.

However, the concept of holistic works of art or the idea of the total work of art can be traced to architects in the Renaissance, who did not see a divisions among their various tasks in structural engineering, interior and exterior design and landscape design, as well as gardening, sculpting, decoration, ornamentation and painting (Figure 5).<sup>15</sup>



Figure 5: The Ceiling of the Sistine Chapel by Michelangelo, (1483). Painting, decoration and architectural space were seen as integrated. (Photo: Jean-Christophe Benoist, GNU Free Document Licence.)

If we look beyond the formal unity of building and art to the functions, programs of use and perhaps political intentions, there are many historic examples. For example, the monasteries of Europe are multifunctional complexes with societal and religious functions. In addition to being cultural hubs, they represent economic and political power. However, in the present article, it might be more interesting to consider two examples that were designed specifically for such multi-functionality rather than being organically developed over centuries. The two examples are contemporary buildings in two opposing empires. The two examples have similar functions but clear differences. The first example is Real Sitio de San Lorenzo de El Escorial (El Escorial) which was built on behalf of Filip II from 1559 to 1584 (Figure 6). The second example is the Süleymaniye Camii (Suleyman Mosque) in Istanbul (Figure 7).



El Escorial was designed to function as a royal palace, government functions, monastery, library, school, and cathedral. The combination of political and religious functions is a political statement about the unity of the reigning monarch and the Roman Catholic Church of Spain. Therefore, the design is not only a purely functional organisation but also a symbolic and political expression. El Escorial is a powerful statement about the Counter Reformation and an expression of the melancholic aspect of Spain. As a whole work of art, it is literally final and enclosed by a clearly defined outer wall that is marked by four corner towers. As *Gesamtkunstwerk* it is also a statement of static un-changeability. It is almost unthinkable to add or subtract from it or to consider that certain functions would be added at the cost of others. It could be argued that the composition reflects the conservatism of the Counter Reformation.



Figure 6: San Lorenzo de El Escorial. Architect Juan Bautista de Toledo. Work was started in 1559. (Monasterio Escorial, Wikimedia Commons.)

More interesting is the development of building types in compositional assemblages that are interlinked with society in religious, symbolic and functional ways. Such examples are found in the Islamic architecture of the Ottoman Empire.

The building complexes that surround most imperial mosques in Istanbul are called Külliye. The term is derived from the Arabic word *kull*, which means the whole. The Külliye constitutes a holistic complex, a multi-layered cultural societal organisation and a political contract between the empire and the people. Typically, the Külliye is a multi-purpose, public service building that contains a library, a soup kitchen for the poor, a birth hospital, a school and so on. Compared with the former example, the design of imperial mosques and their Külliye demonstrates a more complex message. The mosques are final and enclosed compositions; it is hard to imagine that any element could be added or subtracted. In contrast, their Külliye are designed according to an open-ended and flexible scheme, with room to adjust for future



changes and needs. The Külliye are designed according to a main scheme with an enclosed courtyard, but they vary greatly in size and composition in order to adapt to different programs of activities. The examples of El Escorial and the Süleymaniye Mosque demonstrate a concept of *Gesamtkunstwerk* that is politically connected to society and its multiple practical and symbolic functions and layers of meaning.

The concept of *Gesamtkunstwerk* was further developed through Art Nouveau (approx.1890 to 1910). In this movement, important names were Josef Hoffmann and Otto Wagner, Victor Horta and Paul Hankar, Charles Rennie Mackintosh, Antoni Gaudí, Eliel Saarinen and Henry van de Velde. However, in that period, the concept of *Gesamtkunstwerk* was limited compared with older holistic designs.



Figure 7: Süleymaniye Mosque 1558. Architect: Mimar Sinan. (Photo retrieved from [www.egitimkutuphanesi.com](http://www.egitimkutuphanesi.com).)

In the Bauhaus, a complete vision returned and the notion of the *Gesamtkunstwerk* became overtly practised.<sup>16</sup> The Bauhaus created a new type of interdisciplinarity in the *Gesamtkunstwerk*, which was more extensive than the interdisciplinarity of today. It consisted of a natural and necessary interdependence rather than the result of a planned collaboration. However, in some cases, the achievement of a formal holistic design became akin to a strait jacket (Figure 8). A resolved harmonic and holistic composition is necessarily static. It is a closed work of art because it is complete and resolved. Altering it would only result in the breakdown of the composition. In contrast, designs that grow organically over time, (e.g. the interiors of private homes that have been lovingly developed over long periods) tend to accumulate richness, which results in compositional and systemic robustness. In such cases, the



collection of items in a context creates in-between relations that tell rich and complex stories. The lack of fixed and resolved compositional unity creates potentially open-ended and rich spaces. Elements can be added and subtracted without causing the breakdown of the composition or system.



Figure 8: National Bank of Norway (1986). An example of holistic design degenerated to formalism. The same profile, most notably in the horizontal section of the corner of the building, is repeated at different scales throughout the building. Architects: Lund & Slaatto A/S. (Photo: Wikimedia Commons.)

### The city scale

An open framework of structural and material guidelines can add to the openness of the compositional system. This is an argument for a less strictly framed conception of *Gesamtkunstwerk*, which is not based on a perfect interrelation but on a dynamic and open-ended structure. An example is found in the village of Oia on the north end of the island of Santorini (Figure 9). Traditional buildings were predominantly white cement structures in a geometrically rich and free application that was influenced by the buildings inner rooms, which were organically carved from the pumice rock. The restriction of colour and material allowed for a very large degree of freedom in spatial form. Since a devastating earthquake in 1956, over the last 60 years, the village has been reconstructed and largely converted to a cultural heritage

and tourist destination. The (re)-construction is ongoing. The strict schema seamlessly integrated the new buildings with the old renovated buildings. The geometries support a very flexible and open-ended system with a great degree of freedom.



Figure 9: Oia, Santorini (Photo: Wikimedia Commons, Simm).

### Scaling up to regional scale

Another example is the artist and architect César Manrique's<sup>17</sup> role in the creation of the building regulations in Lanzarote (Figure 10, 11 and 12). This role could also be seen as a modern holistic and systemic intervention and the creation of a *Gesamtkunstwerk* on a mega scale. It is as equally open-ended as Oia is but its huge scale has helped to avoid the destructive consequences of mass tourism, thus preserving local identity and pride as well as providing sustainable development (Gordillo, 2015).

Central in the development of Lanzarote is the Plan Insular de Ordenación del Territorio (PIOT), which comprises the general building plan and regulations for the island. The PIOT regulates building height, materials and colour schemes. These seemingly simple regulations have had a major systemic impact on the local society. Manrique was aware of these effects, and he and his fellows avoided the negative consequences of mass tourism, which have drastically affected neighbouring islands and mainland Spain. These include the destruction of local identity, unsustainable development, dispersion of local government and control, economic derailing and drained resources. Manrique was crucial in the development of the tourist industry in Lanzarote. His concerns were multiple and in some ways contradictory. However, he was able to balance these contradictions and to turn the need for development of the tourist industry into a tool for strengthening the local identity. His approach not only framed and tamed the development of tourism but also helped it to thrive.





Figure 10: César Manrique's architecture refers to local tradition as well as creative expression, reflecting the dramatic volcanic landscape of Lanzarote (Casa-museo del Campesino). (Photo: Birger Sevaldson.)

The example of Manrique's design demonstrates that regional development can be balanced, systemic and framed by an overarching concept that has different modes and levels of operation according to functions and building types. A relatively simple design scheme was applied in the housing and tourist developments, and innovative architectural schemes were developed for the well-known attractions. Though Manrique was not an outspoken Systemic Designer, his work was systemic. Despite the weaknesses in his work, such as his lack of involvement with other artists and architects, he gained a predominant role. Manrique's *Gesamtkunstwerk* serves as a good demonstration that systems design can operate on a regional level if it is allowed to have decisive influence.

Manrique managed to merge the vernacular and historic with the modern. Manrique was concerned about originality, and he did not want to copy any ideal but instead refined the local (Pezzi, 2013). Local identity was (re-)constructed in the design and development of several tourist attractions. Manrique managed to bridge the contradiction between local culture and identity and the need for economic development through mass tourism. The tourist attractions crystallised the identity of the island. These attractions, including his own home, which now is open for visitors, changed the conception of the beauty of the landscape of Lanzarote. These projects also helped to exemplify the creative possibilities that were inherent in the strict framing of the building palette.

Manrique's work is truly unique and few examples are comparable. His work is local and international, concrete and symbolic, detailed and systemic, economic and sustainable. His influence on the development of Lanzarote cannot be overestimated, and it should be an example of complex holistic design that transverses scale and includes aesthetics, history, identity, social design, economic development, branding, experience and so on. His work is an example of a 'macro *Gesamtkunstwerk*'. Without the designerly approach, the visualisation, demonstration and social engagement would not have happened.



Figure 11: Contemporary tourist developments on Lanzarote. The building heights are restricted to two storeys. Materials and colours in the pathways, divisions, and gardens were inspired and regulated by the PIOT and César Manrique. (Photo: Birger Sevaldson.)



Figure 12: César Manrique produced many unique buildings and sculptures on Lanzarote, but most importantly, he was the architect behind Lanzarote's unique building regulations, that preserved the island and avoided the destructive tourism architecture. The picture shows an example of Manrique's characteristic modernist architecture and art that works well together with the vernacular building style of Lanzarote. (Photo: Gernot Keller, Creative Commons.)

Maria Giulia Pezzi conducted a comprehensive analysis of Manrique's work in Lanzarote with particular regard to the tourist industry and its effects (Pezzi, 2013). She also has contributed critical discussions of Manrique's work. In particular, Pezzi observed that the PIOT prevented 'natural' development, that the architecture of Lanzarote is superficial and that it has turned the island into a 'theme park'. This criticism has been echoed by architects whose degree of freedom is restrained. However, this argument is inadequate, and it should be disregarded. There is no such thing as a natural development because all human developments are designed.

Some are developed freely and organically, and others are restrained. Some are built according to strict masterplans that result in major problems when they must perform as a frame for organic city life. Others are built without many regulations, which leaves the cityscape open for ruthless exploitation and speculation. However, they are all the result of strategic and detailed design choices, whether planned or emergent. Some designs have brutally destroyed many locations in the service of untamed mass tourism. It is not a question of honesty. There is nothing honest about the development of untamed mass tourism, which is often seen as the driver of accumulating corruption and crime. However, in the case of Lanzarote, such criticism is absurd compared to the 'natural' developments that have resulted in the mass tourism on nearby Grand Canaria. In addition, it could be claimed that the contemporary architecture of Lanzarote has been allowed to develop organically and gently within the guiding framework, thus avoiding brutally disruptive developments that have unintended and irresponsible systemic impacts. Instead, PIOT represents a type of generic plan that allows for organic development.

### **Generalisation**

Although the examples discussed in this article are architectural, they provide information about the development of Systemic Design practice in different fields of design. Perhaps an aesthetics of Systemic Design is better demonstrated by examples from architecture than by examples from other design fields. In addition, the arguments were supported by examples that the reader would find easy to understand. Also, the objects of architecture operate in a relatively stable context; they are fixed in space, which increases the accessibility of the context.

However, it should be possible to expand the present discussion to include all forms of design. Some of the issues are implicit, such as in interaction design where patterns of aesthetic conventions emerged after the years of experimentation had passed. This self-imposed framing worked similar to the geometric and material framings of Oia and Lanzarote providing a degree of freedom and recognisability. For the user it is easier to learn new apps when things are following certain conventions. This comes at a cost. It is easier to convince people of the utility of a new version of software than it is to persuade them to accept a new aesthetic sensibility in the maze of current interactions and service designs. These conventions are far too incidental and in some cases, they are based on orthodoxies rather than conscious strategies. A systems approach to these issues and an aesthetics of Systemic Design could be useful in designing new interfaces, helping users to regain control of and insights into increasingly entangled and dynamically developing services.

### **Conclusions**

Design is changing and diverging into different strands. Some parts of design will continue to produce products and services according to clients' briefs by following the rules of commercial design. However, even this aspect of design should change by becoming more responsible and developing a richly diversified aesthetics that reflects contexts and cultures. However, design has a much larger potential, and it involves all kinds of societal, strategic and political change, innovation and form-giving. Designerly skills have been regarded as belonging in the realm of traditional commercial design, and design thinking has been regarded as useful in strategic management settings. However, attempts to detach the strategic embodied thinking implicit in design and extend it in a simplified manner to strategic management in the form of design thinking have caused the degradation of design. A similar effect has been produced by current attempts to make design more scientific than it has been. These forces threaten the concept of design as a unique discipline. The result of dissolving the unique discipline of design will be the reduction of its potential to contribute to solving systemic problems.

Systemic Design processes are required to meet the enormous challenges of today and in the future. Design thinking and design practice need to integrate systems thinking and



systems practice. It is unknown whether the Systemic Design movement will be able to achieve an integration that results in innovation, whether it will fail to achieve true integration and simply add different perspectives, or whether it will result in a scientific version of design. The consequences of these possibilities could be that Systemic Design would not include the designerly approach. Systems-oriented design is a dialect within Systemic Design, especially concerned with the true integration, refinement and enhancement of the inherent systemic nature of design.

I have argued that many traditional designerly concepts, such as composition, Gestalt and *Gesamtkunstwerk* are central in the integration of design and systems practice. These are the core competences that design can bring to systems thinking. These competences will ensure that Systemic Design will not be yet another academic exercise in the management industry. Instead, they will foster the improvement of our capacity to meet the challenges of complex systems and thereby provide solutions to pressing issues both today and in the future.

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<sup>1</sup> The problem field is a network of problems or a system of problems.

<sup>2</sup> Simon's definition is not inclusive, which can be demonstrated by a number of simple examples. For example, if a child complains to her mother that she is cold and the mother responds by devising a course of action to change the child's existing situation (e.g. go inside or put on a sweater), it does not imply that the mother is 'designing'. Simon missed the central criterion for design, which is the form-giving aspect.

<sup>3</sup> One example is Don Norman (2010). According to Norman, the mission of Systemic Design is to change design in a similar way. This argument is based on the view that this change should not occur at the expense of traditional design skills.

<sup>4</sup> The concept of problem-based learning was developed in medical education. In design education, we build on the long-established tradition of the design studio-based education established by the Bauhaus.

<sup>5</sup> Nelson and Stolterman (2012) argued that design is inherently systemic.

<sup>6</sup> The systemic nature of design was previously elaborated by Nelson and Stolterman (2012).

<sup>7</sup> However, Gestalt psychology has a systemic root.

<sup>8</sup> Form-giving is a term used in Scandinavian languages to refer to the part of design activity that specifically concerns giving form to design objects in general.

<sup>9</sup> Kurt Koffka was central in the creation of Gestalt psychology and was responsible for creating a coherent theory of gestalt. He propagated the idea of a holistic view of psychology.

<sup>10</sup> This description does not apply to all art forms.

<sup>11</sup> Schwanger (1905, p. 37) connects compositional thinking and systems thinking.

<sup>12</sup> This analysis of the Kandinsky's composition rests on an individual interpretation. Others might have different interpretations of the relations between the elements in the composition of this painting.

<sup>13</sup> Other concepts are of a 'lower' nature. Examples might include the development of different types of modularity in architecture and the development of conventions in interaction design.

<sup>14</sup> Wagner participated in the 1848 revolutions, particularly the Dresden revolution. Therefore, he played a liberal role in that context. However, he also wrote the notorious *Das Judentum in der Musik* and had a preparatory role in the notion of the superiority of Germany.

<sup>15</sup> Examples are Michelangelo and Leonardo da Vinci.

<sup>16</sup> The Bauhaus Manifesto begins by stating that the aim of all visual arts is the complete building. In contrast, Gropius stated that the Bauhaus was strictly apolitical.

<sup>17</sup> Cesar Manrique was an artist, architect and ecologist. The reason that he is not better recognized might be that during the civil war he was a soldier in the National Front. In addition, because he was not formally trained as an architect, he might be regarded as a vernacular architect and thus disregarded by the community of architects.