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Actuating (Auto)Poiesis

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Abstract: Creativity in the natural and human worlds is distinct. Designers have always looked to nature as a source of inspiration and in recent decades the computer has been used as a tool to engage with the self-organising and emergent properties of natural phenomena. Used to simulate the dynamic behavioural properties of natural systems the computer has been utilised as a means to open up a world of possibilities and to empower designers to create novel productions. However, whilst the computation is a powerful tool in design which has led to a paradigmatic shift in the sorts of artefacts designers create it has not as yet led to a paradigmatic shift in how we think about designing and creativity. This is because novelty is rarely intrinsic to and thus an outcome of the computational process architects and designers engage with in the simulations they use to explore and design. In this paper we consider the capacity to effect novelty in computational (architectural) design. We propose that whilst autopoiesis is an intriguing concept it does not offer a means to effect novelty, because the identity of an autopoietic system is integral to its constitution. Only by breaking a systems identity may we affect novelty when trying to create through self-organising and emergent processes.

Keywords: Autopoiesis; Novelty; Complex Adaptive systems; Computational Architectural Design; Spatial Relations.

If architecture is an art of making distinctions (Mitchell 1998) which an architect then materialises to form some building it is then a bilateral process of production: as it were a polycephalic condition in which two sides are part-and-parcel yet separate. The age-old adage that architecture is a discipline, which bridges the arts and the sciences. This distinction (between the organisational and materialisation of built form) is what separates the process of creation in the biological and human worlds. Biological phenomena are the product of processes in which organisation and materialisation are intrinsic. There is no distinction. They are conflated, such that they are ubiquitous throughout the process of production.

Whilst biology and the natural world has always been a source of inspiration for architects it has until recently been a matter of analogy (Steadman 2008). However, with the ability to simulate biological processes through the computer architects can now engage with the creative capacity of complex dynamic systems, and explore new methods of organisation and form generation, which reflects the ubiquity of nature. From this stance designing becomes a process of initiation; whereby a process of creation is enabled, dice are rolled and the designer becomes composer bending and leveraging the process towards some point. To design is redefined, on the basis that design is traditionally to configure and define something externally, whilst to create (biologically) is to embody a making process. Ones perspective is thereby transferred from being outside some composition of discrete elements to be assembled to generate a whole to being within a system and having the capacity to steer, nudge and cajole the constituents of that system. This suggests the individual engaged in this process is somehow affecting novelty in the system, such that the user has the capacity to bend and push the system into new domains and spheres of being. This however requires that novelty is introduced into the system; otherwise the system is merely altering its state in response to the perturbations being placed upon it. If novelty is not introduced the result of the process is no more than reconfiguration. We propose that configuration and recombination is the typical manner in which computation is utilised in architectural design, and that whilst this is a powerful use of computation (to engage with natural processes of making) it does not tap into the creative capacity of making in nature. At root, the manner in which computation is typical employed in (architectural) design is determined by the information fed into whatever process is simulated. If no novelty enters into the system then all that is gained is a recombination and/or reconfiguration of the information fed in at the beginning. Whilst this does open up a world of possibilities intrinsically the system does not offer anything new. In this paper we look at the capacity to engage with the creative processes of biological systems to stimulate novelty and argue that we need to get deeper under the hood to effect novelty.

Autopoiesis is an intriguing concept to look to and to embrace as a means to engage with biological creativity, because it demonstrates how a living system is created, and is self-generating (Maturana and Varela 1980). An autopoietic system has no other purpose than to persist, and if the dynamic circularity is interrupted then it disintegrates. Coupled to its environment an autopoietic system draws from and thus conveys to its environment, meaning the system has identity, because it is different from that which surrounds it – for it must different to exist. The boundary between system and environment is therefore pivotal. The boundary is a ‘component’ of the system which is distinguished through its ‘form’, which is determined by its structure and the difference between itself and the environment (Luhmann 2006). The boundary between the self and other is essential for the system to exist. “[The] point of departure for all systems-theoretical analysis must be ‘the difference

between system and environment'. Systems are oriented by their environment … They constitute and maintain themselves by creating and maintaining a difference from their environment, and they use their boundaries to regulate this difference" (Luhmann 1995, p16-17).

The way in which systems are perceived through the concept of autopoiesis is spatial, in that the components of a system are a complex of interactions distinguished by their structure, which determines a closed unity. A boundary condition is thereby defined, through which the system is structurally coupled with, but has autonomy from, the environment. The system is intrinsically different and being distinguishable has identity. The concept may be seen to share similarities with the notion of buildings as systems of spatial relations, and one may at this point be drawn into thinking about social systems and architecture autopoietically (Luhmann 1986; Schumacher 2011). Autopoiesis is an intriguing concept because its central concern echoes what Henri Lefebvre argued about space; that it is something which is produced as well as productive (1995). Space is thus perceived as an active phenomenon which manifests itself and persists. From an ontological perspective of the generation of spatial organisation, autopoiesis is a way of conceiving the production of spatial formation, through modelling the self-organising autonomy of various constituents. It is this aspect, which offers architects a new conception of space and the capacity to generate spatial formations. Autopoietic organisation 'constitutes a closed domain of relations' that are 'specified only with respect to the autopoietic organization that these relations constitute'. The process defines "a space in which it can be realized as a concrete system, a space whose dimensions are the relations of production of the components that realize it" (Maturana and Varela 1980, p88).

Autopoiesis (Maturana and Varela 1980) and Varela's concept of autonomy in biological systems (1979) refer to the topological configuration of networks arising out of component interaction. They do not take into account the quality of spatial relations. "An autopoietic system is defined as a unity by and through its autopoietic organisation. This unity is, thus, a topological unity in the space in which the components have existence as entities that may interact and have relations" (Maturana and Varela 1980, p93-94). The premise is that some characteristics of space comply with those of a complex adaptive system which produces its own organisation, in response to differences in its environment. What this leads to is the intention to translate these differences (information) into 'object', but whilst topology is (perhaps the most typical) means to qualitatively think about space it only accounts for connection and wholes. Spatial relations are more varied than the typical topological focus allows for. We must move beyond topology to incorporate the mereological aspect of parthood relation (Varzi 1996). By allowing for parthood relations we enable variance into the system and thereby allow for differences to occur, on the basis that 'a difference is a difference that makes a difference'; which 'perceived over time' is what we call 'change' (Bateson 2000). Difference is required to alter or affect new states and create asymmetry in the system, and only through difference being either added to or evolving from within the system may novelty occur (Cariani 2008). We need to affect the system to effect change in the system, thereby allowing the system to construct new domains that put its identity into crisis and enables the actualisation of new potentials to emerge.

Approaching spatial formation in relation to a complex dynamical system, we perceive a system as "diverse and made up of multiple interdependent elements, that are often adaptive, in that they have the capacity to change and learn from events, and that can be

understood as emerging from the interaction of autonomous agents" (Johnson in Alexiou et al 2010, p123). In this way the capacities of an element are not only structurally determined but are brought about through the interplay of a three-fold process; which includes the meaning of how one element relates to another, and the history and circumstances under which one element encounters another. The central premise of autopoiesis is that living systems replicate themselves, recreating their components (Maturana & Varela 1980). What is explained is persistence. Change is not an aspect of the system. Autopoiesis is an abstract concept to explain living systems in a manner that is transferable to explain persistence of a system. On the basis that to design is to construct (Glanville 2006) it is tempting to transfer the notion of autopoiesis to design but in so doing we only embrace regeneration and do not engage with novelty. Design is a social process and social systems have the capacity to change and renew. Renaissance is fundamental to the persistence of social systems. Designers need to engage at the level of components and interfere with the persistence of the system to enable novelty in the system and effect new identity(s).

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