07. MORPHOGENESIS

One

Deleuze and Guattari introduced the notion that there are two fundamental structure-generating processes responsible for the development both of material form and social process (Deleuze and Guattari 1987). These are *hierarchical structures* and *self-consistent aggregates*. The former operate like tree diagrams and are therefore called arborescent; they include, amongst many other things, hierarchical structures such as social classes and castes and geological strata or layers of rock. The development of hierarchies occurs by way of sorting mechanisms and the consolidation of relations into more or less permanent architectectonic structures (De Landa 1997: 60). Self-consistent aggregates, which De Landa calls meshworks, are completely different. They are dynamic networks, or "acentered systems," that Deleuze and Guattari illustrate with the metaphor of the rhizome, which spreads by producing stems and filaments in all directions (Deleuze and Guattari 1987: 15). Meshworks develop through the operation of feedback mechanisms where "the product that accumulates due to the acceleration of one reaction serves as the catalyst for yet another reaction, which in turn generates a product that catalyzes the first one" (De Landa: 63). An autocatalytic system can be self-sustaining for as long as its environment contains enough material for the reactions to proceed. Any system that evolves in this way by, as it were, drifting, can grow in directions that are unplanned. Like a rhizome, it adds new nodes when it encounters certain conditions, developing and complexifying, multiplying from point to point without beginning or end but always metabolizing from and in the middle, operating "by variation, expansion, conquest, capture, offshoots … becomings" (Deleuze and Guattari 1987: 21.

Two

Morphogenesis is a term derived from developmental biology to describe the ability of organisms and natural systems to generate form from within. That is to say, the resources involved in the genesis of form are immanent to the organism or the system itself, and do not come from outside the system. De Landa gives as an example the way that the spherical form of a soap bubble emerges out of the interactions among its constituent molecules as they seek the point at which surface tension is minimized (De Landa 1999:120). However, the term has been adopted in architecture with rather a different emphasis. The Emergence and Design Group, who have established a masters program at the Architectural Association in London, have investigated morphogenesis through several issues of *AD* journal (for instance, Hensel, Menges and Weinstock 2004 and 2006). "It is process," Weinstock writes, "that produces, elaborates and maintains the form or structure of biological organisms (and nonbiological things), and that process consists of a complex series of exchanges *between the organism and its environment*" Weinstock 2004: 13. My italics). This definition separates the organism (or system) from the environment to which it connects. As noted in Field Theory, landscape architects are less likely to accept this distinction just because it distinguishes between figure and field. Of interest for landscape architects are the connectivities that enable form and behavior to emerge from process. Because in landscape architecture it is the system rather than the organism (for architecture read: the building) with which the designer works, the sense of a separate, or individuated, condition is much less strong.

Three

All environmental processes work across parameters, or boundary constraints, that act as local principles for self-organization during morphogenesis. These conditions may be as simple as a legal boundary – a garden fence or park wall, for instance – or more complicated: a local authority by-law limiting public use of urban terrain in some way, as when skateboarding is prohibited in a downtown plaza. The parameters define the space of possible states that a landscape system may inhabit, the territory it incorporates, the resources it may call on.

Four

These prior formations are critical to the development of a new system, as it is these, in combination with a specific enactment on the part of the landscape architect, that create the initial conditions for a project. Because emergent properties and processes are sensitive to initial conditions, a small change to the original platform of a project can make a large difference further down the track. Landscape architectural interest in the notion of designing by setting up initial conditions, and then "managing" the process of realization, has increased in recent years. This development has gone hand in hand with the rise of open systems thinking in landscape architecture and with meeting the challenges of autocatalytic design (see Open Systems). As Waldheim notes, these projects are often described as "open works or infrastructural systems that are meant to distance questions of authorship in favor of an explicit open-endedness and indeterminacy in the face of future cultural contingencies or larger urban forces" (Waldheim 2007: 16). Waldheim implicitly harnesses morphogenetic - sometimes wrongly called performative - design techniques to the objectives of landscape urbanism, neatly described as "a modest, socially responsible and economically efficient urbanism," (Waldheim: 16).

Five

But not all landscape design that uses nonlinear techniques of production is to be considered landscape urbanism. Designers who have investigated morphogenetic processes try to facilitate bottom-up form-finding processes that generate structure and organization. The difference, as Neil Leach puts it, lies in the emphasis on form-finding rather than form-making (Leach 2009: 34). This means that the outcome of the design process cannot be known prior to it coming into being. At first glance it might seem that "problematized authorship" is an abdication of intentionality, and that the final artifact is not a product of the landscape architect's imagination or careful analysis, so much as an outcome of a generative process that is blind, an issue Corner canvassed ten years prior to Leach in his essay on eidetic operations (Corner 1999). It might even seem that the use of such an operating system is irresponsible, or at the least will make actualizing local virtualities a matter of chance. That this is not necessarily the case can be found in the work of many landscape architecture firms whose practices incorporate morphogenetic techniques. Vista is an interdisciplinary Dutch design and planning practice whose work on the remediation of the Volgermeer Polder has been cited favorably by landscape architecture commentators, for instance Poole (2004), who calls it a "creative schematization" rather than an explicit design, and Raxworthy (2004). For this project Vista developed a strategy that guided the regeneration of a bog landscape by means of the creation of artificial ponds and the separation of toxic groundwater. Essentially a grading project, the landscape architects developed ponds of different depth that were lined to prevent contamination, and permitted

water to enter the ponds over time in an uncontrolled fashion. Different plant species colonize the different aquatic environments that were established as initial conditions. Cattle and sheep interact with the developing water bodies. If a pond was isolated from fauna it could develop into a forest; if grazed by cattle it would turn into grassland. Vegetation would regenerate rather than being planted, its final configuration and composition being a matter of what seeds were already in the soil, and what seeds were carried there by wind and birds. The repetitive interaction of these agents over time will guide the life of the project.[i]

Six

The proposition that initial conditions can be designed to direct the future movement of those conditions is illustrated by Vista designer Roel van Gerwen's figure of a stick in the sand. "To make a sand pile on the beach," he writes, "you can form a mound of sand with a bucket and shovel, then the mound will disappear with the wind over time. The alternative is to place a large stick in the ground where the wind will constantly form a pile, reshaping the pile every time the wind changes direction" (van Gerwen 2006). In van Gerwen's analogy placing the stick is less exhausting, gives a less predictable result, and is more dynamic. It is also autocatalytic. In process design, as Vista calls their morphogenetic work, the important thing is to use the right "sticks" in order to "unravel and manipulate" the landscape-forming processes that are already at work in both urban and rural situations. Van Gerwen makes the point that "(p)aradoxically, the more unpredictable the landscape proposal the more well-founded one's data and visualization has to be" (van Gerwen 2006: 233).The figure of the stick in the sand is particularly apposite because it demonstrates that a carefully chosen element is key to the actualization of local potentials through the engagement of specific forces. This is clear in Delwyn Shepherd's Birdscapes proposal (described in Barnett 2013: 86), which uses a combination of carefully selected local tree species, local community intervention and indigenous bird-foraging and flight-line behaviors to develop an adaptive approach to coastal erosion on New Zealand's west coast. In a project that plays out over time, she restores coastal forest and creates designs for human inhabitation by working with sand dune formation processes and the prevailing wind, literally by placing sticks in the sand (Shepherd 2009).

Seven

These projects explore the productivity of chance as a form-finding device. But not just any form. Processes are set in motion and then, through autocatalysis, or feedback, landscape conditions change and adapt as a result of the ongoing interaction of the processes with contextual (or sometimes internal) states. Because these states themselves are changing they cause further reactive events within the evolving system and between it and its contextual systems. Nothing commands the system to move in a particular direction and, owing to its sensitivity to environmental factors, it can move in many different ways, given the parameters of its possible forms. The interaction of each part with its immediate surroundings causes a complex chain of processes leading to a new state. A river system is intimately interconnected with the webs of topography, vegetation and surface conditions that comprise its watershed. This goes for urban as well as rural environments. In the urban realm, buildings, transport networks and pedestrian precincts (for instance) are understood not as singular and fixed, but as energetic and material systems that share their environment with many other processes. Within these processes, principles and dynamics of organization and interaction are at work, guiding

and regulating emergent urban patterns. In order to work within these structuring processes, landscape architects need to analyze the micro- and macro-environmental conditions that moderate the systems of inhabitation and encounter that they find on the streets, in the parking lots, along the urban streams and through the fluctuating urban-suburban edge conditions that make up the urban field.

Eight

This requires the development of particular analytical tools, methods and skills so that found conditions can be deployed in design approaches that integrate and regulate rather than relocate or substitute. Analysis is of central importance to morphogenetic design process. Self-organizing tendencies and interactive affordances need to be discovered, and the relationships between these processes and spatial orders revealed. Of special significance are the relationships between people and the dynamic conditions that they create and inhabit. Close observation of behavior is necessary. What are the specific assemblages that comprise these human-nonhuman interactions? How do we find this out? How do low-key social processes, for instance, cause major territorial disturbances? In landscape architecture we have to take account of the immersion of humans and nonhumans in the environments that support and maintain them, and find out how these environments are continually transformed on the basis of this immersive condition. The study of morphogenesis shows that discernible structural and organizational patterns underlie these interactions. When we understand these underlying blueprints we can start to seed urban processes with catalysts for the development of new patterns and forms.

Nine

Here is an example of how morphogenetic processes have been used to interpret urban form. In "The Nonlinear Development of Cities" (1999), De Landa proposes that cities are mixes of "hierarchies of command and control" (strata) and self-organizing systems (meshworks). One of these structural elements typically predominates. Capital cities, such as Washington D.C., that are "state" cities of bureaucracy and governmental regulation, are hierarchically-ordered, while metropolises like New York - that are commercial networks - are self-organizing. "A self-organizing structure [e.g. a beaver dam] typically emerges without central planning, as a consequence of a de-centralized process," whereas a command center is gathered around a state or royal seat of power. "It is not a matter of opposition of one to the other; nature is filled with these two types of structure. What does matter is to determine which structure predominates" (De Landa 1999: 25). Cities, as mixtures of stratified and meshwork patterns of organization, tend to represent some combination of market (self-organizing) and state bureaucracy (command hierarchy). According to De Landa the state or royal towns of Cairo, Peking, Paris and Madrid may be contrasted with the commercial towns of London, Venice and Amsterdam (De Landa 1999: 27). Commercial towns, often maritime, connected to the self-organizing seas and oceans, always exist in networks, which may lack a distinct center. State towns are centers that conquer other towns to enable their wealth to flow in. Like Peking, Canberra and Madrid, they are often land-locked and protected. While this example may seem a little stretched, it is useful as an indicator of how the notion of morphogenesis enables us to understand production and development without requiring a supplementary mover. All of the energetic resources for the evolution of particular urban typologies are found within the

operating system itself. The identity of an urban square – its qualities and characteristics – and therefore what is appropriate and desirable in terms of proposed design interventions, will be a matter of its contingent historical process of individuation, rather than on a form-giver. While we have known this to be the case with respect to the organic development of medieval cities, the idea of morphogenesis fleshes out the word "organic" and describes the specific material principles of growth to which it refers.

Ten

For a long time the genesis of form and structure was based on the Aristotelian conception of matter as an inert receptacle for forms that are imposed from the outside. While ecosystems ecologists now see the ecologist as inside the system that is being observed, and landscape architects are similarly rethinking their ontological geographies, ecologies obviously do not await the designer in order to evolve structure, responsiveness and conditions for life. Designers do not create ecologies, though they do manipulate the processes, elements and conditions that enable ecologies to develop and evolve. As Corner has put it, landscape architects "stir" ecologies into different conditions (note, however, that stirring is a metaphor that requires the agency of a human hand). In ecological situations, design intervention, again, is often a matter of the reconfiguration of pre-existing conditions, as when water-borne toxins that pollute a degraded wetland are diverted or filtered. Can this also be the case for urban design? The best way to create any landscapes that are dynamic, flourishing, productive, suitably-scaled and self-sustaining, according to van Gerwen, is by utlilizing the processes that form landscape. "This counts for rural or natural circumstances but just as well for the urban environment, although the steering processes become more anthropological or democratic as the project becomes more urban" (van Gerwen 2006: 250). If cities are open systems it must be the case that urban processes, too, can be set in motion by means of a careful intervention and permitted to evolve in response to contextual change. It is a matter, then, of those "anthropological or democratic" steering processes. A matter of the landscape architect's ongoing regulatory activity, of his or her own performativity. Of the degree to which the hand stirs the process. Koolhaas and Mau's *Tree City* discussed in Open Systems, illustrates the sensitivity of an urban project, rife with political challenges, to the stirring hand – or lack of it. If one of the advantages of an initial conditions approach to urban landscape architecture is that it sidesteps some of the difficult aspects of ongoing community participation in decision-making, while at the same time enabling participation in form-generation, it is clear that participation is critical. When, as Mitchell and Van Deusen argue in their overview of the role of public space in the Downsview Park entries, the "communities who will use - and continue to create - public space" are to be "drawn into the decision-making process at every step," then the designer must occupy a role that permits a "multiple, shared and combinatory" process. "It is not in design per se that publicness can be encouraged …, but in how that design is administered and implemented." (Mitchell and Van Deusen 2001: 112). The designer's ongoing performance is as an orchestrator of the conditions for democracy.