Heterarchical Systems
and their Relationship to Architecture

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this thesis explores the
hand reaches facets of
simplicity held in a faded
heterarchical field in a faded
still ground for a faded
picture systems and the
potentials taken, folded
in binaries of its application
to broken thoughts growing
in every dimension architectural design

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A heterarchical system is one in which multiple dynamic power structures govern the actions of the system through simultaneous interaction. This definition is my own creation, constructed as a synthesis and compilation of research on the topic. Though heterarchy is not a new concept and certainly is not a new way of organization, there has been surprisingly little research done on it until recently. The Oxford English Dictionary supplies the only existing definition of heterarchy, "rule by an alien," which for all practical purposes is absolutely worthless.
Various other sources supply several other definitions for heterarchy that are considerably more useful, but each of them is narrowly focused on their specific subject material (economics, sociology, biology, etc.), making them too useless for providing a good general definition of the term. If we break the word heterarchy itself down into its basic parts we have “heter-” meaning “other” or “multiple”, and “-archy” meaning “rule” or “order”. So when we reconstruct the separate components of meaning, we have something like “multiple orders”.

A flock of birds flies in a hierarchical pattern, with a clear leader and linear power datums. A school of fish more closely resembles a heterarchical system, with no leader and multiple, dynamic power datums that are continually shifting.
issues of heterarchy have been addressed in various degrees by several architects. the postmodern and deconstructivist architectural movements are both intimately connected to issues of heterarchy. however, heterarchy has rarely been more than a topical factor in these designs. architects like lebbeus woods have addressed heterarchy more specifically in some of their designs, though still not as in depth as is possible.
the site is primarily situated on the Indianapolis Memorial Mall, directly north of the bank one tower. However, the project is conceived of as not being constrained to the site, but merely based in it. The site stretches from the core downtown region of the city north to the less dense inner periphery of the city. Over the length of the site, the context changes dramatically, providing an interesting and complex environment in which to design a project.

Second, it is important to include in the definition the notion that the multiple internal ordering systems control the overall system through instantaneous and simultaneous interaction. That is to say, there is no central processing or decision making facility in a hierarchical system.
the context was perceived as having three distinct scales in terms of its impact on the thesis design: macro-urban, macro-site, and micro-site. The distinct layers of contextual data suggested approaching the thesis design in a similar, multi-scaled manner. The macro-urban scale suggested basic patterns and vectors on the site. The macro-site scale suggested volumetric and spatial patterns that were applied to the basic macro-urban patterns. The micro-site patterns modified these volumes through the smaller scale detail of their immediate surroundings. In this way, the earliest preliminary thesis designs tried to respond to their context, from interstate patterns to single blades of grass.

The actions of a hierarchical system are dictated by the instant in which they are acted out, informed simultaneously by the sum of the internal systems. When all of these elements are put together, we come back to the final general definition of hierarchical systems. A hierarchical system is one in which multiple dynamic power structures govern the actions of the system through simultaneous interaction.
DIT::0.2 explored the nature of growth and decay in complex, heterarchical systems.

Every aspect of contemporary civilization is becoming more heterarchical. Traditional hierarchical canons and methodologies are crumbling in every facet of contemporary life, from economics to politics to media communications to architecture.

DIT::0.3 explored the application of multiple, complex data sets on to simple, primitive forms.
As the old hierarchical models unravel, heterarchical systems take 'control' of these new vacuums of order. Hierarchical systems are failing because they cannot respond to the exponentially growing glut of information that is the mark of our contemporary culture.

dit: 0.4 further explored the application of complex layers of data on to simple primitives. The dramatic difference between the simple primitives and the resultant forms clearly illustrated the physical impact of heterarchical design processes.
Heterarchical systems, on the other hand, eagerly feed off of this information overload. Architecture must endeavor to understand the methods and significance of heterarchical systems in order to play a positive and progressive part in our evolving civilization.

dit: 1.0 started out with the methodologies of the previous iterations, but began to include distinct multiple internal systems in the design process. These internal systems expanded the scope of the design from purely externally referential to being simultaneously externally and internally referential.
In many ways, a heterarchical network acts as if it were a living organism. Indeed, there are many instances of living organisms that act as heterarchical networks. Ontogenetics deals with the pattern of growth or development of an organism, in this case a primarily artificial organism. In studying the ontogenetics of heterarchical networks, it is unlikely that any universal or applicable patterns will emerge. These processes and development of patterns will appear. It is likely that these developments are not linear and require transformation and adaptation.
Nonlinear Relationships:
The old axiom of the shortest distance between two points is a single point, the resultant of a complex folding of space time. Hierarchical networks are not constrained to simple Cartesian points. Quantum mechanics has shown us that the shortest distance between two points is a line no longer holds true. Hierarchical networks are linear logic as hierarchical networks are. Therefore, a hierarchical network can fold, flatten, dissolve, stiffen, or even divide.
The individual connections between units in a heterarchical network may or may not be linear, depending on the circumstances of relationship, but the greater the degree of connections, the more non-linear their connections become, till the network as a whole becomes a finely woven mesh of long, nonlinear relationships. Moreover, information flow in a heterarchical network radiates from its source unit out to all of the units it is connected to, which radiate to all of their connections, and so on, making communication far more efficient than in a linear hierarchy.
Self-Referentiality as Self-Awareness:

If self-consciousness is a measure of intelligence, then some hierarchical systems could be considered to be ‘intelligent systems’. Hierarchical systems are self-referential in that they communicate information between every point equally as necessity dictates. Self-awareness is a second order consequence of self-referentiality that may lead to self-consciousness in some hierarchical systems if they are capable of a cohesive, network-wide thought process. Organic hierarchical systems capable of such advanced self-consciousness are rare, because most organic systems develop a larger scale hierarchical organization before they’re capable of forming cohesive, self-conscious thoughts. However, there are some organisms that approach the level of hierarchical self-consciousness as groups, where potentially thousands of individual organisms may act as a single, intelligent network organism.

dit::4.0 synthesises the knowledge and experience gained in the previous iterations. Earlier design concepts and methodologies such as the hierarchical landscape, the internally/externally referential system, the primitive deformation through application of multiple data, and the macro-urban / macro-site / micro-site have been carried over, refined and further developed as the dit::4.0 process progressed. The "final" images presented hereafter are actually only manifestations of the process frozen in time. Further development of dit::4.0 is both expected and necessary in order to rigorously pursue the concept of hierarchy.
For instance, a school of fish or a swarm of locusts. Thus far, we have not been able to create any artificial heterarchical networks capable of self-consciousness because it requires a level of mechanical complexity that we aren’t currently capable of. The first self-conscious artificial network we create will undoubtedly be a hierarchical one, since hierarchical systems are intrinsically simpler to construct through mechanical means.
Plurality of Process and Communication: Conventional ideas of process and communication dictate a pedagogy of singularities. That is, a single unit can only carry out a single process at a time, and a pair of units can only communicate a single message between them at a time (while one sends information, the other can only receive, and vice versa). However, a hierarchical system dictates a pedagogy of plurality. A hierarchy is partially defined by its ability to perform multiple processes per unit at a time, and to communicate multiple messages per connection in both directions at once.
Furthermore, units in hierarchical systems are capable of communicating with multiple other units simultaneously. This is because the units and lines of communication are flexible and are perpetually transforming to accommodate the immediate needs of the system. In more complex social networks, such as an urban landscape, this notion of plurality takes the form of individual people receiving huge amounts of data from their environment and each other, processing all of it, and then communicating their reactions through facial expressions, body language, and movement.
Recombinant Transformation:
Because heterarchical systems are innately devoid of any sort of centralized power structure, individual units within the system (whether the units be people, money, machines, or molecules) are allowed to freely evolve and interact as their environment dictates.

The resulting dynamic diversity of the parts creates a hypersensitive whole that is continually transforming and evolving as it interacts with its environment and itself. For example, consider the difference between the environmental responses of a canoe (hierarchy) on the ocean, to an inflatable raft (heterarchy) on the ocean.
As the waves oscillate across the canoe, it bounces up and down, whereas the raft moves smoothly in rhythm with waves. Of course a hierarchical system may react inversely to its environment as well, depending on the programming of its parts. However, there is also an inherent element of chaos in the hierarchical system, since different parts of the system may simultaneously react differently to the same environmental conditions. This allows the system as a whole to behave with some degree of creativity, which leads to new knowledge and progress.
view from NE
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