

# machine dreams

기계가 꾸는 꿈 | 생성예술 국제교류전시 & 심포지엄 기계와 생명에 대한 확장된 시각과 융합예술의 가능성

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## ■ 그래함 웨이크필드 | Graham Wakefield (UK/USA)



보다 열린 철학적 관점에서 컴퓨터를 사용하는 작곡가의 작업에 대해 질문을 던지는 것은 악기, 도구, 스튜디오, 엔터테인먼트 기계 등의 전통적 관념(작곡 환경)을 넘어 (그런)환경에 못지 않는 하나의 물질, 매체 그 자체로서 컴퓨터 활용에 대한 착상을 가능하게 한다. 특히 Generative Computation은 창발성의 열린 세계와 더불어 고유한 제약 혹은 입자를 가진 하나의 물질을 반드시 필요로 한다.

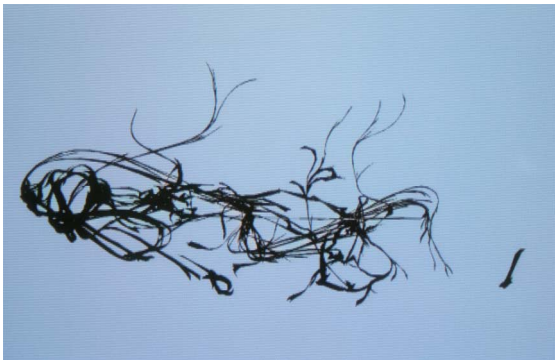
작가는 현재 진화하는 네트워크와 흐름에 대한 그래프 이론(graph theories)에 대한 작업을 하고 있다. 부분적으로는 우리 인간의 생물학적 발달에 의한 복잡계 네트워크에 영감을 받았다. 수학적 그래프의 이산적 성질은 문법에서 데이터 흐름, 나아가 신경 네트워크로의 컴퓨터 계산 그 자체의 근간을 이루지만, 창조적이기 위한 전(前)언어적 접근 또한 허용한다. 하나의 진화하는 그래프는 일련의 단계에서 가능성의 위상학적 공간을 통해 점진적으로 연결과 노드들이 더해지고, 제거되고, 변화해간다. DNA 안의 정보가 모든 종에서 발전적, 대사적 행동을 결정하게끔 되어 있듯, 그 방식은 유사한 그래프, 유전적 규정 네트워크에 의해 결정된다. 복잡한 역학의 세계 안의 놀랍도록 작은 알파벳으로부터 믿을 수 없을 만큼 멋진 형태들이 만들어진다. 이러한 역학을 이끄는 힘은 시스템 내부 (피드백) 과 외부 (관람객)로부터 온다.

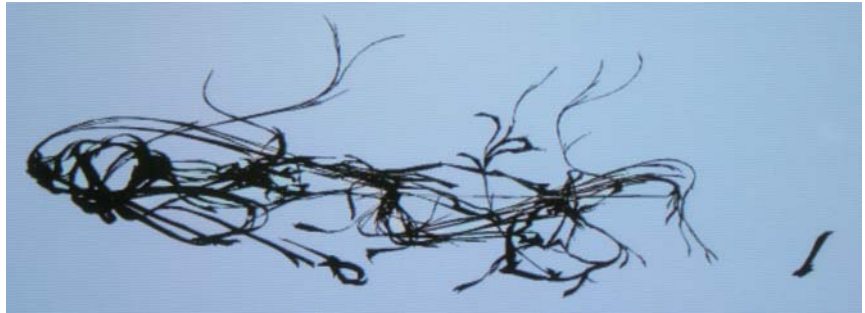
컴퓨터의 사용(computation)은 이미 우리 삶 곳곳에 동시편재하고 있다. 그 일상적 활용은 효율과 편의라는 실리 본위의 태도에만 그치지 않는, 창작과 저항의 창조적인 태도이어야 한다. 작가는 작곡가로서의 본인의 역할이 다른 이들이 탐험할 수 있도록 이러한 가능성을 창출하는데 있다고 생각한다.

By asking the question of the engagement of the composer with computation from a more open-ended philosophical standpoint, it is possible to go beyond conventional notions of instrument, tool, studio, entertainment-machine and so on, and begin to conceive computation as a medium itself; as much a material as an environment. Generative computation in particular calls for open-ended world of emergent capacity, but also necessarily a material with inherent constraint or grain.

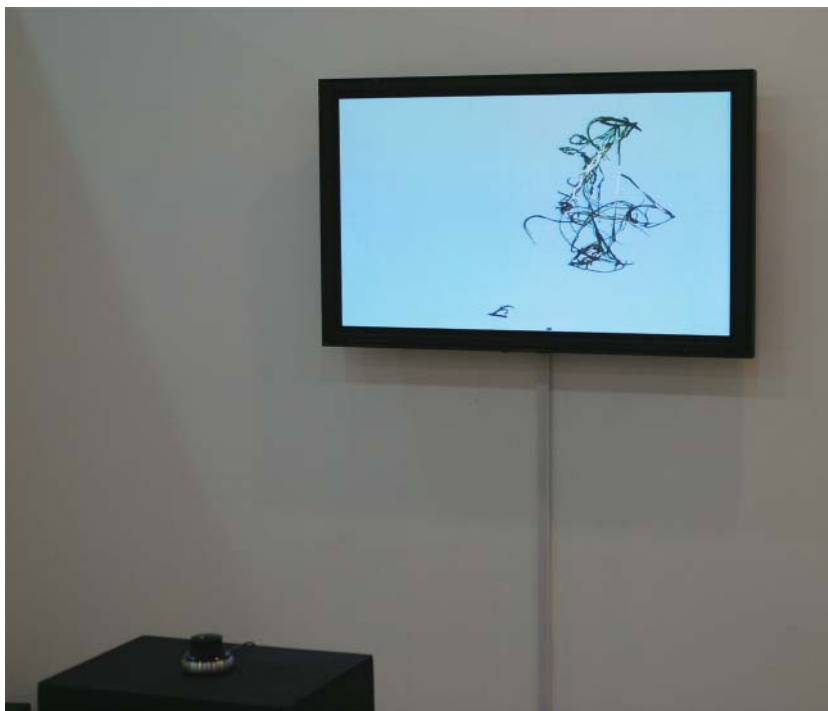
In my current work I am drawing upon graph theories of evolving networks and flows, in part inspired by the complex systematic networks responsible for our own biological development. The discrete nature of a mathematical graph is at the root of computation itself, from grammars to data-flow to neural networks, and yet also permit a pre-linguistic approach to creative becoming. An evolving graph is one in which, at a series of time steps, connections and nodes are added and removed, shifting gradually through a topological space of possibilities. The manner in which the DNA is expressed to determine developmental and metabolic behavior in all species is determined by a similar graph, the genetic regulatory network. From a remarkably small alphabet, placed within a world of complex dynamics, incredibly fascinating forms are produced. In my work, the force that drives these dynamics comes from within the system (feedback) and from outside (such as human participants.)

Computation is already ubiquitous in our lives, but our engagement with it on a daily basis need not be only in a utilitarian mode of efficiency and ease, but also a creative mode of poesis or resistance. My role as composer is to engender this possibility for others to explore.





**Makeshift** Generative Computation (Real-Time, Audio-Visual)



## ■ 섹션 2 | 학술연구로서의 예술, 예술로서의 학술연구

### 기계적 / 열린 Machinic / Open

발표자 Speaker | **그라함 웨이크필드** Graham Wakefield

컴퓨테이션의 기계적 흐름(machinic flow)의 표현과 경험의 열린 흐름을 향한 도전이야말로 생성예술의 핵심을 이룬다. 이번 발제에서는 컴퓨테이션의 내재적 본질과 발생, 복잡성, 생명에서 영감을 받은 철학이 제기하는 풍성한 열린 세계들 사이에, 자연스러운 적합성을 모색하는 소프트웨어 디자인과 컴퓨터 계산 창작(computational composition)에 대한 하나의 방법론을 제시하고자 한다. 본 전시에서 발표한 작품 'Makeshift'에서 이러한 방법의 적용을 실험해보았다.

At the core of generative arts is the challenge of translating a machinic flow of computation to an open-ended flow of expression and experience. This presentation will outline a strategy towards both software design and computational composition that finds a natural fit between the immanent underlying nature of computation and the richly open worlds suggested by emergence, complexity and bio-inspired philosophy. The application of this strategy is examined in the work 'Makeshift', exhibited as part of Machine Dreams.

[http://koian.org/machine\\_dreams\\_symposium\\_Wakefield](http://koian.org/machine_dreams_symposium_Wakefield)



**Graham Wakefield** The title of my talk 'Machinic/Open' appears to be a reflection of the exhibition title 'Machine Dreams'. Both suggest something of the ideas of system, process, control, and the roots of mathematics, yet coupled with the open, the dream, as flows towards change, which I found as the basis of my studies in philosophy and art/music work. In summary my talk describes research into the mechanisms of change.

My interest in computational generative art has been intensified by an increasing awareness of the future we are going to inhabit. I'm thinking about the increasing ubiquity of computation-it's going to be all around us-and the unprecedented extent to which we will control, define and compose the environment we live in. I strongly hope that our future will be composed creatively, and not just pragmatically. I mean to say not just machinic, but open. In that sense it's very important for artists and developers to engage with each other, or become artist-programmers, towards the understanding, design, composition and engendering of new worlds that eschew a closed sense of control for a creative sense of continuation. Right now what I think many of the artists in this exhibition are doing may be the first steps towards this: an attempt to translate the natural flow of computational machinery into a flow of experience and expression that is meaningful and rich. This is a very precise investigation into the nature of structure and change.

My own approach so far has been to take a fresh, critical look at computation as such, to rethink the computer not just as a tool or work environment for an artist, but to look at how computation works as a medium itself. We can even go beneath the linguistic levels of code and grammar, which still bring a lot of unnecessary convention with them, and continue down below. What we find are discrete structures of memory, instructions, and the important complexification of self-modification that distinguishes the computer from a loom. In other words: state, difference, and feedback. These elements are recognizable in the origins of computation in information theory and cybernetics, but what we are increasingly seeing today is a movement away from the first-order cybernetics dominated by control and negative feedback, towards a second-order cybernetics (such as artificial life, complexity, enaction and so on), in which a positive, creative aspect to feedback appears as self-organization.

## ■ Section 2 | Art as Research, Research as Art

**Graham Wakefield** Through the descent from code to syntax tree to processor architecture and actual machinic behavior, many times we encounter the same structure: networks, or what mathematicians would call graphs. I see the network, or graph, as the primal image of computation today: a system of relations between processes, between flows of change.

This idea of the network, or graph, is a general structure; although it has a simple homogenous syntax, it is capable of expressing very heterogeneous semantics. It's not only a structure, it is also a space through which things, that is, information, can flow; and it is something that can gradually evolve.

We can see that this structure is not particular to computation—it's at the root of our bodies too, at the root of the process by which we develop as organisms (the regulatory network as a diagram of the process by which an organism comes into being). The Internet is another celebrated example of a complex evolving graph of course.

The work I'm showing here at Machine Dreams is called Makeshift (makeshift is a colloquial term in English, which generally means something that is only temporarily appropriate, an ephemeral expedient, a transitory truth.) The work represents one step in my research into the nature of dynamic networks.

Makeshift is a network of around 4000 nodes, in which each node has a position and curvature in space, but more importantly each node has a directed relation with one other node (its 'parent'). Continuously over time each node tries to follow its parent node in spatial position and relative curvature, and also communicate any information it receives to the parent node, embodying a network.

Spontaneously, occasionally, there are small changes in which one node will switch parent, attaching to a different random node. It is important for me to emphasize there is no outside influence on the hierarchy of the system, no prior order. The only external influence is that 'small changes sometimes happen'. The structure is not a tree, it is a rhizome: this in itself leads to very interesting behaviors.

**Graham Wakefield** There are recognizable types of structure and behavior that come out. Sometimes several nodes point to the same parent, which produces bunches of multiple flowing tails. Sometimes nodes can form a loop, and by constraining the network in space, it also leads a rotational spinning movement of the loop, which then transmits through the whole network. Some nodes may have a reversed orientation: rather than following their parent, they force their parent to follow them. This produces much spikier branches, rather than smooth parallel strands. Finally, not all nodes need to be reachable - there can be islands that break away and later re-attach, expressing the fluidity between the notion of the singular and the multiple.

The composition of this system was a long process of exploration and tuning according to intuition, to find the kinds of nuances that seemed more expressive, finding an expressive machinic animacy. I mean animacy here in the sense at the root of animation, bringing something to life.

Finally I would like to read quote that I think remains relevant: “Becoming and duration are not in any way a diminution of unchanging eternity; they its expression. Every form occupies not only space but time. Being and becoming are one... What should be grasped and given form are the things that are in flux” (Viking Eggeling, 1920)

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Thank you

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