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Mycorrhizal Curation: minimal cognition for maximal cooperation

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Abstract

Since 2015, when the authors first wrote a chapter about the state of curation for electronic art (pointing to the absence of works significantly addressing the epistemic implications of a computational logic), artificial intelligence and wider algorithmic forms of logic have become more pervasive themes within mainstream art, with, for example, exhibitions such as 'AI More than Human' (2019) at the Barbican Centre, London, the increasing profile of the Lumen Prize, as well as headline grabbing events such as Christie's auction of the AI-generated painting 'Portrait of Edmond Belamy' (2018, created by GAN [Generative Adversarial Network]). The logic of computation is now, if not generally understood, a ubiquitous facet of the curatorial imaginary, begging the question: where are the alternatives and challenges to Western computation, to the Neoplatonist ideals of mathematical logic? Appraising discourse addressing the non-human and the arboreal, the authors present a radically alternative set of practices, framed as *Mycorrhizal Curation*, a provocative affront to human representational systems and power relations which place the human at the apex of all epistemic hierarchies, but also, the authors intend to provide a provocative challenge to the hegemony of the artworld, with shifts to models of amicable cooperation and wealth distribution.

Keywords

Mycorrhizal, Physarum polycephalum (slime mould), epistemic, curation, artificial intelligence.

Introduction

When examining the current state of digital artworks, one might argue that they have not yet made a groundbreaking impact on the cultural landscape of the early 21st century and that a reason for this lack of notoriety is the obsolete model of agency deployed by many digital artists [1]. During the past five years, the authors have been investigating interactive systems, artists' tools, applications and techniques that can provide an insightful and up-to-date examination of emerging trends in the application of new technologies and curatorial thinking. In this context, an interesting model emerges; one that is neither human nor non-human-centred, doesn't recognize decipherable patterns of existence and is in no way linear in its operation. There have been various attempts to 'define' this symptom which, in reality, explains that there are now clusters and a rhizomatic model as an antipode to the previous linear reality (Bourriaud 2009 [2], Bishop 2012 [3], Fuller & Goffey 2012 [4], Manovich 2016 [5], Kholeif 2018 [6]). It is true that one can rationally discern a relation between the technological changes of the past thirty years and the way this has impacted on one's access to information. Networks form an essential part of one's daily routine (whether they are social media, group chats, search engines or algorithmically suggested purchases) and yet there is an implicit assumption that humans remain the initiators of such networks. However, what is proposed here is a shift to our representational systems and the introduction of a model that, as a fungus, can function beyond the human factor.

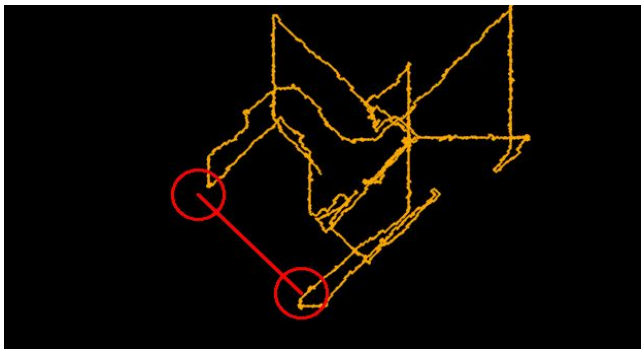

Figure 1. Computational model of slime mould, Eleanor Dare 2019

Orthodox path-finding algorithms are constructed to find optimal pathways through an information space or formalised model of an actual space, through the deployment of graph theory and graph traversal algorithms. A path-

finding algorithm will seek the best path through a space given a starting point and an end point with a set of a priori criteria for success, for example, in Dijkstra's algorithm, the shortest path. Alternative path-finding systems can be found in the natural world, for example, ant colony behaviours, the swarm activity of birds and insects and the phenomena of *Physarum polycephalum*, or slime mould, a primitive sensory system. Slime mould is "an active living substrate" (Vallverdu, Castro et al. 2018 [7]) which is neither animal or vegetable or mineral, it has been used in "developing un-conventional computing devices in which the slime mould played a role of a sensing, actuating, and computing device" (ibid. 1). It has also been used to resolve combinatorial optimization problems, employing highly complex networks as in the case of the Tokyo rail system (Tero, Takagi et al. 2010 [16]). Biological networks such as *Physarum polycephalum* "develop without centralized control and may represent a readily scalable solution for growing networks in general" (ibid., p. 439). As an organism, it is suggested that slime mould can find solutions "with properties comparable to or better than those of real-world infrastructure networks" (ibid., p. 442), taking the form of an interconnected network that serves the purpose of expanding the discovery and exploitation of new resources. As such, unlike anthropogenic infrastructure systems, it has been "subjected to successive rounds of evolutionary selection" and "[is] likely to have reached a point at which cost, efficiency, and resilience are appropriately balanced" (ibid., p. 439).

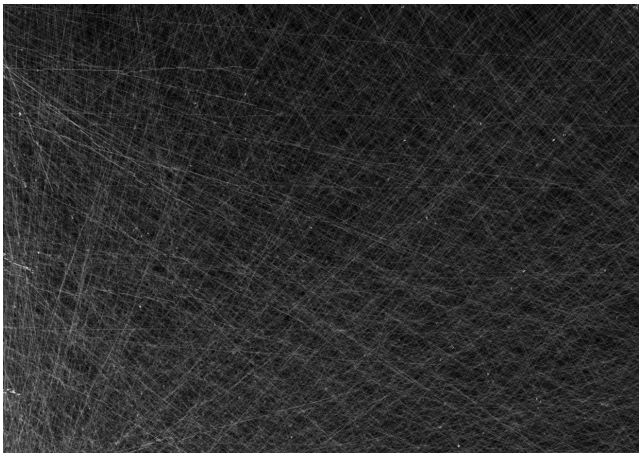

Figure 2. Computational model of slime mould, Eleanor Dare 2019

Unsurprisingly, slime mould has caught the attention of computer scientists for some time but has hitherto been neglected by curators. By modelling the behavior of slime mould and the inter-dependencies of Mycorrhizal networks, the authors propose the deployment of an adversarial approach to both orthodox computation, in particular, artificial intelligence, which perpetuates a neo-platonic, Western colonial legacy, in which mathematical models of the world, and of knowledge, are privileged over myriad other epistemic traditions as well as non-human cognition.

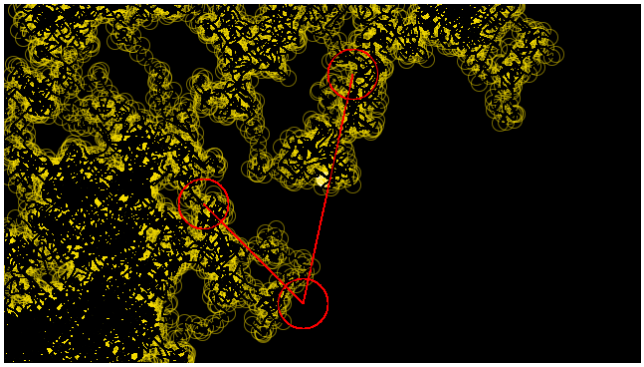

Figure 3. Computational model of slime mould with pathfinding, Eleanor Dare 2019

Slime mould and mycorrhizal networks are here presented as providing alternative curatorial imperatives and patterns of exchange. Readers are invited to interrogate slime mould and mycorrhizal models of affiliation and curation, to enter a cooperative and amicable system of curatorial partnership, a redistribution of wealth in which the exchange of vital nutrients supports new art practices and underrepresented communities. The mycorrhizal and slime mould models avoid, we hope, the reductionism (ethical hedonism) of Bentham's *felicific calculus* [8] and the similarly idealised metaphysics of Aristotles's Organon [9].

Modeling slime mould and Mycorrhizal networks

The algorithms developed by Eleanor Dare in late 2019 began with models of random walks, also known as 'stochastic' movements in two dimensions. Food sources (represented by ellipses) randomly intersect by means of arbitrary walks (pixel movements across the screen). Once discovered, the location of food sources is stored and the shortest path between nodes (or food sources) calculated using graph theoretic equations, such as Euclidean Distance. How slime mould does this in the physical realm, without a nervous system or brain is unclear, it is presumed a form of biochemical signal stores pathways, and that shortest paths are calculated using the flow rates of cytoplasm in the branches of *Physarum polycephalum*. The work of Furnam et al in 2014 [10] has concluded that these simple organisms are effective pathfinders, able to optimise in some cases, as efficiently as mainstream computer programs. By manipulating light sources in physical models of slime mould pathfinding scenarios, researchers Watanabe et al (2011) [11] were able to simulate landscape features which the Tokyo metro cannot navigate, thus

replicating the topology of that network and seeking optimal pathways through it in the event of say, an Earthquake or transport malfunction. Similarly, in the example of Mycorrhizal Curation presented here, we have simulated the wealth of galleries via pixel brightness, thus generating a pattern of avoidance, in which poorer galleries, with lesser known artists, become sources of nutrition for *Physarum polycephalum*. Combining this model with a mycorrhizal network of mutually beneficial cooperation, the simulation inverts presumed orthodoxies of traversal between galleries based on what, in social network analysis, is the idea of the 'rich get richer', where nodes which are already highly connected gain further connections, excluding less connected nodes (in this case artists and galleries), forming a so called 'virtuous circle' of the already privileged.

It is important to point out that our model currently omits the ability of mycorrhizal networks to conduct chemical aggression in the event of resource scarcity. Improvements to the model could include self-avoiding random walks, ones which never intersect with themselves in order to optimize the process of wealth distribution. The work presented here is a provocation in line with Maturana's autopoetic network, or proto-consciousness' [12] as well as curatorial activism [13] and Adversarial Design [14] in which we 'expose and document patterns of influence in contemporary society'[15] in particular its hegemonic or dominant power relations.

Figure 4. Computational simulation of slime mould with Mycorrhizal weighting towards mutual support for less wealthy galleries and neglect of the already well off, auto-generated city, Eleanor Dare 2019

Mycorrhizal modus operandi

Based on current art trends and tendencies, especially as far as digital arts and interactive networks are concerned, a mycorrhizal and slime modus operandi leaves space for a quasi-anarchic, rhizomatic, non-linear system of operation that is not entirely (or not at all, depending on the given situation) dependent on human semiotic systems. As such, it goes beyond mathematical logic to form a non-symbolic intelligence, abiding to a fungal and slimy set of criteria offering an alternative set of practices for future collaborations. From an organisational point of view, it tracks the optimal solutions to complex problems without centralized control. From a Cartesian point of view, it introduces an efficient curatorial model that can accommodate different types of computational and interactive practices, whilst responding to contemporary theories (and increasingly changing requirements) of interactivity, artificial intelligence, and curation.

[The authors will present further visual examples from the ongoing research and report on workshops with RCA students (where participants expand slime mould and fungal networks into live curation strategies) during the conference]

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Authors Biographies

Eleanor Dare is Reader in Digital Media at the Royal College of Art's School of Communication and Head of the MA Digital Direction (London, UK). She has a PhD in Arts and Computational Technology from Goldsmiths University of London (Department of Computing), supported by a full doctoral studentship from the Engineering and Physical Sciences Research Council. Her doctoral thesis and MSc (Distinction) at Goldsmiths were concerned with computer programming practices, subjectivity and artificial intelligence for interactive and responsive books. Since completing her PhD in 2011 (titled: "Navigating Subjectivity: South a Psychometric Text Adventure"), she has continued to research the ways in which computational systems try to understand humans, especially what happens when computers attempt to generate human-like cultural expressions. Inevitably, this has resulted in an increasing concern with the significance of the human and the non-human, with situatedness and embodiment. In 2018, she completed an Open University MA in Creative Writing (Distinction), addressing virtuality and non-linear narrative structures. She has exhibited work addressing both the limits and potential of VR/AR and AI.

Elena Papadaki is a visual historian, cultural theorist and curator based in London and Brussels. Her research interests lie in the intersection of screen-reliant imagery, curation, interactivity and audience reception. Her doctoral thesis from Goldsmiths University of London was titled "Curating Screens: Art, Performance, and Public Spaces". Having previously held posts at the Hellenic Ministry of Culture (department of Museum studies) and the International Council of Museums (ICOM), she has over ten years of professional experience in the arts and museum sector. Elena works as a Lecturer in Curation and Digital Arts at University of Greenwich (London UK) and as a Contextual studies tutor at the Royal College of Art (London UK). She is also founder of Incandescent Square (a collaborative meeting point for design, art, and research); with the latter, she has curated and managed exhibition projects in France, Greece, Malta, Portugal and the UK.