Creative Gardens: Towards Digital Commons

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ABSTRACT
There is growing interest in the potential of *digital commons* for creative activities. However, there are concerns over how prevalent *digital cultures* could affect innovation and creativity. For example, lossy digitisation, limiting models of knowledge cultivation, and a lack of social sustainability. Creative Gardens consider the complexity of creative cultures from the perspective of design innovation, including how to nurture creativity activities. Offering a perspective on what would be required of *digital commons* to support creative activities and distributed innovation. Especially, the required distributed and communal ownership of information resources and technology, including resources designed to be used by the community who provides them. Cloud Computing is becoming the dominant model of computing provision, but lacks distributed and communal ownership, as well as community-designed resources. So, we suggest that Community Clouds would provide a suitable integrative socio-cultural collaborative technology platform for the digitisation of creativity activities. It could support the distributed innovation of Creative Gardens, thereby providing the prerequisites for a new digital renaissance.

Author Keywords
collective; creativity; digital; culture; commons

ACM Classification Keywords
H.1 Information Systems: Models and Principles

INTRODUCTION
There are challenges and opportunities for creative cultures in digital spaces, including the nurturing of creative activities and the potential for distributed innovation. However, many existing digital spaces are *walled gardens*, provided under feudal arrangements by digital oligarchs [8], and are therefore unsuitable for creative cultures. Content and form cannot be separated, because the infrastructure put in place will determine the content created, as well as the ways it will be used. So, *digital commons* [10] with distribution and communal ownership of information resources and technology, with resources provided and designed by the community who provides them, would be required. Furthermore, *digital commons* beyond the form of wikis, open-source software, or open-source licensing, would be required to support creative activities and distributed innovation.

Creative Gardens [5] consider creative activities as *cultures of innovation*, seeking to investigate approaches to create capacity for sustainable innovation. *Cultures of innovation* are viewed as complex adaptive systems that have large numbers of components that can interact, and adapt or learn [19]. This is because innovation is pursued as the novelty that emerges from conversations of collaborations in dynamic, non-linear, networked communities [17]. Also, because it is necessary to understand social goals like creativity, personal satisfaction and freedom in reorganising for innovation. Being mindful of the social fabric of the organisation, recognising culture as a powerful and sophisticated agent [2]. Furthermore, to unlock creative potential requires taking a situational rather than a dispositional view of creative leadership, igniting the collective creativity from the ground up [27]. Therefore, moving beyond simply networking creative individuals to establish diverse communities of practice for innovation through discursive methods. Also, considering how digital disruption leads innovation, because *digital spaces* can only enable creativity if wedded to peoples needs and desires. So, *digital commons* are required in which the community of people building them can intervene in the governing of their interaction processes and of their shared resources.

Community Clouds [6] aspire to combine from Grid Computing, Digital Ecosystems and Autonomic Computing. To provide social sustainability with the use cases of Cloud Computing, without dependence on Cloud vendors such as Google, Amazon, and Microsoft [22]. So, they could provide *digital commons* capable of supporting the creative activities as understood from Creative Gardens. Allowing for the distributed and communal ownership of information resources and technology, such that the community governs their own interactions and shared resources.

We will introduce Creative Gardens in the next section. Then, in the following section, introduce Community Clouds, considering how they could support Creative Gardens. Finally, we will conclude, discussing related policy issues and the wider potential of *digital commons* for creative activities.

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CREATIVE GARDENS

Creative Gardens [5] were proposed to explore achieving innovation through creative activities. The model advocates a holistic hybrid approach to nurturing creativity for innovation, ultimately leading to socio-cultural capital capable of addressing crowdsourced areas of interest. This curation approach to disruptive innovation would integrate *open distributed innovation* [31] with *communities of practice* [12]. Forms of cultivation would include encouraging design innovation, cluster building, diverse grouping, and disruptive collaboration. These would ultimately aim to stimulate the growth of the socio-cultural capital needed to facilitate the creative capability required to achieve innovation on range of applications, for example environmental sustainability. Digitising Creative Gardens required considering the physical and digital interaction utilised by designers, in achieving intuitive community engagement experiences in the complexity of creative spaces [5]. This included how Creative Gardens could form, operate, diverge, and merge to facilitate cultures of creativity for community-driven emergent disruptive innovation. Therefore, allowing for the loss-less digitisation of Creative Gardens to support *distributed communities of practices* [23] in achieving innovation. For example, in promoting networks-of-networks that favour collective creativity, alongside multidisciplinary expertise that is spatially and temporally dislocated. In other words, a distributed approach consisting of place-based resources, which are part of a design innovation solution.

Cultures of Innovation

Cultures of innovation require a discussion on complexity and innovation, because innovation can be considered as being on the *edge of chaos* [32]. This *edge of chaos* in complexity is most frequently associated with work on living systems (e.g. insect colonies, the human body, neural networks, etc). Complex, non-linear dynamic systems with rich networks of interacting elements have a zone of operation (states) that lies between chaotic and near static behaviour (ones with minimal spontaneous activity) [15]. Such systems on the *edge of chaos* appear to constantly adapt, self-organising to create configurations that ensure compatibility with an ever-changing environment. So, humanity is now evolving from the hierarchal structure of industrial culture to a network structure of robust, creative and locally empowered societies [15]. This implies living in social networks with non-hierarchical connectedness, having maximum freedom for the individual and maximum potential for the collective. It has been suggested that innovation is pursued as the novelty that emerges from collaborations in these dynamic, non-linear and networked communities [17]. Therefore, in this network structure creativity is increasingly a form of agency [25], and therefore has the potential to drive cultural evolution [7]. So, we need to experiment with extreme collaboration for networked collectives, challenging traditional models of single disciplinarily and avoiding silos of knowledge. We could then utilise self-organisation within social networks to spawn the collective creatives. Furthermore, we need to consider how digital technologies could facilitate these distributed collective creatives we call Creative Gardens.

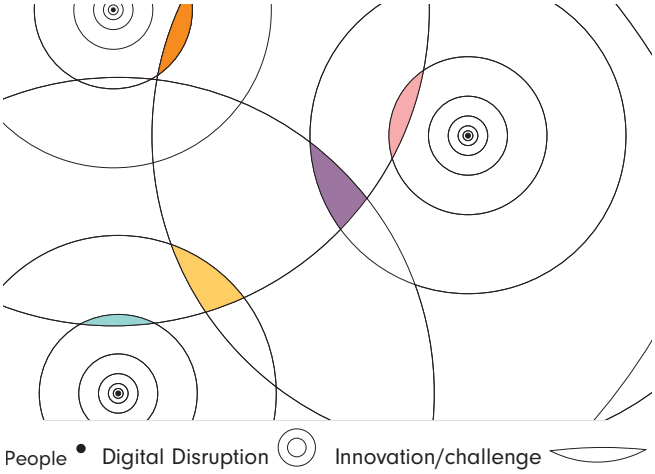

Figure 1. Creative Gardens: Representation showing the potential of digital disruption for creative collectives to crowdsource challenges and innovate. Building networks that favour collective creativity, with multidisciplinary expertise that is spatially and temporally located. [21, 5]

Defining *digital commons* for Creative Gardens requires considering *digital cultures*, the practices and socio-cultural meanings of emerging digital technologies, that could affect distributed innovation and creativity. Digital systems are human-made, and so institutionalise the perspectives held by those who develop them. For example, e-mail was implemented in a more era (so one can e-mail any other person with an e-mail address), but *instant messaging* was implemented in a more commercialised era (so one can only IM another person on the same IM network/protocol).

So, there are a number of challenges prevalent in considering the digitisation of the creative activities of Creative Gardens. Most significantly, the current emphasis on allowing knowledge cultivation to be strictly owned as a source of profit generally results in the established owners of capital, rather then the creators of knowledge, benefitting from intellectual property rewards [24]. This Information Feudalism [11] highlights the concern that the current emphasis on strong intellectual property rights, leads to a situation where the cultivation and ownership of information becomes increasingly concentrated.

The concern for Creative Gardens is that digitisation leads to the adoption of *digital cultures*, such as norms regarding knowledge ownership in digital spaces, that would be inappropriate to the distributed and communal ownership of information resources required. For example, *gift cultures* with *non-subtractability* (multiple users can access the same digital resources with no effect on their quantity or quality [13]) may be more preferable to *digital rights management*. So, a suitable approach would be *digital commons* [10], in which resources are designed to be used by the community who provide them. This is ensured by the distributed and communal ownership of the underlying information resources and technology. While Cloud Computing is becoming the dominant model of computing provision, it lacks distributed and communal ownership, as well as community-designed resources. So, in realising *digital commons* for Creative Gardens we shall also consider Community Clouds.

CLOUD COMPUTING

Cloud Computing is the use of Internet-based technologies for the provision of services [18], originating from the *cloud* as a metaphor for the Internet. It offers the illusion of infinite computing resources available on demand, with the elimination of upfront commitment from users, and payment for the use of computing resources on a short-term basis as needed. Furthermore, users have no knowledge of, expertise in, or control over the technology infrastructure of the Cloud supporting them [9]. Figure 2 (LEFT) shows the typical configuration of Cloud Computing at run-time, in which control is still centralised. Even if the central node is implemented as a distributed grid, which is the usual incarnation within a data centre. Providers, who are the controllers, are usually companies with other web activities that require large computing resources, and in their efforts to scale their primary businesses have gained considerable expertise and hardware. For them, Cloud Computing is a way to resell these as a new product, expanding into a new market. Consumers include everyday users, Small and Medium sized Enterprises (SMEs), and ambitious start-ups whose innovation potentially threatens the incumbent providers.

The growing popularity of Cloud Computing comes from its convenience, but also brings centralised vendor control, an issue of ever-increasing concern [29]. For example, one consequence is the loss of information privacy, with vendors having full access to the resources stored and executed on their Clouds [26]. In particularly sensitive cases of SMEs and start-ups, the provider-consumer relationship that Cloud Computing fosters between the owners of resources and their users could be detrimental. This is beacause there is a potential conflict of interest for the providers [6]. They profit by providing resources to up-and-coming players, but also wish to maintain dominant positions in their consumer-facing industries, therefore risking Information Feudalism.

Community Clouds

Community Clouds [22] offers an alternative architecture to Cloud Computing. Created by combing the Cloud concept with the distributed resource provisioning of Grid Computing [14], distributed control of Digital Ecosystems [4, 3], and the self-management advances of Autonomic Computing [20]. Utilising networked personal computers for liberation from the centralised vendor model, and so remaining true to the original vision of the Internet [1]. Community Clouds would therefore provide a compelling socio-cultural collaborative technology platform. Utilising the spare resources of networked personal computers to collectively provide the facilities of a virtual *data centre* for Community Clouds. Replacing vendor Clouds by shaping the underutilised resources of user machines to form Community Clouds, with nodes potentially fulfilling all roles as shown in Figure 2 (RIGHT).

Community Clouds would therefore be as much a social structure as a technology paradigm, because of the communal ownership of the infrastructure. Carrying with it a degree of economic scalability, without which there would be diminished competition and potential stifling of innovation as is risked in vendor Clouds. Therefore, identity in Community Clouds would arise naturally from the structure of the network, based on the relation of nodes to each other, so that it can scale and expand without centralised control [6]. So, avoiding any inherent conflict between convenience and control, because its communal ownership would provide distributed control that would be democratic.

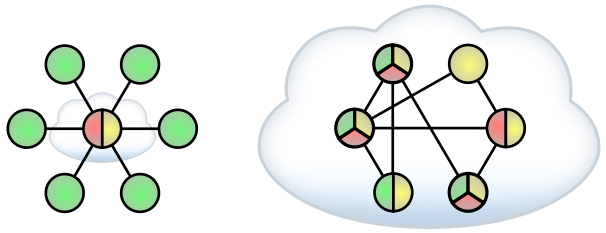

Figure 2. Clouds: Green symbolises resource consumption, yellow resource provision, and red resource coordination and administration. (LEFT) Typical Cloud Computing configuration when consumers visit an application served by the central Cloud, which is housed in one or more data centres. (RIGHT) Community Clouds created from shaping the under-utilised resources of user machines, with nodes potentially fulfilling all roles, consumer, producer, and most importantly coordinator.

Community Clouds could provide a better quality of service (QoS) than vendor Clouds, utilising time-based and geographical variations advantageously in the dynamic scaling of resource provision. However, ensuring acceptable QoS in a heterogeneous system would require reaching a *critical mass* in the participating nodes and available services. A *community currency* (one not backed by a central authority for exchanging goods and services within a community [16]) could support long-term promises between community members in a *gift culture*. It would also open the possibility of public subsidy to support digitally-mediated creative activities.

The method of materialising Community Clouds would be the distribution of its server functionality amongst a population of nodes provided by user machines. Shaping their underutilised resources into a *virtual data centre*. Nodes would be interconnected to form a peer-to-peer (P2P) network. Engineered to provide high resilience while avoiding single points of control or failure. So, fully distributed dynamic P2P designs [28] that offer sufficient guarantees of distribution, immunity from super-peer failure, and resistance to enforced control. Such as the *distributed virtual super-peer* model, in which a collection of peers logically combine to form a virtual super-peer [28], which dynamically changes over time to facilitate fluctuating demands.

A key element of communal ownership would be distributed coordination. This ability of nodes to jointly participate in transactions, without centralised mediation, that influence their individual state. So, distributing the coordination of transactions [28] to permit multi-party service execution.

Community Clouds would naturally require storage on participating nodes, taking advantage of the ever-increasing surplus on most personal computers. Information privacy would be provided by the encryption of user information when on remote nodes. Only being unencrypted when accessed by the user. Therefore, allowing for the secure and distributed storage of private, as well as communal, information.

Digital Commons for Creative Gardens

Community Clouds would provide a self-sustaining scalable resource provision model for realising *digital commons* for the creative activities of Creative Gardens. It would be without risk of compromising the content or trust in the content, because it would be compatible with the distributed and communal nature required, unlike centralised vendor Clouds.

As Creative Gardens would form through crowdsourced areas of interest, participants interacting via the *digital commons* of the Community Cloud, would be able to share the resources of their computers to establish a Creative Garden. Their Creative Garden would be distributed throughout their Community Cloud, potentially alongside other services. The community would then be able to provide the bandwidth for content distribution. Tasks, such as editing shared information, would require an update to the distributed storage of the Community Cloud. This would be achieved by transmitting the new data through its network of nodes, using an eventual consistency model [30]. The community would also provide the computational resources for creative activities, which may have QoS requirements that require a *critical mass* of participating nodes.

As an organisational model for resource provision, *digital commons* realised from Community Clouds, would move the cost of service provision to the user base. Effectively creating a *sharing culture*, dramatically lowering the barrier to entry for digitally-mediated innovation. With the communal ownership of the information resources ensured through the distributed ownership of the underlying computers containing them.

CONCLUSION

We have considered how Community Clouds, a community form of Cloud Computing, could provide *digital commons* for Creative Gardens, addressing the issue of knowledge cultivation for creative activities. Therefore, providing the prerequisites for a new *digital renaissance* in the *networked age*.

Future work should include economic models for such *digital commons*, because as public goods a public subsidy would likely be needed. It would be justifiable, given the benefits to the economy which would derive from the resulting increase in digitally-enabled creativity. The subsidy might be through direct financing, or indirect by giving commercial operators incentives, to provide non-profit spaces or *critical mass*. The principles of public subsidy linked to regulation, which are key features of UK's historic approach to public service broadcasting, would be of relevance given the strong reputation of this system internationally. Future work should further consider *digital commons* for the creative activities, including how to overcome concerns over lossy digitisation, and wider concerns over social sustainability.

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