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The Art of Tokenization: Blockchain Affordances and the Invention of Future Milieus

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Abstract

Ten years after the introduction of the Bitcoin protocol, an increasing number of art-tech startups and more or less independent initiatives have begun to explore second-generation blockchains such as Ethereum and the emergent practice of tokenization (i.e., the issuance of new cryptoassets primarily to self-fund decentralized projects) as a means to intervene in the structures and processes underlying the rampant financialization of art. Yet amidst the volatility of the cryptocurrency market, tokenization has been critiqued as a way to reinscribe and proliferate current financial logics in this new space. Acknowledging such critiques, in this essay I foreground the novelty of cryptotokens and blockchains by exploring different examples of how tokenization has been deployed in the art market-milieu. In spite of recent attempts to extend the scarcity-based paradigm to blockchains, I argue that cryptotokens do introduce differences in kind in the ways in which value generation and distribution are expressed and accounted for in digital environments. In this context, artistic approaches to tokenization can illuminate new aspects of the affordances of these technologies, toward the disintermediation of art production and its networked value from the current institutional-financial milieu. This can open up new ways to reimagine and reprogram financial and social relations, and gesture toward new opportunities and challenges for a practice of digital design focused on the ideation and realization of cryptoeconomic systems.

Keywords

contemporary art, technicity, networked cultures, financialization, tokenization, blockchain

I. Affording affordances: art between financialization and tokenization

Ten years after the invention of the Bitcoin protocol, blockchain is eating the art world – with an increasing number of startups, galleries, institutions and more or less independent initiatives exploring second-generation blockchains such as Ethereum, and the emergent practice of tokenization, as a means to intervene in the structures and processes underlying the rampant financialization of art. Tokenization refers to the issuance of smart contracts tokens, conventionally (but not necessarily) through the ritualized event of an Initial Coin Offering (ICO), which allows access to the existing or prospective value generated by a specific asset – such as gold, computing power, storage, even artworks, and, more generally, an alluring value proposition for a decentralized ecosystem. Promising the disintermediation of funding streams – and more broadly, processes of value generation and transfer – from mainstream financial-institutional channels and the creation of network effects around independent projects, tokenization has been initially heralded as a new tool for organizational and economic autonomy. However, amidst the volatility and sensationalism of the cryptocurrency markets and yet-unresolved technical and regulatory challenges, the practice has been subject to criticism due to its inability to deliver on the promise of an alternative financial-organizational system that would minimize the role of centralizing third parties (states, enterprises, banks, institutions, boardrooms, platforms, exchanges) while fostering an open and decentralized web. Instead, tokenization is often seen as a means to, in most cases, reinscribe and proliferate current financial logics in the digital realm – by providing more granular means for the monetization of digital interactions while leveraging the speculative nature of markets.¹

Acknowledging the extent to which the digital has become a prime site of economic (in addition to social and cultural) production, my proposition in this paper is that we should consider blockchains and tokens as novel technologies in the initial stages of a process of *individuation*, rather than prematurely aborting the inquiry into their affordances as already overdetermined by tendencies of financial accumulation with which we are intimately familiar. I borrow the concept of individuation from Gilbert Simondon's genetic philosophy of technology (2013; 2017). This postulates that

technical objects evolve – “concretize” – analogically to living beings by discovering a “recurrent causality” (a feedback mechanism) with an associated milieu (the surrounding environment), with which the object exists in a relation of mutual conditioning. The associated milieu enables the technical object to acquire an “internal resonance” and convergence according to its own finality (Simondon, 2017: 26). As the technical object evolves, it attains higher degrees of concretization that allows it to become multi-functional by extending and dynamically integrating its associated milieu “into itself through the play of its functions” (Simondon, 2017: 50), therefore gaining not only an internal consistency but also an external resonance.² While Simondon was mainly referring to the physical environment surrounding a technical object — such as the integration of the action of the river, as motor and cooling agent, in the functioning of the Guimbal turbine (2017: 57) — in the unfolding of this paper I will expand on the differences introduced by computational systems in the concretization of a digital milieu through the work of Yuk Hui to provide a reframing of the concept of affordance updated to today’s digital age.

Thus, the theoretical assumption of this paper is that we should understand the token-based networks emerging around blockchain technology as systems in the early stages of a process of individuation with an associated milieu yet to be discovered fully. By emphasizing the concept and role of the milieu as opposed to limited conceptualizations of the market,³ I want to stress that these new digital tools should not solely be investigated according to economic notions inherited from the industrial economy (such as scarcity and return on investment) but, from a more ecological perspective, as means to potentially introduce new modes of organizing processes of collective individuation different from those allowed by computational capital as it currently exists.⁴ Thus following this philosophical trajectory, the challenge becomes one of learning to understand and reason with these tools in order to be able to leverage their novelty, by informing and structuring new dimensions of economic, social, and cultural exchange. In making this proposition, I aim to open up new ways to think constructively about the creation not only of new markets, but first and foremost new milieus, the ‘value(s)’ of which is/are indexed by a circulating token.

A thorough discussion of the philosophical underpinnings of my claim will not be the prime focus of the present paper. Instead, I will illustrate this by discussing examples of how tokenization has been deployed in the art world. Thanks to the capacity for experimentation afforded from within its own domain of operations and its proximity to the logic of networked value production and valuation practices, the art field (as a limit case in a much broader spectrum of creative approaches to blockchains) provides a fecund milieu within which to investigate and express the imperceptible and yet concrete capabilities of blockchains and tokens. As a matter of fact, since at least as early as the *New Tendencies* (1961-1973) and *Cybernetic Serendipity* (1968) exhibitions, artists have played a crucial role in pushing the boundaries of technological research by exploring, making felt and, at times, ‘misapplying,’ the affordances of new technologies (Scarlett, 2018). To be clear, I am not interested in investigating such projects *as* artworks. Rather I will be analyzing them as singular cases of Simondonian technical systems, foregrounding the ways in which they differentially operationalize the affordances of blockchain, as a novel technical form, through their applications and the relations they instantiate with a nascent milieu. While it is true that in many cases the tokenization of art merely reinscribes the scarcity-based approach inherited from the industrial economy to information, I aim to show that artistic approaches to tokenization are able to foreground the potentialities of these technologies to unlock new imaginaries for systems of value creation. In so doing, they gesture to the social, financial and aesthetic affordances that these tools may offer, not only to artists but more broadly to networked producers seeking autonomy from current institutional-financial forms.

In the following section, I introduce the terms of the debate around the financialization of art in relation to networks and blockchains. Subsequently, I reframe the concept of affordance through the lens of Simondon’s philosophy, extended through Yuk Hui’s theorization of digital objects, and foreground the role of the associated milieu in relation to the concretization and individuation of a technical system. Further, I will discuss examples of artistic engagements with tokenization, tracing parallels and differences with current financial and organizational forms. I then discuss in more depth the new possibilities opened up by the structural and transactional affordances of tokenized systems –

“cryptosystems” – toward the structuration of new market-milieus. Ultimately, I gesture towards the opportunities and challenges for emerging cryptocultures engaged with the realization of such systems.

2. The tokenization of art, part I: the financialization of networks, and the (failed?) promise of the blockchain

The relation between art and finance has been widely debated, with a particular focus on the key role of financial markets in shaping the cultural, political and social milieu within which art operates (Wiley, 2018), and as the sources of cultural funding have been put under unprecedented scrutiny by artists, cultural practitioners and institutional players who are receivers of such funding (Corbett, 2018; Fraser, 2018). In this context, the financialization of art is manifested, on the one hand, by the expansion and professionalization of art investments (Velthuis and Coslor, 2012), and, on the other hand, by its operational analogy with the logic of derivatives markets, in view of the abstracted, networked processes that characterize art’s ‘value’ and valuation in its post-medium condition (Ivanova, 2016).

Arguably, the financialization of art can be seen as part of a larger socio-cultural phenomenon, which consists in the spreading of patterns of financialization to the socially networked sphere. This can be conceived in a two-fold manner: on the one hand, it corresponds to the consolidation and increasing legitimacy (in the political economy of the Web) of a business model and power order characterized by its reliance on information trading as a key source of value generation, rather than by material production, coupled with the establishment of dynamic forms of rent to define Internet monopolies (see Marazzi, 2011; Pasquinelli, 2009; 2015). On the other hand, it is manifested as a more insidious tendency by which the operational mode of derivative finance has pervaded digital networked environments. This logic can be described in terms of the abstraction of the forms and processes of value creation from any material referents and the recombination and commensuration of all forms of capital (affective, cognitive, cultural, social) to price, allowing for “the continuity of circulation in and across immensurable difference” (Cooper, 2010: 179; see also Bryan and Rafferty, 2006; 2010).⁵ In digital platforms, it has come to define a new mode of governance in which social relations are organized, valued and monetized through automated predictive models that bear little relation to the

underlying material reality of the users, enabling the ad-driven business model of online platforms (on how this is deployed, for example, by Facebook's social graph; see Arvidsson, 2016).⁶

It is at this junction that the novelty of the blockchain inserts itself more forcefully – not simply by proposing a form of digital money that is not stored in any banks' servers but also by providing, for the first time, a model to enable the development of open networks. As it is well known, as the last financial crisis was unraveling, the Bitcoin protocol offered a tentative, yet concrete, alternative to the current computational-financial paradigm by realizing the very first decentralized monetary system that is native to digital environments. It did so, as I will discuss in more detail below, by providing an elegant solution to the double spending problem – that is, the problem of achieving provable scarcity in digital environments so as to realize a monetary system. This is based on a shared data layer (the blockchain) that is replicated and stored across all nodes in an open and distributed network, and a cryptographic native token used to access the value produced by such network and data (cf. DuPont, 2019 for an overview of the technology). In so doing, Bitcoin retrospectively exposed the structural conditions that imperceptibly enable the financialization of everything as in-built in the current internet stack, in which networked (social, cultural and economic) value is generated through the freely available communicative capabilities of the protocol layer (such as TCP/IP, HTTP, SMTP⁷) and captured and re-aggregated as tradable information at the application layer through the “programmability” of platforms (Helmond, 2015).⁸

In 2015, Ethereum extended Bitcoin's vision with the generalization of a cryptographically secure “transaction-based state machine” (Wood, 2018)⁹ that could run arbitrarily complex computation and enable the creation not only of a decentralized currency but of decentralized applications, ushering in a new wave of experimentations with new socio-economic forms. Yet the very possibility to extend the notion of digital scarcity to “anything that can currently be represented by a computer” (Wood, 2018: 2) coupled with trans-border value transfers (often at a fraction of the cost) and pseudonymous transactions has effectively reinforced incumbent property and financialization forms into this new space, providing more

granular means for the transactionalisation of networked interactions, while leveraging the speculative nature of markets.

In the art world, this has become evident with regards to the issue of collectability in the age of networked markets and digital reproduction. On the one hand, the tokenization of physical art objects reproduces the rent model characteristic of financial capitalism and current Web platforms, promising a more streamlined tracking of provenance, ownership and authenticity of such assets. A case in point is Maecenas, a self-defined “decentralized art gallery.” Maecenas tokenizes artworks into tradable, fractional ownership certificates that are auctioned on the open market, and which can be acquired through Maecenas’ ART token. The artworks themselves, meanwhile, are safely kept in freeports and never exhibited, making contemporary art literally disappear, as J.J. Charlesworth quips (2017).¹⁰ On the other hand, the tokenization of digital assets imports the logic of scarcity inherited from the industrial paradigm to the informational domain, in direct contradiction to the fluidity, copyability and mutability of the digital medium, and against the ethos of open source production. While successful examples of the commoditization of digital art through blockchains already exist (companies such as Ascribe or Verisart have been active in this space for years),¹¹ this tendency has been recently accelerated by the spreading phenomenon of cryptocollectibles – that is, tradeable, unique digital images, such as Rare Pepe, Crypto Punks and the infamous CryptoKitties. CryptoKitties are nothing more than ERC-721 tokens (an Ethereum standard proposal for ‘provably rare’ digital assets) that visualize the uniqueness in the contract itself. By storing metadata (such as an HTTPS¹² link or IPFS¹³ hash) to each token’s attributes on-chain, digital rarity is brought to online space for the first time. While ERC-20 tokens, such as Maecenas’ ART, function well as settlement mechanisms due to their interchangeability and divisibility, non-fungible tokens (NFTs) are indivisible, non-interchangeable, and yet tradeable, ushering in new possibilities for ‘rare digital art.’¹⁴

Consonant with the logic of derivative finance described above, both approaches are based on the abstraction of the ownership claim from any referent (either material, such as gold or fractions of unique artworks, for digital, such as the unique design of

a pixelated cat) and a more streamlined circulation thanks to the tendency toward standardization of basic transfer functionalities in contracts. As Rachel O'Dwyer rightly observes in the context of the infamous CryptoKitties: "Like money then, the ownership claim lays claim to nothing more than the act of ownership itself. What's valuable is the information circulating around the good" (2018). Indeed, the token slips back and forth between a representation of an asset and liquid currency, "whose performance relies on the hype and information that circulates around the good" (ibid.). In this sense, these approaches, it is argued, merely treat art as currency (see Arcand, 2018) – a universal *numeraire* for the circulation of cultural capital, which is abstract, transactional and which, in virtue of its detachment from the material reality in which it is embedded, could also serve to increase one's status, gain political influence, commit tax fraud, or engage in money laundering.

While it is evident how abstraction and circulation have become the defining traits of the logic of techno-financial capitalism in networked environments, perhaps an interesting question to pose is not so much what blockchain can do for (the) art (market), but what art can do for the blockchain, by leveraging such forms of abstraction and circulation, in order to then open up the thinking to how in turn they may affect the organization and evolution of the systems they portend. In order to do so, let me first expand on the concept of the associated milieu in Simondon's philosophy, coupled with an explanation of his theory of technicity, in order to rearticulate the concept of affordance within the broader scope of a genetic theory of technology.

3. Technicity and milieu: In-forming affordance

As mentioned in the introduction, the novelty of Simondon's philosophy lies in his formal approach to the problem of individuation – that is, of how things come into being – on the basis of a non-reductive theory of information, or universal cybernetics. For Simondon, physical, psycho-collective and also technical entities individuate through a relation of mutual conditioning with an associated milieu from a "preindividual" field (2013: 31–32). For Simondon, individuation is the single process underlying the ontogenesis of physical, biological and also technical beings, and it is the sole process that allows for the conservation of being through becoming,

thus allowing for evolution (2013: 25). In so doing, Simondon reverses the perspective by which the individual, as a constituted being, has always been studied, replacing the notion of an ontology of being with an ontogenesis of becoming. In the context of the concretization of technical objects, the preindividual milieu is constituted by culture, understood as that which provides a regulative function on the individuation of the heterogeneous collective constituted by humans, the environment and machines.

A determinant factor in the concretization of technical objects is technicity. In Simondon's genetic theory of technology, technicity corresponds to a "tendency" of concretization of a certain technical paradigm into objects (2017: 51). It is a "determination of forms" (2017: 150). As Simondon explains, technicity manifests itself in the practical use of tools. However, it precedes and exceeds the object as a mode of relationality between the system constituted by human and world.¹⁵ It is technicity that underlies the manifestation of technics and the concretization of a technical paradigm into objects, providing the latter with a normative and evolutionary power to affect the ensemble constituted by the relations between humans and the world (Simondon, 2017: 74). Importantly, by positing technicity as an originary mode of relation with the world, Simondon also reminds us that technicity pre-exists economic determinations. It is technicity alone which defines the conditions of possibility for the technological – and also social and economic – affordances in the broader trajectory of the evolution of a technical lineage.¹⁶

While the technicity of an element reaches its full expression in the artisanal paradigm of production, the technicity of the technical individual (the machine) characterizes the industrial model of production. With the introduction of the cybernetic "cognitive schema," technicity has a tendency to reside in systems. Cybernetics replaced the notion of a teleological mechanist progress with that of feedback, providing a self-regulatory function toward "an active adaptation to a spontaneous finality" (Simondon, 2009: 18; see also: Hui, 2017). Simondon presciently noted that the openness of the "reticular structure" that characterizes informational systems (beginning with telecommunication networks such as phone cables and antennas) makes them open and participable.¹⁷ For this reason, it has the

potential to integrate the modulative function of the “technical reality” into culture (Simondon, 2017: 21).¹⁸ Yuk Hui (2016) extends Simondon’s speculative theory of “post-industrial objects” by articulating the existence of digital objects – examples of which are data and metadata. In contrast to Simondon, Hui argues that digital objects not only *individualize*, developing and integrating an associated milieu, but also *individuate* through their capacity to dynamically restructure their relations with other objects, systems, and users in their associated milieus (Hui, 2016: 57). The process of concretization of digital objects effectively sublates the difference between the object and its material support into a digital milieu, constituted by and through the relations actualized in the multiple networks, protocols, standards, data and algorithms (Hui, 2016: 24). As Hui observes: “digital objects take up the functions of maintaining emotions, atmospheres, collectivities, memories, and so on” (Hui, 2016: 57). In so doing, they also integrate and converge other dimensions of being into their functioning, such as economic and social systems (Hui, 2016: 57) and, in turn, “inaugurat[e] a new set of operations under the names of *social computing* and *crowd sourcing*” (Hui, 2016: 58). The development of the Internet and of the new practices that it enabled, by pervading increasing aspects of the world, exemplifies this well. From its genesis within academic circles, to the military-industrial complex and parallel histories of hackers and cypherpunks, the commercialization of the Internet in the nineties, and the more recent rise of the participatory web with social media platforms, the evolution of networked communication technology has been characterized by a progressive openness of the technology and participation by users. However, this has so far mostly enabled more pervasive forms of control and economic extraction.¹⁹

Simondon’s and Hui’s genetic philosophies of technology offer us key conceptual tools to look at openness and programmability not merely as architectural features of protocols and platforms but as characteristics of the concretising technicity of digital systems – as open, modular and participatory, not only individualising but *individuating* in and through the larger socio-cultural milieu by integrating in turn other domains into their functioning. From this standpoint, it would be misleading to ask to what extent platforms and blockchains engender and are subjected to the logic of derivative finance and speculative distributed markets. Rather, Simondon and Hui

seem to suggest, the programmability and openness of informational systems – as the prevailing technical tendency of the post-industrial paradigm of technological development – have informed the evolution of contemporary financial logics in the direction of abstraction, fragmentation and circulation, in parallel with the transformation of economics into a “cyborg science” (Mirowski, 2002) since its encounter with cybernetics.

In this context, we can think about the capabilities of blockchain technology as a new stage in the concretization of the technicity of informational systems – what Helmond (2015) characterizes as the “programmability” of platforms. My proposition is that it is from the standpoint of the technicity of open digital objects that we should understand the openness and programmability that characterize networked systems (from protocols and APIs to open source development and projects, including permissionless, peer-to-peer forms of value), and temporarily suspend any judgment on the economic forms they engender, investigating instead the relations that they enable with an associated milieu. This is as much an ontological proposition as it is a method of synthetic enquiry: that we should consider such new techno-economic structures and market formations (such as platforms, blockchains, and tokenized networks) from the perspective of the ontogenesis of the digital. In this context, this would entail studying the ways in which blockchains and smart contracts actualize and synthesize relations (technical, but also economic, social, cultural) within the broader scope of the lineage of the openness and programmability of digital systems, and how these systems individuate these very domains in turn, so as to open up lines of constructive enquiry into the processes of feedback with their associated milieu.

Therefore, we should understand technicity as that which defines the conditions of possibility for affordance in the broader trajectory of the evolution (individuation) of a certain technical paradigm into object. The question, following this trajectory, becomes one of how to integrate such technicity into culture so as to overcome the alienation between human and machine established in the industrial mode of production.²⁰ From this standpoint, the concept of technicity as expressive of an individuating technical form allows us to reframe our question in terms of the relation between such novel digital objects and the associated milieu that they

engender, in comparison to the distributed architecture of contemporary financial markets. In the context of a novel technical invention such as that of the Bitcoin protocol, the milieu is yet to be fully discovered. It is “by way of the schemes of the creative imagination”, Simondon remarks, that we can accomplish the “reverse conditioning of time” required for the establishment of the conditions of possibility for the creation of a future associated milieu (Simondon, 2017: 60).²¹ It is from this angle that artistic approaches to tokenization can foreground certain affordances that are exclusive to cryptotokens as a new kind of digital object and programmable value form through the milieus that they envision, by refunctioning standards and best practices existing in their ecosystem and operationalizing them towards the structuration of new forms of value generation and distribution.

4. The tokenization of art, part 2: cryptoeconomics and/as artistic practice

Alongside the above-mentioned examples of applied tokenization of physical or digital art objects, a new breed of art-tech startups and initiatives is emerging, exploring the affordances of blockchain tokens toward the realization of decentralized autonomous organizations (DAOs); i.e., organizations in which interaction among agents is mediated not by legal superstructures, but by rules encoded in protocols, and in which the management of internal capital is mostly automated (for a canonical categorization see Buterin, 2014). Ambitious projects such as terra0, a scalable framework for augmented ecosystems, and 0xΩ, a blockchain-based religion, are examples of how artistic engagement with smart contracts and tokenized systems can shine new light on the organizational affordances of these new digital objects. They do so by generating new imaginaries that may be capable of engaging, in heretofore unprecedented ways, with some of the most pressing issues of our times – such as environmental management and coordination of belief systems.

terra0’s Flowertokens are an experimental test-case toward the realization of a decentralized infrastructure for the self-management of natural resources (forests, woodlands) through a combination of smart contracts, sensors, open-data oracles, and AI bots.²² Like CryptoKitties, Flowertokens comply with the specifications for

non-fungible tokens but take the concept of cryptocollectibles offline, extending the notion of decentralized verification not only from digital to physical assets but, more boldly, to *live* assets; in this case, potted dahlias. While CryptoKitties derive their rarity from their provably unique genetic makeup – which affects the ‘attributes’ of each kitty (byzantinekitty, 2018; CryptoKitties, n.d.) – the uniqueness of each Flowertoken is provided by the metadata (growth rate and height) of each plant, which is captured by an image processing software and transmitted to an oracle, which then submits this information to the Ethereum blockchain. The project, which was active from July to November 2018, consisted of an installation and a website, from which users and visitors were able to buy and sell tokens, in addition to monitoring the history and status of the plants. Anyone could participate in the experiment and interact with the decentralized application through a Metamask browser extension and Ethereum wallet. Flowertokens were launched on 23 July 2018 at the price of 0.09 ETH each (approximately the equivalent of 40 USD at the time) in a limited number of 100 tokens corresponding to the dahlias available. In spite (or because) of the experimental nature of the project, all available tokens were purchased at least once, with some being offered for resale by the current owners at prices between 0.3 and 12000 ETH. This, in a sense, registers the appetite and market viability for such an innovative approach to ecosystem services tokenization.²³ The project ceased all trading and moved to archive mode in November 2018 due to lack of funding and resources (terra0, 2018). While it did not manage to bootstrap itself beyond the gallery space where it was exhibited, its visionary combination of remote sensing agents, machine learning, and blockchains ushered in radically new possibilities to reinternalize the values of ecosystem services, portending (and inspiring) the emergence of a “Nature 2.0” (McConaghy, 2018) based on a human-machine symbiosis that would be at once economic, ecological and, importantly, also cultural and social. From this standpoint, even as a sandbox, Flowertokens can be seen as a step in creating the conditions for the realizability of Nature 2.0 by concretizing new imaginaries, designs and logics for interoperable cybernetic ecologies.

As terra0 experimented with non-fungible tokens standards for the tokenization and automation/autonomization of natural resources management, 0xΩ deploys NFTs in

conjunction with token-curated registries (TCRs) for the creation of a blockchain-based religion or, in the words of the creators, a “consensus-driven hyperstitional engine for the creation of sacred objects” (2018). 0xΩ takes religion as a vehicle for art patronage (each idea for a sacred object being a unique proposition for an artwork, represented by a non-fungible token), and leverages distributed consensus as a way to collectively curate registries of artefacts and associated beliefs. In this context, TCR is one design pattern for so-called ‘cryptoeconomic primitives’ – that is, generic building blocks for tokenized games that enable the coordination and allocation of capital to achieve a shared goal via protocol-based incentives systems (Horne, 2018). Specifically, a TCR is a kind of curation market – a cryptoeconomic primitive that enables the decentralized curation of the content of a list or registry. As developer and TCR pioneer Mike Goldin (2017b) explains: “Token-curated registries are decentrally-curated lists with intrinsic economic incentives for token holders to curate the list’s contents judiciously.”²⁴ In 0xΩ’s case, TCR allow token holders to collectively curate shared beliefs and sacred artefacts (that is, artworks). The initial proposal for a sacred object is auctioned off in the form of a non-fungible token indexing a digital representation of the yet-to-be-realized sacred object. The proceeds of the auction are used by a DAO to realise the idea and artefact that the proposal is describing, leveraging the memetic capability of information to spread such ideas through various channels and hiring artists tasked with the goal of building the object. The unique token representing the yet-to-be-created object is fractionalized in shares (which are, aptly, called prayers) that proselytes speculate upon by trading them. The more the prayers circulate, the higher the transactions fees will be (which are returned to the DAO). As a consequence, the economic engine of 0xΩ becomes more and more robust. Here, speculation and the beliefs that emerge around the proposals for ‘sacred’ artefacts drive the system to grow the religion, leveraging distributed consensus and revisable governance as a way to cultivate and express a collective consciousness.

What differentiates these projects from the previously mentioned approaches to the tokenization of physical and digital art is their coupling of the affordances of tokenization in terms of programmable and disintermediated issuance of units of value with the nascent discipline of cryptoeconomics. Ethereum’s founder, Vitalik

Buterin, defines cryptoeconomics as a subset of economics that “uses cryptography to prove properties about messages that happened in the past [and] economic incentives defined inside the system to encourage desired properties to hold into the future” (2017). Cryptoeconomics is an apt example of the ongoing process of individuation of the blockchain ecosystem, generating new fields of knowledge and practices that are exclusively made possible by this new technological substrate, which entwines code and economics in unprecedented ways. Bitcoin wove cryptoeconomic mechanisms into the core of its protocol, by hardcoding its monetary policy into the software and tying the emission of new coins to the activity of validators, or miners. By rewarding miners for validating blocks (and therefore transactions) through a portion of newly minted coins, the Bitcoin protocol essentially integrates the function of value production in the “executability” (Hui, 2017: 29) of the protocol.²⁵

Smart contracts tokens extend this novelty to the application layer, by making the executability of value production effectively programmable to a broader extent.²⁶ As Hui notes, a digital object (such as a smart contract) is first and foremost a logical entity, “hence, it expresses a logical infrastructure as constituent of the digital milieu” (2016: 57). As mentioned above, from the point of view of Ethereum, a token is simply a contract that defines a mapping of addresses to integers that represent users’ balances (describing the initial state of the contract) and a set of functions to read and update the state. As such, “sending a token” simply corresponds to calling a method on a smart contract that has been deployed onto the Ethereum blockchain. For instance, ERC-20 and ERC-721 Ethereum tokens are contracts that enable standardized functions (such as getting total supply, getting an account balance, transfers, delegated transfers and, in the case of non-fungible tokens, the possibility to trace the external account owner of a specific token ID) to facilitate exchange.²⁷ Yet by looking at the systems that these digital objects engender as a collection of states and functions, it becomes possible to map out the recursive relations between state changes and describe their relations mathematically, in the direction of the creation of the above mentioned cryptoeconomic primitives (such as that used by 0xΩ). This opens up a whole new field of design focused on the realization of cryptosystems – that is, systems in which the token “must work as a necessary

element of a self-sustaining system which is a public utility” (Goldin, 2017a). While cryptosystems rely on the decentralized holding and circulation of their native tokens as an intrinsic aspect of their success and long-term sustainability, a tokenized economy (case in point: Maecenas) is not necessarily a cryptosystem. A cryptosystem, whichever the kind, is not owned by anyone (or better, is reciprocally owned by all its stakeholders), largely self-sufficient, and usable by any agent (human and non-human) in an open context. A self-organizing forest and an emergent religion based on a collectively curated set of beliefs are therefore apt examples of cryptosystems.

Cryptosystems are uniquely enabled by the affordances of the blockchain data structure, which for the first time combines the immutability of a shared past, cryptographically recorded on a distributed ledger, with the programmability of a shared future through a system of internal economic incentives by encoding ‘skin-in-the game’ at the protocol level for each and every self-interested actor (whether human or machine) toward a common goal.²⁸ From this standpoint, the affordances of tokenization in terms of digital scarcity and pseudonymous unique transactions must be understood as a means to move us toward the possibility of creating cryptosystems through the design of cryptoeconomic, i.e., tokenized, games.²⁹ These are protocols for economic, social and cultural interaction, aimed at tightly aligning incentives between ‘investors,’ ‘producers,’ and ‘consumers,’ and thus ultimately blurring the boundaries between them as mutual stakeholders in the long-term success and sustainability of a common project. Yuk Hui and Harry Halpin’s observation in the context of social networks design resonates with the potentials for the new interactive-transactive forms afforded by this newly emerging form: “A project is also a projection, that is, the anticipation of a common future of the collective individuation of groups. ... By projecting a common will to a project, it is the project itself that produces a co-individuation of groups and individuals” (2013: 115). Cryptosystems make explicit the sets of economic relationships and hypothetical incentives that contribute to the scattered holding of a common will for the concretization of a projection (such as ‘Nature 2.0’ or distributed revisable gods) into a viable project. These new projections (or imaginaries) for common futures are uniquely made possible by bridging – through an artful blend of design, computation and economics – the affordances of these technologies with specific use cases,

whether they are forestry management or ideological convictions. This opens up new perspectives that gesture towards new methodologies aimed at the articulation and experience of (not-only-)human values. Of course, blockchains and cryptosystems don't make any of these systemic issues easy to solve. But they do make them possible to think about, experiment with, and reason about in entirely new ways.

Thus, while platforms achieve network effects – the emblematic case of production-through-circulation (of data and information) that characterizes digital economies, in which the value increases through sharing and participating, as more people use the platform – by way of siloing access to data, in the design of a cryptosystem the abstraction and circulation of economic flows is more concretely integrated in the very processes of production of the network's value and public data storage, converging onto the goal of controlled appreciation of the value of the token in the ecosystem, by modulating its circulation. This is by no means a “good” or a “bad” thing. It is a different logic of producing and distributing networked value – value already accreted through digital interactions-transactions around a specific project-projection – through the automation of the mechanisms by which participation in the system is indexed, recorded, and rewarded (this could be voting on a proposal, or providing computing or storage power to the network, or participating in the curation of a list). And as such, it demands a new understanding of its schema of functions, to begin to develop, through a “work of the imagination” (Simondon, 2017: 60), new associated milieus, and bootstrap such new cryptoeconomic networks.

In this sense, if tokenization is merely an accelerated form of transactionalization, projects such as the ones discussed here illustrate some of the ways in which tokenization, coupled with cryptoeconomic mechanisms, may provide new conceptual and practical tools that allow us to face, in novel ways, some of the most daunting issues of our times. They do so by leveraging the forms of abstraction and circulation concretized by blockchain toward the realization of new milieus that differentially integrate market interactions into their designs. This allows us to ask: as distributed capital is encountering a new technological substrate, providing new modes of value generation and distribution in digital environments, what else might

finance and the “cultures of financialization” (see Haiven, 2014) become? Below I attempt to answer this question by illustrating some of the ways in which the above described projects reproblemate and rearticulate some of the main issues currently afflicting the field of art production – including the valuation, funding and collecting of art in light of the increasing financialization of the field – gesturing towards some of the ways in which the structural and transactional affordances of smart contracts tokens have the potential to recode and transcode fundamental mechanisms of how finance works.

5. Cryptotokens and finance: art as derivative

As the regulatory debates about the status of these new financial assets continue, experts’ opinion regarding the valuation of cryptoassets is divided between considering them either as a financial security or a store of value. This confirms the ambiguous nature of smart contracts tokens and indicates the difficulty of framing them according to any pre-existing category. While this essay is not the ideal context for a comprehensive debate regarding the nature of these assets, it suffices to say that, on the one extreme of the spectrum, tokens can be seen as pure, self-fulfilling speculation – new kinds of derivatives contracts with no underlying asset (or, more precisely, as contracts in which the underlying asset is constituted as a claim regarding the uncertain value creation by the platform of which the token is a part).³⁰ At the other extreme, views on cryptoassets as stores of value that emphasize decentralization and security in a cryptosystem point to the synergistic relation between the function of store of value and the utility of each token (i.e., that to which the token gives access, or for what it is possible to exchange it) (Kilroe, 2017; Wang, 2018). Thus, while cryptotokens’ underlying value at the time of issuance and until realization remains unbounded – structurally, it cannot be known in advance – by definition each token is paradoxically fully backed by its functionality, or, in other words, by what it potentially *affords*.

One factor contributing to this seemingly unsolvable tension is the profound structural difference between, on the one hand, the blockchain protocol as a technological system of value creation, recording and transmission, and, on the other hand, the current financial-computational apparatus. As a matter of fact, the

blockchain does not acknowledge the concept and mechanism of debt and fractional reserve; it is an append-only ledger of blocks of valid transactions (transactions in which the balance cannot ever go below zero), which are cryptographically validated, time-stamped, and permanently and publicly stored in a decentralized network of nodes. While it is structurally impossible to have unfunded exposure on a blockchain (which is, as Bloomberg commentator Matt Levine reminds us [2018], one of the goals of all finance), the aforementioned cases emphasize how tokens can enable the expression of non-finite, polymorphous values such as art, ecosystem resources, or memetic value. All of this can be expressed and registered in the appreciation of the token through its circulation and the growth of its ecosystem. In the specific instances of Flowertokens and 0xΩ, each token is backed by the speculative value of an artistic proposition that becomes realized through the market process by being acknowledged and valued by a network of peers according to a synthetic temporality that short-circuits the loop between production, exchange and sheer speculation, and which collapses their differences on the computational plane of the blockchain.

In this sense, the native tokens of Flowertokens and 0xΩ prefigure new kinds of financial instruments capable of accounting, in a non-reductive way, for the economic status of non-standard assets that are constantly generative of value even while being traded as discrete ‘commodities’. This is true not only in the moment in which they are transacted on the market as finite products, but from the very moment in which they are produced – something that is characteristic of art,³¹ but also of environment, education, and any kind of speculative, propositional, and necessarily networked project. Furthermore, these tokens can unlock new possibilities for new funding models and revenue streams for the arts: through the crowdfunding of information and capital, Flowertokens take the art world as a test bed and launch pad from which to generate new human-computational hybrids that really exist. 0xΩ, in turn, takes religion as a vehicle for art patronage and leverages distributed consensus as a way to collectively curate registries of artefacts and associated beliefs.

In so doing, both projects also redefine the question of digital rarity and collectability through the design choices characterizing the economic games they constitute and

through their engagements with smart contracts. This turns forms of collection based on private property into forms of staking based on common access; turns curation into a collective, gamified form of speculation; and turns viewership into participation in the generation of artworlds or ecosystems. By blurring the boundaries between art project and business model, this gestures towards how art can operate differently – that is, how it can individuate in novel ways – through encounters with this new technological infrastructure. By extension, the projects discussed here can be seen as new kinds of financial instruments offered by the artists to the art community at large, turning collectors and audience into investors and players. These new financial instruments represent stakes in the future success of each project (as a collective endeavour made possible by heterogeneous entities), and constitute a way to hedge against the potential disruption of the current art ecosystem, while actually performing it. Here, the act of staking (whether fiat money toward the purchase of these tokens, or tokens toward a proposal) is a constructive gesture toward the realization of the value of said project. As 0xΩ acutely shows, speculation drives beliefs, and not the other way around.

In this sense, in response to the critique of the transactionalization of art through blockchains, these projects point toward a rather different strategy, namely one that already assumes their intensively financialized condition within art's informational milieu and embeddedness in processes of networked value production (economic, cultural, social, aesthetic) (Moss, 2013). This recognizes that flows of capital, information, status and aesthetic expression interrelate in tightly coupled and yet dissonant ways. By expanding (and also partially perverting) the realm of application of non-fungible tokens and cryptoeconomic primitives, the projects discussed deploy new modes of explicitly conceiving and operationalizing themselves *as* derivatives, setting a powerful example in the exploration of new approaches and methodologies engaged with the realization of the autonomy of the field from its institutional-financial milieu.

6. Conclusion: Towards the invention of new markets-milieus

In this discussion I hope I have demonstrated that cryptoeconomic systems and their native tokens (as a new asset class endowed with entirely new affordances) can introduce a difference in kind (i.e. formally and structurally) regarding the ways in which value generation and distribution are expressed and accounted for in digital environments. Artistic approaches to the design of cryptosystems as a new, little studied economic, social, and cultural phenomenon can shine new light on the affordances of these computational objects and data structures by gesturing to the articulation of associated milieus beyond the pre-established economic canons inherited from the industrial economy.

The nature of the above-mentioned experiments remains propositional, since the underlying technology is still in early stages of development. Yet, through the concreteness of their designs and visions, they point to a wide spectrum of new futures that could spring from their offers as emergent plotlines for new social science fiction.³² In this sense, they may have more to do with R&D in cryptoeconomic design than with art galleries and art collection as such. But that is part of my argument here. These projects are proofs of concept that demonstrate new ways of articulating processes of value generation and distribution according to new organizational patterns that put the sacred object, the forest, the art asset and participatory practice in the foreground, leveraging speculation – as “anticipation of a common future” (Hui and Halpin, 2013: 115) – and distributed consensus as a means to operationalize the resources needed for the realization of said common project in manners that have been unthinkable before the introduction of blockchains and smart contracts. In so doing, they portend to new milieus that could be made possible by the techno-economic affordances of blockchains and tokens. terra0 opens up new approaches to scalable economic-organizational hybridized coordination for ecosystem management, for indexing, tracking, sustaining the plurality of ecosystemic value. Similarly, 0xΩ is about new forms of participation, social belonging, cultural-religious content production, the forging of new communities through cryptoeconomically mediated interactions and tools and, more broadly, about inventing social-financial practice anew from the ruins of today’s financialized social networks.

But the eventual and/or not (yet) sustainable character of these aforementioned projects also shows that blockchain is born in a pre-individual milieu that was already financialized to begin with, so it inevitably inherits a historicity that is based on financialization as a means to capital expansion. In this sense, the blockchain is not automatically emancipatory; neither is it inherently connected to right-wing ideology or heightened forms of neoliberal control. Blockchains, at least in their original designs, provide a different technological substrate to capital that is open source, immutable (in the past), and also programmable (in the future). Simply put, this is why new kinds of assets can, potentially, be created and transacted according to different rules – though the old rules can, to an extent, continue to apply.

Bitcoin and Ethereum have proved that behavior can be coordinated in a decentralized fashion through digital objects, i.e., through computers (and humans, in so far as the latter are partaking in the digital milieu; see Hui, 2016) contributing to a consensus protocol. The challenge at the application layer becomes how to enable participation in the “schema of actions” (Simondon, 2017: 236) of this new technology beyond pre-established usages. While usage is first and foremost a cultural matter (such as under the paradigm of work or marketing) and extrinsic to technical becoming, its schema of actions is a function of its technicity. In this sense, the emphasis on technical becoming and the genetic and participatory aspects of technicity as it concretizes and exceeds objects opens up new ways to conceive of interactions with such objects. These can then become available for means other than the industrial imperatives of accumulation and overcoming the alienation between human and machine. By attending to the technicity portended by the blockchain, as a technical tendency to concretization, these projects set a path forward for new practices of digital design that may respond to the challenges and possibilities of new decentralized ecosystems of financial, social and cultural value. They do so by gesturing to the creation of new user experiences capable of advancing the evolution of said technical systems.

From the standpoint of a theory of technical individuation, the projects discussed above also suggest that the financialization of art – and financialization in general, the art market-milieu being a limit case in a broader landscape – is not a financial (i.e.

socio-cultural) problem alone. It is inextricably woven together with the specific affordances of the digital objects and computational systems that enable all too familiar practices of abstraction, quantification, recombination and extraction of information as value in digital environments. That is to say, financialization can be leveraged in generative and propositional ways through new technological affordances; affordances that cannot be suggested through interface design and wireframes, but only through the engagement with new interactive protocols, based on tokens as conduits to the experience of a decentralized ecosystem.

In so doing, the examples under discussion in this essay also gesture towards some exit vectors for a new politics that is commensurate with the opportunities and challenges of the present techno-historical configuration – defined by the convergence of financial capital, computation, and networked communication systems – to be constructed in a collective, transversal manner. This begins by attending to the integration and modulation of the functions of economic production and circulation in the “executability” of these digital objects and systems (blockchain data structures, protocol and application tokens, cryptoeconomic primitives, distributed computing, etc.), and using (and abusing) these new techno-economic affordances to confront existing systemic problems. It is for this reason that experimentation with these new tools is crucial if we want to be able to leverage their novelty or, at least, remain open to the “margin of indeterminacy [...] that allows the machine to be sensible to external information” (Simondon, 2017: 17), towards further co-individuation within larger techno-socio-economic milieus.

While the success of such endeavors hinges heavily upon the capacity of the ecosystem to overcome its own hype – including technical challenges of scalability and interoperability, and the duplicitous hostility of legacy apparatuses – here the art of experimentation lies in the expansiveness of the imaginary designs of the social-economic-aesthetic games afforded by the underlying technological infrastructure. What would it mean to conceive of design patterns that incentivize coordination and allocation of capital to support the arts – and more generally processes of networked value production – through new funding streams and models for self-sustainable organizations that anyone can adopt? What would that art realized in such a context

be capable of? While the answer lies in one (or several) of the many futures that are simmering and bubbling in cryptospace, at least now we have some tools to begin playing with to find answers to these questions.

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Notes

- ¹ The volatility of the ecosystem is evidenced by recent statistics: in 2017, ICOs raised an equivalent of 5.6\$ billion (of which 3.2 only in Q4) with more than 400 projects successfully funded (Coindesk, 2018). However, in early 2018 nearly 50% of those projects had already gone bankrupt (Morris, 2018). This is reflected in the dramatic correction of the market: while in January 2018 the total cryptomarket capitalization eclipsed \$830 billion (Browne, 2018) by the end of the year it had plunged more than 80% – a collapse comparable to the dot-com crash of the Nineties (Kharif, 2018; Patterson, 2018).
- ² Simondon's genetic theory also proposes that, as technical objects concretize, they gain an increasing level of autonomy – from element to individual to system (ensemble) – culminating with the cybernetic paradigm of automation. Yet one needs to be careful not to conflate this evolution with mere historical development: "the technical object is not directly a historical object: it is subject to the course of time only as a vehicle of technicity, according to a transductive role that it plays with respect to a prior age" (2017: 76).
- ³ A discussion of theories of the market is beyond the scope of this paper. For a partial review see Lotti (2018).
- ⁴ For a philosophical treatment of fiat money in the context of the individuation of the capitalist system, see Lotti (2015).
- ⁵ Randy Martin, who first articulated the "social logic of the derivative", describes it according to three features: first, it entails a condition of "fragmentation, dispersion, or isolation by allowing us to recognize ways in which the concrete particularities [...] might be interconnected without first or ultimately needing to appear as a single whole or unity of practice or perspective"; secondly, it evidences "how production is inside circulation," testifying to the generative role of volatility; third, it emphasizes "the agency of arbitrage, of small interventions that make significant difference, of a generative risk in the face of generalized failure but on behalf of desired ends" (Martin, 2015: 52; see also Lee and Martin, 2016).
- ⁶ This has been evidenced, for instance, by recent global events such as the Facebook-Cambridge Analytica scandal in March 2018, which revealed the connections between the social media giant and the political consulting firm, which bought the personal data of 87 million users of the former without their direct consent, to influence voters' opinion in the last US Presidential elections through psychographic targeting. In spite of the increased public disdain toward Facebook's ads

policy, which precisely allows for such fine-grained and wide-spread aggregation and trading of personal information, Facebook market value and user base have remained largely unaffected in the aftermath of the news, as Bloomberg reports, with Q1 2018 revenues beating analysts' estimates and the number of new users continuing to rise (Frier and Ponczek, 2018). It is worth noting that users' profiles were sold between 75 cents to \$5 apiece (Hill, 2018).

- ⁷ TCP/IP (Transmission Control Protocol/Internet Protocol), HTTP (Hyper Text Transfer Protocol), SMTP (Simple Mail Transfer Protocol).
- ⁸ On the features of Web 2.0 see also: O'Reilly, 2005; O'Reilly and Battelle, 2009. On the architectural difference between Web 2.0 platforms and token-based networks see (Monégro, 2016).
- ⁹ While Bitcoin constitutes a simpler case of transaction-based state machine, in which the state is represented by its global collection of Unspent Transaction Outputs (UTXOs), in Ethereum's world computer the global state consists in a mapping between addresses (unique identifiers) and account states, whereby the state "can include such information as account balances, reputations, trust arrangements, data pertaining to information of the physical world" (Wood, 2018: 2). The state is constantly updated through the transactions occurring in the network. In essence a transaction, such as transferring of an arbitrary amount of Ethereum tokens, is what generates a valid state transition.
- ¹⁰ Through this mechanism, Maecenas successfully executed the first smart-contract-run art auction at the beginning of September 2018, with the sale of fractional ownerships of Andy Warhol's 14 Small Electric Chairs to 100 qualified participants, raising US\$1.7m for 31.5% of the artwork at a valuation of US\$5.6m (Garriga, 2018). Yet as Tim Schneider pointedly observed: "'platform' is a synonym for 'middleman,' and middlemen are inherently contradictory to any sincere effort to decentralize anything—at least, if they're charging a fee for their presence at the crossroads" (Schneider, 2018).
- ¹¹ On the pitfalls of the application of the logic of scarcity to digital art through blockchain see: O'Dwyer, 2017; Zeilinger, 2016.
- ¹² Hypertext Transfer Protocol Secure.
- ¹³ Inter-Planetary File System.
- ¹⁴ The emblematic Rare Digital Art Festival, which took place in NYC in March 2018 greatly encapsulated this new tendency: "Rare digital art is a movement to take internet assets that have previously been infinitely copyable (songs, memes, etc.) and turn them into provably rare, tradable blockchain assets" (Rare Digital Art Festival, 2018).
- ¹⁵ As Simondon puts it, "It is insufficient, for understanding technics, to start from constituted technical objects; objects appear at a certain moment, but technicity precedes them and goes beyond them; technical objects result from an objectivation of technicity; they are produced by it, but technicity does not exhaust itself in the objects and is not entirely contained within them" (2017: 176).
- ¹⁶ "If technical objects do evolve toward a small number of specific types then this is by virtue of an internal necessity and not as a consequence of economic influences or practical requirements; it is not the production-line that produces standardization, but rather intrinsic standardization that allows for the production-line to exist. [...] The industrialization of production is rendered possible by the formation of stable types" (Simondon, 2017: 29).
- ¹⁷ "If one seeks the sign of the perfection of the technical mentality, one can unite in a single criterion the manifestation of cognitive schemas, affective modalities, and norms of action: that of the *opening*; technical reality lends itself remarkably well to being continued, completed, perfected, extended" (Simondon, 2009: 24).
- ¹⁸ Simondon distinguishes between culture and technical culture. Culture, according to Simondon, is "that by which the human regulates its relation to the world and to himself" (Simondon, 2017: 227). The need for technical culture stems from the fact that "if culture doesn't incorporate technology, this will imply obscure zones and [technology] would not be able to provide its regulatory normativity on the coupling of the human and the world" (ibid). As Jean-Hugues Barthélémy observes: "As one can see here, that which Simondon calls 'technical normativity' ... is always, as such, a normativity of culture through technics – in other words, it is a normativity of culture thanks to 'technical culture'" (Barthélémy, 2012: 210 emphasis in original).
- ¹⁹ See Turner (2006) on the relation between San Francisco Sixties counterculture and the emerging technological hub of Silicon Valley. Turner shows how the idea of the virtual community has given rise to the networked economy in view of the openness and participation of the early web.
- ²⁰ According to Simondon, there cannot be such a thing as a subsumption of human beings and technology to capital. In Simondon's universal cybernetics there is only place for humanity, nature,

and technics. For him, the problem of the alienation of the human from technology is not only a socio-economic matter, due to the privatization of the labor process, but more profoundly, a physical-psychological one, which started precisely with the mechanist era of technological development, which has hindered “a more profound and essential relation, that of the continuity between the human individual and the technical individual” (Simondon: 2017, 133).

²¹ It is worth reproducing the quote in full: “This is why we notice such discontinuity in the history of technical objects, with absolute origins. Only a thought that is capable of foresight and creative imagination can accomplish such a reverse conditioning in time: the elements that will materially constitute the technical object and which are separate from each other, without associated milieu prior to the constitution of the technical object, must be organized in relation to each other according to the circular causality that will exist once the object will have been constituted; thus what is at stake here is a conditioning of the present by the future, by that which is not yet. Such a futural function is only rarely a work of chance; it requires putting into play a capacity to organize the elements according to certain requirements which act as an ensemble, as a directive value, and play the role of symbols representing the future ensemble that does not yet exist. The unity of the future associated milieu, within which the causal relations will be deployed that will enable the functioning of the new technical object, is *represented*, it is *played* or acted out as much as a role can be played in the absence of the true character, by way of the schemes of the creative imagination” (Simondon, 2017: 60).

²² In the context of blockchains and smart contracts, an oracle is a software agent that finds and verifies real-world events and submits this information to a blockchain to be used by smart contracts. Because a blockchain can only verify statements of truth that pertain to its internal environment (example: whether a transaction is valid or not), decentralized services that depend on occurrences that are external to the blockchain itself (such as the health of a forest, or internet-of-things devices, or prediction markets) by necessity rely on oracles (for an accessible explanation, see *BlockchainHub*, n.d.).

²³ See: <https://flowertokens.terra0.org/>.

²⁴ The first example of TCR is adChain, which applies the pattern to the creation of reputable lists of publishers, aiming to solve some of the problems of the online advertising business. The pattern is also used by FOAM to curate Geographic Points of Interests for their spatial protocol for secure Proof of Location services. TCRs, and cryptoeconomic primitives more broadly, have gained increasing attention since the first proposals and implementations in the open source community, and precisely at a point at which the easy enthusiasm for the booming cryptomarket has begun to fade. Interestingly, it should be noted that, in virtue of their purely formal and necessarily open and relational character (which sets them apart from specific blockchain-based protocols), it is hard if not impossible to fairly monetize such patterns (Horne, 2018).

²⁵ The coupling of a consensus algorithm (to determine how unknown peers can come to an agreement in a decentralized way) and a ‘proof’ of ‘participation’ in the network (e.g., proof-of-work, proof-of stake) provides a mechanism to programmatically modulate the monetary inflation rate to incentivize participation toward specific goals – guaranteeing the security of the network, redistributing value to reward specific behaviors, and also providing ways to fund the early stage of development of the protocol. For instance, Bitcoin and Ethereum attempt to achieve such goals through mining; new blockchains such as Cosmos and Polkadot aim to do so through various forms of staking. The Basic Attention Token provides instead an alternative attention economy by rewarding users with tokens for their attention in their browsing. Decred, Tezos, Zcash have mechanisms in place to self-fund the development of their projects through inflation funding (unlocking new coins, a portion of which is directly channeled to their development teams and/or treasuries). The examples are endless and vary according to the taxonomy of projects and tokens. Worth noting, debates around governance in this context are often concerned with the degree of revisability of the monetary policy of each protocol (an example of this is the “hard fork” between Bitcoin and Bitcoin Cash in mid-2017). What is important to emphasize is that, in so doing, these mechanisms allow untrusted and pseudonymous parties to collectively create a trusted network – not only of value exchange but, perhaps more importantly, of value *creation*, proposing a normative and genetic mode of relationality that is radically different from the financial logic of Web 2.0 platforms. From this standpoint, it would not be too far-fetched to claim that, as a medium of networked value production and funding stream, the Bitcoin blockchain inaugurated a mechanism by which the token indexes the production *of* the funding stream itself.

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- ²⁶ Helmond describes these different degrees of programmability in terms of “Level 1 access APIs” and “Level 2 plug-in API” – the former enables access to a platform’s data and functionalities for external developers; while the latter allows developers to build their applications within a platform’s framework, such as the case of Facebook Canvas (Helmond, 2015: 5). Smart contracts can be said to approximate what Helmond describes as Level 3 programmability, by providing a decentralized runtime environment for applications. The possibility to expose internal states and functions for other developers to use, extend, and fork effectively blurs the boundaries between infrastructure and application. This obviously does not prevent an application from hosting data on proprietary servers (such as the unique designs of the infamous CryptoKitties) but provides a shared data layer for the validation and recording of the information strictly pertinent to the value proposition of the dApp.
- ²⁷ ERC stands for Ethereum Request for Comment and correspond to standards documenting how a contract can interoperate with other contracts. The two most developed standards are ERC-20 for fungible tokens and ERC-721 for non-fungible tokens, discussed above.
- ²⁸ In risk management, having skin in the game refers to the extent of which one is invested (with money and resources) in the success of a venture (‘game’). The phrase has been made popular by quant and scholar Nicholas Nassim Taleb, who colorfully exclaims: “It is not just that skin in the game is necessary for fairness, commercial efficiency, and risk management: skin in the game is necessary to understand the world. First, it is bull***t identification and filtering, that is, the difference between theory and practice, cosmetic and true expertise, and academia (in the bad sense of the word) and the real world. To ermit a Yogiberrism, in academia there is no difference between academia and the real world; in the real world, there is” (2018 ebook version).
- ²⁹ The notion of games is intimately related to economics in the genealogy of cybernetics – for instance, John von Neumann and Oscar Morgenster’s *Theory of Games and Economic Behavior* (1944) equates ‘numerical utility’ in games of strategy to the quantity of money (Mirowski, 2002: 127).
- ³⁰ Within the framework of the notorious Black-Scholes for the pricing of options, cryptoassets analysts Antos and McCreanor (2018) argue against the view of cryptoassets as merely an “innovative form of equity” and instead propose that “the purchase of a cryptoasset is essentially a claim on uncertain value creation, as opposed to a claim on an underlying asset whose value by definition has an upper bound.”
- ³¹ “Art is produced as a commodity, it doesn’t become one when it is sold” (Enxuto and Love, 2016).
- ³² Vitalik Buterin on cryptoeconomics: “I’d be more interested in seeing social science fiction, [...] that explores also all of these complex ideas about how people can interact and how political systems can work, how economic systems can work, how they can fail. Particularly, how they can fail in ways that create interesting stories without anyone being literally Hitler” (Buterin and Cowen, 2018).

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