Control and Communication: A System Study of Platform Economics and Digital Archives in Architectural Design

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Abstract

A platform economy is a peer-to-peer model of circulating resources, facilitated by community-based digital platforms that are rapidly reconfiguring the notion of archives by democratizing the production, aggregation, and dissemination of information. This helps to facilitate a multi-access system for Creative Commons in architectural design, especially with the rise of generative algorithms that feed on large amounts of data. For instance, Pinterest has created one of the largest digital archives of architectural images, and gained immense popularity for its convenience in information exchange, providing a single access point that translates fragments of information between various mediums. Conversely, it can contribute to the generalization and depreciation of heterogeneity in architectural design and the progressive privatization of the platform economy. This gives urgency to the study of the benefits and limitations of digital platforms and technologies to facilitate a multi-access system, for which archival functions are crucial in serving democratization in three ways.

First, control and communication, for which the standardization of protocols facilitates multi-access platforms and crowd contribution to a worldwide architectural archive consortium. Second, information and value exchange within a platform economy, which may help to democratize the institutional model of appraisal by utilizing consensus mechanisms for self-organization, and direct valuable architectural information to users. Third, artificial creative common intelligence – data archives feed into distributive production pipelines comprising various open-source generative algorithms. This paper illustrates its arguments with a speculative research design, called *Current.cam*.

Introduction

For architects, archives are informative and intellectual agencies that feed and inspire our creative neurons, or nowadays, artificial neuronal networks. Within the larger socio-economic system, the role of archives is even more profound. First, archives provide an important legal function in identifying, managing, and preserving the integrity of properties and provide essential protection for the legal rights of constituents (CLIR 2017). This means that archives are our best proof system for authenticating tangible and intangible property rights. Second, value security. It is important to distinguish archives from storage; the latter is largely temporary, whereas the former is for the long-term preservation of singular objects. Storage has to ensure responsivity to logistics, while it is difficult to retrieve something from an archive, partly because of operations, and the cost of archiving acts as a guarantee of the value of an object, whereas storage does not necessarily do the same. The digital transformation of archival functions may help to democratize and integrate the qualities of archive and storage, where authenticity is built into the network structure to enable responsive and secure information transactions. Third, archives exist to accumulate and grow.

From a historiographical perspective, if there are insufficient records of our happenings, it will be difficult for historians to reconstruct events and truth, and this may affect our construction of shared memories. From a governing perspective, insufficient data creates a void of insecurity if the capacity to retain evidence is reduced (Jenkinson 1948). Apart from centralized surveys, which are often difficult to undertake in rural areas, the challenge in crowdsourcing of data is security and validity. For instance, institutions like the World Bank invest effort in designing incentive provisions to motivate individuals to contribute information, such as deed and title mining for land properties (WorldBank 2020). From an architectural perspective, the accumulation and growth of intellectual property (IP) is equivalent to accumulating and growing the wealth of designers. This problematizes the relationship between design as a shared construction, crowd participation, and intellectual wealth in the archives and its digital transformation.

While architecture has always been an economy that relies on information exchange, platform economics is different, in that it emphasizes the peer-to-peer (P2P) collection and distribution of relevant information at an appropriate time (Castells 2000). Platform economies as complex systems can be studied through control and communication (C&C) to examine their capacity for self-organization (Wiener, 1948). The relationship between C&C is embodied in a networking model that enables the description of all types of communication and their control in each layer. The control problem of information exchanges in a network concerns communication functions and protocols, "the latter being a tool for implementing the relevant communication functions" (Puman and Poízek 1979, 1). In architecture, C&C are practiced every day through platforms and technologies that are devoted to the design and development of IP, industrial processes, resources circulation, and value networks. This facilitates a platform economy, in which actors interact, exchange, and make decisions based on feedback from information, and productivity, which depends on the design of C&C within a multi-access information system, in which nodes collectively agree on the value of information assets, quantify the importance of connections in a network, distribute data storage and computing power, and create value through P2P information feedback.

Architectural design is a system that depends on the import and export of information, such as drawings and 3D-models. Digital platforms provide an interface network for users and machines, and archives function as the backend, which supports not only generative algorithms, but also system evaluation. Presently, our indexical measures of development, such as GDP, are designed to quantify the mass of information that is consumed, but not the amount of valued work that is circulating. In other words, architectural industries account for the monetary value generated without taking into consideration relative utility, in which energy and resources may be easily dissipated within the system during participatory processes, like logistics and communication. Economies that assess development solely by its linear consumption become a fundamental obstacle to multi-access systems.

Fig. 1. A platform economy with a network of computers transacting information from P2P on an E_8 topology.

The question of how to take advantage of the network structure through the design of C&C in a system is at the heart of the problem; it helps to think about how our socio-econometric system can be transformed, which depends upon and affects our means of archiving. As architectural production progresses into the digital age, the architectural economy and the means of producing, gathering, trading, and archiving information has to advance beyond the industrial age. This gives urgency to the study of the modern history of C&C. Systematic organization can be traced back to cybernetics, where information feedback on human-machine interactions was investigated under various disciplinary contexts, from the natural sciences to the social sciences.

This study asks the question: What are the roles of archives and platforms in a multi-access system design? More specifically, how may such a system aggregate human and machine intelligence into collectively processing data in architectural design, creating artificial creative common intelligence?

Historiography

This historiography maps a series of events around cybernetics and its related domains, including information and game theory. It focuses on cybernetics as the main field of study because of its interdisciplinary nature, which enables us to approach all kinds of sciences, from social to natural, using a set of vocabularies that is understandable across disciplines, and facilitates communication using both natural and mathematical language to infer models of systems and begin to work with them. Cybernetics is also one of the founding fields of Artificial Intelligence (AI) in its formulation of feedback systems, black boxes, and human-machine interactions.

As cybernetics emphasizes C&C between actors, humans, and machines, it is inevitable that the processes of information circularity be brought into the light of speculation. These processes range from the garnering, structuring, and archiving information from our sensory devices to the control of our environment, according to predictions generated from archived data in a feedback loop. Thus, a historiography of cybernetics provides a prospective starting point that delivers an interdisciplinary vocabulary base to discuss the workings of archives and platforms.

Architecture has always had an intriguing relationship with cybernetics, from Cedric Price’s (1964) Fun Palace to Gordon Pask's (1968) Colloquy of Mobiles. These architectural works embody the spirit of cybernetics, with their interactivity between the occupant and the physical building, while capturing a future where computer-aided design, as a cybernetic method, facilitates the feedback processes between humans and the machines in all walks of life. Pask (1969) stated that such forms of embodiment are merely the veneer of what will lead to extensive disciplinary and philosophical avenues of system design and operational research in architecture.

Today, the legacy of cybernetics and its theories are being deployed in all aspects of architectural production, to such an extent that we barely notice it anymore, including our personalization feedback systems on social media, enabled by AI; smart technologies that facilitate a “man-environment dialogue;” the design of agent-based and goal-oriented generative algorithms; and our interdisciplinary approach, which unifies the concepts of architecture with others “to yield an adequately broad view of such entities as ‘civilisation’ ‘city’ and ‘educational system’” (Pask 1969, 74).

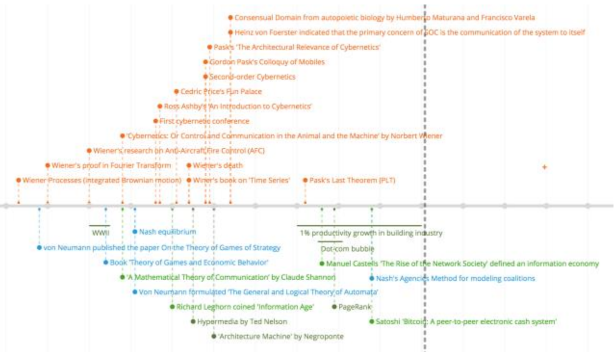


Fig. 2. A brief timeline of cybernetics, information, and game theory from pre-WWII to late 2000s.

Cybernetics and Information

The year 1948 saw the birth of two publications that changed the way we think about information: “A Mathematical Theory of Communication,” by Claude Shannon, and “Cybernetics: Or Control and Communication in the Animal and the Machine,” by Norbert Wiener. The former dealt with the nature of information and its relationship with the tools that operate it; while the latter dealt with how information can become a tool. While both consisted of discovery processes that considered how information becomes value at the point of interaction, Shannon saw value as bandwidth – how much information can be expressed within a transmission; and Weiner saw value as the ability to pre-empt within a statistical structure (Kaiser 2020).

Shannon’s work was born in a time when the democratization of telephone communication was at the forefront. It was in his landmark publication that Shannon (1948) expressed the potential he saw in the digitization of information, which helps prevent messages from being corrupted by noise when transmitted from one end to a distant other end. He used “bits” as a unit of information transmission. “Bits,” short for binary digits, revolutionized the traditional view of communication theory in which the transmission of information could only be analogue, and involved continuous wave forms and modulations. Although the use of “bits” as units predated Shannon (it was coined by his colleague John Tukey from Bell Lab to denote a simple contraction of signals to either 1 or 0 as a unit of data storage), Shannon’s “bits” caused significant savings in the length of transmission by incorporating methods of probability distribution.

Most forms of communication that we use, such as speech, have a statistical structure, a mixture of predictability and surprises characterizes what we can say using a language. Shannon (1948) defined information not simply as a measure of what we say, but as a measure of the predictability of what we can say – entropy. This helps encode the original message into an optimal form for transmission relative to the machine that is generating the message (e.g., compression). In other words, Shannon put forward the idea that the amount of information in a message must be bounded in the design of the system, and also defined a quantitative measure of information from storage to communication – the Shannon-Wiener Index – a value ranking of random variables as the average level of uncertainty based on diversity (Spellerberg and Fedor 2003).

Shannon (1948, 34) noted that he was “heavily indebted to Wiener for … [defining] the first clear-cut formulation of communication theory as a statistical problem, the study of operations on time series ... we may also refer here to Wiener’s Cybernetics, dealing with the general problems of communication and control.” Although Shannon and Wiener were dealing with a similar set of problems with corresponding logic, the subtle distinctions in their understanding of utility in prediction sparked separate discourses of information theory and cybernetics (Kaiser 2020).

Shannon (1948, 32) devoted the entire third section of his paper to a statistical analysis of natural languages, but gave no concern to “meaning,” arguing that “these semantic aspects of communication are irrelevant to the engineering problem.” Wiener (1950, 113), on the other hand, saw the use of information as a tool in C&C within systems that concern humans and machines alike: “questions of information will be evaluated according to a standard American criterion: a thing is valuable as a commodity for what it will bring in the open market.” This thrust cybernetics into becoming a general science that can be used to model and operate complex systems, both social and mechanical.

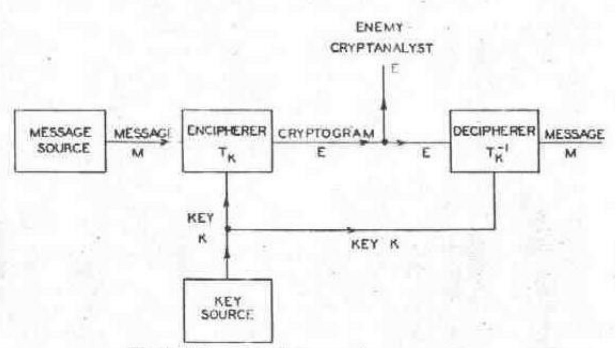


Fig. 1—Schematic of a general secrecy system.

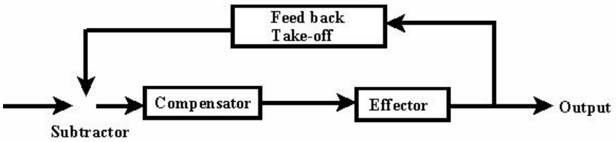


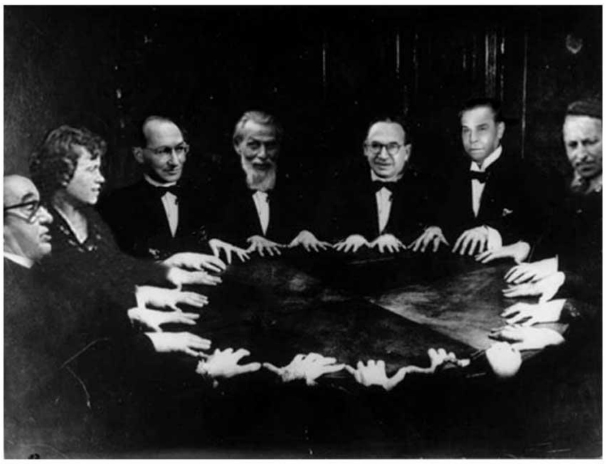
Fig. 3. (a) Schematic of a general secrecy system of communication (Vasiloudis 2018). (b) Wiener’s cybernetic diagram on radar guidance systems for AFC (Johannson 1993).

Before WWII, Wiener made great mathematical contributions to Brownian motion and Fourier Transform (FT) (Mindell et al. 2002). For the former, he “constructed and analyzed a rigorous mathematical model of probabilistic laws” (Doob 1966, 69). For the latter, Wiener (1942) aimed to make predictions based on probabilistic structures of serial events. This was why he was drafted to conduct Anti-aircraft Fire Control (AFC) research during WWII (Galison 1994). Wiener realized the field of concern was pressing the limits of engineering knowledge at the time in both technical and disciplinary terms, falling between the tools of the established fields of expertise (Beer 1999).

AFC is an interdisciplinary problem that encompasses system study of dynamic performance, mathematical precision, corrupted data, information feedback, and the most unpredictable parameter, human operators (Mindell et al. 2002). Wiener began to think from an engineering perspective about ways to simulate a gun pointer situation. He came to the conclusion that the scenario must be reduced to a single structure: either a mechanical interpretation of humans or a human interpretation of machines (Beer 1999). Thus, Wiener's research relied heavily on two key elements of system control: data smoothing and data prediction (Mindell et al. 2002). In other words, Wiener had to consider how a system makes predictions on the movement of German aircraft operators and how this information can be communicated between humans and machines to pre-empt the opponent’s decisions.

When the war ended, Wiener began to elaborate his work beyond military demands, partly because the funding he had received from the National Defense Research Committee (NDRC) had been terminated, and partly because of his long-time interest in physiology (Mindell et al. 2002). Wiener shared a common fascination with the relationship of the computer to the brain with scientists from various disciplines, one of whom was John von Neumann; the two organized meetings together (Beer 1999). Von Neumann (1951) formulated “The General and Logical Theory of Automata,” for which his previous works on game theory provided him with insights into the nature of rationality and complexity (Mahoney 1998). Wiener, (1950), on the other hand, developed his notion of feedback from mechanical to biological processes, to which output is compared with the original goal at each iteration to determine deviations from the predictive model. The probabilistic techniques of information theory were used to study the interactive nature of organisms relative to the larger environment, and expanded the use of pre-emption beyond AFC to real-time responsive feedback towards any behavior of intelligence. (Mirowski 1992).

Wiener’s work on predictive analytics was a fundamental building block in stochastic models and stochastic control, and contributed to the evolution of modern-day information processing that is widely used in many C&C systems, from the military to the everyday consumer world. For instance, it is used in the characterization of the random quantum behavior of particles, fluctuations in the stock market, pre-emptive scheduling in IoT systems, and personalization algorithms on all our mobile devices – pre-emptive marketing (Hardesty 2011).



Cybernetic Séance - New York City, 1947
From Left to Right : Rafael Lorente De No (Neurophysiologist), Margaret Mead (Anthropologist), Kurt Lewin (Psychologist), Warren S. McCulloch (Neuropsychiatrist), Paul F. Lazarsfeld (Sociologist), Arturo Rosenblueth (Physiologist) and Gregory Bateson (Anthropologist).
Front (missing from view): Molly Harrower (Psychologist), Heinrich Klüver (Psychologist), Norbert Wiener (Mathematician), Lawrence K. Frank (Social Scientist), Heinz von Foerster (Electrical Engineer), John von Neumann (Mathematician) and Ralph W. Gerard (Neurophysiologist).
Observers (missing from view): Frank Fremont-Smith (Medical Director of the Macy Foundation), Julian Bigelow (Computer Engineer), Walter Pitts (Mathematician), George Evelyn Hutchinson (Ecologist), Leonard J. Savage (Mathematician), Henry Brosin (Psychiatrist), Theodore Schneirla (Comparative Psychologist), Hans Lukas Teuber (Psychologist), Gerhardt von Bonin (Neuroanatomist), Lawrence S. Kubie (Psychiatrist), Filmer S. C. Northrop (Philosopher), Alex Bavelas (Social Psychologist) and Donald Marquis (Psychologist).

Fig. 4. The 1947 Macy Conference, aka the third cybernetics conference (HEXEN 2011).

These and many other interdisciplinary collaborations gave form to what would later become the foundation of Wiener’s (1948) book on cybernetics. Its title indicated that the C&C of information is necessary to propel any system with self-regulatory functions, which is crucial to a network of P2P interactions, where variety and circularity are the pillars of cybernetic processes. Variety emphasizes option dynamics, multiplicity, and derivatives within self-organizational networks; it paraphrases “surprise” and “entropy” in information theories (Heylighen and Joslyn 2001). Circularity concerns causation and feedback, which enables cybernetics to observe and describe systems from within, such as iteration theories, self-referencing cognitive organization, and autonomous emergent systems (e.g. autopoiesis and financial markets) (Krippendorff 1984).

Second-order Cybernetics

Shortly after Wiener's death in 1964, cybernetics saw a new wave of understanding, which sought to expand and reform the discipline – second-order cybernetics (SOC). Wiener's cybernetics is being reinterpreted as first-order, which is "the study of observed systems;" whereas second-order is "the study of observing systems" – taking into account the observer as part of the system (Scott 2004, 1; von Foerster 1992, 11). The implication of this is both epistemological and social, further democratizing cybernetics from an art of high sciences to an art of civicness.

Von Foerster (1974, 281) indicated that the primary concern of SOC is communication of the system to itself – "explaining the observer to himself" – and that "the environment contains no information; it is as it is." Paraphrasing this in Shannon's (1948) language, any message of the description of an environment can be quantified with the predictability of what an observer will say. In order words, information is a construction by the observer of a system; it is created when the observer makes an effort to reason about the environment. This has design implications in that one cannot reason without constructing and learning from maps and models, where a "map is not the territory," but a blueprint that helps you "act towards the future you desire" (Korzybski 1958, 58; von Foerster 1992, 38).

In an indeterminate world, von Foerster (1984, 282) added that we should "act so as to maximize the alternatives." The context of this dictum is that he was concerned with scientific problems that are undecidable in principle, so it is a scientist's responsibility to provide pluralist perspectives to facilitate decisions. Put differently, if information is a construct of the observer and its creation creates value, then information should help maximize choices in the system. This behooves us to design to facilitate option processes and shed light on the dynamics under which a self-organizing system sustains itself, powered by an archival aggregation of models and options.

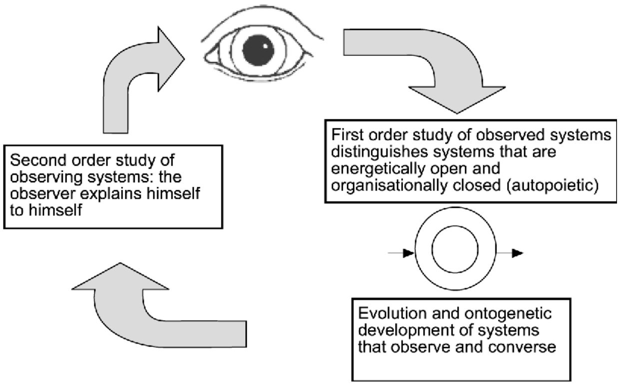


Fig. 5. Feedback loop between first- and second-order cybernetics. (Scott 2004).

The secondary concern of SOC is "to proceed to construct a consensual domain as a system of beliefs" – an idea translated from autopoietic biology to describe self-organizational ontogenetic structural coupling – where individuals amalgamate into communities by reaching consensus facilitated by the circularity of information (Scott 2001, 345; Maturana et al. 1980; Abou-Zeid 2009). If we can model consensual domains using hard sciences, we will be able to apply mathematics as a language to describe these processes and potentially be able to compute them. For instance, if the process of two individuals reaching an agreement through iterative exchanges can be described using FT, we can write down a differential equation and map the variables. Therefore, not only can we understand the anatomy of these processes, they can now be captured computationally to pre-empt the outcome (e.g., automated negotiation). Also, we may start generating sets of questions or testable rafts of hypotheses using alternative process theories that conform with the same principles (Friston et al. 2006). This describes how constructed models and archived options might inform one another to facilitate generative processes.

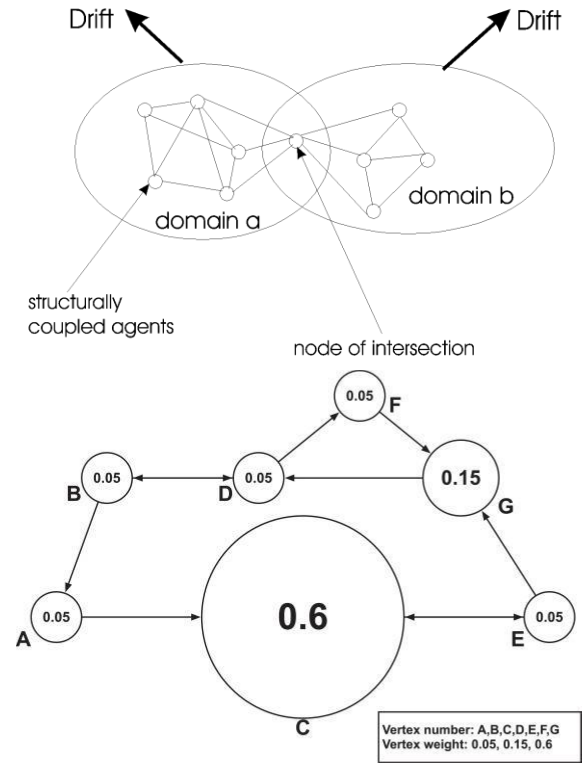


Fig. 6. (a) Systems of structurally coupled agents give rise to nodes of intersection through interactions - a form of consensus domain (Goldspink, 2000). (b) Example of a weighted directed network using a PageRank algorithm (Zhao, et al., 2018).

Gordon Pask studied social dynamics using physical theories as models to map to precision the working of agreements and epistemological dependence. In Pask's (1992) Last Theorem (PLT), he proposed that concepts exchanged during a consensual process are comparable to quantums that spin in a single direction, with like spins repelling and unlike spins attracting. That is, distinctions in concepts attract dialogues across perspectives and propel information transactions that fluctuate, where FT and sampling techniques may be operated to predict deviations. Equally, the creation of knowledge or learning are convergence processes of building connections between concepts (Dubberly and Pangaro 2019).

In Pask’s contributions to Negroponte’s (1970) book *Architecture Machine*, he tried to capture these processes using machines with analogue interfaces that generate different signals when plugged into one another. Pask’s works were influential in the development of hypermedia, coined by Ted Nelson (1974), in which contents can be linked to build network connections, foreshadowing multi-access communal information systems of all kinds. This enabled indexical measures on digital platforms and information archives, like Page’s (1999) Rank, to quantify value by their linkage and collaborative filtering through user interactions and feedback.

Games and Agencies

In Ross Ashby’s *An Introduction to Cybernetics* (1957), he addressed a wide range of adjacent disciplines, one of which was game theory – “the study of mathematical models of strategic interactions among rational decision-makers” (Myerson 1991). Certain branches of game theory are concerned with perfect, complete, and incomplete information within a set of interactions (Mycielski 1992). This became the underlying doctrine of platform economics, where consensus is studied with objective probabilities. Objectives can be understood as short-term plans towards a purpose, or in economic terms, incentives (Merrick and Shafi 2013). Thus, reaching consensus can be understood as achieving an equilibrium within a game, to which actors have no incentive to deviate from their chosen strategy after predicting their opponent’s choices via information feedback; simply put, one has nothing to gain by changing only one’s own strategy (Osborne and Rubinstein 1994).

Von Neumann (1928) established the discipline in a paper published on mathematical means to describe game dynamics. He began with two-person, zero-sum games, where the goals of individuals are diametrically opposed, and then expanded his interest to self-organizations in both cooperative and non-cooperative fashion through actions of C&C amongst human agents. The paper was followed by a book, co-authored with economist Oskar Morgenstern (1944), which included complex interactions of groups – n-person games – which actors might presumably join to form coalitions of optimizing agents.

More often than not, actors in a coalition do not bring the same amount of value. Presumably, this is reflected in the division of payoffs among its members (Leyton-Brown and Shoham 2010). Thus, coalitional analysis is generally concerned with two questions: which coalition it makes sense to form and the possibility for any coalition to redistribute the value it has achieved amongst its members – transferable utility (Ross 2019). These questions, when answered, define the nature and stability of the consensual domain. By cooperative, it does not mean that the actors' interests are aligned, but that the coalition formed may achieve larger benefits or complete tasks the members otherwise could not done on their own. Equally, non-cooperative games can produce harmonious situations, where the overall system increases in value (Nash 2002). Von Neumann broke the ground for scalable modelling in socioeconomic analytics, for which the study of P2P exchanges can help reason about the larger system that emerges.

John Nash's work on the agencies method advanced the modelling of coalitional dynamics, taking into consideration the use of autonomous agents and contemporary economics. Nash "was stimulated to think of the possibility of modelling cooperation in games through actions of acceptance, in which one player could simply accept the 'agency' of another player . . . the action of acceptance would have the form of being entirely cooperative, as if 'altruistic'. . . ." (2018, 539). Nash's study "computationally discovered the evolutionarily stable behavior of a triad of bargaining or negotiation players." Put simply, rather than human subjects, he worked with what is equivalent to a set of three robots, 'so whether or not the experiment can be carried out successfully becomes simply a matter of the mathematics'.

The control variable to the probabilities of acceptance is "demand," which can presumably be assigned a single value. This has design implications in platform economics, which match-make P2P supply and demand, in that we may mathematically pre-empt situations or criteria that would or wouldn't motivate individuals in the market to form and maintain coalitions to achieve a collective payoff (e.g. climate change mitigation). Although Nash's work was modelled only on three-person games, for it was already computationally heavy at the time, he envisioned the feasibility of "much more complicated models for [. . .] more players, with many more distinct strategy parameters being involved" (2008, 540) for the future, forming a true multi-access consensual system.

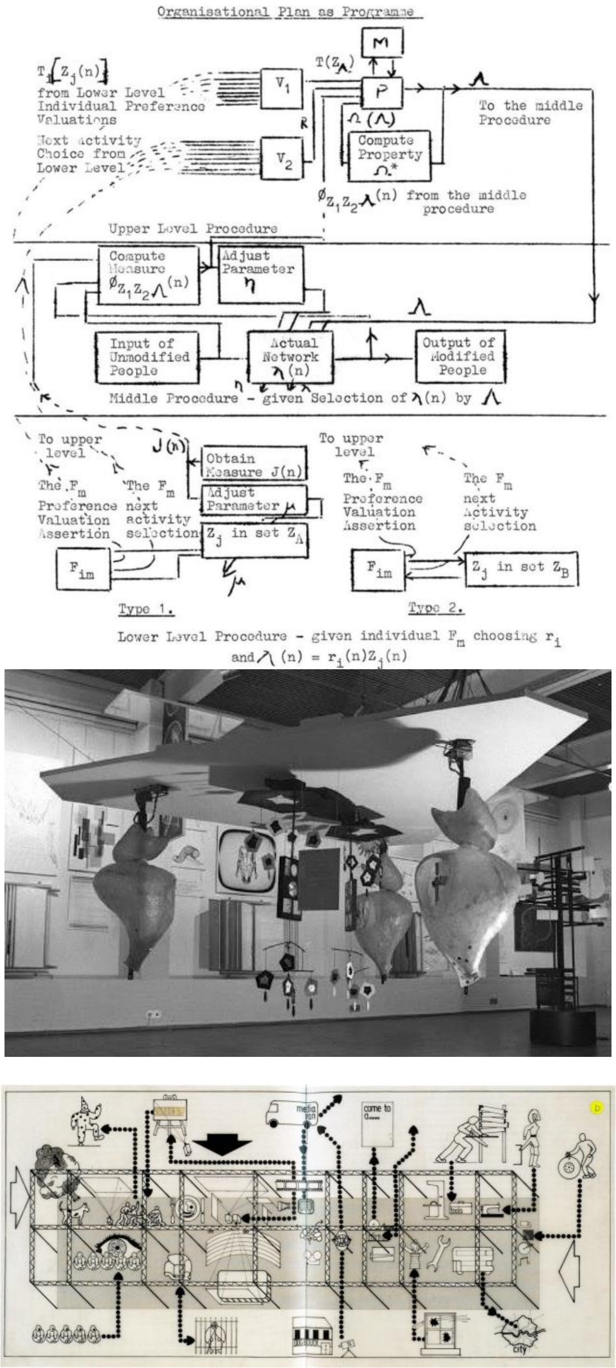


Fig. 7. (a) Cybernetic diagram of the Fun Palace program by Pask (Mathews 2006). (b) The Colloquy of Mobiles by Pask (1968). (c) Price (1964) Fun Palace, architecture marketing.

Multi-access System: Digital Archive and Platform Economy

From the historiography of C&C, this research summarizes the core principles for facilitating a multi-access system, where the platform economy and digital archives serve essential functions in democratization and P2P exchanges.

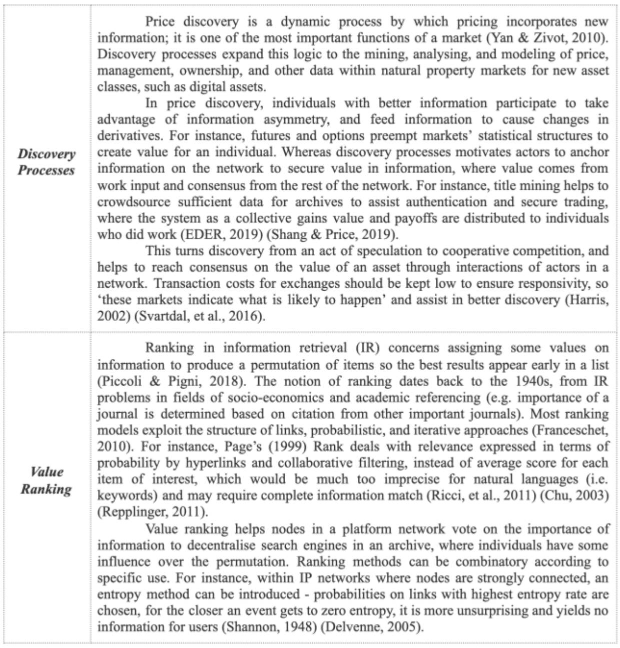
Digital Archiving

- ***Discovery Processes***:
  Motivating crowd contribution of information
- ***Value Ranking***:
  Decentralized search system in archives
- ***Pay-Per-Compute***
  P2P information exchange with instant value realisation to enable transparency between archives

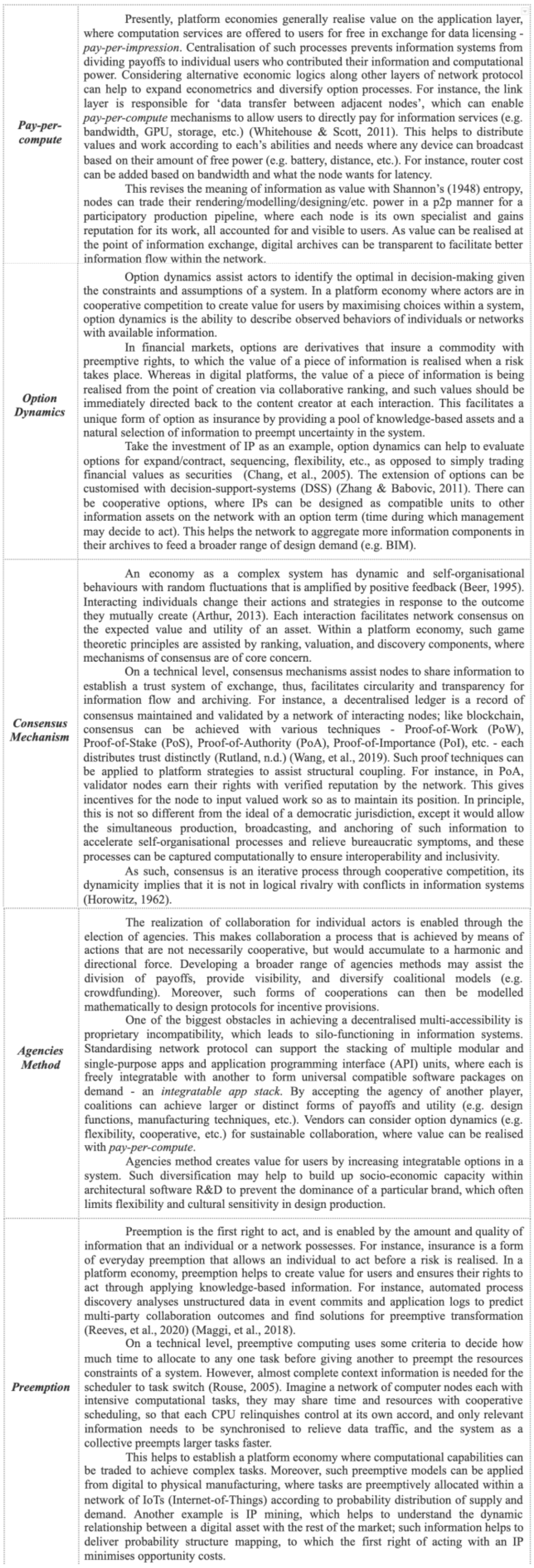
Platform Economics

- ***Option Dynamics***
  Capability to describe system behavior from interacting components.
- ***Consensus Mechanism***
  Achieving equilibrium within sets of P2P interactions.
- ***Agencies Method***
  Collaboration and harmonic system outcome enabled by both cooperative and non-cooperative action.
- ***Pre-emption***
  Self-organisation through predictive action.

Table 1. Multi-access system core C&C principles: democratisation and P2P exchanges



Discovery Processes	Price discovery is a dynamic process by which pricing incorporates new information; it is one of the most important functions of a market (Yan & Zivot, 2010). Discovery processes expand this logic to the mining, analysing, and modeling of price, management, ownership, and other data within natural property markets for new asset classes, such as digital assets. In price discovery, individuals with better information participate to take advantage of information asymmetry, and feed information to cause changes in derivatives. For instance, futures and options preempt markets' statistical structures to create value for an individual. Whereas discovery processes motivates actors to anchor information on the network to secure value in information, where value comes from work input and consensus from the rest of the network. For instance, title mining helps to crowdsource sufficient data for archives to assist authentication and secure trading, where the system as a collective gains value and payoffs are distributed to individuals who did work (EDER, 2019) (Shang & Price, 2019). This turns discovery from an act of speculation to cooperative competition, and helps to reach consensus on the value of an asset through interactions of actors in a network. Transaction costs for exchanges should be kept low to ensure responsivity, so 'these markets indicate what is likely to happen' and assist in better discovery (Harris, 2002) (Svartdal, et al., 2016).
Value Ranking	Ranking in information retrieval (IR) concerns assigning some values on information to produce a permutation of items so the best results appear early in a list (Piccoli & Pigni, 2018). The notion of ranking dates back to the 1940s, from IR problems in fields of socio-economics and academic referencing (e.g. importance of a journal is determined based on citation from other important journals). Most ranking models exploit the structure of links, probabilistic, and iterative approaches (Franceschet, 2010). For instance, Page's (1999) Rank deals with relevance expressed in terms of probability by hyperlinks and collaborative filtering, instead of average score for each item of interest, which would be much too imprecise for natural languages (i.e. keywords) and may require complete information match (Ricci, et al., 2011) (Chu, 2003) (Repplinger, 2011). Value ranking helps nodes in a platform network vote on the importance of information to decentralise search engines in an archive, where individuals have some influence over the permutation. Ranking methods can be combinatory according to specific use. For instance, within IP networks where nodes are strongly connected, an entropy method can be introduced - probabilities on links with highest entropy rate are chosen, for the closer an event gets to zero entropy, it is more unsurprising and yields no information for users (Shannon, 1948) (Delvenne, 2005).



Pay-per-compute	Presently, platform economies generally realise value on the application layer, where computation services are offered to users for free in exchange for data licensing - *pay-per-impression*. Centralisation of such processes prevents information systems from dividing payoffs to individual users who contributed their information and computational power. Considering alternative economic logics along other layers of network protocol can help to expand econometrics and diversify option processes. For instance, the link layer is responsible for 'data transfer between adjacent nodes', which can enable *pay-per-compute* mechanisms to allow users to directly pay for information services (e.g. bandwidth, GPU, storage, etc.) (Whitehouse & Scott, 2011). This helps to distribute values and work according to each's abilities and needs where any device can broadcast based on their amount of free power (e.g. battery, distance, etc.). For instance, router cost can be added based on bandwidth and what the node wants for latency. This revises the meaning of information as value with Shannon's (1948) entropy, nodes can trade their rendering/modelling/designing/etc. power in a p2p manner for a participatory production pipeline, where each node is its own specialist and gains reputation for its work, all accounted for and visible to users. As value can be realised at the point of information exchange, digital archives can be transparent to facilitate better information flow within the network.
Option Dynamics	Option dynamics assist actors to identify the optimal in decision-making given the constraints and assumptions of a system. In a platform economy where actors are in cooperative competition to create value for users by maximising choices within a system, option dynamics is the ability to describe observed behaviors of individuals or networks with available information. In financial markets, options are derivatives that insure a commodity with preemptive rights, to which the value of a piece of information is realised when a risk takes place. Whereas in digital platforms, the value of a piece of information is being realised from the point of creation via collaborative ranking, and such values should be immediately directed back to the content creator at each interaction. This facilitates a unique form of option as insurance by providing a pool of knowledge-based assets and a natural selection of information to preempt uncertainty in the system. Take the investment of IP as an example, option dynamics can help to evaluate options for expand/contract, sequencing, flexibility, etc., as opposed to simply trading financial values as securities (Chang, et al., 2005). The extension of options can be customised with decision-support-systems (DSS) (Zhang & Babovic, 2011). There can be cooperative options, where IPs can be designed as compatible units to other information assets on the network with an option term (time during which management may decide to act). This helps the network to aggregate more information components in their archives to feed a broader range of design demand (e.g. BIM).
Consensus Mechanism	An economy as a complex system has dynamic and self-organisational behaviours with random fluctuations that is amplified by positive feedback (Beer, 1995). Interacting individuals change their actions and strategies in response to the outcome they mutually create (Arthur, 2013). Each interaction facilitates network consensus on the expected value and utility of an asset. Within a platform economy, such game theoretic principles are assisted by ranking, valuation, and discovery components, where mechanisms of consensus are of core concern. On a technical level, consensus mechanisms assist nodes to share information to establish a trust system of exchange, thus, facilitates circularity and transparency for information flow and archiving. For instance, a decentralised ledger is a record of consensus maintained and validated by a network of interacting nodes; like blockchain, consensus can be achieved with various techniques - Proof-of-Work (PoW), Proof-of-Stake (PoS), Proof-of-Authority (PoA), Proof-of-Importance (PoI), etc. - each distributes trust distinctly (Rutland, n.d.) (Wang, et al., 2019). Such proof techniques can be applied to platform strategies to assist structural coupling. For instance, in PoA, validator nodes earn their rights with verified reputation by the network. This gives incentives for the node to input valued work so as to maintain its position. In principle, this is not so different from the ideal of a democratic jurisdiction, except it would allow the simultaneous production, broadcasting, and anchoring of such information to accelerate self-organisational processes and relieve bureaucratic symptoms, and these processes can be captured computationally to ensure interoperability and inclusivity. As such, consensus is an iterative process through cooperative competition, its dynamicity implies that it is not in logical rivalry with conflicts in information systems (Horowitz, 1962).
Agencies Method	The realization of collaboration for individual actors is enabled through the election of agencies. This makes collaboration a process that is achieved by means of actions that are not necessarily cooperative, but would accumulate to a harmonic and directional force. Developing a broader range of agencies methods may assist the division of payoffs, provide visibility, and diversify coalitional models (e.g. crowdfunding). Moreover, such forms of cooperations can then be modelled mathematically to design protocols for incentive provisions. One of the biggest obstacles in achieving a decentralised multi-accessibility is proprietary incompatibility, which leads to silo-functioning in information systems. Standardising network protocol can support the stacking of multiple modular and single-purpose apps and application programming interface (API) units, where each is freely integratable with another to form universal compatible software packages on demand - an *integratable app stack*. By accepting the agency of another player, coalitions can achieve larger or distinct forms of payoffs and utility (e.g. design functions, manufacturing techniques, etc.). Vendors can consider option dynamics (e.g. flexibility, cooperative, etc.) for sustainable collaboration, where value can be realised with *pay-per-compute*. Agencies method creates value for users by increasing integratable options in a system. Such diversification may help to build up socio-economic capacity within architectural software R&D to prevent the dominance of a particular brand, which often limits flexibility and cultural sensitivity in design production.
Preemption	Preemption is the first right to act, and is enabled by the amount and quality of information that an individual or a network possesses. For instance, insurance is a form of everyday preemption that allows an individual to act before a risk is realised. In a platform economy, preemption helps to create value for users and ensures their rights to act through applying knowledge-based information. For instance, automated process discovery analyses unstructured data in event commits and application logs to predict multi-party collaboration outcomes and find solutions for preemptive transformation (Reeves, et al., 2020) (Maggi, et al., 2018). On a technical level, preemptive computing uses some criteria to decide how much time to allocate to any one task before giving another to preempt the resources constraints of a system. However, almost complete context information is needed for the scheduler to task switch (Rouse, 2005). Imagine a network of computer nodes each with intensive computational tasks, they may share time and resources with cooperative scheduling, so that each CPU relinquishes control at its own accord, and only relevant information needs to be synchronised to relieve data traffic, and the system as a collective preempts larger tasks faster. This helps to establish a platform economy where computational capabilities can be traded to achieve complex tasks. Moreover, such preemptive models can be applied from digital to physical manufacturing, where tasks are preemptively allocated within a network of IoTs (Internet-of-Things) according to probability distribution of supply and demand. Another example is IP mining, which helps to understand the dynamic relationship between a digital asset with the rest of the market; such information helps to deliver probability structure mapping, to which the first right of acting with an IP minimises opportunity costs.

Digital Platforms, Data Archives, and Intellectual Property

Platform economies consist of information technologies and the economy of things – the hard and soft infrastructure that help as many people as possible efficiently create, realize, accumulate, and circulate knowledge-based information. In economics, "technologies" are defined as useful arts that help to organize tasks efficiently to increase productivity (Steenhuis et al. 2012). The annual productivity growth of the architectural industry has increased only 1% over the past 20 years, but accounts for 13% of the world's GDP (McKinsey 2017). This implies that we are increasing input with almost no growth in output, rendering the industry low in sustainability. When information and value flows within a supply chain are dry, value is not effectively distributed in the socio-economic structure, leading to poor conservation and greater consumption of resources.

The aim of platform economies should be to aggregate and circulate ideas and value across geographical and disciplinary boundaries. To aggregate is to grow; "growth" refers not only to monetary value, but also utility value. The approach of this research is the following: if buildings are physical property, then architecture is intellectual property; physical property puts liquid capital into concrete form to provide stability, while intellectual property provides fluidity to rigid matter (Harvey 2019). If physical property has the space for growth, which we generally call the real-estate market, how can intellectual property have the same space for growth? If one considers how physical property grows, fundamentally, it gains value through exchanges and interactions - the more time something is traded often, that implies that there is aggregate demand, and its value increases. So what about intellectual property—IP?

In the problematization of IP, it is essential to think about information flow within design production in architecture, as well as the organization of data through archival functions within digital platforms, which constitute around themselves socio-economies.

Data Organization: a Socio-economic Spectrum

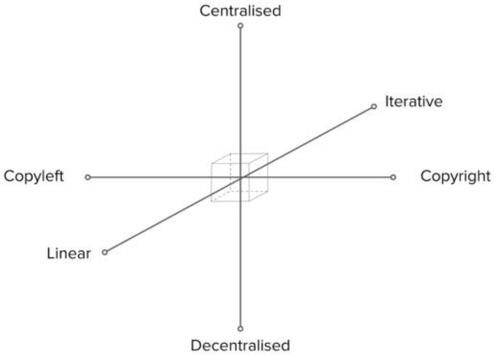


Fig. 8. A socio-economic spectrum for data organization.

The aim of the socio-economic spectrum in Fig. 8 is to model data organization. On the economic axis, there is copyright at one end and copyleft at the other. Within the current system of copyright, design disciplines rely on transacting IP; in the absence of a secure but transparent way to circulate IP, copyright is established on information asymmetry. A corresponding phenomena is proprietary incompatibility. Information and its relative technologies are designed to work in silos, causing output components (from data format to material types) to be incompatible and take extra energy to recycle. This impedes the channels to which information circulates, and thus interferes with the forming of coalitions.

Copyleft – the Creative Commons – is where most small actors are accumulating. For instance, within the habitat of Wikipedia and Google, communal information environments have been set up, where information is offered to users free of monetary value. Copyleft is essentially accumulating the effort of "invisible hands" (Smith 1761). The outcome is that the system has gained a lot of value, which cannot be realized unless it populates the information environment with advertising units or asks users to donate a dollar, but that is not a realization of aggregate value; it's charity. This causes excessive noise and useless information to accumulate in the system, and offsets system functionality and productivity, causing fallback and bottlenecks in growth. And individuals who have contributed valued information do not get appropriate returns. This inevitably results in a form of digital communism, which does not redistribute value effectively between the observer and the observed in a coalition, rendering the system unsustainable in the long run.

On the network axis, there are centralized, decentralized, and, in between, distributed organizations. Centralization benefits responsivity with a focused vision and lowers regulatory and transaction costs through economies of scale (bulk pricing, volume discounts, etc.). In a centralized platform, all nodes share the same set of resources and top-down C&C to divide work and responsibilities for productivity. More often than not with architecture, centralization is translated only in financial terms. In order to acquire or trade architectural IP, one needs a significant amount of upfront capital, and complex contracts are generally trusted to large international actors with substantial financial resources. The impeded flow of information, work, and cash marginalizes many local independent and small-scale actors, such as small and medium enterprises (SMEs), designer collectives, and self-employed architects. Thus, instead of having a circular economy, we have a small clique economy.

Decentralization is a trustless organizational model, where “every node makes a decision for its own behavior and the resulting system behavior is the aggregate response” (BetaNet 2019, 1). Decentralization has no central management or storage, which minimizes the attack surface and prevents a single point of failure. For instance, a decentralized database is installed on systems that have different geographical locations and are not linked through a data communication network (OECD 2019). In participatory archiving, decentralization enables economics to be designed into the network structure, where crowdsourcing and crowdfunding are integrated to build open development platforms. However, performance may be inconsistent if it is not properly optimized and there are no logical connections between nodes, which lowers the data transfer rate and increases difficulty in coordination (Pattamsetti 2017).

A distributed network, in terms of information transaction and storage, is different from decentralization in that there is centrality for its graph connections, and it uses complete system knowledge, where the processing is shared across multiple nodes (Lawyer 2015). Centrality is different from centralization in that centrality is a control-based measure of the importance of a node relative to its network, and all nodes contain information for P2P verification and authentication instead of relying on a central authority (Hossain and Wu 2009). For instance, a distributed database is a single logical database, which is installed on a set of computers that have different geographical locations and are linked through a data communication network (Özsu and Valduriez 2020). Thus, distribution facilitates interoperability, while maintaining independence between database instances. Also, there's more alignment in network ownership, where nodes have an equal incentive to contribute valued work. Nonetheless, there are issues of scalability and high maintenance costs, where synchronizing consensus between all nodes in a network is a time- and resources-consuming process. Inability to solve such issues may lead to the forking of networks and create voids of insecurity.

On the time axis, there is linear and iterative processing at each end. Linear processing uses a simple averaging mechanism, which increases computational capacity. This may help to accelerate the speed of exchanges and run fast statistical fits on simple operations (O'reilly 2020). For instance, linear encoding of information may help to focus on how a message may be altered or influenced in the communication process. The downside is fragmentation (e.g. exchange processes function in isolated and linear units, resulting in high operational costs) and accumulation of risks, especially in immutable operations.

Iterative processing, in contrast, promotes circularity, whereby the output of a process is feedback as input until the operation converges to a desired state. In a platform economy, this may help to minimize discovery cycles and is essential for learning and development processes with high precision C&C. For instance, it may help design iterations to be executed the same way for a range of different data structures to save time and effort in later attempts (e.g. object-oriented programming) (Gatcomb 2005).

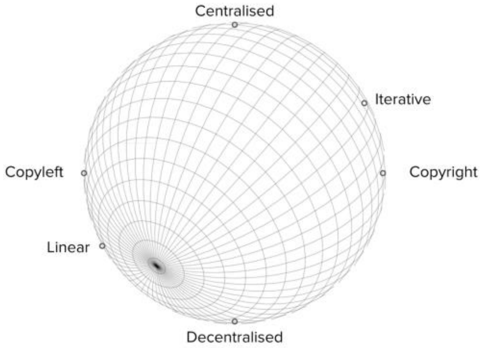


Fig. 9. The spectrum is embedded in a spherical projection so that every point is topologically equal to maximise choices in a multi-access system.

Each point on the spectrum has its own distinct benefits and weaknesses. A multi-access information system emphasizes agencies and option dynamics, which means that this socio-economic spectrum can be embedded in a spherical projection so that every point is topologically equal in probability and opportunity to maximize choices in the system. Data organization strategies may be oriented to any point on the spectrum, according to the system's goals, values, and interests for some criteria to be achieved. Take a blockchain system as an example. Technically, it is distributed (many nodes hold copies of a ledger), but it is not inherently decentralized (which refers to the rights of nodes operating on a ledger); decentralization is a question of design (Rutland n.d.).

Ledger operation design forms part of the essential functions to which an institutional model of appraisal may be democratized within digital archives, where the value of an object may be evaluated based on the record of P2P interactions. Recent initiatives on Non-Fungible Tokens (NFT) exemplify this approach, where platforms and archives are built on top of the data organization, which give blockchain the plasticity to adapt to specific uses and provides an interesting subject for investigation.

Case Studies

Through two case studies, the aim of this research is to develop a better understanding of the implications of the proposed socioeconomic spectrum in three areas: network modelling, C&C protocols, and economic logic.

Pinterest as an Archive

Pinterest is a communal information environment that has created one of the largest digital archives of architectural drawings, which enables the saving and retrieval of information on the World Wide Web (www) using a single access point. Pinterest is successful because of its capability to provide uniform access points, enabling crowd contribution, and translating fragments of information between various mediums to streamline information exchange: for instance, bridging Google and Baidu incompatibility by functioning as a platform that takes advantage of the link structure of hypermedia.

One of Pinterest's biggest challenges in data organization is information ranking (IR). In terms of archives, ranking concerns means assigning value to information to produce a permutation, so that during a search or a query, the best results appear early in the list. Pinterest uses a SmartFeed algorithm to help nodes in the network vote on the importance of information; images are labelled with keywords by collaborative filtering. The algorithm deals with search relevance expressed in terms of probability.

Nonetheless, Pinterest's network tendency has little control over centrality, except for promotion or paid advertising; it is highly susceptible to spam and repetitive information, where IR utility becomes problematic, especially in the discipline of architectural design. For instance, in the first 10 results recommended by Pinterest for 'modernist art', three were from North America; three were contemporary pieces; one was a Bauhaus poster for an advertisement selling a replica for £3.45, and the remaining three were recommendations, notably, all of which were paintings.

This illustrates a few potential limitations of the platform model of Pinterest in data organization of its online archive: 1) the format of data input restricts the definition of art to the format of paintings; 2) the dominance of certain user groups diminishes plurality (the absence of modernism art from Russia, South America, etc.); and 3) the commercial pricing of information influences the ways in which we perceive and define history. Based on its benefits (multi-accessibility) and limitations (low IR utility), Pinterest exemplifies tendencies in decentralized copyleft information systems, where data organization is a linear process.

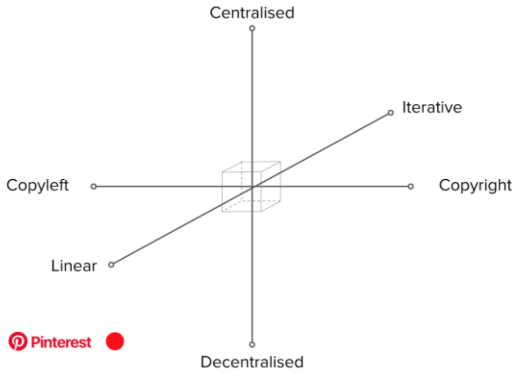


Fig. 10. The Pinterest platform exemplifies tendencies of decentralized copyleft linear data organization.

Blockchain Platforms

Satoshi Nakamoto (2008) proposed a P2P transaction system secured with timestamp functions, called bitcoin, with the aim of improving the autonomy of information transactions within a decentralized network to eliminate the time and resources needed for institutional authentication. The back-end mechanism of this is blockchain.

Blockchain operates information archiving functions that are built into the network structure itself. It anchors information in an immutable manner, and archives not only IP, but all transaction and exchange data that comes with it. In this way, an architecture archive that builds upon blockchain guarantees authenticity, much like the way in which museum specialists authenticate a painting by the transaction labels and signatures that are attached to the back.

Blockchain's quality as a distributed ledger has the potential to be coupled with platform strategies to specify architectural design functions, for instance, with Building Information Modelling (BIM) systems to act as a real-time archive and tackle fragmentation in the architectural supply chain, at both a technical and socio-economic level. Blockchain's universal C&C protocols standardize data organization along the chain, from data input to encryption vehicles, and enable a means for BIM systems to freely integrate with crowdsourced efforts for democratization. This describes the agencies method, coined by the famous mathematician Nash (2008), where multiple parties can simply accept the agencies of another to accomplish larger, more complex tasks that each party otherwise could not have achieved on its own, facilitating (non-)cooperative games and self-organization.

Blockchain is technically distributed, but not inherently decentralized, where decentralization is a question of data organization design. DAO and Twetch are two great examples.

DAO, or decentralized autonomous organization, is a crowdfunded venture capital fund, allowing any user to pitch their IP to the community and potentially receive funding, according to network consensus (Santos and Kostakis 2018). DAO built the role of an archive into its economic logic, a form of "Fully Automated Luxury Communism" (Bastani 2020). Automated refers to running on smart contracts to streamline information transactions and immutability. Luxury refers to eliminating human labor in dealing with repetitive contractual work. And communism refers to complete transparency, total shareholder control, unprecedented flexibility, and autonomous governance (Puyang 2018). This leftist tendency is made clear by the actions it has taken to resolve difficult situations, such as the DAO hack, and its introduction of a proof-of-stake consensus mechanism (Castillo 2016).

Twetch (2019) is a start-up that explores the minimal tradable unit of information – a micro-information economy. Twetch modelled its interface after Twitter, but its economic logic is the polar opposite of Twitter's. Twitter shares information for free, realizing value on the application layer within the protocol stack. Nonetheless, the system gains a lot of value, which is difficult to realize unless it populates the information environment with an infinite scroll of advertising units. This causes excessive noise to accumulate in the system and offsets system functionality.

Nowadays, such platforms utilize personalization algorithms and collaborative filtering to assist in data retrieval and tackle the information overload problem in the every-mounting terabytes of data. Instead of maintaining the quality of information in the archive, Twitter invests in creating better recommendations and search methods. This creates problems such as data licensing. Also, individuals who have contributed their data do not get appropriate returns, resulting in digital communism, which does not redistribute value effectively.

Twetch, in contrast, assigns every piece of information with a micro-value from a tenth of a cent. Every time a user posts, likes, comments, or forwards a tweet on Twetch, it costs the user, and the micro-value is instantly directed back to the content creator. In this way, Twetch enables its users to own the financial rights to their digital content, and directly profit from social media's attention economy.

Although DAO and Twetch are both built upon the data organizational models of blockchain, DAO exemplifies the opportunities and limitations of decentralized copyleft systems, Twetch illustrates that of decentralized copyright, and Twitter depicts that of distributed copyleft.

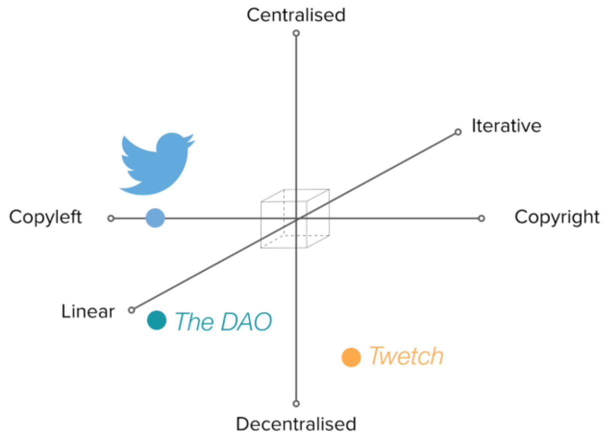


Fig. 11. Platforms on blockchain illustrating different qualities of the spectrum: DAO, Twetch, and Twitter.

Design Research—Current.cam: A Platform of Urban Archiving for Artificial Creative Common Intelligence

Any changes in the technologies we use to perceive space changes the way in which we intervene with space (Bottazzi 2020). The archiving of architectural and urban data helps us evaluate, analyze, predict, and navigate both physical and mediated space.

Current (2019) is a speculative urbanism project that examines the future of broadcasting cinema, facilitated by collaborative urban archives, and its impact on our cities, including current questions about the democratization of institutional appraisal, the existing models of data organization from digital platforms, which form economies that extract value from crowd contribution of IPs, and the future role of archives in a design world increasingly governed by Creative Commons and open-source generative algorithms.

Fig. 12. *Current*, 2019, Volumetric Cinema, www.current.cam.

In the process of training our machines to see and comprehend, Current anchors its data feeds from livestream, because of its real time and crowdsourcing qualities. Streaming data channels from multiple sources and perspectives provides Current with a means to outsource imagination. Current seeks to facilitate an "artificial creative common intelligence." This points to a new form of creativity, where authorship is participatory and the relationship between AI and creativity is contextualized within the Creative Commons.

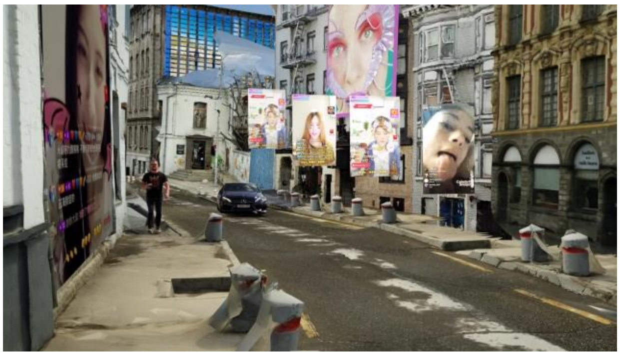


Fig. 13. Livestream urbanism: a platform for participatory archiving: https://youtu.be/4ngiZ5X0-kY.

The word "creativity" has its root in Latin, with the Christian implication of 'creation from nothing' – genesis from a higher being. It was not until the 19th century that the term embedded itself in poetry, science, and art. It was no longer a mere form of repetition and propagation, but creativity that reconciles with rules, from constructing and deconstructing – a creation from something.

Today, creativity has encountered a third archetypal turn in the face of AI, which can take the form of "rule-based" and "machine learning" systems. The former involves the design of models with a set of rules. The latter achieves intelligence through machines that define their own rules based on available data, transcending creativity from causation to correlation, and from small data to big data.

This probabilistic approach implies a measure of the amount of possible arrangements within the state of a system – the measure of entropy. If we are to contextualize the use of entropy within the art of design that is bounded by our socioeconomic system, it implies cognition of their possible arrangements in the future. Thus, measuring entropy not only gives us information about the present state of a system; it seems to capture the critical information that we need to speculate on the future evolution of a system. Within any large-scale information system, such a measure is made available only through a crowdsourcing model, which aggregates data and has the computational power to process the ever-increasing terabytes of data.

Fig. 14. Shots from *Current*, illustrating the personalized future of infinite livestreams.

Current, which investigates livestream culture, has experimented first-hand with a range of rule-based machine-learning systems that are readily available to any individual, and developed a production pipeline that provides a means for individuals to collectively reconstruct, navigate, and understand event landscapes that are often hidden from us, from the handling of trash to changes in nordic animal behavior. In the process of iterative feedback, filling in voids between sensory data in an endless stream of history, where designer intuition and algorithmic generation come together as a larger whole, this is the current definition of "artificial creative common intelligence."

What is the role of urban archiving? The quality of our built environment is often assessed through records of data and history. But traditional architectural archives include mainly drawings and models of buildings since it is operational costs that guarantee the value of an object. But this does not give a comprehensive overview of the qualities and impact of a design. Advances in digital technologies expand the possibilities of archiving and democratizing it into a real-time multi-accessed system. One of the challenges of urban archiving is the abundance of data with no simple or economic way to structure and extract useful information. For instance, livestream data from media platforms often consists of information about our built environment and its events, but this infinite scrolling of image and video data at 30 frames per second presents immense challenges for processing and analysis. Along these lines, emerging tools such as volumetric navigation, AI image processing, and algorithmic personalization may assist us in collective information operations, such as indexing, analyzing, filtering, ranking, and synthesizing.

In its research, Current references various initiatives in its approach to urban archives and event reconstruction using AI, including Intel® True View, which renders 3D video captured from a football field of cameras in near real-time to reconstruct sporting events; Forensic Architecture, which investigates violence and terrorism using a composed archive of social media data; and Tzina, which virtually preserved a demolished historical site and its occupants in Tel Aviv (Intel 2020; FA 2020; Tzina 2016.

Inspired by these works, Current focuses on democratizing these techniques to facilitate a collective contribution to urban archives and AI – an artificial creative commons intelligence. Instead of using high-end technology and software, which are available mainly to institutions and corporates, Current tested a range of open-source neural networks, photogrammetry frameworks, and low-end sensors (mobile phones, Kinect, motion sensing, drones, etc.). The proposed production pipeline enables individual users to simultaneously produce, broadcast, and acquire information through livestream.

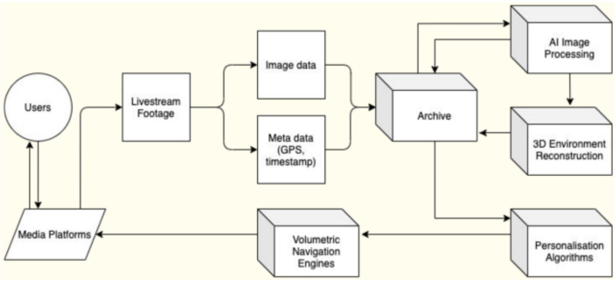


Fig. 15. Proposed democratized production pipeline for Current.

Livestream includes images and metadata that can be extracted for environmental reconstruction. Machine learning allows an estimation of what is behind a foreground object, and thus it can be paired with photogrammetry frameworks that calculate based on vantage points. We experimented with AI image processing using Autoencoder, which helps fill in missing information on texture maps based on archived data, and object detection, which helps estimate scene descriptions. The output volumetric data is then plugged into personalization algorithms, which label, rank, and deliver recommended content through collaborative filtering. Finally, the output is pulled into displays on demand, which are volumetric navigation engines, like WebVR, which can be multi-accessed by a network of users. This helps reconstruct 3D environments based on multiple vantage points from sequences of 2D images. Using this pipeline, the team produced a cinema in the most economic way possible for democratization and participatory purposes.

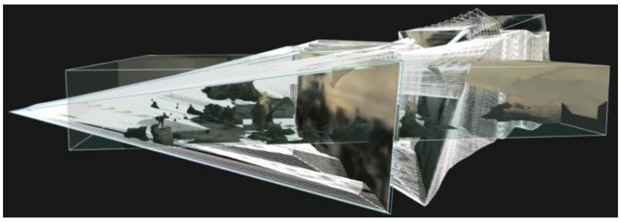


Fig. 16. Volumetric reconstruction showing the peculiar aesthetic of shadows around the scene; generative algorithms negotiate to fill in data voids.

This may facilitate an attention economy via platform technologies, where the reconstruction of certain events and environments may direct value back to the entity through harnessing network effects. For instance, Current reconstructed polar bear tracks using livestream data from bear cams to give a sense of immediacy in a simulated virtual environment. This can potentially generate financial and social credit for the protection of species via virtual signaling, with blockchain helping automate P2P transactions, facilitate value routes, where each reconstructed data point may be minted as an NFT, and enable endangered environments to own themselves by raising public awareness and crowd contributions. These are the next steps of Current's design research.

The resulting speculative cinema illustrates what such a multi-access system may look and feel like, based on the convergence of democratized urban archiving and artificial creative commons intelligence. Current remains a form of artistic expression for now, but it foresees a near future as computational power advances in which such pipelines calculate to precision reconstructions, facilitating live volumetric streams and data flows that update simulated environments in real time.

OUTPUT (Results)

The production pipeline have been tested to produce a 12-min prototype of environment reconstruction. The prototype can be accessed:

https://dai.ly/x7g1v7k

password: 00000

Below are screenshots from the output of 'Current' alongside reconstructions from Intel and Nvidia. Resolution of mesh and texture mapping from 'Current' is relatively low in comparison, but the cost of production is near zero and all technologies used are ready at hand.

In the coming year, 'Current' intends to update the production pipeline with the latest open source technologies to improve on the quality of reconstruction for archiving urban environment and events. It also aims at surveying same sites every other year to archive the changes over time.

Fig. 6. An overlay of reconstruction on original livestream data in 'Current'.

Fig. 7. **Intel® True View** large scale sports event reconstruction.

Fig. 8. 'Current' applied texture mapping combining techniques of crowdsourced pix2pix AI algorithm and reconstructed models from Tokyo city livestream.

Fig. 9. **Nvidia Pix2pixHD** texture mapping using AI algorithm Generative Adversarial Networks (GANs).

Fig. 17. Comparison between reconstruction output of Current, which aggregates open-source efforts and enterprise grade AI technologies from Intel and Nvidia.

Conclusion

The paper discusses how platform economies and types of digital archiving may act as socio-economic drivers of change in architectural design production. Through theoretical, historical, and technical means, this paper hopes to stimulate discussion about the design of systems in a social realism that is increasingly molded by data organization.

It looks to the 20th century to search for the rise in modern system study (including cybernetics, information, and game theory in the 1940s, second-order cybernetics in the 1970s, and agency methods in the 2000s), and proposes a set of control and communication principles to allow us to begin to discuss the integration of network dynamics and economic logic: specifically, the use of Discovery Processes, Value Ranking, Pay-per-Compute, Option Dynamics, Consensus Mechanisms, the Agencies Method, and Pre-emption to build multi-access platforms that form economies around data organization in digital archiving. On this basis, we propose a socio-economic spectrum and its qualities, illustrated with existing platform examples, including Pinterest and those built with blockchain. This research discusses the potential and limitations of the strategies of democratizing technological systems and knowledge-based information.

Finally, this research illustrates its arguments with a design called *Current.cam*, which aims to build a relationship between AI and creativity that is contextualized in the creative commons, and proposes ways in which urban archives and "artificial creative common intelligence" may converge, which provide a means for us to collectively speculate on our future.

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Provides currently teaches at the Bartlett School of Architecture (UCL), where she received a distinction in her Master of Research on Digital Theory and Architecture. She actively engages in speculative design in interdisciplinary collaboration with talent around the world. She has also established a creative practice, @current.cam, and a researcher collective, @R.E.Ar_, to experiment with technologies first-hand and expand the audiovisual spectrum of design production and architectural representation.