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COSMOS + TAXIS

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Ostrom amongst the Machines: Blockchain as a Knowledge Commons

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Abstract: Blockchains improve on previous ledgers on several margins, including transparency, immutability, and openness. Though cryptocurrency tokens such as Bitcoin and nonfungible tokens (NFTs) are now part of the popular lexicon, institutional analysis of blockchains is just beginning to blossom. We add to the burgeoning institutional analysis of blockchains and their governance by considering novel insights from Hayekian and Ostromian perspectives on blockchain governance. We contend that concept of taxis is especially useful to describe the origins of any individual blockchain and that the concept of spontaneous order is uniquely suited to analyze the competitive features of blockchains. A novel insight is that blockchains may arise without government design, but they are centralized entities. Ostromian analysis is especially useful to characterize blockchains as knowledge commons and to provide an empirical method to analyze how rules internal to and external to blockchains combine to explain the performance of any individual blockchain network.

1. INTRODUCTION

Cryptocurrencies and NFTs (nonfungible tokens) are now part of the popular lexicon. Bitcoin, the first cryptocurrency with commercial success, brought new confidence in distributed ledgers (Luther 2019). Since its initial offering, Bitcoin has taken off in significance. Perhaps as a result of concerns about the economy and with governments during the coronavirus pandemic, the price of Bitcoins reached an all-time high of $63,000 in April of 2021, with a market capitalization of over $700 billion, and new highs in October 2021.[1] NFTs burst onto the scene around the time Bitcoin was enjoying its meteoric rise. NFTs have already generated buy-in in popular culture with digital assets such as CryptoKitties (collectible digital cats) and with the highly-publicized purchase of Wu-Tang Clan's "private" album, *Once Upon a Time in Shaolin*, by PleasrDao, a crypto-collective hoping to make the album available to the public (Vee 2021).

Though cryptocurrencies are probably the best-known application of blockchains, public and private blockchains, such as Ethereum, Hyperledger Fabric, Corda, and Ripple, allow for applications to be developed on top of the blockchain. These include financial applications notary services, smart contracts, and DAOs (decentralized autonomous organizations). These developments, especially smart

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contracts built on the Ethereum platform, create opportunities for different types of contracting whereby agreements are self-executing once the terms are agreed on. These have had ripple effects on law. Unlike traditional written contracts, which are often characterized by *incompleteness*, smart contracts presume the inclusion of all terms and definitions, thus prioritizing contractual *completeness* to a greater degree. Smart contracting illustrates how blockchains create new opportunities for experimentation with different forms of governance, including not only commercial arrangements but also different voting rules among self-organized communities (Allen, Berg, et al. 2019).

Several broad themes emerged as people engaged more deeply with blockchain, including exploration of uses of the underlying technology (blockchains) beyond digital currency, emergence of the idea that blockchain is a philosophy of freedom as much as a technology, and the pluralistic character of blockchain, with many distinct blockchains or blockchain networks, each having a unique set of technical, economic, and social characteristics. Accordingly, blockchains can be thought of as a new *institutional* technology alongside firms, governments, and relational contracting as a building block of the economy (Davidson et al. 2018). Blockchains are significant because they record information about people, property, and contracts without the need to rely on trusted third parties, especially governments, firms, and courts, to validate the information contained in those ledgers. Though blockchains involve some degree of trust in those who establish the blockchain, with permissionless (or public) blockchains, trust is placed in blockchains' powerful consensus algorithms, enabling new opportunities for contracting without relying on hierarchies (Berg et al. 2019) or trusted third-party intermediation.

Despite an outpouring of research into blockchains, the institutional analysis of blockchains is just starting out. For example, there remains debate about the nature of blockchains. Much of the discourse on blockchains sees them as synonymous with decentralized coordination. However, blockchain is not the only decentralized coordination mechanism, and it is not the first decentralized ledger. More significantly, from a governance perspective many blockchains are centralized. This is not only the case with permissioned blockchains, which are organized much like conventional firms, but also with public blockchains, whose leadership typically consists of entrepreneurs and programmers with the ability to shift the evolution of a given public blockchain's rules (Alston et al. 2022).

The defining feature of a blockchain is that it is an append-only cryptographic log rather than its being centralized or decentralized *per se*. Blockchains are distributed, shared ledgers in which all the entries in the ledger are stored in a chain of blocks. This chain is ever-growing as new transactions (entries in the database) occur, in a network of connected nodes that are appended to the chain through the creation of new blocks. Since blockchains can only be appended, they can both provide for greater transparency than previous ledgers and also offer potential security improvements over traditional ledgers. The applications or uses of blockchains are not limited to cryptocurrencies, or even to ledgers themselves; there are applications of blockchain that provide for cooperation among agents that do not depend on a ledger. The diversity of uses illustrates that blockchains characteristically involve cooperation and collaboration in distinctive ways but are not necessarily decentralized, as they may have features more like a conventional firm. Blockchain's append-only feature has some novel advantages and enables blockchains to do things that had not previously been possible.

Our contribution in this paper is to compare and contrast Hayekian and Ostromian perspectives in the analysis of blockchain networks. Hayekian political economy is especially useful in clarifying the differences between governance of an individual blockchain and the market for blockchains. In Hayek's (1973) typology, an individual blockchain has features of a taxis. Much of the institutional analysis of blockchains adopts that view, including research which sees the formation of any given blockchain network as akin to a process of constitutional choice (Cowen 2019). A blockchain is established when programmers produce a white paper, and any given blockchain is governed by rules made there. Still, there are features of blockchains that fit more closely with cosmos, especially the relationship of any given blockchain to its "competitors." Though individual blockchains are taxis, the overall evolution of these blockchain networks is a cosmos. This proliferation of blockchains, especially in the cryptocurrency realm, enables "consumer choice"

and contributes to institutional innovation in blockchain networks seeking to attract and keep users in their network (Alston 2020).

Seeing blockchains as primarily taxis rightly shifts the focus to rules internal and external to blockchains. Here, a burgeoning Ostromian literature on blockchains is especially relevant. Some of the themes in this literature include the ways in which uncertainty is addressed through changes in a blockchain network's rules (Howell and Potgieter 2021), the kinds of rules that have emerged to address negotiation costs among users of blockchain networks (Allen, Lane, et al. 2019), and governance dilemmas arising from the necessity of linking blockchains to data in the real world through oracles (Poblet et al. 2020). Additional research considers whether blockchain networks are polycentric entities (Frolov 2021), and if so, the nature of those polycentric governance arrangements (Alston et al. 2021).

The research above, though not all explicitly based on the insights of Nobel laureate economist Elinor Ostrom, share the Ostromian concern with governance institutions in the real world. Rozas et al (2021) is among the first to explicitly apply Ostromian analysis to blockchains. Their focus is on how features of blockchain technology (tokenization, self-enforcement and formalization of rules, autonomous automatization, decentralization of power over the infrastructure, increasing transparency, and codification of trust) can support coordination in other decentralized communities, such as Commons-Based Peer Production (CBPP). In other words, they consider governance *by* blockchains, rather than governance *of* blockchains. Such analysis of governance by blockchains clarifies the ways in which blockchains can improve prospects for decentralized governance, in this case by improving prospects for already-decentralized social organizations to better achieve prospects for self-governance (Rozas, Tenorio-Fornés, and Hassan 2021).

We add to this Ostromian literature. We depart from a specific application of Ostrom's commons research to blockchain and explain why blockchains are best analyzed as knowledge commons, adopting an Ostromian theme on institutional governance but highlighting the distinctive knowledge and information attributes of the blockchain context. Blockchains are social institutions, not merely technological systems. We emphasize the ways in which the Governing the Knowledge Commons (GKC) perspective can be used to develop an empirical research program that embraces the diversity of blockchain arrangements. Together, these perspectives can explain the limits of human ability to design institutions for innovation and open up the black box of institutional design within the blockchain. In addition, our analysis clarifies the differences in Hayekian and Ostromian perspectives on blockchain, as well as argues that generally speaking, the perspectives are complementary.

2. HAYEK AMONGST THE MACHINES

Austrian Institutionalism

Economists have long recognized that "institutions matter." The New Institutional Economics (NIE) has been especially successful in defining institutions and how they matter. Working from within the NIE tradition, Alston et al (2018) define institutions are rules that "recognized entities (individuals and organizations) devise and enforce." They define norms as behavioral beliefs that reduce uncertainty.

Austrians have a rich traditional of institutional analysis. Here, we explain why it aligns with the NIE definition of institutions, as well as how it offers some novel insights into the process of institutional change. These conceptual clarifications also serve to illustrate why an Ostromian perspective, with its emphasis on real-world analysis of complex organizations for self-governance, complements Austrian institutionalism.

Austrian institutionalists see individuals as purposeful agents whose actions to achieve their subjective goals contribute to emergent order (Cowan and Rizzo 1996). Human choice is central to this vision of institutionalism. The result is a more open-ended character of institutions than one may get from the constrained maximization view which sees the possibility of identifying "optimal" institutions (Kirzner 1997).

Institutional change—change in the enforceable rules, using the definition of institutions given above—is a result of an entrepreneurially-driven market process.

The definition of institutions as enforceable rules also provides a way to organize ideas about taxis and cosmos. According to Hayek (1973), made orders (taxis) are the product of members of groups choosing rules that specify consequences for specific actions. Made orders are thus artificial, as Hayek described them. Order, such as a firm, results from command through taxis.

A cosmos is a spontaneous order. The Austrians built on Adam Ferguson's view that social institutions result from human action but not human design, which Carl Menger interpreted to mean that institutions are unintended creations of the human mind (Palagashvili, Piano, and Skarbek 2017). For Menger, order consists of pragmatic orders that were consciously designed (and enforced) and organic orders that cannot be explained as the result of the intentions of any individual human mind, such as market prices, morality, language, and money. Menger considers cities and states as organic in that any given complex human organization is reflects a process of reciprocal adaptation. Menger further distinguished state-made law (statutes) from law that emerged spontaneously. Spontaneous orders, or cosmos, result from deliberative behavior, but institutions can only be understood by abstracting from the specific choices of any given individual or organization (Boettke and Coyne 2005).

Hayek's political theory, with its emphasis on limited government (see, for example, Hayek 1944), follows from this appreciation of spontaneous order. Rules are more appropriate than discretion when the social order that society wishes to preserve is more complex. This is a positive statement about how society is best able to preserve complex social orders, including those arising from the market process, *if* society wishes to do so. For the economist to impose this view on society would be inappropriate, given the knowledge problems identified by Hayek (1945) and his generalized opposition to planning expressed in *The Fatal Conceit* (1988). In analyzing taxis, Hayek distinguished between nomos (law) and thesis (legislation). Law consists of general rules that regulate future conduct of individuals in any number of unknown future situations. Legislation, in contrast, specifies specific actions in any given situation and are enforced; law, in Hayek's sense, is not carried out, but specifies frameworks for making rules.

The above is useful in clarifying that the new definition of institutions provided by Alston et al is consistent with Hayek's and Menger's view of institutions as pragmatic orders and taxis, each enforceable rules that are products of human design. Spontaneous order is a concern with norms, such as morality, culture, and language, each of which influence behavior, but are not necessarily enforceable via sanctions and are did not originate from any conscious design. As we explain below, a concern with each type of order is relevant for analyzing blockchain networks.

Individual Blockchains as Taxis

Blockchains have features of taxis in that they have designers. The white papers that set forth the technology had authors—Satoshi Nakamoto, whose white paper announced Bitcoin in 2008, was a pseudonym, but their white paper had a definitive author(s). Four people were the "authors" of Ethereum. Even permissionless blockchains, which allow potentially anyone to participate, are a product of institutional design and agreement on sets of rules (Alston 2020).

There is also an evident role for rules internal to any given blockchain (Bert, Markey-Towler, Novak, and Potts 2018). This is most obvious with a private blockchains, which are organized much like traditional firms in the sense that they may have internal decisionmaking hierarchies, and there are clear boundaries between insiders and outsiders, that is, between those who are permitted to participate in blockchain transactions and those who are not. To some extent, governments have in some instances view blockchain as rule-based rather than only as a technology, as some attempted to ban cryptocurrencies (Hendrickson and Luther 2017). Consistent with their rule-dependent character, middlemen have also emerged to facilitate individual transactions on blockchains (Spithoven 2019).

Summing up, in terms of institutional analysis blockchains are not simply a technology, but a novel constitutional choice, the result of a constitutional process such as any taxis described by Hayek, or later by James Buchanan in the public choice tradition (Rajagopalan 2019). That conclusion clarifies how some blockchains, especially permissioned ones, are not so different from firms, as institutionalists have long been analyzing such phenomena with a similar framework (Alston Forthcoming). We argue not that blockchains are firms, but that the two phenomena share an institutional character.

The Landscape of Blockchains are Taxis

The entire system of blockchains has features of a cosmos. The blockchain (especially its underlying technology—public key encryption, one-way functions, consensus approaches - and philosophy) itself did not come from an individual, and its evolution reflects the cumulative consequences of individual decisions. There is no ultimate plan for the landscape of blockchains out there for blockchain developers and users to choose from. What this enables is Hayekian anarchism—a polycentric collection of venues and organizations to resolve and address disputes (Stringham and Zywicki 2011). Blockchains realize this Hayekian vision. Exit and voice within any given organization may be improved by blockchains (Berg and Berg 2020), up to and including crypto-secession (Allen et al. 2018). In addition, as entrepreneurship has a spatial aspect (Andersson 2005), blockchains are interesting as cosmos because their evolution creates and builds on opportunities for entrepreneurs to engage in peer-to-peer interactions across distances previously unheard of. Reliance on social trust is replaced, significantly, by reliance on resolution by the algorithms that constitute a blockchain.

Legal scholars interested in the evolution of law highlight the ways in which people are able to create their own rules to govern themselves, as well as the role of markets for rules in shaping the evolution of law (Hadfield 2016). Cowen's (2019) market-for-rules perspective on blockchains adopts this view. The market itself is a cosmos, with an open-ended character. The resultant institutions established are a taxis, but the participants are interacting in a market, much like firms—made orders—operate in a market. Blockchains thus illustrate a more general point that Hayek understood, which is that made rules exist along spontaneous orders (Pennington 2011).

3. EXTENDING THE GOVERNING KNOWLEDGE COMMONS APPROACH TO BLOCKCHAINS

Following the Hayekian tradition, we can think of a given blockchain network as a taxis, and the landscape of blockchains as a market that contributes, in open-ended fashion, pressure to change rules of any given blockchain. What is missing is a framework to empirically analyze blockchains. Below, we suggest the Governing Knowledge Commons research framework offers a general empirical approach to characterizing the diversity of rules governing blockchain networks. In addition, we see distinct advantages to recognizing that blockchain networks are knowledge commons.

We see the GKC approach as appropriate because of its emphasis on governance of shared non-depletable resources, as well as its emphasis on the designed or constructed character of those resources; on distribution and coordination relative to those resources as well as production and consumption; nested-ness; legal regimes and property rights considerations; interactions between insiders and outsiders; and dispute resolution. Each offers insight into blockchain networks generally.

Elinor Ostrom's (2005) design principles for commons settings focused on boundaries, the link between rules and needs, opportunities for participation, and the design of enforcement mechanisms, as well as the nested nature of governance. Those guidelines, and the Institutional Analysis and Design (IAD) framework that followed them, were anchored primarily in empirical analysis of cases of natural resource governance. They relied on the corresponding assumption that self-governing communities could sustain production of shared, depletable resources and surmount overconsumption (free riding) dilemmas posed

by the conceptual "tragedy of the commons." Subsequently, Ostrom and Hess (2007) applied related reasoning to knowledge, which confronts related but distinct social dilemmas issues of underproduction, withdrawal of information, enclosure, inequitable access and distribution, coordination among producers and users, conflict, deception, congestion (insufficient availability at times of peak demand), and pollution (Hess and Ostrom 2007). They hypothesized that self-governed communities could be successful with respect to managing shared knowledge and information resources. Early adaptations of Ostrom's work to knowledge characterized these arrangements as "new" commons (Hess 2008).

The GKC approach adopts the instinct behind this early work, that communal or collective governance of shared knowledge resources could successfully overcome social dilemmas and create successful governance institutions as alternatives to state- and market-based models. The GKC framework likewise adopts Ostrom's perspective that the instinct can be validated empirically by close, systematic case-based research. It departs from Ostrom's work, including both Ostrom's guidelines for commons governance and the IAD research framework, by opening important research questions about the character of shared knowledge and information, about the types of social dilemmas that shared knowledge responds to and creates, and about the role of formal legal and legal institutions in constructing and shaping informal practice (Frischmann et al. 2014). None of those things formed a significant part of Ostromian approach to commons or shared resource governance. The GKC framework assembles those research inquiries into a strategy for investigating specific cases of knowledge commons governance in a systematic way, a strategy that is modeled on Ostrom's IAD framework but that is not simply an extension of Ostrom (Frischmann et al. 2014).

In the GKC framework, cases of knowledge commons governance are highlighted because of their functional attributes rather than because of a definitional distinction that labels certain institutional arrangements as "knowledge commons." The characteristic that distinguishes "commons" governance from the "noncommons" is institutionalized sharing of resources among community members (Madison et al. 2010). Identifying the resource and the community or collective are two critical, initial steps in a knowledge commons research project, but one of the key aspects of knowledge commons is how self-governance can be linked to other formal and informal governance mechanisms and the constraints on self-governance imposed by technology and other material constraints. Werbach (2018) describes an attack on the Ethereum blockchain known as The DAO in which the governance process involved rolling back transactions (essentially setting the ledger back to an earlier state). In such instances, governance processes involve interactions between human stakeholders that relate to but exist independent of the technologically-mediated governance processes that determine when blocks are added to a blockchain. The contents of a blockchain ledger involve executing and enforcing (in computer software) the terms of the contract that was defined algorithmically in advance, but the fact of the ledger—and the possibility that the ledger might "fork" and become two ledgers, with different contents—is a product of human decision making.

Just as Ostrom insisted that commons governance offers no panaceas or one-size-fits-all solutions to challenges of resource sharing, the knowledge commons literature questions simple solutions to the challenge ofgoverning knowledge (Madison et al. 2010). The GKC program emphasizes that research on knowledge commons must be empirical as well a conceptual exercise (Frischmann 2013). The literature documents numerous and varied examples of community and collective self-governance of shared resources, often distributed across decentralized spaces. Successful distributed commons governance examples, such as open source software production and Wikipedia, illustrate cases where knowledge and information are naturally shareable, and where the absence of clear property rights does not inevitably lead to "tragedy" (Madison et al. 2009).

Some of the best-known examples of knowledge commons governance are peer-production networks, such as Wikipedia and Linux (Benkler 2013). Blockchain networks are another example of knowledge commons. In applying the GKC framework to blockchains, the unit of analysis is a blockchain network. Blockchain networks are digital resources that consist of technologies for innovation and a community that governs the production of outputs from the network. The GKC perspective suggests that further elaboration of the resources in question is appropriate, along with elaboration of the social dilemmas to which

each resource is subject. For example, a preliminary view of the resource question here is that a blockchain network is characterized by distributed but shared computing power (one resource, subject to coordination dilemmas, to free riding dilemmas, and to environmental externalities), by distributed but shared human labor (a second resource, involving designing and evolving the code that defines the network, subject to coordination dilemmas, depletability dilemmas, and free riding dilemmas), by the shared contents of the blockchain (the information documenting transactions in blockchain assets (a third resource, which combines pooled information about the transactions with shared information about each specific transaction within each specific block, subject to trustworthiness, traceability, and durability dilemmas). The community includes developers, users, and others who contribute to the emergence of the network. In GKC terms, "the community" ordinarily should be scrutinized to separate the roles, responsibilities, obligations, and contributions of different members of the community. Commons governance does not automatically entail an absence of hierarchy. Nor does it exclude risks of misbehavior or worse. The outputs of a blockchain are what is produces. For cryptocurrency networks, this includes digital currencies and may include architectures to write smart contracts, such as with Ethereum. Blockchain networks may also produce information that is used by individuals, where the information has features of knowledge commons (Allen, Davidson, et al. 2021). As with knowledge commons generally, a critical "product" of a blockchain network may not be resources themselves but may instead be the community or organization that the blockchain sustains. Unlike Ostromian commons, which typically exist to ensure a sustainable supply of biophysical resources, knowledge commons governance may exist to ensure the sustainable creation and continuation of a human community.

Like peer-production networks, blockchain networks arise in decentralized fashion and are governed by a community of users. For public blockchains, the community of users can be anyone who has the means to participate, which include some basic know-how and access to the Internet. For private blockchains, the community is defined by individuals, including developers and programmers, with definite boundaries. Public and private blockchains depend for this success on internal and external rules. These internal rules include protocols, which as noted constitute a realm of collective choice. The external rules include regulations and laws. In addition, the polycentric features of blockchains ensure that the outputs of any blockchain network depend in part on the competitive environment within which a given blockchain competes. Further, blockchain networks often depend on shared resources, such as the smart contract architecture provided by Ethereum, which can be used by other blockchain networks.

The multiplicity of shared resources evident in a blockchain network illustrate how governance institutions may be nested, or layered. Governance at one layer relates to but may be independent of governance at adjacent layers. In that vein, Dekker and Kuchar (2021) see markets as dependent on knowledge, some of which are governed as shared resources, that is, as commons. Blockchain networks often excellent examples of knowledge commons governance that operates within a market environment, both borrowing market strategies and interacting with market actors. Outputs such as cryptocurrencies are available to any market participants, and so they constitute market-supporting knowledge commons. Blockchain networks also provide a way to pool innovation resources, as emphasized in the innovation commons literature. As a species of knowledge commons, innovation commons are institutional solutions to innovation dilemmas, notably collective action problems (Allen and Potts 2016). In innovation commons, entrepreneurs pool innovation resources under defined governance rules (Potts 2018). Blockchain networks may perform precisely that function, enabling communities to collaborate to produce goods and services. Blockchains can be used by commons-based peer production communities to improve prospects for sustainable self-governance (Rozas, Tenorio-Fornés, Díaz-Molina, et al. 2021). These are not either/or interpretations; both market production and peer production via blockchain networks illustrate the strength of the knowledge commons perspective in understanding how blockchain addresses various social dilemmas related to shared knowledge and information.

The account is compatible with perspectives that emphasize private property rights over the outputs produced by blockchains. Transactions on public blockchains are effectively transfers of individuat-

ed property interests within the overall institutional context of the blockchain, as suggested by Davidson, DiFillippi and Potts (2018). The GKC framework highlights the non-depletable character of the property in question and the fact that property interests are specific by combinations of computer code and positive law—both attributes being contingent and subject to design choices in the construction of the blockchain and adaptation and evolution during its performance.

In the next section, we describe in greater detail how the GKC framework may be employed to analyze blockchains. In doing so, we highlight some of the features of blockchain networks to illustrate the kinds of questions that the approach would ask. Consistent with the framework's overall approach, we suggest taking the following steps in analyzing blockchain networks as commons contexts:

1) Producing a detailed story of the origins of a blockchain network and its general features, including an account of the resource characteristics of the blockchain, the dilemmas that it may have been designed to solve, and the dilemmas that it may have created, and the community or collective engaged in producing, managing, and participating in its operation;
2) Producing a description of protocol choice, namely the rules governing the blockchain network;
3) Analyzing the extent to which the blockchain is nested in higher-level institutions;
4) Describing relevant legal and regulatory regimes governing the blockchain network;
5) Accounting for the structure of interactions between users of a given blockchain network and non-users, as well as between blockchains and other communities or market actors; and
6) Analyzing processes and procedures for addressing disputes on the blockchain network.

4. OSTROM AMONGST THE MACHINES

The Story

Here, we consider how to proceed for each step by considering blockchain in general, with emphasis on the kinds of institutional comparisons that are significant. The story naturally begins by explaining how blockchain began, both generally and as to a specific blockchain. One need not search for the source of the Nile. The point of investigating the story is to understand the problems, or social dilemmas, to which blockchain, with its knowledge and information sharing features, was imagined to be an institutional solution, and to decode the roles and motivations of different actors in constructing the blockchain as they did. Depending on the character of the knowledge or information resource, such as a cryptocurrency or an NFT market, relevant dilemmas would involve questions of congestion, conflict, deception and fraud, efforts to create boundaries, inequities in who can participate, and efforts to distinguish one blockchain network from another. Inequities may be reflected in the intensive demands for understanding mining activities for Bitcoin, for example. Blockchains do not have boundaries in the usual sense of institutions and property rights, and there is much freedom for transactors to move from one blockchain to another (Alston 2020), giving blockchain networks a fluid character. Still, the non-depletability of information resources does not automatically correspond to non-excludability. Blockchains can be distinguished from one another, and some are clearly excludable. Public (or permissioned) blockchains can alter trust relationships between transacting parties by restricting who may execute transactions on the chain.

For analysis of public blockchains, the story may also begin by consideration of the white papers that showed the world how to deploy blockchain technologies. Bitcoin emerged with Nakamoto's (2008) white paper on Bitcoin. Subsequently, white papers were released that described smart contracts (Buterin 2014). Together, these enable innovation in the blockchain realm, including an architecture for DAOs, which create opportunities for self-contained blockchain networks that could include their own cryptocurrency and their own rules for a communities of users. The origin story of a blockchain network may reveal much in the way of its nested or layered character.

Description of a blockchain network may also include a review of the broad typology of blockchains (public or private) and how they relate to but are distinguished from other, similar systems. For analy-

sis of public blockchains, a starting point for analysis is the tremendous diversity of public blockchains. Public cryptocurrency blockchains are an important type, and within that category, there are many cryptocurrencies—thousands, in fact. Still, an important part of the story of these blockchains is their uniqueness compared to previous ledgers, particularly in that they are append-only distributed ledgers. Like other peer-to-peer systems, blockchains allow users to transact digitized, valuable, and tokenized assets. Unlike those systems, blockchains provide greater transparency and security because of their append-only features; public blockchains (including cryptocurrencies), are not reliant on centralized entities to record information.

Rozas et al (2021) summarize the core features of public blockchains as follows: transparency (no one can control information, and the blockchain produces a consensus among users in the network; all histories of transactions are public; the masses have access to the information); decentralization (all nodes in the system have a copy of the ledger, and the consensus algorithm allows for updating); user empowerment (anyone with internet connections have complete authority or read or re-write the blockchain); and immutability (no one can tamper with the system, as double spending will be rejected by other nodes). Those general features offer an excellent preliminary account of how blockchains respond to different social dilemmas associated with knowledge and information, how blockchains situate their solutions in communities and collectives, and how and particular blockchains depart from the core model.

Protocol Choice

The second step involves analysis of the rules internal to a blockchain network. What is clear is that there is no one-size-fits-all ruleset for blockchain governance. Each blockchain may represent a somewhat different institutional context and may (but need not) represent an evolution (or specialization) of previously existing blockchains. New blockchains may even begin with the same code base (computer software) of a prior blockchain and modify it to implement it in a new institutional context. The story, or the analysis of the rules, would map the processes in detail. The rich literature on blockchain constitutions, as exemplified by Cowen (2019), Rajagopalan (2019), and Alston (2020), is especially apt and offers insight into better understanding of the design of these institutions. Such analysis, when married to the institutional detail identified in recent work seeking to establish a grammar of blockchain institutions (Allen, Berg, et al. 2021), provides a useful framework for empirical research into these rules.

Analysis should account for the open-ended aspects of creation of blockchain networks. The process of creating a new blockchain is normally the effort of a small team of people within that blockchain environment who then seek to have their innovation adopted by, and subsequently governed by, the full community. In most cases, the "community" consists of transaction validators (miners), software developers, and (typically) transactors with large stakes (coins) on the chain. The different labels clearly indicate their different default institutional roles within the blockchain network, though even within each group, there are many members of these teams, and subsidiary roles and responsibilities may vary. As Howell and Potgeiter (2021) explain, questions of membership and governance include membership status of different groups, including end users, transaction members, node members, software members, and donor members. They emphasize rules and relationship formalization, such as permissionless versus public blockchains. Such considerations are a significant aspect of the story of blockchains.

The analysis of rules internal to a blockchain may begin with the broad features, such as access (public or private). Public blockchains allow any user (usually anonymously or using pseudonyms) to access the network. On the other hand, in a private or permissioned platform, such as Hyperledger Fabric or Corda, only a limited number of users (usually with known identities) can access the network. This allows for identifiable users, where older users exercise access control to the new entrants.

Analysis of the blockchain's protocol would also involve consideration of the consensus mechanisms. Unlike traditional governments and most markets, blockchains do not rely on trusted, centralized entities to validate transactions. Validating consistently and securely in a distributed environment, as with indi-

vidual actors located all over the world, constitutes a social dilemma, in that individual actors may be motivated to free ride on the efforts of others, by not participating, or to corrupt the system as a whole, by defecting.

Blockchain networks solve the consensus dilemma via a decentralized, algorithmic system that ensures that distributed nodes agree on the validity of the transactions in each block, and on the order in which blocks are appended to the chain, thus sharing that information throughout the network. Consensus algorithms are sets of rules that ensure that a consistent copy of the ledger is persistent across the entire blockchain network. The details of the implemented consensus mechanism in a blockchain platform depends on the type of blockchain (e.g., private vs. public), the network configuration (e.g., known user identities), and the type of digital asset being exchanged (e.g., cryptocurrencies, NFTs). Due to the popularity of cryptocurrencies and the considerable amount of applications being developed on top of blockchain-based platforms, a substantial number of consensus algorithms is being developed (Cong and He 2019).

Proof of Work (PoW) is the most widely known consensus algorithm in blockchain due to its use in Bitcoin. The goal of the algorithm is to validate transactions so they can be batched into blocks to be appended at the end of the blockchain. In order to append a new block, each node (known as a "miner" in Bitcoin) competes with other nodes to show that it has performed (i.e., mined) some amount of computational work such as solving a complex mathematical puzzle. Miners are typically compensated for their contributions in the form of tokens created when the new block is added. Miners may consist of or be operated by entrepreneurial firms, and rent-seeking by those firms—demanding additional tokens in return for commitments of greater computing resources -- has been identified a consideration that complicates governance of the blockchain by a consensus algorithm (Berg 2021).

One of the limitations of PoW is that it is resource intensive and therefore environmentally wasteful, as miners have incentives to form pools to harness computing power. As a resource-efficient alternative to PoW, Proof of Stake (PoS) operates on the assumption that nodes with higher stakes in the network are less likely to harm (i.e., attack) the system. In PoS, users with higher stakes (e.g., ownership of digital assets), rather than miners with greater computing resources, have bigger chances to become validators. Many alternative variations of PoS have been proposed in different blockchain-based systems. These include Delegated Proof of Stake (DPoS), Proof of Weight (PoWeight), and Leased Proof of Stake (LPoS). Further, many consensus algorithms have tried to combine the best of two worlds. New mechanisms are being developed as a hybrid version of PoW and PoS (e.g., Proof of Importance, Proof of Capacity, etc.). All of these systems share the core characteristics of PoW and PoS, with some variations, including representative democracy, different definitions of stake, and single leader selection.

Beyond differences arising from consensus, one could compare blockchain networks across several of the properties identified with blockchains, including immutability, transparency, persistency, resilience, and openness (De Filippi and Wright 2018). Another feature is decentralization. Though public blockchains are considered more decentralized than private blockchains, the extent to which public blockchains are decentralized is variable, and they have centralized aspects. Protocol choices influence the extent to which a network attains success on these dimensions, though as we discuss in considering insiders and outsiders, competitive features of the landscape of blockchains, and the ability to choose among public blockchains, or to establish new private blockchains, creates incentives to compete on each of the dimensions above. For example, a blockchain's rules can be modified to provide for greater immutability. Indeed, The DAO hack resulted in a split into two blockchains, Ethereum and Ethereum Classic. Ethereum Classic promised greater immutability, as its members believed that the money stolen by the hacker should not be returned to remain aligned with the core belief in immutability.

Nested-ness

The third step of analysis involves a description of the institutional contexts or "action arenas" in which a given blockchain network is situated, including its polycentric environment, or, if the analysis is con-

sidering a collection of blockchains, the nested-ness of the collection of blockchain networks. Polycentric systems situate governance responsibility relative to a resource (decision making, conflict resolution) in overlapping and distributed centers and actors, rather than in a single point of authority. Blockchains are polycentric in that sense: within any network, blockchains are governed by rules that provide the basis for interaction in political, socio-economic systems, while establishing the social positions that different individuals may occupy according to their rights, obligations and empowerments to act in specific situations (Markey-Towler 2018).

Alston et al (2021) take this as step further in arguing that polycentricity is the defining features of *any* blockchain network. Blockchains are nested in higher-level organizations and involve multiple interfaces with human elements. Those interfaces occur through oracles, third party services that provide interfaces between the blockchain environment and the outside world, collecting and distributing information about payments within a smart contract, for example, and authenticating data about the human world that is fed to that smart contract for processing. Because they acquire, consolidate, and process information, oracles are themselves centers of decision making responsibility and potential conflict and are therefore parts of blockchain's polycentricity. To the extent that governments regulate blockchains and via information law systems define property and related rights that co-exist with blockchains, governments, too, are part of blockchain's polycentricity.

Legal and Regulatory Regime

The fourth step in applying the GKC framework is considering the specific legal and regulatory regimes relevant to blockchains. Focusing on the role of law in knowledge commons governance is consistent with Ostromian attention to self-governed communities; Elinor Ostrom paid special attention to formal rules in describing the performance of complex social systems (Cole 2017). Law plays a distinctive and unusually important role in knowledge commons governance because the relevant resources themselves typically have no material (or in Ostrom's phrase, biophysical) existence. Their existence as social objects is due in large part to how they are constructed, defined, and regulated by legal rules.

Thus, every blockchain network and every resource in a blockchain network exists in some respect in the shadow of the law. Some depend on the law for their identity. For example, the knowledge resources that constitute the blockchain network are defined and regulated by law. Blockchains are built on open source computer code, which means that they exist on a foundation of copyright law (as computer programs are governed by copyright) and open licenses (private property and contractual devices intended to preserve the code against cooptation by private firms). In another example, a "smart contract" on a blockchain network is a contract in conceptual terms in the sense that, and only to the extent, that the computer code instantiates an exchange that in conceptual terms would be legally enforceable if it existed only in the non-blockchain world. The utility of putting the smart contract "on" the blockchain is that various gaps and limitations of real world contract law are avoided, such as jurisdictional differences, cost of enforcement, and legal rules applied to contract interpretation.

Thinking about legal considerations also directs attention to the broad framework or constitutional rules governing blockchain. There is not a unified system of law governing blockchain to rival the Uniform Commercial Code, which provides a standard legal baseline for regulating commercial practices in the United States. Rather, patterns of legal acceptance and regulation of blockchains have developed on a sector by sector basis. Blockchains do not rely on statutes, as they emerged without any statutes. But statutes can make them illegal. Though some states have made blockchains illegal, many more have enacted statutes that give legal status to blockchain contracts, building on the conceptual observation above (Lemieux 2019). Generalized criminal and common law are also available. For violations, the enforcement would presumably come from a third-party enforcer, including the state. Here, the rich body of research on how computer code does well and does poorly when it encodes legal principles, per the evolving lex informatica

(Reidenberg 1997) and cryptographia (such as Werbach and Cornell 2017), can inform analysis of blockchains, including how legal rules are evolving in response to new challenges.

Interactions between Insiders and Outsiders in the Blockchain

One of the features of blockchains is that they are relatively immune from outside interference. The "cypherpunk" community developed Bitcoin in part because of this feature and a desire to exist outside of the state. It remains challenging for outsiders to come in and destabilize governance, as the size of the distributed environment makes blockchain relatively challenging to control. Self-governance is a critical feature of a blockchain network and something that is difficult for outsiders to eliminate. If one is not a blockchain insider, one interacts with the blockchain via an oracle, that is, according to the blockchain's protocols.

The chief alternative framing of insider/outsider interactions is based on competition. Blockchain networks compete with each other with respect to their features and qualities, such as processing speed and environmental impacts, in attracting and retaining developers and users. Alston et al (2022) highlight that these competitive features are essential aspects of blockchain governance. They extend research by Berg and Berg (2020), which considers competition among blockchain networks as the ground for discussions of exit and voice in blockchain governance. Quality and feature competition explains not only the emergence of new blockchains but also pressure for existing blockchains to adapt and change.

Dispute Resolution and Discipline in the Blockchain

The final empirical step is analysis of disputes and institutions that address disputes. Forking, which in its basic form involves an existing blockchain network splitting, with the source blockchain carrying on in its prior form and a new, modified fork of that same blockchain taking independent form, is the paradigmatic outcome of a dispute in blockchain. A change to a blockchain can be initiated by anyone who proposes an upgrade in the protocol. It only fully succeeds if the whole network accepts the new upgrade.

Forking adds additional layers of technical and analytic complexity to knowledge commons analysis of a blockchain due to the decentralized nature of the system and the non-depletable character of the information resources in that system. With every fork, there is always a risk of a chain split into two halves. Hence, an owner of a cryptocoin, for instance, would receive two new coins. Both currencies then start functioning as separate entities. As Arruñada and Garicano (2018) explain, the process of change differs in distributed entities compared to more centralized ones. In blockchain, the platform architect may play a limited role: the nature of the system is that all nodes can unilaterally determine which protocol they run, and whether they update it or not is their decision. Consequently, the challenge for blockchain-based systems lies in developing effective mechanisms producing soft forms of governance that accommodate decentralized decision-making (via potential splits) and by providing a mechanism to adapt to new circumstances.

Dispute resolution in blockchain networks thus highlights a key feature of knowledge commons governance. In a knowledge commons environment, governance consists largely of decisions about the identity and character of the community—are we members of this group, or of that group?—as well as decisions about the identity and character of the resource and how it is shared. With only a bit of rhetorical stretching, blockchain can be thought of as a crypto-democracy, with all of the strengths, limitations, power, and fragility that such a metaphor implies. The GKC framework is well-suited to extended that metaphor via specific empirical research into particular blockchain networks.

CONCLUSIONS

The tools offered by scholars such as Hayek, Ostrom and Buchanan—Boettke (2021) calls this tradition the mainline of economics—provides powerful tools to study blockchains. Certain features of the evolution of

blockchain as an institutional technology can be understood as a spontaneous order. Others reflect taxis. A careful application of Hayek's insights avoids the mistake of seeing blockchains as inherently decentralized when in reality, many are made orders, or taxis.

A Hayekian perspective is also incomplete. An Ostromian perspective is useful to understand blockchain governance and, ultimately, how blockchains can be successful in providing us with opportunities, including cryptocurrencies and smart contracts. The Ostromian perspective is expressed here via the Governing Knowledge Commons research framework, an approach to empirical research that is built in the style of Ostrom but with careful and distinct attention to the different concerns of institutions built around knowledge and information resources. Polycentricity is woven into the fabric of GKC analysis. Together, these tools provide an especially useful approach to understand blockchains and analyze similarities and differences across blockchain networks.

The prospective aspect of our paper is to invite empirical research on the diversity of rules governing blockchains, and in the process, adding more to our understanding of the taxis side of blockchains. Such research is underway, as far as conceptual frameworks go. Darcy Allen and colleagues (2021) initiated conversations along these lines with their "Ostrom-Complete Grammar" of blockchains. That work is based on the insights that blockchains represent a tremendous diversity of governance institutions and that Ostrom's work offers a useful framework for capturing it. We see the GKC framework as providing perhaps a richer context beyond the institutional grammar of blockchains, as it retains the context-specificity of Ostrom's work (such as attention to relevant action arenas) without being bound to Ostrom's assumptions about resource attributes or the expected benefits of commons governance.

We see no need to choose among institutionalisms. As such analysis proceeds, Hayek's admonition that the more complex the order we wish to preserve, the greater the importance of rules, remains a significant background consideration as legislators across the world now begin to regulate blockchains. To the extent such regulation is seen as beneficial, it can and should be informed by Ostromian case studies of blockchains. Since the Ostroms' approach is complementary to Austrian institutionalism and the public choice tradition (Harris et al. 2020), we see such cross-fertilization of institutional perspectives on blockchains as useful starting point for further analysis of blockchains and their governance.

NOTES

1 In January 2021, political unrest in Kazakhstan, one of the hotbeds of cryptocurrency mining, led to a substantial drop in Bitcoin's price after the government interfered with Internet access (thus slowing ability of miners to solve cryptographic puzzles). These events illustrate that Bitcoin may be seen as a solution to political instability, but also that its success appears to depend in part on government stability.

REFERENCES

Allen, D. W. E., Berg, C., Davidson, S., MacDonald, T., & Potts, J. (2021, June 16). Building a grammar of blockchain governance. *Cryptoeconomics Australia*. https://medium.com/cryptoeconomics-australia/building-a-grammar-of-blockchain-governance-c2cb4b70f915. Accessed 10 August 2021

Allen, D. W. E., Berg, C., & Lane, A. M. (2019). *Cryptodemocracy: How Blockchain Can Radically Expand Democratic Choice*. Rowman & Littlefield.

Allen, D. W. E., Berg, C., Lane, A. M., & Potts, J. (2018). Cryptodemocracy and its institutional possibilities. *The Review of Austrian Economics*, *33*(3), 363–374.

Allen, D. W. E., Davidson, S., & Potts, J. (2021). Property rights, knowledge commons and blockchain governance. In E. Dekker & P. Kuchar (Eds.), *Governing Markets as Knowledge Commons* (pp. 159–175).

Allen, D. W. E., Lane, A. M., & Poblet, M. (2019). The Governance of Blockchain Dispute Resolution. *Harvard Negotiation Law Review*, *24*, 75–101.

Allen, D. W. E., & Potts, J. (2016). How innovation commons contribute to discovering and developing new technologies. *International Journal of the Commons*, *10*(2), 1035–1054.

Alston, E. (Forthcoming). Blockchain and the Law: Legality, Law-like Characteristics, and Legal Applications. In J. Caton (Ed.), *Handbook on Blockchain and Cryptocurrencies*. Edward Elgar.
_____. (2020). Constitutions and Blockchains: Competitive Governance of Fundamental Rule Sets. *Case Western Journal of Law, Technology and the Internet*, *11*(5), 133–171.
Alston, E., Alston, L. J., Mueller, B., & Nonnenmacher, T. (2018). *Institutional and organizational analysis: concepts and applications*. Cambridge University Press.
Alston, E., Law, W., Murtazashvili, I., & Weiss, M. (2022). Blockchain networks as constitutional and competitive polycentric orders. *Journal of Institutional Economics*. https://doi.org/doi:10.1017/S174413742100093X
Alston, E., Law, W., Murtazashvili, I., & Weiss, M. B. (2021). Can Permissionless Blockchains Avoid Governance and the Law? *Notre Dame Journal of Emerging Technologies*, *2*(1), 1–32.
Andersson, D. E. (2005). The spatial nature of entrepreneurship. *The Quarterly Journal of Austrian Economics*, *8*(2), 21–34.
Arruñada, B., & Garicano, L. (2018). Blockchain: The birth of decentralized governance. *Pompeu Fabra University, Economics and Business Working Paper Series*, *1608*.
Benkler, Y. (2013). Commons and growth: The essential role of open commons in market economies. *University of Chicago Law Review*, *80*(3), 1499–1555.
Berg, A., & Berg, C. (2020). Exit, voice, and forking. *Cosmos + Taxis*, *8*(8–9), 76–89.
Berg, C. (2021). Rents Seeking in Blockchain Governance: The Awkward Transition from Market Decision Making to Non-Market Decision Making. *Available at SSRN*.
Berg, C., Davidson, S., & Potts, J. (2019). *Understanding the blockchain economy: An introduction to institutional cryptoeconomics*. Edward Elgar Publishing.
Boettke, P. J. (2021). *The Struggle for a Better World*. Fairfax: Mercatus Center.
Boettke, P. J., & Coyne, C. J. (2005). Methodological individualism, spontaneous order and the research program of the Workshop in Political Theory and Policy Analysis. *Journal of Economic Behavior & Organization*, *57*(2), 145–158.
Buterin, V. (2014). *A next-generation smart contract and decentralized application platform*. White paper.
Cole, D. H. (2017). Laws, norms, and the Institutional Analysis and Development framework. *Journal of Institutional Economics*, *13*(4), 829–847.
Cong, L. W., & He, Z. (2019). Blockchain disruption and smart contracts. *The Review of Financial Studies*, *32*(5), 1754–1797.
Cowan, R., & Rizzo, M. J. (1996). The genetic-causal tradition and modern economic theory. *Kyklos*, *49*(3), 273–317.
Cowen, N. (2019). Markets for rules: the promise and peril of blockchain distributed governance. *Journal of Entrepreneurship and Public Policy*, *9*(2), 213–226.
Davidson, S., De Filippi, P., & Potts, J. (2018). Blockchains and the economic institutions of capitalism. *Journal of Institutional Economics*, *14*(4), 639–658.
De Filippi, P., & Wright, A. (2018). *Blockchain and the law: The rule of code*. Harvard University Press.
Dekker, E., & Kuchar, P. (Eds.). (2021). *Governing Markets as Knowledge Commons,*. Cambridge University Press.
Frischmann, B. M. (2013). Two enduring lessons from Elinor Ostrom. *Journal of institutional economics*, *9*(4), 387–406.
Frischmann, B. M., Madison, M. J., & Strandburg, K. J. (2014). Introduction. In B. M. Frischmann, M. J. Madison, & K. J. Strandburg (Eds.), *Governing knowledge commons* (pp. 1–44). New York: Oxford University Press.
Frolov, D. (2021). Blockchain and institutional complexity: an extended institutional approach. *Journal of Institutional Economics*, *17*(1), 21–36.
Hadfield, G. K. (2016). *Rules for a flat world: why humans invented law and how to reinvent it for a complex global economy*. New York: Oxford University Press.
Harris, C., Cai, M., Murtazashvili, I., & Murtazashvili, J. B. (2020). *The Origins and Consequences of Property Rights: Austrian, Public Choice, and Institutional Economics Perspectives*. New York: Cambridge University Press.
Hayek, F. A. (1945). The use of knowledge in society. *American Economic Review*, *35*(4), 519–530.
_____. (1956). *The Road to Serfdom*. Chicago: The University of Chicago Press.
_____. (1973). *Law, legislation and liberty: a new statement of the liberal principles of justice and political economy*. Chicago: University Of Chicago Press.
_____. (1988). *The fatal conceit: The errors of socialism*. Chicago: University Of Chicago Press.
Hendrickson, J. R., & Luther, W. J. (2017). Banning bitcoin. *Journal of Economic Behavior & Organization*, *141*, 188–195.
Hess, C. (2008). Mapping the new commons. *Available at SSRN 1356835*.
Hess, C., & Ostrom, E. (2007). *Understanding knowledge as a commons*. Cambridge: MIT Press.
Howell, B. E., & Potgieter, P. H. (2021). Uncertainty and dispute resolution for blockchain and smart contract institutions. *Journal of Institutional Economics*, *17*(4), 545–559.
Kirzner, I. M. (1997). Entrepreneurial discovery and the competitive market process: An Austrian approach. *Journal of economic Literature*, *35*(1), 60–85.
Lemieux, V. L. (2019). Blockchain and Public Record Keeping: Of Temples, Prisons, and the (Re)Configuration of Power. *Frontiers in Blockchain*, *2*. https://doi.org/10.3389/fbloc.2019.00005
Luther, W. J. (2019). Getting off the ground: the case of bitcoin. *Journal of Institutional Economics*, *15*(2), 189–205.
Madison, M. J., Frischmann, B. M., & Strandburg, K. J. (2009). The university as constructed cultural commons. *Washington University Journal of Law & Policy*, *30*, 365–403.

Madison, M. J., Frischmann, B. M., & Strandburg, K. J. (2010). Constructing commons in the cultural environment. *Cornell Law Review*, *95*, 657–710.
Markey-Towler, B. (2018). Anarchy, blockchain and utopia: a theory of political-socioeconomic systems organised using blockchain. *Available at SSRN 3095343*.
Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system*. White paper.
Ostrom, E. (2005). *Understanding institutional diversity*. Princeton: Princeton University Press.
Palagashvili, L., Piano, E., & Skarbek, D. (2017). *The Decline and Rise of Institutions A Modern Survey of the Austrian Contribution to the Economic Analysis of Institutions*. New York: Cambridge University Press.
Pennington, M. (2011). *Robust political economy: Classic liberalism and the future of public policy*. Cheltenham: Edward Elgar Publishing.
Poblet, M., Allen, D. W. E., Konashevych, O., Lane, A. M., & Diaz Valdivia, C. A. (2020). From Athens to the Blockchain: Oracles for Digital Democracy. *Frontiers in Blockchain*, *3*(575662). https://doi.org/doi: 10.3389/fbloc.2020.575662
Potts, J. (2018). Governing the innovation commons. *Journal of Institutional Economics*, *14*(6), 1025–1047.
Rajagopalan, S. (2019). Blockchain and Buchanan: Code as Constitution. In R. E. Wagner (Ed.), *James M. Buchanan: A Theorist of Political Economy and Social Philosophy* (pp. 359–381). Palgrave Macmillan.
Reidenberg, J. R. (1997). Lex informatica: The formulation of information policy rules through technology. *Tex. L. Rev.*, *76*(3), 553–593.
Rozas, D., Tenorio-Fornés, A., Díaz-Molina, S., & Hassan, S. (2021). When Ostrom Meets Blockchain: Exploring the Potentials of Blockchain for Commons Governance. *SAGE Open*, *11*(1), 21582440211002530.
Rozas, D., Tenorio-Fornés, A., & Hassan, S. (2021). Analysis of the Potentials of Blockchain for the Governance of Global Digital Commons. *Frontiers in Blockchain*, *4*(577680). https://doi.org/10.3389/fbloc.2021.577680
Spithoven, A. (2019). Theory and reality of cryptocurrency governance. *Journal of Economic Issues*, *53*(2), 385–393.
Stringham, E. P., & Zywicki, T. J. (2011). Hayekian anarchism. *Journal of Economic Behavior & Organization*, *78*(3), 290–301.
Vee, A. (2021). NFTs, Digital Scarcity, and the Computational Aura. *Interfaces: Essays and Reviews in Computing and Culture*, *2*, 38–54.
Werbach, K. (2018). *The blockchain and the new architecture of trust*. MIT Press.
Werbach, K., & Cornell, N. (2017). Contracts ex machina. *Duke Law Journal*, *67*, 313–382.

Efficiency and Inefficiency Arguments in Evolutionary Neurobiology: *The Sensory Order,* Social Conformity, and Adaptation

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Abstract: A vast body of literature on evolutionary neurobiology typically argues that the brain evolves through adaptations which improve the organization of information-processing capacity, thus freeing available capacity for alternative uses. This strand of research often emphasizes social conformity and the benefits of an expectation of uniform behavior within the community group, e.g., enhanced group cohesion, facilitation of minimally counterintuitive narratives, and minimizing cognitive burdens. Contrasting arguments have also arisen in the same literature based on the greater information-processing burden, either imposed by interaction in larger social groups, or created by inefficiencies which arise as byproducts of path-dependent development. The cognitive burden imposed by simultaneous navigation of social and natural environments, sometimes with conflicting incentives, imposed short-run disadvantages but better enabled us to survive in the long run by supporting evolution of a more sophisticated and powerful brain. Distinguishing between short-run and long-run costs and benefits suggests a possible resolution of this apparent conflict. High social conformity saves energy, time, and uncertainty in the short run, facilitating more immediate responses and social consensus, and allowing efficient utilization of currently available information-processing capacity. When conflicts between behavior and reality have to be resolved in the longer run, the information processing burden imposed by abstract reasoning, and perhaps more importantly by discussion, argument, and debate within the social group, may well contribute to enlargement of the neocortex.

Keywords: sensory order, neocortex weight, minimally-counterintuitive narrative, self-organizing systems, spandrel.

1. INTRODUCTION

This paper examines the manner in which the emergence of cultural traditions and social norms among our distant ancestors contributed to enhancing their sociability and improved their reproductive and survival opportunities. In Hayek's (1952) construction of the sensory order, the mind constructs, evaluates, and maintains networks of interconnections which evolve over the individual's lifetime. Social interaction relies on common areas of belief and overlapping congruencies among potentially varying subjective beliefs held by individuals. Individuals measure their own belief systems against those of others, as well as against external reality.

Behavioral regularities arise to exploit the available structure of cortical connectivity, which evolves further in accordance with the extent we take advantage of the available level of organization and complexity. Subtle and apparently random local variations in brain structure occur naturally, facilitating particular behavioral rules and institutional arrangements. If a behavior turns out to be advantageous, then the structural adaptations it exploits are passed on throughout the species. For rules and other behavioral regularities to survive, they must first be experimentally adopted by entrepreneurial carriers, and then must enhance their survival and reproductive opportunities.

Hayek suggests the human mind evolved to construct tentative models of external reality. Continual revision of these provisional models constitutes the sensory order and provides a sophisticated, flexible, and yet effectively simple set of classifications for the otherwise unintelligible mass of experience and memory. In Hayek's view, the mind works by organizing sensory impressions into manageable summaries. It does this through categorizing new impressions according to classifications already in place, but also subject to partial reorganization to accommodate new experience. Thus, the sensory order is a naturally occurring, naturally evolved, spontaneous order, which emerged through natural selection to enhance the survival and reproductive opportunities of the organism.

Hayek's insight was that learning implies something beyond the passive recording of information received from the external reality. The brain organizes sensory impulses according to evolving abstract categories learned through experience, and continually reorganizes them. We are thus free to make mistakes, and our recollections can also be mistaken, however since we cannot avoid the consequences of errors, there is always an incentive to correct them. This contrasts sharply with behavioral psychology's atomistic-positivistic conception of the mind, which views memory as a passive tape recorder that unselectively perceives everything, though our access to these memories is flawed and limited, and even more sharply with the radical empirical behaviorism of B. F. Skinner (1953, 1968; Ferster & Skinner 1957), which subordinates the role of the organism to that of the environment (Skinner 1957).

Hayek (1952, pp. 70-73 [3.54-3.62]) describes the emergence of higher-order classificatory schemata or mappings as being limited by the possible permutations of the primary impulses, but efficiency imposes the much lower threshold of physical feasibility, where classification strategies emerge to address the individual's most immediate needs. Conformity, such as that imposed by social norming, lessens the need for higher-order schemata. Experience potentially forces continual revision of the complex of classificatory linkages. These complexes of hypothesized causal linkages constitute the sensory order, a working model of reality which supports our perception, conceptualization, and logical reasoning (Hayek 1952, p. 143).

The remainder of this paper is organized as follows: Section 2. "The Sensory Order," reviews Hayek's theory of the psychology of perception; Section 3. "Efficiency and Inefficiency Arguments in Sociobiological Adaptation," introduces the debate over whether efficiency necessarily confers evolutionary advantages; Section 4. "Efficiency Arguments," discusses why adaptations improving information processing efficiency are generally seen as conferring evolutionary advantage; Section 5. "Inefficiency Arguments," presents the more subtle dissenting view, that less efficient information processing may also be adaptive; Section 6. "Time Horizon and Efficiency Arguments," develops the view that both adaptations may work in parallel over different time scales; and finally, Section 7. "Conclusion," presents concluding comments.

2. THE SENSORY ORDER

> *Perhaps it is too bold a venture for the human mind to speculate about its own nature and origin.*
> —Ludwig von Mises (1957, p. 97).

In 1919-1920, Hayek produced an outline for a doctoral dissertation in psychology, "Contributions to a Theory of How Consciousness Develops," taking as his subject a speculative theory of perception (D'Amico & Boettke 2010). He set his outline aside for nearly thirty years when he decided to study economics. In returning to his original ideas in the late 1940s, he updated and expanded his theory with extensive references to contemporary and intervening developments in psychology. In *The Sensory Order*, Hayek synthesized those schools of contemporary psychological thought he felt could be applied most fruitfully to explaining human behavior, especially economizing behavior. Nevertheless, Hayek recognized the spontaneous character of markets and the price mechanism, not to mention market organization. The economic significance of the theory of knowledge can be appreciated by contrasting papers strewn at random around a room, a state of noise or chaos, and the same papers organized neatly in filing cabinets (or on computers) and retrievable through a particular, though non-unique, system of organization. Butos (2003) and McQuade and Butos (2005) see the sensory order as an archetypal model of such knowledge-generating orders, including the entrepreneurial activity of generating the market-based knowledge of prices. One key ingredient of knowledge-generating orders including the sensory order, is a necessary reduction in entropy or disorder.

Hayek appreciated the ambition of his research program, and perhaps influenced by the notable lack of critical approval during his lifetime, remained both modest about the extent of his accomplishment and cautious about extending his work on the sensory order. Hayek's subsequent work on spontaneous evolution of the liberal order (Hayek 1960, 1973, 1976, 1979) displays a notable thematic consistency with this seminal early work, in that both address spontaneous order. *The Sensory Order* presents an even more ambitious and original application of spontaneous order doctrine to the field of psychology. In some way this new application was intermediate between traditional applications of spontaneous order to legal, political, and economic theory (by, e.g., such figures of the Scottish enlightenment as David Hume, Adam Ferguson, and Adam Smith, and related thinkers Sir Matthew Hale and Bernard de Mandeville (Ratnapala 2001)), on the one hand, and to biological evolution on the other.

Hayek (1952, p. 77 [3.74]) followed the gestalt school of psychology in rejecting the atomistic conception of sensory qualities. According to gestalt psychology, the importance of sensory data lays less in those purely physical aspects which lend themselves to atomistic thinking, than to the way the organism uses, integrates, and acts on sensory data (Ehrenfels 1890; Wertheimer 1912). The gestalt school called this integrative facility "organization of the field" (Braly 1933; Leeper 1935; Duncker 1939). Hayek reinterpreted this rather vague concept in terms of subjective "causal connections between physiological impulses" (Hayek 1952, p. 77 [3.74]). The impulses might be atomistic in some sense, but our subjective and opportunistic organization of the impulses as a whole, interpreting them in terms of causal connections cannot be. More importantly, this organization must also be tentative—the sensory order is always subject to revision as we experience and integrate new data.

By the early twentieth century, the traditional introspective approach to psychology typified by William James (1890) and Wilhelm Wundt (1910) was being criticized as subjective and non-rigorous by such founders of behaviorism as John B. Watson (1913, 1919). Some behaviorists viewed the stimulus-response as an automatic causal relation (Watson & Rayner 1920; Pavlov 1927), while others emphasized its volitional character (Skinner 1938). Behaviorism imitated the empirical approach of the physical sciences to focus almost exclusively on atomistic-deterministic aspects of psychology which lent themselves to that approach. In contrast, gestalt psychology recognized that insight and intuition could enhance the efficacy and efficiency of the learning process far beyond mere trial-and-error. Tolman and Honzik (1930) were able to demonstrate that rats' ability to learn mazes was enhanced through recollection over time, and this

enhanced learning could be demonstrated long after their most recent experience with a particular maze configuration. Their study contributed to the belief that recall enhances learning because it reinforces or corrects existing knowledge. It was suggested that the rats constructed an internal conceptual model of the maze, but would not necessarily demonstrate that knowledge objectively until reinforcement was offered. Tolman (1948) later demonstrated that humans construct comparable conceptual mappings, along with Adrian's (1947, pp. 16-18) use of conceptual mappings, results Hayek (1952, pp. 107-118 [517-549]) relied on to build his theory of revisable mappings onto reality. Hayek (1952, pp. 61-64 [3.25-3.34]) starts with the observation that within the brain, neurons serving adjacent sensory receptors are necessarily organized spatially in juxtaposition with the receptors they serve, and therefore with each other. Even viewing the central nervous system as an inactive physical object, Hayek observes its connections are organized for the efficient processing and coordination of information from the receptors, enabling us to form consistent perceptions of experience, coordinating the senses of taste, touch, smell, etc. This explains why we would be confused if we were shown one kind of food, but exposed to the odor or taste which experience has taught us to associate with another. Hayek considers further that an additional level of categorization is imposed by the gross physical need to process the different sensory qualities of sight, taste, hearing, smell, touch, and distinguish among them (Hayek 1952, p. 66 [3.43]). As infants we learn first to distinguish between light and dark, then to identify shapes and colors, then distinguish objects, and finally to understand and distinguish among an unlimited variety of abstract qualities which are properties of the objects we perceive, including size, proximity, temperature, vibration, texture, etc. Depth perception rests on such abstract qualities. Sufficient experience is required before we can imagine, for example, fictional objects which may or may not exist, but at this early stage, cognitive development limits our ability to coordinate sensory inputs and conceptualize actual objects.

The vast majority of sensory impulses are set aside and largely ignored, unless subsequent events focus our attention on particular qualities, or cognitive dissonance triggers recall of something which previously failed to capture our attention (Mayer 1992). Implicitly, the most important category we create is the default one of inessential impulses which fail to merit our attention. Impulses which do receive the attention of the brain's classificatory apparatus are first implicitly classified by timing of reception, the sense engaged (e.g., sight or touch, etc.), and location (fingertip v. toe, near v. far, etc.) Because of the structural organization of the central nervous system, this initial classification is a spatial one, where impulses related through qualities, senses, proximity, etc., are organized spatially through temporary storage on neurons near those receiving the initial inputs, i.e., neurons immediately juxtaposed within the brain to those connected to the sensory receptors. However, this is only the beginning of the classification process. At each stage, the majority of information is judged useless and is discarded, serving to further focus attention on memories which are retained for further processing. Those categorizations of primary impulses are combined and aggregated to form more sophisticated and intricate classification systems, which now apply not to primary impulses, but to broader classes now identified as having some perceptible concrete, or some synthetic, imperceptible abstract characteristics in common. Since Hayek, numerous cognitive psychologists have described similar classificatory structures: e.g., frames (Minsky 1975), schemata (Rumelhart 1975, 1991), and scripts (Schank & Abelson 1975; Abelson 1981).

Bartlett (1932) found memory recall to be a reconstructive activity—we construct selective recreations of the original constellations of sensory impulses. These selectively retained internal models of primary sensory impulses and their complex combinations, both map onto objective reality, and guide our subsequent experience and expectations. Classification is always experimental, tentative, and subject to revision. Rather than dramatic paradigm shifts, a classification schema tends most often to be subsumed into more intricate schemata, rather than discarded entirely. Often, a more effective classification will evolve out of an older, more primitive one, which served the organism's needs well enough at one point, but eventually sufficient new experience emerges to support a more subtle and effective appreciation of reality (Hayek 1952, p. 145 [6.45]). Rizzello (2004) concludes that the sensory order so conditions the learning of new information, that path dependency dominates cognition, decision-making, and institutional change. Clearly, Hayek em-

phasizes the extent to which the sensory order is developed through building on previously-established associations, but it is also clear that the sensory order can be superseded when sufficient disconfirming sensory evidence or logical dissonance is encountered. Institutional change may be more narrowly bounded by path dependency than an individual's sensory order, due to the complexity imposed by interaction among many cooperative individuals, compared with the organization of one individual's perceptual impulses or even their higher and more abstract classificatory schemata. Some degree of revision and reorganization of the sensory order can occur even in the absence of new experience, through sudden insight, but this always seems to depend on relating past experiences in a new way.

Damasio (1995, 1999, 2003) emphasizes that the central nervous system evolved to be aware of the human body, the external reality, and their interrelationships. Thus, we can imagine responses to an external stimulus before it is applied. In extreme cases, merely thinking about stimuli which can trigger anxiety, can trigger an anxiety response even in the absence of the actual stimuli. For example, imagining a rapid pulse can elevate one's pulse and blood pressure, as can recalling or imagining an embarrassing or dangerous experience. Hayek notes that expectations require some vision or model of causal relationships, that is, a mapping of temporally-ordered impulses onto external reality. The act of revising a course of action to better realize disappointed expectations clearly calls for an ability to model reality and to revise those models in response to new data (Hayek 1952, p. 95 [4.54]). Revising expectations in light of current perceptions constitutes a feedback loop. Educated by experience, the mind forms linkages among both simple sensory data, and complex aggregates of sensory information summarized in concepts used to categorize sensory impulses (Hayek 1952, p. 143 [6.37-6.38]).

Cognitive psychology emerged subsequently (Broadbent 1958; Neisser 1967) in further reaction to the atomistic-reductionist approaches of the dominant behaviorist school of psychology, against which the gestalt school which originally inspired Hayek had been the only major alternative. Along with Hayek, cognitive psychology recognizes that prior belief and understanding are critical for determining behavior in general, as well as determining our approaches to learning in a particular context, and even for how we frame problems for possible solution (Eysenck & Keane 1990; Schallert 1991; Mayer 1992). We adopt patterns of behavior, problem-solving algorithms, and heuristics. Given our level of cognitive development, these are constructed to address the problems we define, which also help determine our approach to defining problems (Piaget 1951, 1953). Cognitive psychologists identify schemata, "hypothesized mental frameworks that give organization to incoming information" (Bruning 1994, p. 8), as the context we use to interpret subsequent experience. As Hayek suggests, the classificatory schema organizing sensory data accommodates the simplest, unassociated, concrete impulses as well as the most abstract, higher-order generalizations. Rumelhart (1991) proposes several features of these classificatory schemata:

1) they accommodate a range of information from simple to highly complex;
2) they organize information into one or more non-exclusive hierarchical structures;
3) they drive our interpretations of experience, and influence how we integrate current experience with memories of past experience; and
4) they contain slots or place-holders for the reception of fixed or variable values, which may be qualitative or quantitative, and which may be empty at any point in time.

Each of these features can be found in various forms throughout *The Sensory Order*.

While construction of the sensory order is a problem-driven scientific inquiry which normally proceeds subconsciously, it can also be applied consciously and intentionally (Hayek 1952, pp. 132-136 [6.2-6.13]), in which instance we are not merely passive recipients of problems, but exercising entrepreneurial awareness in defining new ones. Subjective human intentions focus individual approaches to learning and awareness (Newell & Simon 1972). In Hayek's view, the sensory order we construct in the mind is a spontaneously-evolving order which the organism adapts—for the most part unconsciously—to engage and make use of the experience the organism encounters or is led to seek. The external environment may change, eventually requiring revision of the sensory order, or accumulated experience may lead the organism to re-

vise the sensory order even in the absence of external change. We cannot manage the burden of processing each new sensory impulse as if it were unrelated to others received simultaneously or in the recent past, and we cannot make sense of existence without reference to memory of past experience. Conscious thought is inadequate for receipt of all primary sensory impulses, thus most of the apparatus of perception operates automatically most of the time (Dijksterhuis et al. 2006, p. 1006; Gifford 2007, p. 270). As the organism maintains this sensory order, the order evolves spontaneously in response to the organism's past experience, unconscious choice of classification schemata, and subsequent experience. Our memory is focused by the sensory order, as are our awareness and sensitivity to new impressions.

3. EFFICIENCY AND INEFFICIENCY ARGUMENTS IN SOCIOBIOLOGICAL ADAPTATION

> *We shouldn't be so discontented all the time.*
> —Sloan Wilson (1955), *The Man in the Gray Flannel Suit*

Anthropological study of sociobiological adaptation searches for objective benefits which enhanced our ancestors' survival and reproductive opportunities (e.g., Atran 1990, 2002). The extreme contrasting view of Dawkins (2006), Harris (2004), Dennett (2006), and others, is that notable evolved features emerged only as a byproduct of other, actually desirable adaptations, and like the appendix serve no useful purpose. Byproduct theory (Boyer 1994, 2001; Barrett 2004; Bloom 2004) views many emergent features as nonfunctional and potentially inefficient "spandrels" (Gould & Lewontin 1979). Spandrels evolved as a consequence of other, actually beneficial features. A nonfunctional spandrel could potentially be useless in its own right, but also present an efficient medium for, or at least adjunct to, the emergence of an actually beneficial adaptation.

Atran and Norenzayan (2004a, 2004b; Norenzayan & Atran 2004; Norenzayan et al. 2006) present the argument that evolutionary social adaptations were passed down because they enhanced our ancestors' survival opportunities. Their argument is two-pronged: first, emergent features shared by a community allow individuals to rapidly construct "minimally counterintuitive narratives" to explain observed phenomenon and respond as a group; and second, communal activities increase the degree of group cohesion, which in turn facilitates social cooperation (Edney 1981). In addition, though not emphasized by Atran and Norenzayan, communal activities also allow for specialization and division of labor, permitting a highly sophisticated social organization while relying on simple individual tasks.

It becomes inevitable to consider cultural manifestations as evolutionary adaptations as soon as we realize that not all are equally adaptive, that is, not all offer the same increased survival and reproductive opportunities. However, the argument made by Atran and Nourenzayan is largely independent of varying cultural norms, which differed as much across social groups in primitive times as today. In the absence of cultural norming, our ancestors would have faced the far greater burden of constructing individual and holistic explanations and responses to their environment on very short notice. One requires a sophisticated knowledge of natural science before this individual strategy could even begin to work, and in primitive times the risks in the short term were too great, e.g., of being devoured by predators, killed by other humans, or merely dying of exposure. Furthermore, in many cases community acceptance of one among several competing hypotheses might be inevitable, but often could not occur rapidly. Atran-Nourenzayan "minimally counterintuitive narratives" suggested by the community's social tradition benefited individuals directly in facilitating immediate responses in a forbidding environment, and served to coordinate the community's reaction as well, while economizing on energy, time, and resources. This allowed social groups to respond quickly, and facilitated acceptance of psychologically satisfying explanations stemming from established cultural traditions.

Iannaccone & Makowsky (2007) conducted simulations which demonstrated beneficial clustering of homogeneous religious groups allows for faster population growth because it lowers transaction costs

among individuals with similar moral standards and expectations of acceptable behavior. Interaction with different communities imposes higher transaction costs because both parties do not share a common cultural tradition, and may have drastically different ethical standards and behavioral patterns. One faces less uncertainty about the experience, behavior, and expectations of social partners from within the group, because of shared practices and norms. The information burden prevents some interactions, and makes others more costly.

However, successfully overcoming inefficiency is also adaptive. Greater diversity allows us to expand our range of activities and makes the division of labor possible. Furthermore, inefficiencies cannot be overcome if they are never permitted to arise. The underlying tension may be as simple as the observation that a level of complexity arises through a series of successful adaptations, where the complexity constitutes a non-functional spandrel, but the very existence of this newly-generated complexity or inefficiency forces the selection of a more powerful brain. Certainly toleration and diversity help select for larger, more adaptive brains, while conformity contributes to efficiency, which maximizes the adaptive advantage which can be achieved with a given level of organizational sophistication.

In certain regards, this tension may be only apparent. Efficiency and conformity allow primitive societies to grow over time and increase in sophistication, to the point where inefficiency, diversity, and toleration become both necessary and beneficial. Division of labor is very limited in social animals other than man, and tends to focus on differentiated sex roles. Among bees, wasps, and ants, workers are unspecialized and undifferentiated sterile females. The queen establishes the colony and breeding males or drones are otherwise unproductive. Among ants the males die before the colony is established, and among bees, breeding males continuously fertilize the queen, and are driven out after they become old and sterile. In lion prides, the lionesses both hunt and rear the cubs, and the male lions seemingly contribute no labor, though they will join the females in repelling outsiders. Both genders of wolves hunt in packs. Humans seem to anthropomorphize social animals—to the extent both genders are protective of the young, we admire their behavior, though we sometimes fail to emulate it.

The economic division of labor becomes increasingly beneficial as society increases in sophistication, but relies on toleration of differences. Entrepreneurial planning must be tolerated for civilization to flourish. Lowering time preference, increasing time horizon, and adopting roundabout production methods, cannot occur unless entrepreneurs are free to act on their own vision, regardless of the judgment or expectations ossified in social norms.

4. EFFICIENCY ARGUMENTS: EVOLUTIONARY BENEFITS OF MINIMALLY INCONSISTENT NARRATIVES

> *Nature makes nothing in vain.*
> —Aristotle, *Politics;* Darwin (1859), *Origin of the Species*

One of the more common arguments in evolutionary neurobiology is that the brain evolves through adaptations which improve or exploit efficient organization of information-processing capacity, freeing brain capacity for alternative uses. The more efficiently we use available processing capacity, the more capacity we have available for additional activities. Social conformity is one institutional adaptation which improves efficient processing for individuals. The expectation of uniform behavior in the community group frees individuals from having to confront the possibility of unexpected outcomes. Group cohesion and the ability to marshal common action will be high when everyone shares the same norms and expectations. When everyone thinks and acts alike, it becomes a simple matter for individuals to coordinate their activities. Even in our highly pluralistic society, we typically observe great discomfort in response to those whose values or premises differ sufficiently.

In terms of Hayek's sensory order, this kind of beneficial efficiency would require minimizing the number and complexity of mappings in the brain, frequent consolidation of existing mappings in response

to additional experience, and a strong positive external benefit from social norming that lowers individuals' cognitive burden. The organism learns advantageous classifications of sensory data through experience, and it is the mapping of the simplest internal subjective model onto the external reality which is the essence of an efficient classificatory process. The sensory order enlists a highly selective, finite model, to explain, categorize, and respond to, the inexhaustible manifold of the external world.

Maintaining the sensory order is less an intentional activity, especially as it relates to processing concrete perceptions, than a side-effect of its own operation. Nevertheless, it allows us to adapt to reality by enhancing the individual's experience and survival opportunities. Empirical studies of learning demonstrate that the context of information and prior knowledge influence the way and extent it is learned (Pichert & Anderson 1977), and generally, the more sophisticated understanding and experience an individual possesses in a given field, the easier that individual finds it to articulate and solve problems in that area (Chi, Glaser & Farr 1988). This applies not only to the content of prior knowledge, but how it is organized by the individual. Hayek recognizes the subjective models of the sensory order are continually tested against both the external reality and the subjective beliefs of others revealed through social intercourse.

It may seem illogical to claim that the sensory order can be measured simultaneously against both the external reality and the subjective beliefs of others; however, economists and philosophers have long recognized that commonality of belief systems confers adaptational advantage by facilitating social cooperation. Horwitz (2004) suggests that monetary calculation enables and is enabled by anonymous cooperation in advanced economies. Such calculations need not imply identical values, and allow individuals with very different values and preferences to mutually benefit from voluntary exchange. Even when a shared belief turns out to have been objectively mistaken, the fact that it was shared by a group contributed to the predictability of behavior within the group, lowering transactions costs and facilitating exchange and other forms of cooperative action. Culture is present only to the extent it is shared. Although economics emphasizes the individual subjective decision, culture points to a consensus on which among the network of interconnections are most important.

Confirmation bias, first identified by Wason (1960, 1966, 1968), describes our tendency to selectively overemphasize evidence confirming preexisting beliefs and underemphasize disconfirming evidence that is more difficult to integrate with existing beliefs. Lord et al. (1979) and Evans et al. (1983) also found that prior belief generally dominates logical reasoning. Although the beliefs supported by confirmation bias may be individually held and subjective, a particularly deep-seated source of bias would likely come from communally-shared moral values. Furthermore, the benefits of Atran-Nourenzayan minimally counterintuitive narratives help explain why our behavior displays confirmation bias. The adaptiveness of confirmation bias is strengthened if many individuals within a group agree. Confirmation bias may have provided adaptive benefits in primitive times, even if it no longer does.

Socialization enables us to benefit from the experience of others, granting us not only a vastly larger and more valuable stock of experience, but also condenses this volume to a manageable digest. We rely on language, social intercourse, and literature to broaden the range and perspective of our experience far beyond what we could incorporate in the sensory order on our own. This is an essential achievement of civilization.

Wallace (1864) observed that gross anatomical evolution had largely ceased for humans, suggesting we had advanced beyond depending on purely physical development to achieve adaptive advantage, perhaps due to the physiological complexity attained by the human species, or our high level of social organization, unprecedented in the animal kingdom, had advanced to the level where further development was frustrated by path dependency. Wallace sought explanations for

1) the comparative stability in human physiology from the late Pleistocene epoch, approximately 130,000 years ago, during which lower animals had continued to evolve drastically;
2) the emergence of racial varieties among humans without reliance on a discredited theory of successive emergence; and

3) the extent to which the human brain drastically altered the prevailing rules of evolution. Wallace argued that brain evolution outpaced gross anatomical changes because that was the most efficient way to gain evolutionary advantage. This was not the case for animals with smaller brains who continued to diversify in variety over the same period.

The animal brain confronts us with a physical object behaving at least partly according to deterministic physical rules, but also seems to display a degree of behavioral indeterminacy. This flexibility or adaptability is the kind of evolutionary advantage which might contribute to heightened entrepreneurial awareness. Some primitive hominids had larger brains than homo sapiens, suggesting that improved organizational efficiency is among the adaptive advantages we possess over our ancestors and their competitors.

Minimally inconsistent narratives contribute to group survival to the extent they improve survivability better than alternative explanations. A high degree of social conformity imposes great costs on the individual. However, for social adaptations to be successful, the benefit to individuals need only outweigh the cost. Some cultural traditions do not pass this test, or in a changing environment do not continue to pass. These traditions are abandoned, or the group which persists in the tradition and associated behavior becomes extinct, outcompeted by a group with a tradition more adaptive to prevailing conditions. One plausible reason why cultural traditions evolved, especially in light of the extraordinary time and energy devoted to elaborate and sophisticated rituals, architecture, hierarchical institutions, cultural artifacts, etc., is that in primitive social groups, the time and energy devoted to these artifacts were outweighed by the incessant savings of time and energy offered by recurrent group adoption of minimally counterintuitive narratives dictated by the cultural tradition.

Even when these explanatory narratives diverged from factual reality, they always had the immediate advantage that they were nearly certain to be accepted throughout the group and that they were likely to fulfill individuals' most urgent psychological needs. Thus, the community's energy was not occupied with debate, and consensus could emerge rapidly and at minimal cost. Sosis (2004) argues that specific elements of belief have to have a certain internal consistency to work together for the individual, who employs a kind of aesthetic cultural framework against which additional beliefs are evaluated. Aesthetically dissonant or culturally incompatible hypotheses are likely to be rejected, even if factually true. The evolutionary benefit comes from shielding the individual from the staggering burden of having to justify all beliefs about the external environment as they arise. Cultural traditions evolve spontaneously like property rights (Bailey 1992) and other cooperative arrangements (Benson 1991, 1999). A social group with less competitive institutions and cultural norms may adopt those of its faster-growing neighbors, may merge with them, or may be outcompeted to extinction. In each case, the less adaptive institutions are always evolutionary dead ends.

The value of emergent cultural traditions as evolutionary adaptations can be illustrated through a counterexample. In the *absence* of a spontaneously emergent cultural tradition allowing for the generation of minimally inconsistent narratives, members of the social group would have had to devote far more time and energy to constructing these narratives, and because narrative construction occurs cooperatively, further time and energy would then need to be devoted to discussion and persuasion aimed at attaining the assent of others in the social group—something we engage in extensively today. Inheriting any cultural tradition substitutes for this extraordinarily cumbersome process. Agents thus freed from the burden of constructing their own narratives and achieving consensus, would necessarily have more time and energy to devote to long-range planning and speculative foresight, giving them the adaptive advantage of lowered time preference and longer planning horizons.

In contrast, however, it will be argued below that the greater cognitive burden required to evaluate competing individual narratives better enabled us to survive in the long run by supporting evolution of a more sophisticated and powerful brain.

5. INEFFICIENCY ARGUMENTS

A man's reach should exceed his grasp,/Or what's a heaven for?
—Robert Browning (1812-1889), *Andrea del Sarto*

A contrasting set of admittedly more loosely-related arguments has also arisen based on the greater information-processing burden imposed merely by interaction larger social groups. A related argument is often made for the adaptive benefits from greater toleration of social divergence within groups of a given size. Though these two features of what will be called the inefficiency argument seem closely related, they will be analyzed separately, though keeping potential interactions in mind. Both larger social groups and weaker enforcement of conformity promote, require, and reward, development of a larger neocortex. The cognitive burden imposed by simultaneous navigation of social and natural environments, sometimes with conflicting requirements, better enabled us to survive in the long run by supporting evolution of a more sophisticated and powerful brain. In contrast to the first class of arguments—efficiency arguments—the second class—inefficiency arguments—suggests that benefits accrue from forcing relatively inefficient use at the limits of already-evolved information-processing capacity, leading through natural selection to the evolution of a more powerful and better-organized brain, though not necessarily a larger one.

In Hayekian terms, inefficient processing would be manifested through increasing the number and redundancy of cognitive mappings held by the brain, proliferation as opposed to consolidation of mappings in response to added experience, and strong external benefits to the individual (i.e., requiring here more processing rather than less) from comparison with various mappings articulated by others in the community, and communication with other individuals, or simply implicit in the behavior or inferred goals of others.

Information-processing Requirements Expand Geometrically with Group Size

The larger brain confers evolutionary advantages on the species, and is necessary to handle the volume, complexity, and sophistication of social interactions which increase geometrically with the size of the social group. The larger the social group a species evolved to interact with, the greater the species brain weight devoted to the neocortex or neo-mammalian brain which processes intersocial interaction and communication. Once primates began to live in social groups, natural selection began to balance the benefits of cooperative defense, hunting, and child-rearing behaviors against the cost of intragroup competition. Brain size and social group size tend to have evolved together (Dunbar 1992, 1993, 1996). The larger brain confers evolutionary advantages on the species, and is necessary to handle the volume, complexity, and sophistication of social interactions which increase geometrically with the size of the social group. The larger the social group, the greater the percentage of brain weight devoted to the neocortex or neo-mammalian brain (Sawaguchi & Kudo 1990). Macaque monkeys interact in social groups of approximately twenty and have neocortexes that account for 50% of their brain weight. More advanced, intelligent, and social than macaques, chimpanzees live in groups of approximately fifty, and have neocortexes accounting for approximately 65% of their brain weight. In humans the neocortex accounts for 80% of brain weight and includes the language centers (Table 1).

Table 1. Primate Neocortex Size

Primate species	*Social group size*	*Neocortex % of total brain weight*
Macaque monkeys	20	50 %
Chimpanzees	50	65 %
Humans	100-200 ?	80 %

Note: Kudo and Dunbar 2001. Only mammals possess the neocortex, aka the neo-mammalian brain.

Regressing information for 38 primate species, Dunbar (1992) found a predicted human social group size of 148, with a 95% confidence interval ranging from 100 to 230. Alternative estimates by Killworth, Bernard, and others, are somewhat larger, with a median of 231 and a mean of 290 (Bernard, Shelley & Killworth 1987; McCarty et al. 2000; Bernard 2006). With only three data points, and depending on the value taken for humans as Dunbar's number, social group size explains 97-99.5% of the percent of total brain weight accounted for by the neocortex (Table 2).

Table 2. Regression results: Neocortex % of brain weight explained by ln(*n*)

Assumed size of human social group (Dunbar's number)	*Regression equation*	*t-statistics*	*Adjusted R-square*
100	$P = -0.061\ n^{0.185}$	(-1.05) (12.49)	.9873
150	$P = 0.060\ n^{0.148}$	(1.91) (19.14)	.9946
200	$P = 0.127\ n^{0.129}$	(2.09) (8.49)	.9726

Ethical norms held across group members apparently help maximize the benefits of social cohesion while minimizing the destructive potential of group life. Individuals living in groups engage in such undesirable practices as deception, politicking, coalition formation, cheating, stealing, adultery, and various other negative activities. Although the argument is made that primate's need to engage in and overcome these negative behaviors forced us to develop larger brains, social norming, including morality and religion, seems to act as a brake against unbridled wantonness—however imperfectly.

Toleration makes Larger Groups Possible

Among several competing societies, the one imposing the most socially beneficial and cohesive behavioral rules on the individual would have an evolutionary advantage over the others. Normally the most adaptive behavioral rules would be those minimizing harm to others in the society. The need to devote significant resources to enforcing conformity must also grow geometrically with group size. This ever-expanding resource burden, together with the information processing burden imposed by interaction in large groups, acts as a brake on community expansion—a form of x-inefficiency (Liebenstein 1966). One way to mitigate this burden, or shift it from enforcing social conformity to information-processing, is to tolerate differences among individuals. This is initially done on only one margin, but eventually individual sovereignty triumphs over the collective will to conform.

The modern concept of toleration was forged in the crucible of the Thirty Years War of 1618-1648. Though this war had many political aspects, it was the last major conflict that was so dominated by religious divisions, and the last major conflict between Catholic and Protestant powers in Europe. The peace of Westphalia established that independent states could peacefully pursue different religions, a freedom which was eventually recognized for individuals. If larger groups generally have an advantage against smaller competitors, then toleration of diversity provides an advantage over conformity. Tolerant groups can combine to form larger communities, while groups which enforce conformity generally seek to destroy their competitors, or at least remain separate from them.

Larger Groups allow Greater Division of Labor

In addition to making cooperative behavior easier to facilitate, social interaction allows for development of other evolutionary adaptations like language and abstract reasoning. Once primates began to live in social groups, natural selection began to balance the benefits of cooperative defense, hunting, and child-rearing behaviors against the cost of intragroup social competition. Brain size and social group size evolved in

parallel (Dunbar 1996). Darwin (1871, p. 152; Eiseley 1958, p. 295) hypothesized that humans evolved from weaker anthropoids who would have gained advantages from socialization and cooperative hunting. More formidable gorilla-like primates were not then thought to be capable of the relatively sophisticated socialization which has since been observed in mountain gorillas, though it should be noted they live in smaller groups than chimpanzees or humans. Physically weaker animals face greater incentives to live socially, but the social adaptation can result in weaker though better-adapted successor species. Particularly large wasps, about whose ferocity and venom we can fortunately only speculate, began to live in proximity for mutual protection against predators. They eventually became true social insects, giving rise to far smaller modern wasps. Some species lost their stingers entirely, and have largely lost the ability of flight, evolving into ants, whose morphological resemblance to wasps remains particularly striking. Ants became more successful and prolific than their ancestors through socialization, and many ant species have become as docile as their environment will allow.[1]

Hayek's construction of the sensory order contributes to understanding a number of developments in modern neurobiology and cognitive psychology. The sensory order is itself one of the tools individuals exploit to achieve evolutionary advantage, and with further development and sophistication, contributes to the cortical interconnectivity necessary to attain and understand further advantages. Recent findings in neurobiology show that nerve cells are structured to implicitly categorize related sensory data in proximity (Nader et al. 2000; Si et al. 2003a; Si et al. 2003b; Duvarci & Nader 2004; Harvey & Svoboda 2007). This may be the very physical mechanism through which the sensory order works. Humans clearly economize on physical energy and mental effort by attempting to preserve classificatory schemata, once these schemata are established and verified by experience, suggesting at least a temporary justification for confirmation bias.

6. TIME HORIZON AND EFFICIENCY ARGUMENTS

> The lyf so short, the craft so long to lerne.
> —Chaucer, *The Parliament of Fowles* (1380-86)

Social conformity confers survival benefits on both societies and individuals because it allows a general lowering of time preference. Time preference is one of the most basic economic concepts and a fundamental category of human action. Theories of interest, term structure, and opportunity cost all depend on time preference, which is also the basis for capital budgeting in modern finance. Social conformity supported a reduction of time preference, allowing for employment of capital in time-consuming roundabout means of production.

Time preference explains why conforming behavior conferred survival value as we evolved, and why beyond a certain point, non-conforming behavior offers similar benefits. Time preference is the preference for immediate over delayed gratification. Though a universal determinant of human action, it has been observed to vary greatly in intensity across individuals. For example, time preference is especially high in children who lack experience and maturity, and in individuals with low life expectancy. Time preference is also high for criminals, and the general lowering of time preference both facilitates and is facilitated by the development of civilization and the increase in complexity of social relationships. The essence of low time preference is planning for the future, a willingness to delay gratification, and patience to wait for future benefits.

Our distant ancestors, who experienced both an appalling brief life expectancy and very high infant mortality, were fully absorbed with problems of immediate survival. Homo sapiens evolved in an environment where infant mortality approached 100% and life expectancy *for those surviving infancy* was certainly below 20 years. Our remote ancestors had little reason not to consume all their seed corn at once, and one problem which had to be overcome was rapid discrimination between members of one's own group, competing hunter-gatherers of the same species, dangerous predators of other species, and potential prey.

Rituals, practices such as characteristic dress, behavior, or tattooing, could serve as adaptations which distinguished members of one's own group from that of groups which could be competitive rivals, enemies, or prey.

It appears unlikely that people with notably high time preference would bother to engage longer-term reasoning or *planning*. Increasing peoples' time preference leads to more impulsive and short-sighted decision-making and weakens community cohesion. High-time-preference individuals live in the moment and do not characteristically deliberate, philosophize, or plan for the future. In contrast, low-time-preference individuals can still be alert to immediate threats like predators. Fundamental cognitive categorizations like belief in agency for inanimate objects, would enable low-time-preference individuals to respond immediately. Low-time-preference individuals have comparative advantage for deliberation and debate, but any benefits this capacity may have conferred could only have been realized *after* immediate threats had been addressed. The low-time-preference savers are the group which makes the more intensive use of the available neocortex, and in whom it likely evolved. They are, incidentally, the ones with comparative advantage in entrepreneurial planning.

Once life expectancy lengthens to the point where, in and of itself, it results in lowered time preference and more responsible, more forward-looking behavior from the majority, at some point, the survival dynamic of conformity reverses. Once competing groups of other humans cease to be the greatest danger, toleration of diversity becomes increasingly adaptive, or at least less maladaptive. In the context of hunter-gatherer societies, high time-preference recommends and rewards the attitude of "kill the outsider," but in the more civilized context lower time-preference makes possible, the lower one's time preference, the more accepting one becomes toward "outsiders"—even to the point where they are no longer considered outsiders. The Talmud has the famous expression of Hillel the Elder, "That which is hateful to you, do not do to your fellow," (Shabbat 31a), the lesson of the Good Samaritan parable. The intense small-group cohesion which is a high time-preference liability in a civilized society, though atavistic, is one behavioral adaptation which made the attainment of civilization and low time-preference possible. It seems to be a ladder to be discarded once it has been climbed.

We have little memory of practices which may have increased time preference, perhaps because societies with such practices were evolutionarily disadvantaged. The more foresightful the behavior of individuals in a community, and the longer their time-horizon, the more resources are saved instead of being immediately consumed. Saving output allows for time-consuming, capital-using, roundabout means-of-production, which are more productive and lift a community above subsistence. Once a community saves some of its output, its wealth is virtually guaranteed to grow more rapidly than groups which save less. Lower time-preference behaviors spread because they enabled social groups to outcompete groups which failed to plan for the future. The obvious structural transition this suggests is the transformation from hunter-gatherer to agricultural societies.

Conformity of belief and behavior rewards high time-preference individuals, making more efficient information processing possible by restricting the range of possibilities confronting the individual. Individuals with high time preference or short time horizons benefit more from information processing efficiencies. However, it is the ability to engage in inefficient or more burdensome information processing, relying on low time preference or a long time horizon, which allows eventually for the development of a larger and more efficiently-organized brain. Toleration of "the other" is clearly a more advanced trait. It is this transformation from the simplistic black-and-white logic of "identify-friend-or-foe," to a multidimensional continuum of value scales, which represents the civilization and domestication of the human animal.

7. CONCLUSION

Evolutionary neurobiology has developed explanations for adaptive brain development which appear at least superficially in conflict. Clearly, both efficiency and inefficiency arguments cannot both be valid in the same respect. This paper argues that social conformity is an efficiency promoting and exploiting evolutionary strategy. However, it was argued that beyond a certain population threshold, diversity and toleration become the dominant strategies. Hayek's construction of the sensory order was used to evaluate developmental strategies as either promoting or exploiting, efficiency or inefficiency, as well as being more or less successful.

The conformity defined by a cultural tradition confers survival benefits on societies and individuals which adopt it to the extent it allows a general lowering of time preference. Although social customs can be arbitrary in the sense that they are not necessarily subject to any objective, naturalistic justification, they enhance the survival and reproductive opportunities of the societies they shepherd through adverse selection. Only the most adaptive practices survive and contribute to the evolution of a cultural tradition. The emergence of religion and morality supported a reduction of time preference, allowing for employment of capital in time-consuming roundabout means of production.

Cultural traditions which did not confer survival benefits, if adopted, clearly would have disadvantaged communities which may have died out as a result. Researchers arguing for the adaptive benefits of cultural norms cite such characteristics as group cohesion, the facilitation of ready explanations, and impacts on cognitive burden. Some feel the efficiency of minimally inconsistent narratives benefits a cultural group by lowering the cognitive burden through simple, intuitive, though usually objectively false or unverifiable, explanations. Others feel the multiple burden of competitive alternative explanations is beneficial because it contributes to the evolution of a more powerful brain.

Wallace observed that brain evolution is the most rapid form of biological evolution. As social animals, humans have adopted an even more rapid strategy of achieving adaptive advantage through spontaneously evolved institutions and other self-organizing systems which arise as a natural outgrowth of our social interaction and unplanned social organization. Efficiency strategies, including the social conformity which facilitates the generation of minimally counterintuitive narratives and strong group cohesion, are more powerful and effective over shorter time horizons and for individuals with higher time preference. Inefficiency strategies, when they are not dominated in the short run by more urgent efficiency strategies, force and reward the development of a larger, more powerful brain, and thus contribute more to neurological complexity. Larger group size calls for greater processing capacity, as well as greater toleration of behavioral diversity. Another problem with conformity for larger groups is that enforcement costs expand exponentially.

NOTES

1 Insect brain size lends mixed support to the hypothesis that socialization helps animals evolve a larger brain (Lihoreau, Latty, & Chittka 2012, Godfrey & Gronenberg 2019). Solitary wasps generally have smaller brains than social wasps. In particular, the tiny parasitic wasp *Megaphragma mymaripenne* has the smallest measured insect brain with 7,400 neurons (Polilov 2012). The house fly *Musca domestica* has 340,000 neurons (Strausfeld 1976) and the honeybee *Apis mellifera* has the largest insect brain, with workers having 850,000 neurons and drones having 1,200,000 (Witthöft 1967). Honeybees are among the most docile and domesticated insects. Various bumblebee species (Bombus) form colonies between 20 and 1700, far smaller than honeybee hives which typically average 50,000 (Cueva del Castillio, Sanabria-Urbán, & Serrano-Meneses 2015). Though bumblebees seem to have fewer brain neurons than honeybees, their brains account for a larger percent of the insect's total weight. Ants generally have smaller brains (c. 250,000 neurons) than many of the social wasps they presumably either evolved

from or in parallel with. Entomologists suggest this anomaly arises from the fact that social wasps retain the power of flight which ants have largely lost, requiring a larger brain for 3-dimensional navigation. The solitary parasitic wasp *Dasymutilla occidentalis* variously known as the cow killer or velvet ant would be especially interesting to analyze in this regard, since males fly but females do not.

REFERENCES

Abelson, R. P. 1981. Psychological Status of the Script Concept. *American Psychologist* 36: 715-729.

Adrian, E. D. 1947. *The Physical Background of Perception.* Oxford: Oxford University Press.

Atran, Scott. 1990. *Cognitive Foundations of Natural History: Towards an Anthropology of Science*. Cambridge and New York: Cambridge University Press; Paris: Editions de la Maison des sciences de l'homme.

_____. 2002. *In Gods We Trust: the Evolutionary Landscape of Religion*. Oxford and New York: Oxford University Press.

Atran, Scott and Norenzayan, Ara. 2004a. Religion's Evolutionary Landscape: Counterintuition, Commitment, Compassion, Communion. *Behavioral and Brain Sciences* 27: 713-770.

_____. 2004b. Why Minds Create Gods: Devotion, Deception, Death, and Arational Decision Making. *Behavioral and Brain Sciences* 27: 713-770.

Bailey, M. J. 1992. Approximate Optimality of Aboriginal Property Rights. *Journal of Law and Economics* 35: 183-198.

Barrett, Justin. 2004. *Why would Anyone Believe in God?* Lanham: AltaMira.

Bartlett, F. C. 1932. *Remembering: a Study in Experimental and Social Psychology*. Cambridge: Cambridge University Press.

Benson, Bruce L. 1991. An Evolutionary Contractarian View of Primitive Law: the Institutions and Incentives Arising Under Customary American Indian Law. *Review of Austrian Economics* 5: 65-89.

_____. 1999. An Economic Theory of the Evolution of Government and the Emergence of the State. *Review of Austrian Economics* 12(2): 131-160.

Bernard, H. Russell. 2006. Honoring Peter Killworth's Contribution to Social Network Theory. University of Southampton, http://nersp.osg.ufl.edu/~ufruss/.

Bernard, H. Russell, Shelley, Gene Ann & Killworth, Peter. 1987. How Much of a Network does the GSS and RSW Dredge Up? *Social Networks* 9: 49-63.

Bloom, Paul. 2004. *Descartes' Baby: How the Science of Child Development Explains What Makes Us Human*. New York: Basic Books.

Boyer, Pascal. 1994. *The Naturalness of Religious Ideas: a Cognitive Theory of Religion*. Berkeley: University of California Press.

_____. 2001. *Religion Explained: the Evolutionary Origins of Religious Thought*. New York: Basic Books.

Braly, K. W. 1933. The Influence of Past Experience on Visual Perception. *Journal of Experimental Psychology* 16: 613-643.

Broadbent, D. E. 1958. *Perception and Communication*. London: Pergamon.

Bruning, Roger H. 1994. The College Classroom from the Perspective of Cognitive Psychology. In: Prichard, Keith W. & Sawyer, R. McLaren (eds.) *Handbook of College Teaching* (pp. 3-22). Westport & London: Greenwood Press.

Butos, William N. 2003. Knowledge Questions: Hayek, Keynes and Beyond. *Review of Austrian Economics* 16: 291-307.

Chi, M. T. H., Glaser, R. & Farr, M. 1988. *The Nature of Expertise*. Hillsdale: Erlbaum.

Cueva del Castillo, R.; Sanabria-Urbán, S.; & Serrano-Meneses, M. A. 2015. Trade-offs in the Evolution of Bumblebee Colony and Body Size: a Comparative Analysis. *Ecology and Evolution* 5(18): 3914-3926. doi:10.1002/ece3.1659.

Damasio, A. 1995. *Descartes' Error.* London: Quill.

_____. 1999. *The Feeling of What Happens*. New York: Harvest.

_____. 2003. *Looking for Spinoza*. London: Vintage.

D'Amico, Daniel J. & Boettke, Peter J. 2010. Making Sense out of *The Sensory Order. Advances in Austrian Economics* 13: 357-381.

Darwin, Charles R. [1859] 2009. *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*. London: John Murray. *The Annotated* Origin*: a Facsimile First Edition of On the Origin of the Species*. Costa, James T. (ed.) Cambridge & London: Belknap Press of Harvard University Press.

_____. 1871. *The Descent of Man, and Selection in Relation to Sex*. 2 vols. London: John Murray.

Dawkins, Richard. 2006. *The God Delusion*. Boston: Houghton Mifflin.

Dennett, Daniel C. 2006. *Breaking the Spell: Religion as a Natural Phenomenon*. New York: Viking.

Dijksterhuis, A., Bos, M. Nordgren, L. F. & van Baaren, R. B. 2006. On Making the Right Choice: the Deliberation-without-Attention Effect. *Science* 311: 1005-1007.

Dunbar, Robin Ian MacDonald. 1992. Neocortex Size as a Constraint on Group Size in Primates. *Journal of Human Evolution* 22(6): 469-493.

_____. 1993. Coevolution of Neocortical Size, Group Size and Language in Humans. *Behavioral and Brain Sciences* 16(4): 681-735.

_____. 1996. *Grooming, Gossip, and the Evolution of Language*. Cambridge: Harvard University Press.

Duncker, K. 1939. The Influence of Past Experience on Perceptual Properties. *American Journal of Psychology* 30: 10-22.
Duvarci, S. & Nader, K. 2004. Characteristics of Fear Memory Reconsolidation. *Journal of Neuroscience* 42: 9269-9275.
Edney, J. J. 1981. Paradoxes on the Commons: Scarcity and the Problem of Equality. *Journal of Community Psychology* 9: 3–34.
Eiseley, Loren C. 1958. *Darwin's Century: Evolution and the Men who Discovered It*. New York: Doubleday.
Evans, Jonathan St. B. T., Barston, J. L. & Pollard, P. 1983. On the Conflict between Logic and Belief in Syllogistic Reasoning. *Memory and Cognition* 11: 295-306.
Ehrenfels, C. von. 1890. Über 'Gestaltqualitäten.' *Vierteljarsschrift für wissenschaftliche Philosophie* 14: 242-292. In: Smith, B. (ed. and tr.) *Foundations of Gestalt Theory* 1988, pp. 82-117. Munich & Vienna: Philosophia Verlag.
Eysenck, M. W. & Keane, M. K. 1990 [2008]. *Cognitive Psychology: a Student's Handbook*. London: Taylor & Francis.
Ferster, C. B. & Skinner, B. F. 1957. *Schedules of Reinforcement*. New York: Appleton Century Croft.
Gifford, A., Jr. 2007. The Knowledge Problem, Determinism, and *The Sensory Order*. *Review of Austrian Economics* 20: 269-291.
Godfrey, R.; & Gronenberg, Wulfila. 2019. Brain Evolution in Social Insects: Advocating for the Comparative Approach. *Journal of Comparative Physiology* A 205(10): doi: 10.1007/s00359-019-01315-7.
Gould, Stephen Jay & Lewontin, Richard. 1979. The Spandrels of San Marco and the Panglossion Paradigm: a Critique of the Adaptationist Programme. *Proceedings of the Royal Society of London Series B* 205: 581-598.
Harris, Sam. 2004. *The End of Faith: Religion, Terror, and the Future of Reason*. New York: W. W. Norton.
Harvey, C. D. & Svoboda, K. 2007. Locally Dynamic Synaptic Learning Rules in Pyramidal Neuron Dendrites. *Nature* 450(7173): 1195-2000.
Hayek, Friedrich A. 1952. *The Sensory Order: an Inquiry into the Foundations of Theoretical Psychology*. Chicago: University of Chicago Press.
_____. 1960. *The Constitution of Liberty*. Chicago: University of Chicago Press.
_____. 1973. *Law, Legislation and Liberty, Vol. I, Rules and Order*. Chicago: University of Chicago Press.
_____. 1976 *Law, Legislation and Liberty, Vol. II, The Mirage of Social Justice*. Chicago: University of Chicago Press.
_____. 1979. *Law, Legislation and Liberty, Vol. III, The Political Order of a Free People*. Chicago: University of Chicago Press.
Horwitz, Steven. 2004. Monetary Calculation and the Unintended Extended Order: the Misesian Microfoundations of the Hayekian Great Society. *Review of Austrian Economics* 17: 307-321.
Iannaccone, Laurence R. & Makowsky, Michael D. 2007. Accidental Atheists? Agent-based Explanations for the Persistence of Religious Regionalism. *Journal for the Scientific Study of Religion* 46(1): 1-16.
James, William. 1890. *Principles of Psychology*. New York: Henry Holt.
Kudo, H., Dunbar, R. I. H. 2001. Neocortex Size and Social Group Size in Humans. *Animal Behaviour* 62: 711-722.
Leeper, R. W. 1935. A Study of a Neglected Portion of the Field of Learning—the Development of Sensory Organization. *Pedagogical Seminary and the Journal of General Psychology* 46: 41-75.
Leibenstein, Harvey. 1966. Allocative Efficiency vs. X-Efficiency. *American Economic Review* 56(3): 392-415.
Lihoreau, M., Latty, T., & Chittka, L. 2012. An Exploration of the Social Brain Hypothesis in Insects. *Frontiers in Physiology* 3: 442. https://doi.org/10.3389/fphys.2012.00442.
Lord, C. G., Ross, L. & Lepper, M. R. 1979. Biased Assimilation and Attitude Polarization: the Effects of Prior Theories on Subsequently Considered Evidence. *Journal of Personality and Social Psychology* 37: 2098-2109.
Mayer, R. M. 1992. Cognition and Instruction: Their Historic Meeting within Educational Psychology. *Journal of Educational Psychology* 84: 405-412.
McCarty, C., Killworth, P. D., Bernard, H. R., Johnsen, E.& Shelley, G. 2000. Comparing Two Methods for Computing Network Size. *Human Organization* 60: 28-39.
McQuade, Thomas J. & Butos, William N. 2005. *The Sensory Order* and Other Adaptive Classifying Systems. *Journal of Bioeconomics* 7: 335-358.
Minsky, M. 1975. A Framework for Representing Knowledge. In: Winston, P. H. (ed.) *The Psychology of Computer Vision*. New York: McGraw-Hill.
Mises, Ludwig H. E., von. 1957. *Theory and History: an Interpretation of Social and Economic Evolution*. New Haven: Yale University Press.
Nader, K., Schafe, G. E. & Le Doux, J. E. 2000. Fear Memories Require Protein Synthesis in the Amygdala for Reconsolidation after Retrieval. *Nature* 406: 686-687.
Neisser, U. 1967. *Cognitive Psychology*. New York: Appleton Century Crofts.
Newell, A. & Simon, H. A. 1972. *Human Problem Solving*. Englewood Cliffs: Prentice-Hall.
Norenzayan, Ara & Atran, Scott. 2004. Cognitive and Emotional Processes in the Cultural Transmission of Natural and Nonnatural Beliefs. In: Schaller, M. & Crandall, C. (eds.) *The Psychological Foundations of Culture* (pp. 149-169). Hillsdale: Lawrence Erlbaum Associates.
Norenzayan, Ara & Atran, Scott, Faulkner, J. & Schaller, M. 2006. Memory and Mystery: the Cultural Selection of Minimally Counterintuitive Narratives. *Cognitive Science* 30: 531-553.

Pavlov, I. P. 1927. *Conditioned Reflexes: an Investigation of the Physiological Activity of the Cerebral Cortex*. Anrep, G. V. (ed. and tr.). London: Oxford University Press.
Piaget, J. 1951. *Psychology of Intelligence*. London: Routledge and Kegan Paul.
_____. 1953. *Logic and Psychology*. Manchester: Manchester University Press.
Pichert, J. W. & Anderson, R. C. 1977. Taking Different Perspectives on a Story. *Journal of Educational Psychology* 69: 309-315.
Polilov, Alexey A. 2012. The Smallest Insects Evolve Anucleate Neurons. *Arthropod Structure & Development* 41: 29-34. https://doi.org/10.1016/jasd.2011.09.001.
Ratnapala, Suri. 2001. Eighteenth-century Evolutionary Thought and its Relevance in the Age of Legislation. *Constitutional Political Economy* 12: 51-75.
Rizzello, S. 2004. Knowledge as a Path-Dependence Process. *Journal of Bioeconomics* 6: 255-274.
Rumelhart, D. E. 1975. Notes on a Schema for Stories. In: Bobrow, D. G., & Collins, A. M. (eds.) *Representation and Understanding: Studies in Cognitive Science* (pp. 268-281). New York: Academic Press.
_____. 1991. Understanding Understanding. In: Kessen, E., Ortony, A., & Craik, F. (eds.) *Memoirs, Thoughts, and Emotions: Essays in Honor of George Mandler* (pp. 257-265). Hillsdale: Lawrence Erlbaum Associates.
Sawaguchi, T. & Kudo, H. 1990. Neocortical Development and Social Structure in Primates. *Primates* 31: 283-290.
Schallert, D. L. 1991. The Contribution of Psychology to Teaching the Language Arts. In: Flood, J., Jensen, J. M. & Squire, James R. (eds.) *Handbook of Research on Teaching the English Language Arts* (pp. 30-39). New York: Macmillan.
Schank, R. C. & Abelson, R. P. 1977. *Scripts, Plans, Goals, and Understanding*. Hillsdale: Lawrence Erlbaum Associates.
Si, K., Giustetto, M., Etkin, A., Hsu, R., Janisiewicz, A. M., Miniaci, M. C., Kim, J. H., Zhu, H. & Kandel, E. R. 2003a. A Neuronal Isoform of CPEB Regulates Local Protein Synthesis and Stabilizes Synapse-specific Long-term Facilitation in Aplysia. *Cell* 115(7): 893-904.
Si, K., Lindquist, S. & Kandel, E. R. 2003b. A Neuronal Isoform of the Aplysia CPEB has Prion-like Properties. *Cell* 115(7): 879-891.
Skinner, B. F. 1938. *The Behavior of Organisms*. New York: Appleton Century Crofts.
_____. 1953. *Science and Human Behavior*. New York: Macmillan.
_____. 1957. *Verbal Behavior*. New York: Appleton Century Crofts.
_____. 1968. *The Technology of Teaching*. New York: Appleton Century Crofts.
Sosis, Richard. 2004. The Adaptive Value of Religious Ritual. *American Scientist* 92: 166-172.
Strausfeld, N. J. 1976. *Atlas of an Insect Brain*. Berlin: Springer.
Tolman, E. C. 1948. Cognitive Maps in Rats and Men. *Psychological Review* 55: 189-208.
Tolman, E. C. & Honzick, C. H. 1930. Introduction and Removal of Reward and Maze Learning in Rats. *University of California Publications in Psychology* 4: 257-275.
Wallace, Alfred Russell. 1864. The Origin of Human Races and the Antiquity of Man Deduced from the 'Theory of Natural Selection.' *Anthropological Review* 2: 158-187.
Wason, P. C. 1960. On the Failure to Eliminate Hypotheses in a Conceptual Task. *Quarterly Journal of Experimental Psychology* 12: 129-140.
_____. 1966. Reasoning. In: Foss, B. M. (ed.) *New Horizons in Psychology* I: 135-151. Harmondsworth: Penguin.
_____. 1968. Reasoning about a Rule. *Quarterly Journal of Experimental Psychology* 20: 273-281.
Watson, J. B. 1913. Psychology as the Behaviorist Views It. *Psychological Review* 20: 158-177.
_____. 1919. *Psychology from the Standpoint of a Behaviourist*. Philadelphia: Lippincott.
Watson, J. B. & Rayner, R. 1920. Conditioned Emotional Reactions. *Journal of Experimental Psychology* 3: 1-14.
Wertheimer, M. 1912. Experimentelle Studien über das Sehen von Bewegung. *Zeitschrift für Psychologie* 61: 161-265. Eng. trans. Experimental Studies of the Perception of Movement. In: Shipley, T. (ed.) *Classics in Psychology* (1961). New York: Philosophical Library.
Wilson, Sloan. 1955. *The Man in the Gray Flannel Suit*. New York: Simon & Schuster.
Witthöft, W. 1967. Absolute Anzahl und Verteilung der Zellen im Hirn der Honigbiene. *Zeitschrift für Morphologie und Ökologie der Tiere* 61: 160-184.
Wundt, W. M. 1910. *Principles of Physiological Psychology*. 2nd ed. London: Swann Sonnenschein.

On the emergence of the system of modern science

THOMAS J. MCQUADE

Abstract: It is widely acknowledged by both historians and scientists that in the course of the 17th century in Western Europe a new way of thinking about nature and knowledge took hold and new methods of obtaining knowledge of nature were proposed and tried. The spectacular success of this new science was recognized even at the time, and the genius of its leading practitioners was widely appreciated. There had been brilliant upsurges in scientific activity in various times and places before this, but this episode is unique in that, rather than lapsing into stasis or abandonment, it has continuously grown in both results and participants to the point where it is an integral part of modern civilization. Many reasons have been proposed for the origin and the success of the new science, but none convincingly address why this scientific revolution should have the staying power that others have not. The hypothesis developed here is that the innovations of the 17th century—changes in methodology, epistemology, ideology, and institutions—coalesced to form a radically new social arrangement in the form of a self-maintaining system of scientific processes, an arrangement that can be formally described as an anticipatory social system.

Keywords: science, scientific revolution, emergence, social systems, anticipatory systems.

I. INTRODUCTION

Over the course of the 17th century there occurred remarkable changes in the mode of understanding and the methods of investigating natural phenomena. Historians of science refer to this multifaceted transition as "the Scientific Revolution", and the capitals and the definite article are there with good reason.[1] This was certainly a "golden age" of scientific development, but there had been significant periods of scientific development before—in Greece from about the 4th to the 2nd century BCE stemming from the philosophical schools of Plato and Aristotle, in China at roughly the same time in the era of the Hundred Schools of Thought, in northern India from about the 4th to the 6th century, in the Middle East from about the 9th to the 12th century as Greek manuscripts were translated into Arabic and studied, and in medieval Europe in the 12th to the 14th century as Arabic manuscripts including those Arabic translations of Greek manuscripts were in turn translated into Latin.[2]

All of these periods of progressive intellectual activity came to an end—either they simply lapsed into intellectual stasis, as was the case with the Greek[3] and medieval European episodes, or they were not resilient enough to survive societal changes (political regime change in the cases of China and northern India, and religious in-turning as a result of external threats in the case of the Middle East). In contrast, the intellectual revolution of the 17th century has initiated a form of scientific activity which has continued to grow, in discoveries, in active participants, in application, and in societal acceptance and prestige, to this day, and which, despite major political upheavals, shows no signs of tapering off.[4] But what was different about this particular revolution, what explains its staying power? The hypothesis developed here is that the system of science as we know it originated from a coalescence of methodological, epistemological, ideological, and institutional innovations that emerged during the 17th century, forming a radically new social arrangement: a self-maintaining system of scientific processes.

Popular accounts of 17th century science emphasize the numerous significant discoveries that were made in a relatively short period.[5] And significant discoveries there certainly were. Magnetism was investigated and the Earth's magnetic field described (Gilbert), laws characterizing the (non-circular) planetary orbits were deduced (Kepler), a new theory of motion and of falling bodies was developed (Galileo), the circulation of the blood and the role of the heart as a pump was described (Harvey), atmospheric pressure was investigated and the existence of a vacuum proposed (Torricelli), relations between gas pressure and volume were formulated (Boyle), a wave theory of light was proposed (Huygens), the spectrum of white light was discovered (Newton), microscopic phenomena were observed and studied (van Leeuwenhoek and Hooke), and the integrating ideas of force and universal gravitation were elaborated mathematically (Newton). These and other scientific successes did not gain automatic acceptance—as with most discoveries that challenge the status of existing knowledge, they encountered opposition, and in general it was the younger scientists who championed the new developments. But these additions to scientific content could not have taken place had there not been radical changes in scientists' underlying conceptions of knowledge and experiment. And further, had there not occurred changes in social attitudes and institutional arrangements that worked to support these new conceptions and to leverage their fertility, the history of this new golden age would have been similar to that of earlier golden ages.

II. KNOWLEDGE AND EXPERIMENT

The Aristotelian approach to the study of nature, still prevalent among intellectuals in the 16th century despite various recognized inconsistencies and difficulties of interpretation casting doubt on Aristotle's physical explanations,[6] was based on an overall conception of the world which conformed to casual observation—a stationary Earth at the center of the universe, every move having a mover, change (including movement) as the result of seeking to obtain an end characteristic of the material, with heavy materials constrained to seek to move linearly toward the Earth's center, light ones linearly away from it, and heavenly ones in circles. Explanations were deductions from such unquestioned first principles, and although observations were by no means ignored and discoveries of new phenomena were made, the thought of overturning the overarching principles because of an awkward observation was inconceivable. And, in addition to the authority of Aristotle, there was the even greater authority of the Church, requiring explanations to conform to biblical dogma.

But such authorities did not go unquestioned, and by no means did everyone interested in understanding nature adhere to the Aristotelean methodology. Rather than being satisfied with the sufficiency of deductions from first principles, casual observation, efforts to come up with explanations of observations consistent with what the authorities took to be incontrovertible, and clearly unrealistic models designed to simulate the phenomena,[7] the new investigators sought understanding based on precise observation. Vesalius, with his detailed anatomical drawings published in the 1540s,[8] and Tycho Brahe, with his mapping of the stars and planets to the limit of accuracy possible with naked eye observation, first published in 1588, exemplify this trend. The idea that knowledge of nature was not derivable from abstract first prin-

ciples but was to be had by systematic observation was taken up by Francis Bacon. In a comprehensive treatise published in 1620, Bacon argued that principles could be deduced inductively not only from observation but also from deliberate experiment carried out with the aid of instruments, intelligently designed and assessed. He gave elaborate instructions on cataloging and generalizing the raw results. Although his specific methodology (which he preached but did not practice himself) was unworkable, the underlying thrust of obtaining knowledge via exploratory research directed at confirming or refuting generalizations was significant—knowledge was contestable, nature itself was the judge, and experiments could be designed to force nature to render judgment.[9] The roughly contemporaneous discoveries of Harvey in anatomy, Gilbert in magnetism, and von Helmont in chemistry all followed such an approach.[10]

At the same time, another new scientific methodology, similar in that observation and experiment was determinative, but different in the central role played by mathematical reasoning, was being developed and demonstrated. Johannes Kepler, in striving to simplify Copernicus's hypothetical arrangement of a Sun-centered universe which maintained the ideal of circular planetary motion (but, like Ptolemy's Earth-centered scheme, required many epicycles to approximate observed planetary positions), recognized clues in his analysis of Brahe's observations that suggested that the orbits were in reality elliptical, deduced the exact mathematical form (specifically, of the orbit of Mars), and used the observations to confirm the much simpler arrangement. In addition, he was able to deduce and confirm (to the limits of precision the observations allowed) two further mathematical laws of planetary motion.[11] It was a demonstration that nature obeyed mathematical laws, laws which were confirmable by observation. Galileo Galilei, studying the motion of more local bodies and seeking to render it mathematically,[12] reasoned, in direct contradiction of Aristotle, that a body once put into motion would persist in that motion—with uniform velocity for horizontal motion, with uniform acceleration for vertical motion. Deviation from the mathematical ideal could be ascribed to such complications as air resistance. Galileo created an experimental setup—an inclined plane smoothed to minimize friction—to approach the mathematical ideal as much as possible in order to provide a test of his theory.[13] Here, as with Kepler, nature was conceived of as obeying, in ideal circumstances in which extraneous factors are abstracted away, simple mathematical laws which, with pertinent observations and carefully designed experiments, could be exposed to testing and shown to be true to nature. The stunning achievement of this mode of thinking was realized in the integration of Kepler's and Galileo's work by Isaac Newton, creating a mathematical edifice equally applicable to earthly and heavenly phenomena, and abundantly confirmed by probing experiment and precise observation.[14] The idea that aspects of nature could be precisely and reliably described by simple and elegant mathematical equations has been a cornerstone of science ever since.

The mathematically oriented methodology could be characterized as a revolutionary new way of looking at old phenomena, whereas the Baconian method was effective in producing unexpected discoveries in new scientific fields such as electricity and magnetism, and its application transformed chemistry from a craft into an experimental science.[15] But both have as their essential base the stipulations that knowledge is contestable and, whereas nature is the final arbiter of truth, it can and should be probed by suitably designed experiment to uncover phenomena which would not be observed under ordinary circumstances. Though different in origin, they have become merged, as can be seen in Newton's *Opticks*, in which the mathematical edifice of geometrical optics sits side by side with experimentally driven investigations into phenomena such as light polarization.[16]

A third conceptual innovation, developed concurrently with the other two, was the idea that the natural world could be understood in terms of the motions of various particles, varying in size and shape and invisible to the naked eye. The advance from Greek atomism centered on the attention paid to the motion of these particles, and specific mechanisms involving particle motion were proposed—for example that sound was caused by agitated particles of air. Descartes built this corpuscular idea into an all-encompassing theory of the world in which whirlpools of particles moved according to fixed laws.[17] On the one hand, this mode of thinking gave free rein for hypothesizing particle types and their motions to explain any phe-

nomenon of interest; on the other, this arbitrariness was not a scientifically attractive feature. The problem was addressed in two different ways—by Huygens (and, later, Newton) insisting on mathematical descriptions of these motions, and by Boyle and Hooke (and, later, Newton) engaging in exploratory experiment. The corpuscular approach, inadequate on its own, was thereby integrated into the other two conceptual developments as a unifying agent.[18]

III. IDEOLOGY AND INSTITUTIONS

Traditionally, the social status of the scientist—understood as an independent thinker pursuing knowledge about nature as a vocation in its own right—was not particularly high. Even in those "golden ages" when the study of nature was actively pursued, science was generally subservient to moral philosophy, and the only widely valued scientific pursuits were those that could see direct application in satisfying immediate societal needs such as healing, building, astronomical prediction, and the provision of an overall world view. For example, in Greece, where there were some outstanding independent science specialists such as Aristarchus, Archimedes, and Apollonius, they were not at the center of societal interest or concern. However, many of these scientists were able to pursue their vocation due to the (sometimes unreliable) patronage of the Ptolemies in Alexandria, where they were isolated from the wider society and did not need their sanction or support.[19] The situation was not substantially different in medieval Europe, where scientific topics were subsumed under the umbrella of philosophy in the universities, and even into the early 17th century in Italy scientists such as Galileo relied on the patronage of powerful families and ran the risk of moral condemnation and religious persecution.

But considerable social changes were underway in Europe during the 16th century, and these were particularly evident in what became the Protestant regions of Northern Europe. This was a period of economic expansion and the opening-up of opportunities for entrepreneurship. The discovery of the New World, the expansion of trade routes over both land and sea, technological advances in machinery, printing, and navigation, and the fragmentation of traditional sources of political and religious authority produced a segment of non-aristocratic society in which the idea of progress and aspirations for personal betterment (in this world, not only in the next) took hold.[20] The new discoveries in science by the likes of Kepler, Galileo, and Gilbert were received positively in this social environment because (even if one's understanding of them was rather superficial) they promised progress in the ability to comprehend and control nature. It was clearly not the case that the scientific discoveries of the early 17th century actually produced useful technology, but the possibility was there, and that idea, written up and talked up, served to enhance the social status of science and scientists.[21] And the great popularizer of the notion that science was an important and socially valuable enterprise was none other than Francis Bacon, who envisioned extensive benefits that were to come from science that would enrich society.[22]

The new social status of science not only made science a respected vocation (which made patronage easier to come by) but also a field of interest to intelligent laymen. It opened the way for scientists together with individuals with some ability (and some means) to participate in discussions about scientific issues and even to engage in scientific experimentation itself.[23] Regular meetings involving such like-minded individuals took place in homes, business premises, coffeehouses, and college and university lodgings. For example, in England, an important (for later developments) group formed around 1645, centered at Gresham College London. Its members included the mathematician John Wallis, the physician William Harvey, and the astronomer Samuel Foster. Some members of this group relocated to Oxford around 1649, forming a group there, the Oxford Philosophical Club, while the Gresham group continued in London, its meetings often attended by London-visiting Oxonians. Members of the Oxford group later included the chemist Robert Boyle and the astronomer and architect Christopher Wren, and interacting with the group on occasion were the physicist Robert Hooke and the German diplomat Henry Oldenburg, who maintained a large network of correspondence with scientists across Europe.[24]

Perhaps to some extent inspired by Bacon's elaboration of an ideal scientific society,[25] a number of these informal groups, but most importantly the Gresham and Oxford groups, meeting at Gresham College in 1660, made plans to establish a more formal scientific society.[26] The new society sought and obtained royal approval from the newly restored Charles II, and in 1663 took the name "The Royal Society of London for Improving Natural Knowledge". The members chose the motto *Nullis in verba*, understood as "take nobody's word" and intended to emphasize the insufficiency of loose speculation and the need for experimental demonstration. Such demonstrations were conducted at the early meetings under the auspices of Hooke, appointed as Curator of Experiments. Oldenburg, one of the secretaries of the Society, at his own initiative and cost, established a regular periodical, which he named *Philosophical Transactions of the Royal Society*. This publication, which he described rather humbly in the Dedication in the first issue as "these Rude Collections, which are onely the Gleanings of my private diversions in broken hours", disseminated letters received, experiments reported and performed, and other items he expected to be of scientific interest to his subscribers (sometimes copied from other publications), not all of which was discussed at Society meetings.[27] The first issue appeared in 1665 and, although the monthly schedule was not reliably maintained and eventually abandoned, the *Transactions* has been in continuous publication to the present day. Following Oldenburg's death in 1677, it was financed by various secretaries of the Society and its editorial policy gradually became more oriented to publishing finished research which the Society Council thought fit to publish. But it was not until 1752 that it became the Society's official publication.

Besides being simply a vehicle for the dissemination of scientific news and research findings, Oldenburg's *Transactions* served to address an important problem faced by scientists in the new era of scientific experiment and discovery. If new worlds could be discovered by sailors, then, by analogy, new phenomena and new understandings of phenomena could be discovered by scientists, and, with respect and reputation to be had, the question of priority in discovery loomed large.[28] But the severity of the priority disputes that occurred during the 17th century, and the vigor with which associates of the disputants pursued them, is an indication that more than self-interest alone was at play, and that a code of scientific conduct had emerged—that although clearly multiple people could discover more or less the same thing, the recognized discoverer was the one who made public a convincing account first.[29] Oldenburg saw his journal as a vehicle for the public registration of discoveries by author and date and expected that such a service, offering evidence for priority, would encourage submissions.[30]

The *Transactions* inaugurated some other innovations, although their full significance was probably not recognized at the time. One involved the assessment of the quality of material submitted. Oldenburg had available to him more material than could be included, and so inevitably acted as referee, deciding what to publish and what to ignore. In this task, he probably had assistance from colleagues, and indeed his understanding with the Society was that the Society Council would review articles for approval for publication. And besides this gatekeeping function, the *Transactions* offered opportunities for scientists to comment on earlier papers, whether to criticize, to reinterpret, or to build on, and thus provided a widely read public forum where scientists could engage with each other. Finally, the accumulating issues of the *Transactions* were an accessible archive of scientific discovery, contention, and resolution and, as such, were a resource for future scientists to learn their craft and to build on an understanding of what had gone before.

The Royal Society and the *Transactions* were not the only scientific society and journal to be established in the 17th century—the *Journal des Sçavans*, whose content consisted largely of book reviews augmented by news articles that might be of interest to intellectuals in general (but did include some scientific papers), was published in Paris in the same year as the *Transactions* (but two months earlier)[31], and the Académie Royale des Sciences was established by the French government in 1666 as an advisory body for scientific matters. The Accademia de' Lincei operated between 1600 and 1630 in Rome, and the Accademia del Cimento, under the patronage of the Medici, supported scientific experimentation between 1657 and 1667. In German territory, the journal *Acta Eruditorum* began publishing in Leipzig in 1682 and was the

outlet for the partisans of Leibniz in the priority dispute with Newton over the calculus, and the Akademie der Wissenschaften was formed in Berlin in 1700. By the end of the century there were at least eight publications containing reports of society meetings and discussions, and many of these societies, (including the Académie Royale) initially followed the policy of the Accademia del Cimento that discoveries made under the auspices of the society were represented as being made by the society, not the individual discoverer. This mode of reporting was eventually abandoned, however, and the policy of the Royal Society and the *Transactions* of registering individual credit became the norm.[32]

The upshot of these social and institutional innovations was that the 17th century saw the vocation of science achieve social acceptability and respect, and norms for interaction between scientists become institutionalized, both of which served to support and enhance the emerging idea that knowledge was contestable and that the only authority for assessing knowledge claims, even mathematically elegant ones, was verifiable observation and experiment.[33] It is at this point that the growth in scientific activity took off, slowly at first, but noticeably accelerating in the 18th century, at which point Bacon's promise of technological applications of scientific discoveries began to be realized, and the now familiar two-way interchange between science and technology established itself.

IV. A COALESCENCE OF INNOVATIONS

The Scientific Revolution is now well over 300 years old, and the growth both in scientific results—the ability to understand and manipulate nature—and in numbers of active participants in scientific endeavor shows no indication of tapering off.[34] The prestige of science in society is undiminished, and even those of the public who disagree with particular conclusions of some scientists cite other scientists for rebuttal.[35] Science has become an integral part of modern culture. It is this record of continuous growth and success and aura of indispensability to society that sets this scientific revolution quite apart from those that preceded it.[36] The question is: what was it about the developments in science and in the surrounding society in the 17th century that could account for such a remarkable phenomenon?

The methodological, epistemological, ideological, and institutional innovations that emerged during that century are well known, and all have been cited as causes of the Revolution.[37] For both Immanuel Kant and William Whewell, the key figure was Bacon, whose elaboration of the experimental-inductive method marked the clear break from Aristotelean science. Ernst Mach points to Galileo's revolutionary method of forming an abstract mathematical model and submitting its consequences to experimental test. For Eduard Dijksterhuis, the Revolution was set in motion by Copernicus, whose inspired placing of the Sun at the center of the universe, despite the work being very much in the tradition of Greek mathematical astronomy, led to the decisive innovations of Kepler and Galileo in mathematizing natural phenomena. Alexandre Koyré saw the essence of the Revolution as the emergence in the work of Galileo and Descartes of a new conception of motion which sheared it of the purposefulness with which Aristotle had endowed it and replaced that with the idea of different states of bodies in a mathematically described space, which fitted together with a new emphasis on precise measurement. Edwin Burtt also pointed to the emergence of a new mathematically oriented world view which, in the work of Copernicus and Kepler, and finally Galileo, resulted in the replacement of Aristotle's formal cause with mathematical description. Rupert Hall downplayed the empirical innovations and emphasized the new ideas involving the embrace of mathematics in describing nature in terms of lawlike regularities, a method which had possibilities for application to sciences other than astronomy and physics. Thomas Kuhn divided the sciences into two groups: the "classical sciences" (such as astronomy and physics) had their mathematically oriented upheaval in the conception of how the world is to be described, while the "Baconian sciences" (such as magnetism and chemistry) had their empirically oriented upheaval in methods of investigation. And Richard Westfall saw as crucial the integration over time, culminating with Newton, of the two separate ideals of exact mathematical description and a world view in which the underlying causes of phenomena could be deduced from experiment in

terms of the motions of particles. All these authors cite, with varying degrees of emphasis, causes involving radically new conceptions of knowledge and experiment.[38]

Another group of authors cite causes external to the content of science, causes involving ideological and institutional changes, as necessary for the Scientific Revolution to take place. Included here are those who highlight the emancipation from religious dogma, such as Andrew White, whose polemical account of the "warfare of science with theology" had a run of popularity in the early 1900s. In contrast, Reijer Hooykaas saw an ideological shift conducive to experimental science in the aftermath of the Reformation, when the idea that scripture could be studied individually independent of authorities led to the attitude that God's other book, nature, could be approached similarly and that the answers found therein had to be humbly respected. Hooykaas also pointed to the downstream effects of the voyages of discovery in changing social attitudes in favor of an investigatory approach to nature. Robert Merton's study of the relation between science and the society in which it was embedded in the 17th century led him to point to aspects of the "Puritan ethos"—its utilitarianism, its empiricism, and its antitraditionalism—which altered social attitudes in the direction of making the new empirical approach of science commendable. Although Merton did not make the claim explicitly, his thesis has been taken as describing a driver of the Baconian side of the Scientific Revolution. George Clark proposed that the experimental method had its origin in procedures used in the emerging industrial processes and in the quantitative thinking necessary in business accounting, as well as in the new utilitarian religious attitudes. Elizabeth Eisenstein saw the availability of the printing press as enabling the wide communication and follow-up, a crucial feature of modern science not possible in a scribal culture. And Joseph Ben-David asked how it came to be, in the 17th century, that a socially acceptable and respectable vocation of science emerged and found his answer in science's compatibility with a developing ideology of progress in rational political and educational reform, an attitude shared by the sorts of men who were instrumental in forming the informal, and later formal, scientific societies.[39]

Floris Cohen has invoked most of the aforementioned causes in a comprehensive story of the rise of modern science in the 17th century.[40] He stressed the revolutionary changes that the three innovations—mathematically precise laws, exploratory experimental methods, and corpuscular conceptions of reality—introduced, changes in not only the content of science but also in the conception of what constituted knowledge and how it was to be sought. As something of an afterthought, he noted the various aspects of the current societal environment which increased the chances that these developments would be pursued. When explaining the Revolution's survival, his major points were, first, that the Revolution was not snuffed out by religious and political forces thanks to the openness to innovation provided by the Reformation and the political stability following the Peace of Westphalia and the English Restoration, and second, that the potential for application (initially more hope than reality) resulted in both political endorsement in the chartering of scientific societies and societal acceptance in the growing industrial economy. If one regards, as Cohen does, the Revolution as a circumscribed episode that culminated with Newton, then that is possibly all there needs to be said, but what is not explained is the remarkable aftermath in which the science born in the 17th century has grown unabated into the cultural mainstay it is today.

In summary, with regard to the emergence of modern science, what we are left with are elaborations of necessary conditions; there is no compelling argument as to which set of them might be sufficient. And there is no viable explanation of why this particular upsurge in scientific activity, unlike all those that preceded it, has not lapsed into scientific stasis—instead, it shows continuous, even exponential, growth. So, rather than championing any particular necessary cause or set of necessary causes as providing sufficiency, the sufficient cause could be looked for in interactions between these causes. If the confluence of innovations of the 17th century resulted in the formation of a mutually supporting set of scientific processes, and if this system of processes was organized such that its interactions with its environment were adaptive in facilitating its own maintenance and growth, then the Scientific Revolution could be seen as the spontaneous formation of a radically new order of scientific endeavor and its remarkable continuance explained. This

amounts to characterizing the scientific community that emerged in the 17th century as an autopoietic social system—in fact, more specifically, an anticipatory social system.

V. ANTICIPATORY SOCIAL SYSTEMS

An autopoietic system, as originally defined by the biologists Humberto Maturana and Francisco Varela, is a circumscribed physical domain in which the processes that maintain its operation are able to recreate themselves, using material and energy from the environment, but not requiring the assistance of any outside process. In other words, an autopoietic system is an operationally closed but thermodynamically open self-organizing and self-maintaining system. Maturana and Varela were building on the work of earlier systems biologists, particularly Ludwig Bertalanffy, to characterize the properties of living cells. Bertalanffy's approach to understanding self-maintaining biological systems, which was followed up and extended by Robert Rosen, was to emphasize the organization of the internal processes rather than the organization of the physical matter—in fact, he held that the former determined the latter.[41] This is because in autopoietic systems it is the functional processes that persist, whereas the physical components are continuously being reconstituted by the functional processes with the help of inputs from the environment.

Turning to the consideration of systems of social interaction, it is evident that, while there are suggestive commonalities at a very general level, the analogy with biological autopoiesis is a limited one. Thermodynamic openness is an obvious commonality. And the property of persistent functional processes operating on changing internal components can be seen in certain circumscribed social arrangements—specifically, in communities, where the norms of interaction that are understood and generally adhered to by the members of the community are symptomatic of the repeated exercise of specific types of functional processes.[42] But, whereas in biological systems the functional processes are implemented by the chemical action of some of the material components (enzymes, for example), in social systems the processes are implemented by the purposeful actions of the members of the system and the internal components produced and acted on can be intangible (expressed ideas, for example) as well as material.[43] And, to qualify for the designation "autopoietic", the functional processes in the social system would have to be a closed set, in which the inputs of any process were provided as outputs of at least one of the other processes.[44]

Simple biological autopoietic systems can maintain their integrity by reacting to changes in internal state by negative feedback to maintain homeostasis. But openness to the environment allows for greater flexibility in the face of environmental changes via anticipation, where there is some ability to attempt to predict possible future states of the environment and their impact on the system itself. For example, some plants anticipate future cold weather and set in motion adaptive responses to it by sensing changes in day length—in effect, they have a simple internal model relating present day length to future temperature. In more complex systems with a facility for memory, the anticipatory responses can be modified by experience.[45] Perhaps the most complex anticipatory system known is the human brain, a system in which an internal model of the environment is maintained, is employed in the prediction of possible future situations and the preselection of suitable actions, and is modified by experiences of success and failure.[46] In general, a system is anticipatory if it implements within itself a model of itself and of its environment—a model which constitutes the system's knowledge—which allows it to change state on account of the model's predictions as to a future situation. The change of state may result in actions on the environment, or simply in dispositions to act. And the system's input from the environment may be processed within the system to confront, and perhaps modify, the model—for the model to be useful for anticipation, the system must be capable of learning, *i.e.*, adjusting its model to reflect experience of reactions from the environment.[47]

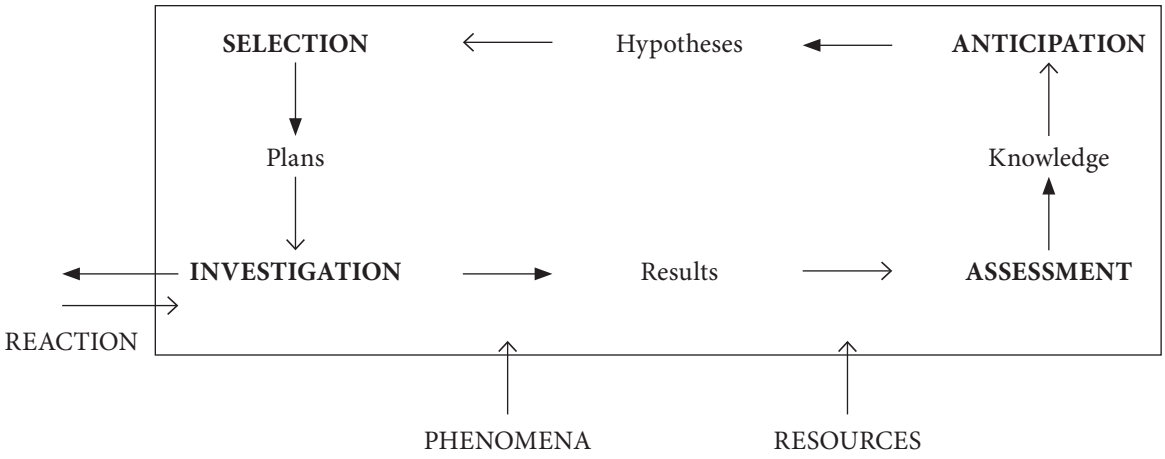
Arguing by analogy from these attributes of a biological anticipatory system, a social system would be autopoietic and anticipatory if it were materially open to its environment and contained the following sets of processes which form a functionally closed cycle:

- Investigative processes, which act on the environment and register and record the environment's reactions.

- Assessment processes, which assess these results for coherence and reliability and update the system's knowledge base.
- Anticipatory processes, which hypothesize future states and appropriate system actions with the aid of the system's knowledge base.
- Selection processes, which perform a culling operation on these hypotheses, selecting those considered actionable as plans forwarded to the investigative processes.

These processes are activated by the actions of the system's members who, like all individuals, "pursue happiness" according to their own subjective values, but are constrained (in large part, but not completely) by the norms that operate within the system and the available modes of interaction. The members are maintained by resources coming into the system from the environment. The system being open, phenomena in the environment can, in principle, be inputs to any of the system's processes. Outputs generated within the system are also, in principle, available as inputs to other processes and, depending on their implementation, parts or all of them may be visible to the environment. The processes of anticipation and selection, which bridge the system's knowledge and its plans for investigation, could, since their outputs are generated by assessments of an uncertain future, be termed "entrepreneurial".

The following is a schematic representation of the fundamental process organization of such an anticipatory social system, showing the self-sustaining cycle of social processes just described—investigation, assessment, anticipation, selection, investigation—together with their critical inputs and outputs. Processes are shown in bold within the system boundary; process outputs are indicated by closed-headed arrows and inputs by open-headed ones:



It is to be emphasized that this is a model of the organization of the processes within the system, not of the system's members. There is no necessary one-to-one association of members and processes—individuals may, and often do, participate in more than one of these processes. While the process organization is quite straightforward, the network of relationships and interactions between members can be a complex one of both competition and cooperation as members pursue their own interests under the constraints of the norms of behavior that emerge within the system and the modes of interaction provided by the system's processes.

It remains to be demonstrated that the confluence of scientific innovations in the 17th century provided the norms and functional processes necessary for the emergence of such an anticipatory social system and the built-in incentives for its growth.

VI. THE SYSTEM OF SCIENCE

Perhaps the most fundamental of the scientific innovations of the 17th century was the radical change in the conception of scientific knowledge. No longer was knowledge thought of in terms of deduction from an overarching authoritative scheme, and no longer could ingenious and elaborate constructions designed to "save the appearances" be acceptable as providing an understanding of phenomena. Instead, nature was to be actively investigated by probing experiment. The plans for such experimental action could be based on suggested mathematical generalizations or on inductions from previous observation, but whatever the source it was the reaction from nature that was to determine whether the suggested understandings were plausible or defective. A strong indication that the idea that active experiment was the final arbiter of truth had taken hold in the minds of the scientists of the time is evident in the Royal Society's motto, *Nullis in verba,* which was dismissive of speculation not backed up by experiment.

If knowledge were to be discovered and not simply deduced, then knowledge was mutable, and could be added to or corrected, depending on how the experimental results were understood and assessed. And here is where the genius of the Oldenburg innovations can be seen. There is an inevitable subjective component in the assessment of experiments—the results could be questioned, the apparatus judged unreliable, the experimenter considered incompetent, or complicating phenomena identified. Or the results could be ignored or dismissed out of hand because they did not conform to ingrained expectations. The resolution that Oldenburg provided for this pervasive problem was to enable the wide publication among scientists of experimental results and commentaries on them, so that assessment could take place in open discussion, and when (or if) a consensus emerged, it could be taken (at least provisionally) as an update to existing scientific knowledge. Without the availability of the printing press, this wide and timely distribution of purported facts and probing opinions would have been much more difficult, to the point of impracticability. This arrangement instantiated a decentralized process of systemic learning from experience in which there was no overriding personal authority, although reputational effects (which, in principle at least, reflected previous reliability) would mean that some assessments were more influential than others.

The access to widely distributed publication also played a large part in both fostering and constraining scientific entrepreneurship. Hypothesizing about scientific matters was certainly not a new activity in the 17th century, but its character changed with the new conception of knowledge and the new immediacy of exposure to criticism. Newton was famously dismissive of hypothesizing in the sense of loose speculation—"I feign no hypotheses" was the credo he added to the second edition of the *Principia*—and he insisted that scientific propositions be inferred from, and consonant with, the phenomena. Further constraining speculation was the acknowledged success of the use of mathematics for formulating coherent hypotheses, and this influenced the reception that published hypotheses met with in the scientific community. On the other hand, with the concepts of discovery and discoverer at play, there were rewards to be had for putting forward a viable hypothesis (and being the first to publish it), and this induced a competitive element into the process. For the first time in such an organized manner, scientific hypothesizing became the process of formulating anticipations of empirical phenomena based on an existing (and growing) base of knowledge,[48] an activity consistent with the age-old drive of curiosity but now hedged about with the possibility of both reputational costs and benefits.

With the new focus on experiment, both informal groups and, later, formally organized ones such as the Royal Society provided facilities where scientific experiments could be carried out. This, again, was the implementation of an entrepreneurial process, motivated of course by curiosity but also by the reputational rewards of discovery. Hypotheses (whether published or developed personally by the experimenter) can provide the rationale for experimental plans, but experimentation is neither a cost-free activity nor one certain of success, and so, given such constraints and likely faced with more hypotheses than can reasonably be addressed, a process involving selective judgement in the face of uncertain future outcomes is required. And again, the new institution of publication within the scientific community of results and hypotheses and the commentary on them is a vital innovation, for it provides considered reasons why particular hy-

potheses might or might not be confirmable and thereby reduces the inherent uncertainty of the selection process. The practice of vetting submissions for approval for publication (a process which has grown into the now-familiar refereeing procedure) was also a helpful element in the culling process.

The final components for completing this system of science, for adding a driving force to the closed cycle of social processes just described—investigation, assessment, anticipation, selection, investigation—and for imbuing the system with the propensity to grow, are to be found, respectively, in Oldenburg's innovation of ensuring credit to authors of publications, and in the societal attitudes promoted by Bacon through which scientific work came to be seen as a respected and valuable activity. There may be several motivations for a person to adopt science as a vocation, and possibly the major one—certainly the one most often cited by scientists themselves—is curiosity and the promise of pleasure in its satisfaction.[49] But reputation amongst one's peers is also a natural motivation, whether openly acknowledged or not, and is the criterion of success in science (even if sometimes, unfortunately, it is only achieved posthumously), and the explicit recognition of personal contribution (an innovation which has grown into the norm of citation) is crucial for grounding that motivation in a tangible form.[50] The new system of science thereby presented strong incentives for intelligent people to enter a profession which was socially valued and supported, and which offered realistic opportunities for pursuing satisfying endeavor and obtaining recognition of success. And shortage of work for a growing number of participants was not likely to be a problem—in stark contrast to a system of knowledge based on deductions from an authoritative source, a system in which knowledge is based on experiment is open-ended, as technological innovations stemming in part from that experimental activity allow for more and more extensive and finely detailed investigation of what is an effectively (and may be actually) infinite nature.

VII. SUMMING UP

The 17th century in Western Europe saw a significant phase change in social space, out of which emerged a new social order—the system of modern science—that was stable, closed and self-maintaining in its process structure (but open to the environment for material resources obtainable from a growing and liberalizing economy), and possessing an inbuilt propensity to grow.[51] The methodological, epistemological, ideological, and institutional innovations that were developed and adopted during that century combined to enable the formation of such an order. None of them was sufficient in itself, but together they provided the building blocks for a social arena in which people with an exploratory attitude, executing the procedures that formed the new arrangement, could pursue their interests with reasonable hope of some positive return. The success of this social arrangement has been such that, today, any discipline with pretensions to be scientific organizes its community of practitioners along the lines pioneered in the 17th century and first fully realized in the sciences of physics and astronomy.[52]

The characteristics of this new system of science suggest that it can be modeled as an anticipatory social system, a closed system of processes whose outputs include a structure which can serve as the system's internal model of itself and its environment and which can be updated based on internally assessed experience of the environment. The body of scientific knowledge—a mutable complex of current consensus assessments of theories and methods is that structure which serves as that internal model.[53] The hypotheses and judgments of scientific entrepreneurs (which are the anticipatory element of the system affecting its research propensities), the environmental feedback from investigations, and the assessments of hypotheses in the light of that feedback are all transmitted within the system by the agency of repeated publication and citation transactions through which scientists engage with each other.

It is only by conceiving of science as a system—in particular, as an anticipatory system—that the reason why the scientific and societal innovations of the 17th century were able to combine with such spectacular effect can be understood. Individual contributions, brilliant as they were, were not sufficient to produce such a lasting effect, just as they had not been in the past. Thinking in terms of systemic properties, such as knowledge, anticipation, and assessment, and differentiating them from their counterparts as properties of

individuals—certainly without denying the importance of the lower-level individual activities that produce these systemic properties—can have a very productive place in social theory. And the use of such "systems thinking" in understanding the phenomenon of the emergence and persistence of modern science is just such a case.[54]

NOTES

1 According to Cohen (1994, ch. 2), although the revolutionary character of the period was recognized as early as 1756 in d'Alembert's *Encyclopédie*, it was first Koyré (1939) and then Butterfield (1949) who gave the singular term currency with historians of science, even though the boundary dates, particularly the starting date, vary considerably from author to author. Wootton (2015), for example, picks Tycho Brahe's observation of a nova in 1572 as his starting date. But the idea has not been without controversy. Kuhn (1962) finds at least four separate revolutionary "paradigm shifts" in the 16th and 17th centuries, but in a later work Kuhn (1977, ch. 3) returns to the concept of a single scientific revolution as a paradigm shift but encompassing only the classical physical sciences. Shapin (1996, p. 1) cast scorn on the notion that any single event could initiate a decisive change in how natural knowledge was perceived or obtained. In the same skeptical vein, it has been questioned, for example by the historian Jan Golinski in 1988, as quoted by Cohen (1994, p. 499), "whether the notion of a coherent, European-wide, Scientific Revolution can survive continued historiographical scrutiny" as more detailed historical research has uncovered difficulties in explanations based on it. However, Cohen (2015), dealing explicitly with such difficulties, has developed a detailed and convincing account of the Scientific Revolution as a unique confluence of a specific series of developments during the 17th century.

2 An obvious omission from this list of "golden ages" is the European scientific Renaissance of the 16th century, triggered by the fall of Constantinople which enabled the release and subsequent translation of original Greek documents including, significantly, some works of Archimedes. Butterfield (1949) includes this period as part of the Scientific Revolution, dating its beginning at 1500. Maier (1949) considers the Renaissance (coupled with the earlier medieval European developments) as (p. 5) "the first stage of a grand development process of which the second and decisive stage falls in the 17th century". See also Maier (1982). For the purposes of this paper, it matters not whether the scientific developments of the 17th century constituted a separate revolution, marking a clear break from Renaissance thinking, as Cohen (2015) argues, or the second and final stage of a longer series of changes—what is important is that the 17th century developments were decisive in establishing a revolutionary new regime of scientific activity.

3 Cohen (2015, p. 26) dates the end of Greek science's golden age at the death of Hipparcus in about 150 BCE. He does not claim that there were no original Greek thinkers subsequent to this—Ptolemy and Galen in the 2nd century certainly stand out—but these were isolated cases. There were similar cases after the end of the other golden ages, but none of these represented a sustained revival in intellectual progress.

4 Cohen (2015, p. 263) is clear about the uniqueness of this revolution: "The enduring survival of the new nature-knowledge broke with all historical precedent. What we have become used to in our day, the unbroken growth of the scientific enterprise, is the big exception in world history and as such demands an explanation."

5 See, for example, Windelspecht (2001). Even contemporaries who were not scientists could see that a major revolution in scientific achievement was in progress—an example, quoted by Cohen (1994, p. 1), is the poet Dryden (1668), who (not without some exaggeration) asked "Is it not evident, in these last hundred years … that almost a new Nature has been reveal'd to us? that more errours of the School have been detected, more useful experiments in Philosophy have been made, more Noble Secrets in Opticks, Medicine, Anatomy, Astronomy, discover'd, than in all those credulous and doting ages from Aristotle to us?".

6 For example, to explain the fact that a pendulum bob does not stop at its lowest point, the notion of "impetus" acquired during the downswing was proposed, providing a mover for the upswing. Grant (1971) notes that, while problems like this were addressed, it was done piecemeal as disparate (and not necessarily consistent) amend-

ments within the Aristotelean system, and the system itself, with its top-down explanatory orientation, remained intact.

7 The classic case of such simulation was Ptolemy's ingenious astronomical model with its proliferation of epicycles, which provided a workable vehicle for prediction of planetary orbits. It maintained the ideal of circular motions in the heavenly sphere, while "saving the appearances" of irregular planetary motion.

8 In detailed and realistic anatomical rendering, Vesalius had an unpublished predecessor in Leonardo da Vinci, who made a series of drawings based on dissections in the early 1500s.

9 In Bacon's (1620, p. 28) words: "the real order of experience begins by setting up a light, and then shows the road by it, commencing with a regulated and digested, not a misplaced and vague, course of experiment, and thence deducing axioms, and from those axioms new experiments". Also (p. 36): "The true labor of philosophy … neither relies entirely or principally on the powers of the mind, nor yet lays up in the memory the matter afforded by the experiments of natural history and mechanics in its raw state, but changes and works it in the understanding." To get a feeling for the unworkability of his specific methodological recommendations, see his illustration (pp. 56-77) of the study of the various phenomena that he takes to be associated with heat (or the lack of it).

10 See Cohen (2015, pp. 129-135), who summarizes (p. 135): "In a gradual process around 1600, practically oriented, accurate observation is condensed into fact-finding experiment, where artifices are increasingly employed to force the manifestation of natural phenomena which would not have appeared of their own accord."

11 Kepler's Laws are: 1. The planets' paths are elliptical, with the Sun at a focus; 2. Each planet-Sun line moves over equal areas in equal times; 3. The ratio of the squares of the periods of any two planets is equal to the ratio of the cubes of their average distances from the Sun. The first two laws were published in Kepler (1609) and the third in Kepler (1619).

12 Galileo's desire to provide a mathematical description of motion arose from his study of the works of Archimedes. Although he failed in an attempt to apply Archimedean statics to the problem, he was able to surmount the difficulties with a more dynamic approach. See Rose (1975) and Cohen (1994, p. 284).

13 Galilei (1638) is a final summary by Galileo of his research. For extensive treatments of Galileo's work, see Koyré (1939) and (for an answer to Koyré's skepticism regarding the precision of Galileo's measurements) Drake (1978).

14 The *Principia Mathematica,* Newton (1687), contained the exposition of his "system of the world". His later work, Newton (1704), systematically followed the methodology of deducing mathematical generalizations from observation which were then subjected to experimental tests carefully designed both to confirm the generalizations and to exclude possible competing explanations. As he noted in his introduction (p. 7): "My Design in this Book is not to explain the Properties of Light by Hypotheses [i.e., loose speculation], but to propose and prove them by Reason and Experiments". For a comprehensive personal and scientific biography of Newton, see Westfall (1980).

15 See Kuhn (1977, pp. 41-46), who arranged the scientific disciplines of the 17th century into two clusters: the "classical physical sciences" such as astronomy and geometrical optics (to which he added the new study of motion), and the newly emerging "Baconian sciences".

16 Mokyr (2017, p. 105) puts this point forcefully: "Newton singlehandedly combined the deductive powers of mathematical modeling with Baconian stress on experimental data and observations, showing that the two were not only capable of coexisting in the same mind but could actually be complementary. The combination of his formidable mathematical and analytical skills with his continuous reliance on empirical and experimental data was regarded in his own day as a shining example that lesser scientists could only hope to mimic."

17 Ironically, Descartes' mode of theorizing—an overall conception based on unassailable principles from which local explanations can be deduced—is very reminiscent of that of Aristotle.

18 Cohen (2015, pp. 218-240) provides a compelling story of the activities of Huygens, Boyle, Hooke, and Newton in achieving an integration of the three different epistemological and methodological approaches to knowledge.

19 Ben-David (1971, pp. 40-41), a sociologist, placed much importance on the lack of societal legitimization as a reason for Greek scientific decline: "The newly differentiated role [of the independent scientist] was never given a dignity comparable to that of the moral philosopher. Independence from philosophy was a decline and not a rise in the status of the scientists. … [The] few astronomers, mathematicians, natural historians, and geographers who worked mainly in Alexandria were completely isolated from any general intellectual or educational move-

ment. [And so] specialized science lost its moral importance. … As a result, the role did not develop any further and, starting from the second century BC, scientific activity declined."

20 See Ben-David (1971, pp. 65-69) and Cohen (1994, pp. 367-374). For a quick summary of the economic, religious, and political changes that took place during the 16th century in Europe, see the article in Encyclopedia Britannica at https://www.britannica.com/topic/history-of-Europe/The-emergence-of-modern-Europe-1500-1648.

21 Ben-David (1971, pp. 65-66) emphasized the importance of these social developments, asserting that "fortunately for the development of science … there existed in Northern Europe a mobile class whose aspirations, beliefs, and interests—intellectually as well as economically and socially—were well served by the utopian claims made on behalf of science. … Thus, when the ebbing tide of science, which was receding from the scientific circles and academies of Italy, finally touched France and England, its direction was reversed." Merton (1938, pp. 453-454) emphasized the role of the English Protestant Puritans, asserting that "through the psychological sanction of certain modes of conduct [the Puritan ethos] made an empirically founded science commendable rather than, as in the medieval period, reprehensible or at best acceptable on sufferance. In short, Puritanism altered social orientations. It led to the setting up of a new vocational hierarchy, based on criteria which inevitably bestowed prestige upon the natural philosopher. … And one of the consequences of Puritanism was the reshaping of the social structure in such a fashion as to bring esteem to science." See also Ben-David (1985).

22 For a detailed discussion of Bacon as a "cultural entrepreneur", see Mokyr (2017, pp. 70-98). Bacon (1592, p. 216) was an impassioned and effective promoter of the promise of science: "Is not knowledge a true and only natural pleasure, whereof there is no satiety? Is it not knowledge that doth alone clear the mind of all perturbation? … But is this a vein only of delight, and not of discovery? of contentment, and not of benefit? Shall he not as well discern the riches of nature's warehouse, as the benefit of her shop? Is truth ever barren? Shall he not be able thereby to produce worthy effects, and to endow the life of man with infinite commodities?"

23 According to Ornstein (1913, p. 67): "Enthusiasm for experimentation and the widespread interest it aroused apparently led those devoted to science to enter into more or less formal affiliations. The rich and noble amateur devoted some of his wealth to gathering about him men who would jointly experiment and benefit by this collaboration. The professional scientist would become the center of people who joined him for instruction and whom he needed for assistance."

24 A fuller list of some of the major participants in these groups, and a good picture of the range of topics discussed, is contained in John Wallis's autobiography, in Scriba (1970, pp. 39-40).

25 Bacon (1626) set out his vision of a societal institution expressly dedicated to scientific documentation and research which he called "Saloman's House".

26 According to the Royal Society's website at https://royalsociety.org/about-us/history: "The very first 'learned society' meeting on 28 November 1660 followed a lecture at Gresham College by Christopher Wren. Joined by other leading polymaths including Robert Boyle and John Wilkins, the group soon received royal approval". Wren's lecture and the first meeting were in fact three years apart, as the following extract from the history of Gresham College, Chartres & Vermont (1998, pp. 30-32), makes clear: "In 1657, … Christopher Wren … gave his inaugural lecture as Professor of Astronomy. … Wren's inaugural lecture was also a kind of manifesto of the new science … Three years after this seminal lecture, the monarchy was restored and the scientific network which centred on Gresham College played a crucial part in the meetings which led to the formation of the Royal Society. The entry in the first journal book of the Society dated 28 November 1660 reads thus: 'These persons according to the usual custom of most of them met together at Gresham College to hear Mr. Wren's lecture. Robert Boyle, William Petty and others were there. After the lecture was ended, they did according to the usual manner withdraw for mutual converse. Where among other things that were discoursed of, something was offered about the design of founding a college for the promoting of physico-mathematico experimental learning.' There follows a discussion on the constitution and a great deal of time was spent on this subject."

27 Moxham (2016, p. 466) notes that the *Philosophical Transactions* "though widely acknowledged as the first scientific periodical, was intended by its founder as a commercial enterprise predicated on his privileged access to the latest natural-philosophical goings-on rather than an editorially neutral vehicle for presenting research in finished form". Nonetheless, Oldenburg did not himself make appraisals of any knowledge claims other than to accept

them for publication, and so (p. 478), by "bringing disparate communications on related subjects into one place Oldenburg helped to create, for highly interested commercial reasons, an ideal of disinterested communication".

28 For a survey of many priority disputes occurring during the 16th and 17th centuries, see Wootton (2015, pp. 112-119).

29 According to Merton (1957, p. 639): "To say that these frequent conflicts over priority are rooted in the egotism of human nature, then, explains next to nothing; to say that they are rooted in the contentious personalities of those recruited by science may explain part, but not enough; to say, however, that these conflicts are largely a consequence of the institutional norms of science comes closer, I think, to the truth."

30 In letters to Boyle in late 1664 discussing plans for the new journal, Oldenburg observed that "We must be very careful as well of regist'ring the person and time of any new matter, as the matter itselfe, whereby the honor of the invention will be reliably preserved to all posterity" and, further, that "all ingenious men will thereby be incouraged to impact their knowledge and discoverys". These letters are in the RS Archives—see https://en.wikipedia.org/wiki/Philosophical_Transactions_of_the_Royal_Society.

31 To get a good picture of the differences in content between these two journals, see Banks (2009).

32 For a detailed discussion of scientific societies, journals, and other publications in the 17th century, see Kronick (1962), and in particular (pp. 113-117) for a citing of the policies of non-attribution in society proceedings. The notion that discoveries should not be individually credited was probably a reflection of the influence of Bacon's urging that science should be an endeavor pursued for the common good of society. Prior (1954, p. 362), discussing Bacon's ideal conception of a man of science, notes that, for Bacon, "If the fatal sin against the canons of true science is pride, the all-embracing virtue is charity." But this ideal did not work well in practice—according to Middleton (1971, pp. 327-328), Borelli, a prominent member of the Accademia del Cimento, grew disenchanted with the sharing of credit and left the society, soon after which it disbanded. Ornstein (1913, p. 91) also refers to the "intense jealousies" which festered as a result of the credit-sharing policy.

33 It should be understood that the absolute authority of empirical data is an ideal. Scientists, for good reasons, will summarily reject apparently confirming observations and will decline to repeat them if the theory in question seems in their judgment to be highly implausible. Michael Polanyi (1967) explains this aspect of scientific behavior very clearly, with examples, and sums up as follows (p. 536): "A vital judgement practised in science is the assessment of *plausibility*. Only plausible ideas are taken up, discussed and tested by scientists. Such a decision may later be proved right, but at the time that it is made, the assessment of plausibility is based on a broad exercise of intuition guided by many subtle indications, and *thus it is altogether undemonstrable. It is tacit*."

34 One measure of the growth of science is provided by Bornmann & Mutz (2014, p. 2215), who report: "We have looked at the rate at which science has grown since the mid-1600s. In our analysis of cited references we identified three growth phases in the development of science, which each led to growth rates tripling in comparison with the previous phase: from less than 1% up to the middle of the 18th century, to 2 to 3% up to the period between the two world wars and 8 to 9% to 2012. For a survey of various ways in which measurement of the growth of science has been attempted, see Gilbert (1978).

35 The prestige of science in modern society is such that the *ad hominem* tagging of an intellectual opponent as a "science denier" packs significant emotional punch. Shapin (1995, p. 390) affirms this underlying trust in science itself: "The homage paid to science is best evident in the very existence of a public stock of formal natural knowledge. All those who believe that the earth goes around the sun, that DNA is the genetic substance, that there are such things as electrons, and that light travels at 186,000 miles per second are, by so believing, doing scientists honor. Nor is that honor restricted to blind acceptance. … Legitimate concerns over the 'use' and 'consequences' of scientific knowledge do not affect the honor paid to science: the very problems that science is said to generate flow from the recognition of its potency."

36 Cohen (1994) discusses in some detail the lack of longevity in the periods of scientific activity in Greece (pp. 241-260), in medieval Europe (pp. 260-267), in the Islamic world (pp. 384-417), and in China (pp. 439-482).

37 The following one-sentence descriptions of the views of various historians writing on the subject of the causes of the Scientific Revolution are obviously totally inadequate at capturing the detail, the nuance, and even the con-

tradictions of these views, but they are an attempt to capture what seems, admittedly subjectively, to be their most important point.

38 For a summary and comparative discussion of the contributions of Kant, Whewell, Mach, Dijksterhuis, Koyré, Burtt, Hall, Kuhn, and Westfall, with references to and quotations from their original works, see Cohen (1994, pp. 21-150). Also discussed are the contributions of Pierre Duhem, who located the birth of modern science in a 13th century proclamation by the Bishop of Paris allowing for some freedom in theorizing about the nature of the world, and who found in the impetus theory of Buridan and others in the 14th century a direct forerunner of the concept of inertia; Anneliese Maier, who contested Duhem's conflation of the ideas of impetus and inertia and regarded the Scientific Revolution as a gradual repudiation of Aristoteleanism occurring in two phases, a preliminary one in the 14th century and the decisive break coming in the 17th century; Herbert Butterfield, whose historical survey gave intellectual heft to the concept of "the Scientific Revolution" which he also, like Maier, regarded as a long process with a decisive phase initiated by Kepler and Galileo; and Auguste Comte, who proposed a stage theory of scientific development and identified the 17th century as the period in which the combination of Galileo and Bacon moved astronomy and physics into the "positive" stage in which quantitative mathematical laws were discovered.

39 For a summary and comparative discussion of the contributions of White, Hooykaas, Merton, Eisenstein, and Ben-David, with references to and quotations from their original works, see Cohen (1994, pp. 308-377).

40 See Cohen (2015, pp. 262-269).

41 See Maturana & Varela (1972), Bertalanffy (1928; 1968), and Rosen (1975; 1991). In Bertalanffy's (1968, p. 27) own words: "In the last resort, structure (i.e., order of parts) and function (order of processes) may be the very same thing: in the physical world matter dissolves into a play of energies, and in the biological world structures are the expression of a flow of processes." Rosen's (1991, pp. 119-120) short statement of his approach to understanding biological systems was "throw away the matter and keep the underlying organization … The organization of a natural system … is at least as much a part of its material reality as the specific particles that constitute it at a given time, perhaps indeed more so." For a good historical overview of the development of the role of process organization in biology, with references to the historical literature, see Mossio *et al.* (2016).

42 For detailed discussions of social norms, their contexts, their emergence, and their theoretical treatments in different disciplines, see Hechter & Opp (2001). A distinct, but very much related line of thought goes under the rubric of "spontaneous order", in which social arrangements are characterized as emerging and sustaining themselves, in the words of the Scottish Enlightenment philosopher Adam Ferguson (1767, p. 187), by "the result of human action, but not the execution of any human design". Adam Smith (1776, pp. 24-32, 484-485) deployed the idea in the context of markets, most famously with his metaphor of the "invisible hand", and Carl Menger (1870, pp. 257-285; 1883, pp. 139-159, 223-234) revived it with a number of applications, including the origin of money. The great exponents of spontaneous order theory in the 20th century were Michael Polanyi (1962) with reference to science, and Friedrich Hayek (1960; 1973) with reference to markets, the law, and liberal society in general. For detailed treatments of the development of spontaneous order theory see Barry (1982) and Hamowy (1987), and for an analysis and criticism of both Polanyi's and Hayek's treatments see Butos & McQuade (2017).

43 The concept of autopoiesis has been transplanted to several social disciplines, including sociology. See Mingers (1995) for summaries and critiques of these applications. An influential sociological application is Luhmann's (1984) theory of society as a whole as autopoietic communication, but this is pitched at such a high level of abstraction that it is difficult to see its usefulness in specific cases, although it has found some application in the area of law. For valiant attempts to clarify Luhmann's work, see Seidl (2004) and Mingers (1995). The social application of the concept in this paper stays clear of the difficulties that bedevil other attempts by limiting the analogy and clearly defining both the domain and the set of functional processes of the specific system involved.

44 In Rosen's (1991) terminology, the thermodynamic openness and functional closure of systems are referred to as "openness to material causation" and "closure to efficient causation" respectively, where "material" and "efficient" are two of the four Aristotelian causes. See also McQuade (2019).

45 Rosen (1975, pp. 53-61) sets out a general classification of types of adaptive—and anticipatory—systems in order of growing complexity.

46 The economist Hayek, who had originally trained as a theoretical psychologist, was one of the first to describe the functional aspects of the brain in these terms, showing how a mutable model of the environment could be maintained and updated within a complex neuronal structure and used to create dispositions for action in particular circumstances based in part on past experience. See Hayek (1952).

47 Rosen (1974) defined "anticipatory modes of behaviour of organisms … [as those] in which an organism's present behaviour is determined by: (a) sensory information about the present state of the environment; and (b) an 'internal model' of the world, which makes predictions about future states on the basis of the present data and the organism's possible reactions to it." See Rosen (1985) for a detailed mathematical treatment of anticipatory systems.

48 Polanyi (1967, pp. 540-541): "This is what the existing body of scientific thought offers to the productive scientist: he sees in it an aspect of reality which as such is an inexhaustible source of new and promising problems."

49 A Pew Research Center survey, posted online at https://www.pewresearch.org/fact-tank/2016/10/24/as-the-need-for-highly-trained-scientists-grows-a-look-at-why-people-choose-these-careers/ dated October 24, 2016, shows clearly that curiosity as to how the world works and the expectation that it can be satisfied (often planted in childhood by parents, teachers, and books) is given by a large majority of the scientist respondents as a motivating factor for their entering a scientific career.

50 Evidence that the desire for reputation is a strong driver motivating scientific activity is seen in the competitive behavior of scientists. In his study of scientific competition which focuses on the danger of being anticipated in a discovery, Hagstrom (1974, p. 3) notes that "competition is severe when being anticipated means losing all or nearly all recognition for one's work" and that (p. 8) "these results demonstrate the sensitivity of scientists to proper recognition of their work".

51 Stability and growth are not guaranteed, however, for science is an open system and not only is it dependent on the surrounding society for resources but also it requires that the surrounding society respect the integrity of its processes, for these are the geese that have laid the golden eggs of scientific knowledge. See Butos & McQuade (2006; 2012).

52 In fact, all modern academic communities are organized with a similar process structure. Where they differ is in the investigative process. For the sciences, this process operates as a probe of the environment from which the environmental responses are taken as strong evidence in assessments of hypotheses about the environment. It is the system's anchor to reality, and for the physical sciences in particular it holds tight. For sciences whose objects of study are complex systems—climate science and (even more so) economics, for example—the bottom is much sandier, and the interpretation of experiments and observations subject to correspondingly greater latitude. For the humanities, the grip may be even more tenuous, and the possibilities for restraint on speculation much more attenuated. Mathematics is a hybrid case in which investigations are often conditioned by findings in the well-anchored sciences, but in which internal conceptions of what is interesting are also operative. The differences in the perceived "progressive" nature of the various academic disciplines seem to be strongly correlated with the extent of the attachment of the system's anchor—its mode of probing its environment—to real phenomena and to the definitiveness of the results obtained. In the case of the social sciences, this observation would support Hayek's (1967, pp. 22-42) analysis of the difference between natural and social sciences in terms of "the degree of falsifiability" of proposed facts as opposed to a fundamental difference in the structure and procedures of the two groups of sciences. But an alternative viewpoint, one stressed by Mises (1949, pp. 39-41) and bolstered by Hayek (1948, pp. 57-76), is that the problem with the social sciences lies in the widespread application of the method of the natural sciences to the social sciences, due to a lack of recognition of fundamental differences between the nature of the relevant facts in the two domains.

53 There is no implication here that the body of scientific knowledge will always grow in a uniform way as more and more of the environment is probed. The very nature of its construction—based on consensus assessments of sensed phenomena and their posited explanations in the light of previous consensus positions—is that of a layered structure in which additions and changes tend to be concentrated in the outer layers. Questioning deeper consensus positions risks reputational costs, but if successful not only are reputational gains realized but outer layers of knowledge which were built on the now-discarded position must be reassessed and a new overall consensus formed. This is consistent with the alternation of periods of "crisis" with long periods of growth and con-

solidation described by Kuhn (1962) and others. For a discussion of this and other issues in the philosophy of science—including constrained relativism, antifoundationalism, underdetermination, theory-ladenness, and incommensurability—from the point of view of science as an adaptive system, see McQuade (2010).

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REFERENCES

Bacon, F. 1592. In praise of knowledge. In: *The works of Lord Bacon, vol. 1* (1874), pp. 216-217. London: Henry G. Bohn.

_____. 1620. *Novum organum, or true suggestions for the interpretation of nature*. J. Devey ed. (1902). New York: Collier. http://oll.libertyfund.org/title/1432.

_____. 1626. *New Atlantis, a worke unfinished*. Rep. by Project Gutenberg (2000). https://www.gutenberg.org/files/2434/2434-h/2434-h.htm.

Banks, D. 2009. Starting science in the vernacular: notes on some early issues of the *Philosophical Transactions* and the *Journal des Sçavans*, 1665-1700. *ASp. La revue du GERAS* 55: 5-22.

Barry, N. 1982. The tradition of spontaneous order. *Literature of Liberty* 5(2): 7-58. http://www.econlib.org/library/Essays/LtrLbrty/brytSOCover.html.

Ben-David, J. 1971. *The scientist's role in society: a comparative study*. Englewood Cliffs and London: Prentice Hall.

_____. 1985. Puritanism and modern science: a study in the continuity and coherence of sociological research. In: I. B. Cohen ed., *Puritanism and the rise of modern science: the Merton thesis* (1990), pp. 246-261. New Brunswick: Rutgers University Press.

Bertalanffy, L. 1928. *Kritische Theorie der Formbildung*. Gebrüder Borntraeger. Tr. and adapted by J. H. Woodger, *Modern theories of development: an introduction to theoretical biology* (1933). Oxford: Oxford University Press.

_____. 1968. *General system theory: foundations, development, applications*. New York: George Braziller.

Bornmann, L. & R. Mutz. 2014. Growth rates of modern science: a bibliometric analysis based on the number of publications and cited references. *Journal of the Association for Information Science and Technology* 66(11): 2215-2222.

Butos, W. N. & T. J. McQuade. 2006. Government and science: a dangerous liaison? *The Independent Review* 11(2): 177–208.

_____. 2012. Nonneutralities in science funding: direction, destabilization, and distortion. *Journal des Economistes et des Etudes Humaines* 18(1), article 4.

_____. 2017. Polanyi, Hayek, and adaptive systems theory. *Cosmos + Taxis* 4(1): 1-22.

Butterfield, H. 1949. *The origins of modern science 1300-1800*. Rev. ed. (1965). New York: Free Press.

Chartres, R. & D. Vermont. 1998. *A brief history of Gresham College 1597-1997*. Bury St. Edmunds: St. Edmundsbury Press.

Cohen, H. F. 1994. *The scientific revolution: a historiographical inquiry*. Chicago: University of Chicago Press.

_____. 2015. *The rise of modern science explained: a comparative history*. Cambridge: Cambridge University Press.

Drake, S. 1978. *Galileo at work: his scientific biography*. Chicago: University of Chicago Press.

Dryden, J. 1668. Of dramatic poesie: an essay. Henry Herringham. In: M. Summers ed., *Dryden: the dramatic works, vol. 1* (1932, p. 12). London: Nonesuch.

Ferguson, A. 1767. *An essay on the history of civil society* (1966). Edinburgh: Edinburgh University Press.

Galilei, G. 1638. *Discorsi e dimostrazioni matematiche intorno a due nuove scienze*. Appresso gli Elsevirii. Tr. H. Crew & A. de Salvio, *Dialogues Concerning Two New Sciences of Galileo Galilei* (2015). Mansfield Centre CT: Martino Publishing.

Gilbert, G. N. 1978. Measuring the growth of science: a review of indicators of scientific growth. *Scientometrics* 1(1): 9-34.

Grant, E. 1971. *Physical science in the Middle Ages*. Hoboken: John Wiley & Sons.

Hagstrom, W. O. 1974. Competition in science. *American Sociological Review* 39(1): 1-18.

Hamowy, R. 1987. *The Scottish Enlightenment and the theory of spontaneous order*. Carbondale: Southern Illinois University Press.

Hayek, F.A. 1948. *Individualism and economic order* (1972). Chicago: Henry Regnery.

_____. 1952. *The sensory order*. Chicago: University of Chicago Press.

_____. 1960. *The constitution of liberty*. Chicago: University of Chicago Press.

_____. 1967. *Studies in philosophy, politics, and economics*. Chicago: University of Chicago Press.

_____. 1973. *Law, legislation and liberty*, vol. 1: *Rules and order*. Chicago: University of Chicago Press.

Hechter, M. & K.-D. Opp (eds.). 2001. *Social norms*. New York: Russell Sage Foundation.

Kepler, J. 1609. *Astronomica nova*. Tr. W. H. Donahue as *New Astronomy* (1992). Cambridge: Cambridge University Press.

_____. 1619. *Harmonices mundi*. Tr. E. J. Aiton, A. M. Duncan, & J. V. Field as *The Harmony of the World* (1997). Philadelphia: American Philosophical Society.

Koyré, A. 1939. *Études Galiléennes*. Hermann. Tr. J. Mepham as *Galileo Studies* (1978). New York: Humanities Press.
Kronick, D. A. 1962. *A history of scientific and technical periodicals: the origins and development of the scientific and technological press, 1665-1790*. New York: Scarecrow Press.
Kuhn, T. S. 1962. *The structure of scientific revolutions*. 4th ed. 2012. Chicago: University of Chicago Press.
_____. 1977. *The essential tension: selected studies in scientific tradition and change*. Chicago: University of Chicago Press.
Luhmann, N. 1984. *Sociale Systeme: Grundrifß einer allgeminen Theorie*. Tr. J. Bednarz Jr. & D. Baecker as *Social systems* (1995). Redwood City: Stanford University Press.
Maier, A. 1949. *Die Vorläufer Galilei im 14 Jahrhundert*: *Studien zur Naturphilosophie der Spätscholastik*. Edizioni di Storia E Letteratura. Selected extracts tr. in Cohen (1994, pp. 56-59).
_____. 1982. *On the threshold of exact science: selected writings of Anneliese Meier on late medieval natural philosophy*. Tr. S. D. Sargent. Philadelphia: University of Philadelphia Press.
Maturana, H. & F. Varela. 1972. *Autopoiesis and cognition: the realization of the living*. 2nd ed. 1980. Dordrecht: Reidel.
McQuade, T. J. 2010. Science and *The Sensory Order*. In: W. N. Butos (ed.), *Advances in Austrian Economics 13: The social science of Hayek's "The sensory order"* (pp. 23-56). Bingley: Emerald.
_____. 2019. Organization, anticipation, and closure in markets and science. *Cosmos + Taxis* 6 (6+7): 1-18.
Menger, C. 1870. *Principles of economics* (1950). Tr. J. Dingwall & B. F. Hoselitz. New York: The Free Press.
_____. 1883. Problems of economics and sociology (1963), Tr. F. J. Nock. Champaign: University of Illinois Press.
Merton, R. K. 1938. Science, technology and society in seventeenth century England. *Osiris* 4: 360-632.
_____. 1957. Priorities in scientific discovery: a chapter in the sociology of science. *American Sociological Review* 22(6): 635-659.
Middleton, W. E. K. 1971. *The experimenters: a study of the Accademia del Cimento*. Baltimore: The Johns Hopkins University Press.
Mingers, J. 1995. *Self-producing systems: implications and application s of autopoiesis*. New York: Plenum Press.
Mises, L. 1949. *Human action* (1998). Auburn: The Ludwig von Mises Institute.
Mokyr, J. 2017. *A culture of growth: the origins of the modern economy*. Princeton: Princeton University Press.
Mossio, M., M. Montévil, & G. Longo. 2016. Theoretical principles for biology: organization. *Progress in Biophysics and Molecular Biology* 122(1): 24-35.
Moxham, N. 2016. Authors, editors and newsmongers: form and genre in the Philosophical Transactions under Henry Oldenburg. In: J. Raymond & N. Moxham (eds.), *News networks in early modern Europe*, pp. 465-492. Leiden: Brill.
Newton, I. 1687. *Philosophiæ naturalis principia mathematica*. Tr. A. Motte as *The mathematical principles of natural philosophy* (1729). London: Benjamin Motte.
_____. 1704. *Opticks: or, a treatise of the reflexions, refractions, inflexions and colours of light*. (2011), 4th ed. Digireads. com.
Ornstein, M. 1913. *The rôle of scientific societies in the seventeenth century*, 3rd ed. (1938). Chicago: University of Chicago Press.
Polanyi, M. 1962. The Republic of Science. *Minerva* 1: 54-74.
_____. 1967. The growth of science in society. *Minerva* 5(4): 533-545.
Prior, M. E. 1954. Bacon's man of science. *Journal of the History of Ideas*, 15(3): 348-370.
Rose, P. L. 1975. *The Italian renaissance of mathematics: studies on humanists and mathematicians from Petrach to Galileo*. Geneva: Droz.
Rosen, R. 1974. Planning, management, policies and strategies: four fuzzy concepts. *International journal of general systems* 1: 245-252.
_____. 1975. Biological systems as paradigms for adaptation. In: R. H. Day & T. Groves (eds.), *Adaptive economic models*, pp. 39-72. Amsterdam: Academic Press.
_____. 1985. *Anticipatory systems: philosophical, mathematical & methodological foundations*, 2nd ed. (2012). Berlin & Heidelberg: Springer
_____. 1991. *Life itself: a comprehensive inquiry into the nature, origin, and fabrication of life*. New York: Columbia University Press.
Scriba, C. J. 1970. The autobiography of John Wallis. *Notes and records of the Royal Society of London* 25(1): 17-46.
Seidl, D. 2004. Luhmann's theory of autopoietic social systems. *Munich Business Research* (2004-2). https://www.zfog.bwl.uni-muenchen.de/files/mitarbeiter/paper2004_2.pdf.
Shapin, S. 1995. Trust, honesty, and the authority of science. In: R. E. Bulger, E. M. Bobby, & H. V. Fineberg (eds.). *Society's choices: social and ethical decision making in biomedicine*, pp. 388-408. Washington DC: National Academy Press.
_____. 1996. *The scientific revolution*. Chicago: University of Chicago Press.
Westfall, R. S. 1980. *Never at rest: a biography of Isaac Newton*. Cambridge: Cambridge University Press.
Windelspecht, M. 2001. *Groundbreaking scientific experiments, inventions, and discoveries of the 17th century*. Santa Barbara: Greenwood.
Wootton, D. 2015. *The invention of science: a new history of the scientific revolution*. New York: HarperCollins.

Identity and Conservation

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The twenty-first century, particularly throughout its second decade and continuing into its third, has seen the notion of 'identity' in the Western World come to the forefront of many social and political conversations. What precisely is meant by this concept, however, often remains unclear or even contradictory. One of the more common discussions in which we hear this term is in connection with what is often called 'identity politics' wherein various aspects of people's identities are considered within a given social context and political implications are drawn forth from those claims; in the case of North America, this most often presents itself as issues surrounding a conflict between different ethnicities, between the sexes, or between various forms of sexual identities. Strict categories are drawn and then a conflict between the categories is problematized. On the other hand, however, there is striving to posit and construct identities in a way that suggests nothing more than that identity is that which someone *wills*. There is no solid foundation in this conception, which posits that the volition of individuals is all that is constitutive of identity.

Of course, day-to-day discourse on these subjects is often quite simplistic and quickly demonstrated to have internal inconsistencies that cannot be sustained, but to say that these views are only held vaguely by a few people would be misleading. This confusion is also seen within academic discourse: the most salient example which comes to mind is that of Judith Butler and her view of gender identity as 'performative.' Over three decades ago, Butler argued that gender was nothing more than a performance, akin to that of actors upon a theatrical stage, which becomes concretized in social taboos and norms which become oppressive and contrary to freedom. This view has, needless to say, many perplexing dimensions. The first is that she desires to dismantle what we mean by 'man' and 'woman' by showing that such notions of gender are historically situated and therefore not intrinsic, but then simultaneously seeks to maintain those labels for her theory—a tension she seemingly notes herself but never addresses. The second and, in my view, more distressing aspect of her argument is that she provides no understanding of what identity is in itself; she provides no consideration of its purpose, the context in which it emerges, or why identities do need to be concretized in some manner. The closest she comes is acknowledging that people are historically conditioned, but never explains why that history would emerge other than vaguely gesturing towards oppression and power.

The prevalence of this topic and its subsequent confusions has led me to desire a more substantial and thorough investigation of what precisely identity is and

what it means to possess one. Where do our identities come from? Why are they important? How does one maintain his identity? These concerns led to the reading of a perhaps unlikely source: the English philosopher and political theorist, Michael Oakeshott. Though identity is surely not something which Oakeshott spends a considerable amount of time discussing in detail, we can gain a complex and thoughtful understanding of what identity is through reading both his original philosophic text, *Experience and Its Modes*, and his essay entitled, "On being conservative." In his former work, he established the milieu in which men act out their lives; in the latter, he establishes the need for identity and how we come to have our various identities. As opposed to a notion of identity as something which is merely immutable as it is in identity politics or as something which is merely *willed* as suggested by those who believe we can construct ourselves however we please, Oakeshott offers a much simpler and grounded view. *Oakeshott understands identity as a learned manner of living that allows for an enacted constancy within the flux of an ever-changing world; it is, therefore, a conserved practice that allows us to find a home and continuity despite the dynamic cosmos we inhabit.* He is aware that the world is contingent and subject to change, both due to human volition and from changes beyond human volition, but he also understands that this flux is precisely why identity cannot be merely treated as something to be flippantly cast-off, based on what we may will in one moment then another.

To consider his view, we must first understand what Oakeshott calls the 'practical mode' of experience within which he believes human beings pass their lives; practice begins to take shape from this description of the human condition and the needs of the active human being come into focus. From within the practical mode, Oakeshott then establishes why the human condition calls for a steady identity, not as something merely posited or eternally immutable, but as a continuous string of contingencies that allow for people to get along agreeably within the vast and fluctuating cosmos. He does not prescribe particulars as he is sensitive to the plurality of the human condition and the many shapes it may take, but he nevertheless provides an explanation of the attitude necessary for identity to take shape: a conservative disposition. It is only from such a mindset that one may come to love his world and want to maintain it, despite that he understands that it is not ultimately true or perfect in any manner suggestive of eternal truth. His love is for that which is familiar, conserved due to its already-being-known, allowing for the world to become not a chaos of terror or dread but a place where we are allowed to get on well enough to find joy and delight.

To understand the purpose and place of identity in Oakeshott's thought, a preliminary exploration of his modal conception of experience must be considered. In his view, identity is something restricted to what he calls the 'practical mode' of experience, but this view cannot be understood without touching upon Oakeshott's philosophy as elucidated in his seminal text, *Experience and Its Modes*. His philosophical approach is quite radical, to the point that its viability could even be questioned, but it nevertheless provides insight into how Oakeshott understands truth and other lesser forms of experience such as practice. For Oakeshott, philosophy pursues an understanding of experience in its totality and is ultimately the only way to substantiate truth in an absolute manner; however, he believes that there are 'modes' present within experience that, being lesser than philosophy, provide a modified form of experience that is less demanding to navigate. For the purposes of this discussion, I focus on disentangling philosophy and the practical mode, as the latter is the mode that Oakeshott believes is most common to man as well as the mode in which we find our need for identity.

Oakeshott's philosophy, though not reducible to its time and place, emerges from a specific historical context that deeply influenced his approach. The nineteenth and early twentieth centuries were dominated by philosophies that could be described as fundamentally "historicistic," "scientistic," or "pragmatistic." Each of these three positions holds that the totality of experience can be explained from a single vantage point: that of history, science, or practice, respectively. *Experience and Its Modes* is, at its core, a repudiation of these views. Oakeshott's express aim is to explain why history, science, and practice are insufficient explanations for the whole of reality as they cannot substantiate their own activity, though they are legitimate forms of activity and should not be dismissed. To do this, he provides a rough sketch of what

he considers to be the character of philosophic experience before using this view to reject the alternative "philosophies" he is considering.

Oakeshott's philosophical enquiry, directed toward understanding experience without any modifications, presuppositions, or divisions, begins by analyzing what he understands as "experience" in its totality. What this term signifies is not merely the subjective experience of an individual agent within experience, but all that *could* be within experience in a *holistic* manner. What Oakeshott outlines is not a sense of personal experience trying to take in the whole of 'external' or 'objective' reality. Like other idealist philosophers, Oakeshott is instead interested in collapsing such notions as the 'subject' and the 'object,' or the 'experiencer' and the 'experienced.' The notion of experience, which he argues philosophy aims to achieve, breaks down all such binaries, leaving nothing outside of the coherence produced; this creates what many idealists have referred to as the "concrete whole" of experience of which there is nothing outside or left unconsidered.

Oakeshott's philosophical view, therefore, provides no possibility of understanding something in total abstraction from the rest of experience. The mere perception of a book does not qualify such as an absolute truth claim, and instead, such a truth claim requires the perception to be qualified within the whole of experience in which the identification of the book is made. This is the simplest definition of how Oakeshott understands philosophic truth: *holistic coherence*. For Oakeshott, truth is the whole of experience being reconciled to itself; "truth…is correlative to experience. It is the world of experience itself in so far as that world is satisfactory in itself." This means that particular claims always must be considered in light of the whole world to which they contribute, and the whole world must be understood as comprising many interlocking parts—to leave this behind is to leave behind an aspect of experience which is always counter-productive to the philosophic desire for holistic coherence.

This leads to Oakeshott's view that truth is based on the interdependent relationships of various parts which comprise a whole. Within the whole of experience, "particular ideas may perhaps be said to be known in experience as the products of analysis and abstraction." Oakeshott's phrasing here is important: what is perceived as particular is a *product* that is born of *analysis and abstraction*, meaning that a certain kind of thought must modify what is present in experience. Though it may appear that experience begins with particularized observations, Oakeshott argues that "we begin…with a world of ideas; the given is neither a collection, nor a series of ideas, but a complex, significant whole. Behind this there is nothing at all." At first, the given whole is mysterious and unexamined—but it is nonetheless whole. As aspects of this mysterious whole are then analyzed and abstracted, the nature of the whole is gradually revealed, becoming more consciously concrete: "to modify the system as a whole is to cause every constituent to take on a new character; to modify any of the constituents is to alter the system as a whole." These subtle reformulations of the subject at hand, both in its totality and its details, continuously allows for a more complete understanding. The mysteriousness of the world as initially encountered gives way to a more concrete world. This is the continuous effort of the philosophic impulse.

Oakeshott's notion of philosophy thus summarized indicates what he believes the core focus of philosophy to be; however, there is a secondary aspect to philosophy which is that it is also the voice within which one speaks when he elucidates the frameworks that are present in other modes of experience—the most prevalent being, in Oakeshott's view: practice, science, history, and poetry. This is curious as his conception of philosophy as a form of total experience seems to eliminate the possibility for other kinds of experience or knowing—if it encapsulates everything, what else could be known? Oakeshott acknowledges, however, that "diversity no less than unity appears in experience." He is able to maintain this claim and his theory of philosophy by arguing that the modes are not altogether separate from philosophy or separate from one another in the sense of them being some sort of 'nonoverlapping magisteria.' Instead, the modes are modifications of that holistic and coherent notion of philosophic activity, meaning that they are forms of experience that assume various presuppositions that are not justified by the modes themselves, but which grant them a relatively independent form of experience. These other modes of experience, therefore,

maintain the key aspects of truth as defined by philosophy: coherence and completeness, insofar as those are possible despite the modifications that each mode presupposes.

As stated above, I only explore this notion of modality through consideration of the practical mode for the purposes of my present discussion. Nevertheless, it should be acknowledged that there are three other modes besides practice that Oakeshott considers at length: science, history, and poetry. Oakeshott sees each of those three modes as excursions; they are intellectual achievements that have little bearing on the day-to-day life of men and are therefore rarely ventured into—perhaps never ventured into by some people. They are not excursions, however, from philosophy—they are only modifications of philosophy. The other modes are only considered excursions from the standpoint of the practical world of ideas, as Oakeshott believes it is the most common to man; in some sense, it is the mode of living as humanity knows it, and "unless we make some conscious effort to step outside, it is within this world that we pass our lives." It is, therefore, considered the concrete form of experience by many thinkers—as if to be practical is to experience reality as it truly is. Given Oakeshott's view of philosophy, however, we may expect that he will reject such a position of practical truth being synonymous with philosophical truth. In reviewing his definition of practical activity, Oakeshott's view of it as merely a mode of experience becomes self-evident.

At the broadest level, Oakeshott describes practical activity as experience in which "the alteration of existence is undertaken. Practical life comprises the attempts we make to alter existence or to maintain it unaltered in the face of threatened change." Oakeshott does not shy away from the fact that this notion of practice has wide implications; what Oakeshott is discussing here is not merely a set of moral rules, nor those things which are typically viewed as significant aspects of life such as family, jobs, and finances. "Practice comprises everything which belongs to the conduct of life as such," as it must be maintained as a coherent world of ideas in which all particulars affect one another and the whole world to which they contribute. A set of moral dictates or the highlights of what we are concerned with in day-to-day life are not exhaustive of our experiences, as there are many micro-happenings perpetually at play in our lives that are necessary for what may concern us self-consciously. Practice, as Oakeshott considers it, is the definitive form of experience for us human beings—stumbling around in a cosmos far greater than ourselves in an effort to understand what it means to live at all.

This is indicative of the first presupposition that is inherent to the world of practical activity: individual volition. Oakeshott refers to practical experience as "*sub specie voluntatis*," or 'under the form of will.' This necessitates that there be at least one self—though there are always presumably more—within the world of practice who possesses volition and causes changes within the world he inhabits and is, in some sense, distinct from said world. It is important to note that such "individuals are designated, not defined," meaning that this notion of the individual is presupposed and cannot be justified internally by the practical mode. Oakeshott points out that for the volitional individual to question his own legitimacy as a being who possesses a will would contradict the very foundation of practical experience; in so doing, he has left the world of practice and must engage in a different sort of experience, most likely that of philosophy. The individual must consider his own will as self-evident if he is to act practically. Having established the necessity of volition for practice, it must be asked how this agent engages in practical activity: what is necessarily implied by a world of change?

Oakeshott argues that the existence of volition, of an individual who can change his world from within, necessitates two other presuppositions: the world of 'what is' and the world of 'what ought to be.' The volitional individual must consider both his world as it is and the world as he desires it to be, and these two conceptions must have a relative degree of autonomy; he first considers the world as it presently exists in order to find his place in it and must then consider his world as he wants it to become. Now, though Oakeshott does refer to both of these concepts as worlds, I believe it is more effective to consider them as 'sub-worlds.' The reason I make this distinction is that the realm of practical experience is itself a single world comprised of these two sub-worlds: "Practice is the alteration of one given world so as to make it agree with another given world. And it is, therefore, qualified and governed at every step by the character of the two worlds it presupposes and the character of the alteration it attempts." Conversely, the two sub-

worlds of 'what is' and 'what ought to be' become nothing more than "vicious" abstractions in the absence of one another. The practical world allows for a dynamic interplay between the two sub-worlds to create a coherent and relatively complete world of activity; each sub-world, however, cannot be made sense of without the invocation of the other—the world of 'what is' stagnates when taken on its own and the world of 'what ought to be' has no foundation from which to begin if taken by itself.

These three presuppositions—designated volition, the world of 'what is,' and the world of 'what ought to be'—comprise the character of the world of practice. If any one of these three presuppositions collapses, the other two must go as well. In the absence of a volitional individual, there is no agent to consider the present and how it may change; without the world of 'what is,' there is no basis from which the volitional individual may incite change; and, without the world of 'what ought to be,' the present must be taken as the whole of experience and volition becomes impossible. What is considered true within the world of practice is, therefore, the maintenance of a relatively coherent and holistic manner of living that the volitional individual maintains between the world as it is and the world as it could be. Now, in some sense, to have identified this balanced trio of presuppositions is to have understood the character of practical activity in Oakeshott's view. I believe, however, that there are two further points that can be drawn out from these observations that help elucidate Oakeshott's connection between identity and conservation: the observation of a beginning and end for each volitional individual and the malleability of what is 'true' for each individual as he passes from birth to death.

Oakeshott argues that practical life is something naturally thrust upon mortal humanity and thus the circumstance of human life is defined by change; aging and death are inevitable though their precise movements and details are, to some degree, malleable by human volition. The human condition is thus one of seeking reconciliation of the self with the inevitability of change. Insofar as a volitional individual can maintain an understanding of his world as it is alongside the world as he would like it to be, he continues to live in a manner that can be called practically 'true.' The truth can, therefore, change for a man from one moment to another without outright invalidating how he once lived. What is true for a man in his twenties may not be precisely true for the same man in his seventies; his younger self may have not hesitated when anticipating the sixty-hour workweek, while his older self could handle little more than resting in a chair and reading a book. What holds perpetual for this form of experience, however, is that there is always the world of what ought to be; and "so long as the future is an essential element of practical appraisal, coherence has eluded us; we are never without unrealized ideas."

Oakeshott foresees that this is a view many people will find difficult to accept; people tend to understand what is factual in a static manner, as in the way that "scientific and historical experience presuppose a world of fact which does not change or move." The fact that the molecular structure of water is understood as H_2O must always remain true or it must be overturned and deemed to have only ever been mistakenly thought of as true; though we think that President Lincoln was shot and killed by John Wilkes Booth, if this was proven untrue it means that we were once simply in error about that fact. If something is deemed to be scientifically or historically untrue presently, it is also asserted that it was always untrue, and we were only mistaken about the factual nature of a given idea. Practice, on the other hand, does not function in this manner. Invoking his understanding of truth once more, Oakeshott argues that truth is found in particulars when they are in accord with the world of ideas to which they contribute; in other words, "what is [a] fact in practical experience is, in the end, the world of practical experience as a coherent whole." The particularity of the young man may not accord in its details with his life of retirement to come, but the manner in which he traverses that journey from youth to wisdom can be considered greater or lesser insofar as it is a coherent continuation of experience.

This means that, for Oakeshott, there can be no static 'answer' to the questions of practical life. It is a world characterized by change, but it is not a sort of change that has a destination. Unlike the worlds of science and history, practice does not seek to generate a 'factual' world that is, theoretically, static and immortal. To seek a sort of truth in practice that is akin to the truths of history or science is to confuse what is being pursued in the first place—a confusion which Oakeshott believes plagues the "modern mind."

The volitional individual, the sub-world of 'what is,' and the sub-world of 'what ought to be' are always necessary for the world of practical ideas. As soon as a desirable 'what is' is realized, "a new discord springs up elsewhere, demanding new resolution, a fresh qualification of 'what is here and now' by 'what ought to be'." It is these characteristics that make the nature of practical experience ultimately unsatisfactory as, in Oakeshott's view, its necessary trio of presuppositions—the self, the world as it is, and the world of what ought to be—are never able to be utterly reconciled to one another to allow for ultimate coherence. Nevertheless, Oakeshott maintains that it is the mode in which we move from birth to death, containing all we do, hopefully with as much grace as possible.

Having considered this distinction between philosophy and practice in Oakeshott's view, we can return to our main concept under consideration: identity. For all philosophers, the notion of identity must ultimately be the same: to be one with the absolute whole of experience. For a philosopher to be explicitly identified with anything else—meaning something within the whole of experience—would *ipso facto* cause him to pursue something lesser than the whole and no longer follow his philosophic impulse in full. Every philosopher, therefore, has but one identity which, I believe, we have been aware of since the teachings of Plato: a lover of wisdom. But to only ever love wisdom is not the way in which man lives his life, as "a man cannot be a philosopher and nothing else; to be so were either more or less than human." To live philosophically is to leave the cave, to find oneself in direct confrontation with the source of all light and Being; but to do this also destroys the particularity that we find relevant to the human condition, and it is only in practical life that man learns to be himself—to discover an identity that transforms the vicissitudes of this life from a prison-sentence into a joyful delight.

Experience and Its Modes is, fundamentally, a philosophic text. It is written from the standpoint of philosophy and therefore does not discuss *how* one acts practically in detail, but rather elucidates the *why* in considering the presuppositions that undergird practical activity. This does, perhaps, mark Oakeshott as somewhat anomalous within Western thought, as he believes that "philosophy is without any direct bearing upon the practical conduct of life, and that it has never offered its true followers anything which could be mistaken for a gospel." What he is acknowledging is that the much simpler and contingent nature of human goings-on do not have the same eternal status, solidity, and reality as do philosophical claims: man is no god, and man must therefore live in accord with principles not predicated directly upon eternal truth, though he may be informed by such truth. Regardless of whether we agree with this claim, it is essential to note that Oakeshott takes this distinction seriously and his thought follows accordingly. When we turn to *Rationalism in politics and other essays*, we find that Oakeshott is no longer speaking in his philosophic voice but has instead shifted into a practical idiom as he considers political activity, education, and the day-to-day life of human beings. He writes, therefore, not as someone attempting to establish foundational claims about experience but is instead interested in how we deal with our contingent reality and its various implications for living well.

In the former section, through reviewing Oakeshott's notion of practical experience from a philosophical perspective, I argued that the main mode of experience human beings exist within is a world characterized by change; however, there are three critical claims that he provides in "On being conservative" that further flesh out the world of practice from within that modified form of experience. The first is that the world of practice contains many conditions that we are obligated to contend with as we are born into a context where a rich complexity of happenstances is already in motion; no one is responsible for all that is given in our immediate world of practice, but it is also one in which we all engage and to which we all contribute. The identities we develop are thus outcomes of and reactions toward the world in which we exist—they cannot simply be dreamt up, nor will they have something of an eternal status, though they can be more or less enduring. The second, which emerges from the first, is that much of practical life is not exactly 'chosen' in any decisive sense, but is better thought of as 'given'—we simply adopt the given and adapt to it, doing so in ways we may consider conservative or innovative. Men are within a continuum of contingencies, bound together and chronologically conditioned though not determined; identity is that

which we appropriate and subsequently develop to surf this wave of contingencies with some semblance of grace, perhaps even doing so in a way which provides a similar even keel for those around us.

The third claim, which is perhaps Oakeshott's most enlightening in the essay, is a distinction that he makes between "change and innovation: change denoting alterations we have to suffer and innovation those we design and execute." In this sense, innovation is a form of change, but it is those forms of change that are generated directly by human volition—albeit, this is not restricted to what is self-consciously intended. On the other hand, there are many aspects of the human condition which are not the direct outcomes of any human act. This more fundamental notion of change is understood by Oakeshott as those aspects of life which are, by and large, beyond our control; if no person were to act, such changes would go on of their own accord. No one escapes aging, the sun sets and rises each day, and the grass will continue to grow—we might even say that "changing—themselves and their world—*is* what human beings *are*." Though it is true that people may take care of themselves to slow aging, invent their own notions of time so as to not be entirely ruled by the sun, or they can mow their lawn to keep it pristine, the changes beyond humanity's control are nevertheless accepted, and people will only ever abate the ramifications of such inevitable occurrences. Change is thus, in some sense, inevitable; whereas innovation, though highly likely and often even warranted, is not something that is constant within practice.

Considering how dynamic and fluid this understanding of practical life is, Oakeshott believes that human beings require a sense of stability that allows them to navigate the world: in short, men need a continuous identity. What is meant by 'continuous' is not the invocation of any transcendent principle or an appeal to some notion of 'human nature.' Instead, Oakeshott argues that "a man's identity (or that of a community) is nothing more than an unbroken rehearsal of contingencies, each at the mercy of circumstances and each significant in proportion to its familiarity." What he means by 'identity,' therefore, is something which has been *practiced* so as to make the experience of life itself less confusing and more enjoyable. As humans encounter the circumstances they were born into, made up of series of treasures and contradictions given to them by their forebearers, they develop ways of navigating the world that are certainly not immutable but which also undoubtedly work to stabilize their particular circumstances. This notion of identity, therefore, has less to do with evaluating one's experiences based on some external criterion such as 'truth' or by positing some felt need or ideal, but with a familiar set of given customs and manners that allow for engagement with the world in the first place.

The development of such an identity is then predicated upon a fundamental need to conserve that which we have continuously adopted in our actions and which, therefore, comprise aspects of our identity. The desire to protect our habits and customs is not to claim that they are eternally true or far better than any other, but simply to acknowledge that they are the one's that we are presently acquainted with and therefore reliant upon: "not, *Verweile doch, du bist so schön*, but, *Stay with me because I am attached to you*." This is, for Oakeshott, the core of why we must understand what it means to be conservative of our habituated and enduring practices, so that we may continue to navigate the complexities of our contingent goings-on; in fact, without an identity to calm the storms of daily life, it would be nearly impossible to adequately grasp or evaluate anything we do in the world.

An excellent example, perhaps *the most* enlightening, is that of language, as it is something which no man chooses explicitly but which we all enjoy, maintain, and pass on. We might imagine a man who prefers his native tongue of German over any other language: he is hardly making this judgement based on German being 'truer' or 'better' than other languages, but rather on account of his capacity to express himself most fully in German due to his familiarity with the language. For him to find out that he is the last German speaker alive would be a tragedy, not on account of German being the best language he could possibly know or that there are no other languages for him to eventually learn, but because our *deutscher Freund* may never again find someone to whom he can best convey himself. This example of German falling out of usage may seem impossible for now but, by incremental and contingent changes, may eventually be a reality as fewer people learn the language. This would not necessarily happen because someone was attempting to eradicate the language or kill off the German people but would come about due

to the changes that slowly and inevitably occur within practical life—no differently than the loss of Latin. The German speaker *identifies* with his own language because it was given to him to help navigate the world, and he has learned how to find comfort through maintaining his capacity to engage in life through his native tongue.

Without the desire to conserve, every practice we have would be considered no more crucial than any other, but that endangers our capacity to even think in the world—indeed, to even consider such a possibility requires that I rely on a variety of practices such as my native tongue and common customs. Instead, man must be protective of what he has grown accustomed to, not in a manner that is closed off to possibility, but which understands that new possibilities could not even be comprehended without relying on what is possessed presently. This is what Oakeshott means when he says that to be conservative is "to prefer the familiar to the unknown, to prefer the tried to the untried, fact to mystery … the near to the distant … the convenient to the perfect." This is a *preference*—and hardly an irrational one—which emerges from the recognition that people rely on what they already know in order to move beyond to what they may not know yet. If I were learning a new language, I would not attempt to grasp it as if I had never encountered any language before; rather, I, as an Anglophone, would rely on my mother tongue as I worked through the intricacies of French, German, or whatever other language I may pursue. The adoption of new practices and aspects of my identity does not come through the destruction of my prior self-understanding but emerges only from within that extant identity. To do otherwise is impossible, as I cannot know what I do not yet know, nor can I come to know what is presently unknown without transitioning from what is presently known. Even when someone reaches beyond his bounds, he will inevitably rely on what he already has in order to make sense of the new boundaries he is breaking. Men ought always, then, to be careful that they conserve that which allows them to tread further into what is not yet known.

Now, some critics of Oakeshott have objected to him on the grounds that not everyone has an identity worth conserving, nor does Oakeshott, supposedly, "allow the possibility that change might also enhance or develop the self, that change is opportunity, that a self without challenges must either invent some or atrophy." The first claim is, in my view, simply self-defeating; it must be granted that, even if someone had absolutely nothing worth conserving, his desire for innovation would not be for its own sake—rather, he would be doing so in the hopes of eventually having an identity worth conserving, which reinforces the claim that the conservative impulse has on the human condition. This brings us to the other objection: in my view, this second claim against Oakeshott only makes sense if he argues that the conservative disposition is the only legitimate approach to life—but he does not. It is, in fact, "not part of Oakeshott's purpose to recommend, simply and equivocally, this conservative disposition." He is a thinker who is supremely aware of the dynamic and pluralistic manner of life to which we are accustomed, but he believes that a dynamic system must ultimately have a continuous identity in something which can act as its foundation.

Oakeshott is perfectly cognizant of situations in which someone may believe innovation is necessary given the circumstances in which he finds himself. It is easy to imagine examples of people stumbling upon situations to which they object and consequently desire to change. Oakeshott provides an innocuous one: "a customer who finds a shopkeeper unable to supply his wants either persuades him to enlarge his stock or goes elsewhere; and a shopkeeper unable to meet the desires of a customer tries to impose upon him others which he can satisfy." We may think of many other situations such as a child persuading his mother that he deserves a new toy or an employee bartering with a co-worker to get a certain day off. These circumstances may not *feel* particularly innovative, but they nonetheless involve an agent actively attempting to modify the way things are as opposed to what would happen if he or she made no such effort. What is evident, however, is that in each of these circumstances the identities of each party involved are largely maintained and it is merely the details of their dynamics that shift slightly: the customer and shopkeeper both acknowledge the art of bartering; the child recognizes his continued dependence upon his mother for his needs and desires; and the co-workers understand a relationship of mutual support.

These examples, elucidated by Oakeshott's argument, in fact overturn a common misunderstanding about the relationship between innovation and conservation that was succinctly stated over sixty years ago by Neal Wood: "without innovation there is nothing to conserve, and with conservation there is the continual need for innovation." Such a statement implies that innovation, 'progression' forward, is the status quo for human beings—an absurdity as this implies that 'innovation' is the 'conserved' practice of men—and that conservation is merely an unnatural halting or slowing down of that movement. What Oakeshott reminds us of is that, in distinguishing innovation from change, it is not in fact innovation that is integral to practical life; it is change that fundamentally distinguishes practical life, but man must have a conserved identity that allows him to navigate that change. Innovation is therefore reliant on the conservation of a known and hospitable form of conduct from which it can then leap; without the conservation of our identities, we cannot begin to consider how to make a change for the better.

In answering a challenge put to Oakeshott by Stephen Turner, I believe the complexity of this issue is further clarified. Turner argues that a possible problem that could be leveled against Oakeshott's view is that of providing evidence for his claims about this balancing act between what is presently had and what may be gained. As Stephen Turner aptly identifies, Oakeshott's aversion to risk seems to imply that he has a knowledge of the effects an innovation will entail. Yet, if this is true, innovation should not be an issue because then even Oakeshott is conceding that he knows the outcome of said innovation and can simply evaluate if it is worthwhile. If he denies this knowledge, on the other hand, the critic may then argue that Oakeshott's knowledge of the future is as uncertain as the innovator's. The innovator, therefore, presents no more of a risk than the conservative.

Despite the merit of this critique, it misunderstands the relationships between the world as it is found presently and the world as it could be. These are not two distinct notions that exist independently of one another but are instead mutually revelatory and require each other to be understood. A man cannot act in the world if he has no vision of how the world might eventually be; he also cannot disregard the world as it is if he would like to arrive at some desired world that is not yet. There is, nevertheless, a privilege afforded to the world as it is over the world as it ought to be due to it being actual and practiced—one's identity is far more defined by what is than what could be. By acting conservatively, an identity may be found through habituation that is sustained and known; if anything, it is as close as one can come to a continuous conception of the world as it is and will be—any radical shift would need to come from change beyond the scope of human control, and this is nevertheless better dealt with when one possesses a familiar manner of living. The innovator, on the other hand, incites the change that can cause instability as he "generates not only the 'improvement' sought, but a new and complex situation of which this is only one of the components." Additionally, having shaken his identity which was tied to his former practices, there is now the added confusion of not fully understanding how to deal with whatever changes may emerge from beyond the influence of human intentions. This means that, though the specifics of the circumstance may not be known, there is a general risk ever-present when a man decides he is going to incite some form of innovation that will threaten how he has learned to deal with the challenges of human life.

With these tensions between the conservative and innovative viewpoints in mind, Oakeshott does not seek to merely dismiss the role of innovation in human affairs. Instead, he argues that what is often sought by the conservative disposition is something of a middle ground with an innovative spirit. Despite concerns about the costs and benefits of innovation, there are moments when the conservative temperament must give way to innovation regarding a specific defect in one's manner of life; however, in such an instance, the innovation in question emerges slowly from within his present identity, allowing him to adapt to it more easily. Oakeshott's concern, however, is that such a middle ground is not being pursued. He believes that the people of his own time and place have become disconnected from any sense of the conservative disposition, always "ready to drop the bone we have for its reflection magnified in the mirror of the future," instead of enjoying the delights of life with which they are presently familiar.

This leads Oakeshott to worry about the possible ramifications of an all-consuming desire to innovate. Innovation is, as noted above, actively attempting to change the world as we find it so that it might accord

with a vision of what it could be—it is antithetical to a sustained identity. If this disposition is pushed to an extreme, it could eventually call for the total overhaul of the world as presently experienced. The conservative disposition ought to be the counterbalance to this innovative impulse, but it is impossible to gain equilibrium when the innovative spirit is drowning out the cry of its conservative counterpart. Each disposition plays a role in the human condition, and one cannot merely overcome the other. Their relationship should be understood not as a boxing match with a single victor but as a dance in which each partner moves with the other to create a sense of delight for all involved. No doubt, this also means that the conservative disposition cannot exist apart from its innovative counterpart, and to perpetually conserve is as unlikely as perpetually innovating. Oakeshott's concern is that if people do not recognize the importance of the conservative disposition in sustaining their identities, they will continue to tear apart these stable foundations upon which they rely to navigate the world. He therefore outlines two sorts of activity that he believes demonstrate how the conservative disposition is integral to the formation of identity: activities done for their own sake and activities that require the use of tools to be executed effectively. In looking at these aspects of practical experience, we gain a clearer picture of how our identities emerge and why we would desire to sustain them through reflecting upon aspects of practical life that most strongly call upon the conservative disposition.

Oakeshott remarks that, given the present proclivity toward innovation in all manner of life, "the disposition to be conservative…might be expected to end, with the man in whom this disposition is strong last seen swimming against the tide, disregarded not because of what he has to say is necessarily false, but because it has become irrelevant." As so succinctly put by Neal Wood, there is a present assumption that men must reach beyond what they presently have, for "time does not stop. Men deserve more than poignancy and old port." Yet, it seems more likely to Oakeshott that the conservative disposition is seen as *passé* only due to a lack of understanding; conservation in action persists throughout the human circumstance, and to not recognize this will only cause further confusion and turmoil. Indeed, Oakeshott argues it is not difficult to see that "there are many occasions when this disposition remains not only appropriate but supreme." In looking to aspects of practical life that are emblematic of this disposition, people may begin to see how various aspects of their own lives are better understood by considering themselves from a conservative standpoint.

Oakeshott argues that all activities and relationships "which are engaged in for their own sake and enjoyed for what they are and not for what they provide" are thoroughly conservative—indeed, they are the emblem of what it means to conserve. Oakeshott's often used example is that of friendship, a theme he returns to throughout his works. To hold someone as a true friend is not to obtain anything other than the experience of having someone who is familiar and comprises a part of what one considers his 'world,' what he considers *home*. With other relationships, this may not be so: "to go on changing one's butcher until one gets the meat one likes…is conduct not inappropriate to the relationship concerned; but to discard friends because they do not behave as we expected and refuse to be educated to our requirements is the conduct of a man who has altogether mistaken the character of friendship." In a friend, one may find a confidant, a counselor, or a jokester; though he may be appreciated for all these qualities, the love that a friend has for him will not be reducible to any of those singular aspects. It is no wonder that friendships often develop when people are traversing great challenges in life, be that in grade school, traveling, or war. For, in those moments, friends discover themselves together, their mutual journey acting as a continuous reminder to each friend of who they are in themselves. The identity of my friend, as separate and uncontrolled by me, can provide me with a reminder of who I was, how I came to be as I am, and what I shall become; to force my friend to be what he is not will crush the identity which I possess through him being an external and continuous pillar of my own self-realization.

In brief, to enjoy something for its own sake is not to engage in the endeavour for some other end to come, but rather to engage in the activity because it approximates an end in itself. As Oakeshott sees it, life is a delight when engaged in this sort of activity, but human beings—as finite creatures that must always be conscious of change—often must work to provide for their needs through activities that derive some

external end, such as labours for a wage to put food on the table. Such activities that are done for the sake of an end to come always cause a separation of the world as presently engaged compared with the world as it is desired to be. In performing any activity for its own sake, however, the separation between the world as it is and the world as it is desired to be is abated for a moment—whether that is in enjoying a walk through a flowering meadow, reading T. S. Eliot's *The Waste Land*, or enjoying the company of one's husband or wife. It is in such experiences that the conservative disposition has taken hold, as the enjoyer of such activities desires to stay in that moment of delight for as long as humanly possible.

A seemingly strong objection, however, could be made against this desire for activities pursued as ends in themselves: do these not make up just a fraction of the human experience, and are we not much more often engrossed in activities that require the separation of the world as presently engaged and the world as it could be? This is a question that cannot go unaddressed—fortunately, Oakeshott is well equipped to anticipate such objections. He recognizes that human affairs so often entail the emergence of unforeseen circumstances, and it should therefore be expected that any activity pursued for its own sake cannot sustain itself perpetually. This is a perfectly valid point, which is why Oakeshott is no less receptive to actions pursued for the sake of an extrinsic end; he is not, however, willing to grant that these activities are beyond the scope of the conservative disposition.

Oakeshott points out that, even among activities that are the means to an end, most "projects are often provoked and governed by the tools available." What he is pointing out is that, even if an activity has radical or varied ends that it pursues, the means with which that activity is performed will likely remain constant. Now, this topic can become muddled in certain details, particularly the fact that the end produced by one man may become the tools of another; for example, some time ago, a woodworker would have used his carpentry tools to perfectly cut and shape pieces of wood into a hockey stick—the end of the woodworker's activity—which would then become the tool used by a professional hockey player to try and score goals to win games. Notwithstanding that this distinction between means and ends may be somewhat relative in certain instances, it is still helpful for understanding situations in which someone may be conservative despite the activity in question not being an end in itself.

Oakeshott argues that "tools are less subject to innovation than projects because, except on rare occasions, tools are not designed to fit a particular project and then thrown aside, they are designed to fit a whole class of projects." Familiarity with a tool is necessary for it to be used effectively. A man who has never touched a chisel—let alone taken the time to figure out which chisels are best for him and his work—will have a tough time doing even the simplest stone sculpting. Any tradesman will acknowledge that "tools call for skill in use and skill is inseparable from practice and familiarity." It would not be a stretch to say that tools—when discussed in the context of certain roles, be that a trowel to a mason, a saw to a carpenter, or a wrench to a plumber—eventually become an extension of the tool-user and are critical to his identity, and the tools are valued insofar as they relate to a conserved practice of using them.

Now, though tradesmen are helpful for understanding this point, as they use readily recognizable tools such as trowels and shovels, the conservative implications of tool-using extend beyond to other professions or activities that may appear less obvious. For example, a professor of English will likely have a copy of Shakespeare's *Macbeth,* complete with his substantial underlining, highlighting, and marginalia. If I were to steal his copy and replace it with an identical edition, save for the various page markings he had inserted over the years, his next lecture about the play would likely be far less organized and informative; perhaps he would be no longer remember the exact line in which he believes Lady Macbeth shows herself as the true mastermind behind the plot, or this professor will no longer recall precisely how he wished to describe the influence of the witches' prophecies upon Macbeth himself. The professor has lost his bearings as an educator—an aspect of his identity—through the loss of his text which had become something of a map for him in traversing the intellectual landscape of Shakespeare. What is clear is that, in both the case of a tradesman using a literal tool or an intellectual using his own annotated copy of a text to organize his thoughts, "familiarity is the essence of tool using; and in so far as man is a tool using animal he is disposed to be conservative."

Oakeshott's final move in his analysis of tools is to expand the conception of what is generally meant by a 'tool.' He wants to move beyond the idea of a physical object—be that a drill, a saw, or even a book—that is designed to help with some task and instead consider "a certain kind of tool in common use, namely, general rules of conduct." This may not seem to follow, but what Oakeshott is here acknowledging is that there is an aspect of relativity about our social customs—what is important about them is not that they are immutable but that they are useful, just like any other tools. It is true that people's mother tongues are largely a product of chance, no one chooses where he or she will be born, and our customs emerge spontaneously through local interactions of different peoples. Yet neither language, nor geography, nor custom precisely dictates what people ought to do substantially. Rather, they act as guidelines, conduits to help people more easily engage with the world and provide common spaces within which they can express themselves and seek a sense of delight. They constitute something of a routine for all involved; but, whether on the scale of a community or just one person, a routine does not go from non-existence to perfect order overnight. A man must begin with simply *a* routine which is often more important than the substance of the routine, and one can only generate a good or better routine by first establishing a routine at all. This is the sense in which customs, routines, or habits are *social tools*, as they make the social interactions of humans more manageable through practice. Just as having a shovel makes digging a hole much easier than doing so within one's bare hands, so it is that having a common language, familiar routines, and habituated customs makes human interaction much easier to navigate—thereby making them worthy of conservation.

Oakeshott acknowledges that human customs "are the product of reflection and choice, there is nothing sacrosanct about them, they are susceptible of change and improvement; but if our disposition in respect of them were not, generally speaking, conservative, if we were disposed to argue about them and change them on every occasion, they would rapidly lose their value." Oakeshott, as stated, acknowledges that there is a relative aspect to much of the human condition; the customs used by a people have a sense of arbitrariness in that we could imagine that they could have been otherwise. What does not follow from this line of thinking, despite the protestations that may emerge from many contemporary readers, is that these social tools and customs should therefore be thrown away. The fact that something exists does not make it sacred, but it certainly implies that it informs the manner in which a person or a people presently live—especially if it is a long-enduring practice. To simply dispense with a certain custom because it is not explicitly understood is as foolish as saying that a word is meaningless because *I* do not know what it means.

In short, the conservative disposition is most obviously present in situations when an activity is being performed for its own sake or in relation to the tools people use to perform certain tasks. In both cases, the reason for conservation is never justified on the grounds that the specific activity or tool is 'naturally' or 'metaphysically' necessary. Rather, through practice of a specific activity that is its own end or the habituated use of a tool that makes a certain sort of task easier, people will begin to consider those things as aspects of their identity in the world. It is not that this developed identity is immutable or that there is no other manner of living and acting that we could imagine, but that this identity *is developed* and therefore governs present ways of living. The claim of the conservative disposition is never truth or goodness, but familiarity and practice. In Oakeshott's view, identity is thus not something which I dream up or contrive, but it is rather a series of learned responses to the world in which one lives so as to stabilizes the difficulties inherent in the contingent and fluctuating world of practice.

In reading through Michael Oakeshott's writings, we see someone who evidently has a great sense of and appreciation for style and wit—we may even call him an aesthete in the best sense—but we also find a man who is very careful not to say too much. He is doubtful of his capacity to make a fundamental claim about the human condition, typically preferring to be critical of those who claim to have all the answers. Though it may annoy us that he provides no concrete alternative, I do not think this is emerges from ignorance or stupidity but rather from a great respect of the complexity of human affairs. If anything, he is more com-

fortable making grand philosophical claims, yet in his own view that provides no explicit direction for the day-to-day actions of men engaged in mere practice.

This leads Oakeshott to a seemingly peculiar view to emerge during the modern era. He does not agree with any sort of foundationalism to be found in the human condition, as the contingent nature of humanity does not allow such a solid ground to even be sought. What this implies is not that there is nothing to be found of value in our practices; rather, due to his insistence upon the fundamentally contingent nature of human goings-on, Oakeshott is keen enough to see that we must maintain our manners and customs which comprise our identity, for without such practices our worlds become so chaotic and uninterpretable that life ceases to be worth living. Identity is thus the closest we come to a stable ground that allows for a better path through the turbulence of human existence. We are men at sea on a mere raft, and to believe the raft is harmful and poorly made requires that we jump into the wide-open waters—a decision which we will undoubtedly regret when we no longer have the energy to tread the ever-moving seas of the world.

Identity for Oakeshott cannot, then, be understood as something merely posited or willed; to merely impose an identity is to constrain oneself to a sort of living that may have nothing to do with the world that we find ourselves in. Such a view of identity also often confuses us about ourselves, as identifying with something often means rationalistically imposing a form of self-understanding that may obscure the problems one faces in the world at present. Identity is predicated upon what we do in the world, most notably in those activities to which we perpetually return for their own sake and those activities in which a learned and sustained set of tools and customs are continuously called upon. These activities comprise much of the human condition, and there is nowhere else to place one's identity that may be made sense of. For someone to posit an identity that is rationally constructed without reference to his daily life is not to find a better manner of life than he presently has, but simply to alienate himself from the world in which he finds himself. In understanding Oakeshott's defense of identity and its connection with a conservative temperament, we may learn not precisely how the world works, but rather how we can get by agreeably alongside it.

REFERENCES

Butler, Judith. 1988. Performative Acts and Gender Constitution: An Essay in Phenomenology and Feminist Theory. *Theatre Journal* 40(4): 519-531.

Flathman, Richard. 2010. Conservation, Conversion, and Conservation: Oakeshott, Arendt, and a Little Bit of Cavell. In: *The Meanings of Michael Oakeshott's Conservatism*. Ed. Corey Abel, pp. 161-182. Charlottesville: Imprint Academic.

Franco, Paul. 1990. *The Political Philosophy of Michael Oakeshott*. King's Lynn: Biddles Ltd.

Fuller, Timothy. 2010. The Relation of Philosophy to Conservatism. In: *The Meanings of Michael Oakeshott's Conservatism*. Ed. Corey Abel, pp. 112-125. Charlottesville: Imprint Academic.

Gerencser, Steven. 1995. Voices in Conversation: Philosophy and Politics in the Work of Michael Oakeshott. *The Journal of Politics* 57(3): 724-742.

Kim, Sungmoon. 2016. Abating contingency: Michael Oakeshott's political pluralism. *Philosophy and Social Criticism* 42(3): 267-288.

Oakeshott, Michael. 2015. *Experience and Its Modes*. Cambridge: Cambridge University Press.

_____. 1991. On being conservative. In: *Rationalism in politics and other essays*, pp. 407-437. Indianapolis: Liberty Fund.

_____. 1999. *On History*. Indianapolis: Liberty Fund, Inc.

_____. 1975. *On Human Conduct*. Oxford: Oxford University Press.

_____. 1991. The voice of poetry in the conversation of mankind." In: *Rationalism in politics and other essays*, pp. 488-541. Indianapolis: Liberty Fund.

Pitkin, Hanna Fenichel. 1973. The Roots of Conservatism. *Dissent* (Fall): 496-525.

Plato. *Republic*. 1997. Tr. G. M. A. Grube. In: *Plato, Complete Works*, ed. J. M. Cooper, pp. 971-1223. Indianapolis: Hackett Publishing.

Trimçev, Eno. 2019. Conservative theory as sympathetic dissent: the example of Michael Oakeshott. *Journal of Political Ideologies* 24(3): 275-294.

Turner, Stephen. 2010. The Conservative Disposition and the Precautionary Principle. In: *The Meanings of Michael Oakeshott's Conversation*. Ed. Corey Abel, pp. 204-217. Charlottesville: Imprint Academic.

Wells, Harwell. 1994. The Philosophical Michael Oakeshott. *Journal of the History of Ideas* 55(1): 129-145.

Wood, Neal. 1959. A Guide to the Classics: The Skepticism of Professor Oakeshott. *The Journal of Politics* 21(4): 647-662.

A Comment on Hoppe's "Egalitarians as Libertarian"

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Abstract: Hoppe (2014) claims that libertarianism, properly understood, is aligned with the right, not the left. The present paper defends the view that it is affiliated with neither; instead, it is unique, *sui generous*. What, then, is its relationship with both: it agrees a bit more with the right on economics, more with the left on personal liberties, and with neither on foreign policy.

Keywords: left, right, libertarianism, immigration.
JEL Category: HO

Hoppe (2014)[1] starts this essay in the splendid manner from which we are accustomed to viewing his publications. He brilliantly begins with:

> Libertarianism is logically consistent with almost any attitude toward culture, society, religion, or moral principle. In strict logic, libertarian political doctrine can be severed from all other considerations; logically one can be—and indeed most libertarians in fact are: hedonists, libertines, immoralists, militant enemies of religion in general and Christianity in particular—and still be consistent adherents of libertarian politics. In fact, in strict logic, one can be a consistent devotee of property rights politically and be a moocher, a scamster, and a petty crook and racketeer in practice, as all too many libertarians turn out to be.

I am not aware of any other statement of this brevity which gets to the very core of what this philosophy is all about. He continues by properly identifying it as a "a pure deductive theory." Well, then, what are its major, foundational premises? Again, we can do no better than to agree with, and appreciate, the spotlight he focuses on libertarianism: its essence, private property rights:

> Absent a perfect harmony of all interests, conflicts regarding scarce resources can only be avoided if all scarce resources are assigned as private, exclusive property to some specified individual. Only then can I act independently, with *my* own things, from you, with *your* own things, without you and me coming into conflict. But who owns what scarce resource as his private property and who does not? (Ref)

This scholar goes on to demonstrate, again quite correctly, that this stems from ownership of our own bodies, and, then, extrapolating from that, property properly belongs "to that person, who appropriated the resource in question *first* or who acquired it through voluntary (conflict-free) exchange from its *previous* owner."

Hoppe is also on target here:

> The difference between the Right and the Left … is a fundamental disagreement concerning an empirical question. The Right recognizes, as a matter of fact, the existence of individual human differences and diversities and accepts them as natural, whereas the Left denies the existence of such differences and diversities or tries to explain them away and in any case regards them as something unnatural that must be rectified to establish a natural state of human equality.

Yes, score one point for the right, none, at least so far, with the left. The latter is mired in egalitarianism,

> … all observable individual human differences are to be equalized. And where this cannot be done literally … the Left insists that the undeservedly 'lucky' must compensate the 'unlucky' so that every person will be accorded an "equal station in life," in correspondence with the natural equality of all men.

This leads the "progressives" into supporting all sorts of policies entirely incompatible with the liberty philosophy. Such as affirmative action, welfare, progressive taxes, soak the rich schemes of many varieties, etc. So far, the score is still one to zero, favoring the right over the left.

But then, I fear, Professor Hoppe goes a bit off the rails when he avers:

> Is libertarian theory compatible with the world-view of the Right? … the answer is an emphatic 'yes.' Every libertarian only vaguely familiar with social reality will have no difficulty acknowledging the fundamental truth of the Rightist world-view. He can, and in light of the empirical evidence indeed must agree with the Right's empirical claim regarding the fundamental not only physical but also mental inequality of man; and he can in particular also agree with the Right's normative claim of "laissez faire," i.e., that this natural human inequality will inevitably result also in un-equal outcomes and that nothing can or should be done about this.

"The right's normative claim of 'laissez faire'"? This otherwise brilliant libertarian theorist is surely wrong here. Which right wing conservative member in good standing ever came out in favor of this libertarian policy of laissez faire capitalism? The facts of the matter are quite the opposite. Not only do political economic theorists of the right not support any such thing, but they actively attack it as anathema.

To boot, rightist conservatives support all sorts of government intervention.

For example, Republican Senators Tom Cotton and Mitt Romney favor a $10 minimum wage (Birenbaum 2021). Now, it is possible to deny right wing status to Romney, the creator of socialist Romneycare in Massachusetts. But it would be difficult to do so for Mr. Cotton. A $10 minimum wage is compatible with laissez faire capitalism? Alright, neither of these gentlemen are conservative theoreticians; they are, rather, politicians. But have any of the former ilk publicly criticized them for this stance. My research has been unable to uncover any such thing.[2]

No one can doubt the right-wing credentials of Pat Buchanan. And yet he has been for many years a vociferous opponent of free trade (Sanger 1995). Tariffs and quotas are compatible with laissez faire capitalism?

Republicans favor the U.S. military to remain in Afghanistan, after 18 years. This is libertarianism (BBC 2020)?[3]

Thus we see that Hoppe's unadulterated praise for the right is hardly justified.[4]

Asks this author:

> Is libertarianism compatible with leftist views? … the answer is an … emphatic 'no.' The empirical claim of the Left, that there exist no significant mental differences between individuals and, by implication, between various groups of people, and that what appear to be such differences are due solely to environmental factors and would disappear if only the environment were equalized is contradicted by all everyday-life experience and mountains of empirical social research.

Hoppe then waxes eloquent about the shortcomings of the left's egalitarianism, and a truly splendid job he does in this regard. I am tempted to quote at length here, since I have never read a better excoriation of our friends on the left. I will resist. Read this for yourself, I suggest. No, I urge this; it is brilliant.

Where, then, do I have a problem with any of what he writes in this article?

Hoppe is extremely and unjustifiably supportive of the right, with the exception of reparations theory. Reading him here, one would suppose conservatives are all but indistinguishable from Rothbardians. As regards the left, he takes the opposite tack. He denounces them, very properly so, for their egalitarianism. But what kind of a way is it to judge an entire political philosophy on the basis of one and only one element, even though it is admittedly an important one? The socialist, "progressive" leftists have views on much, much more, and on several of these issues, they are far closer to libertarianism than are the rightists.

For example, for many decades homosexuals were thrown in jail for engaging in consenting adult behavior. The left protested police raids on their bath-houses, while the right cheered on these blatant rights violations. Similarly, the left was and still is far closer to libertarianism than the right in terms of legalizing prostitution. Then there is the entire drug issue. Nowadays, marijuana is almost entirely legal in the U.S., whether for medicinal or recreational purposes. But this very libertarian policy was accomplished with impetus mainly from the left. To the extent that the right acquiesced in drug legalization, it was due to being kicked and screaming. Oregon has just legalized small amounts of harder drugs, and it is the Democrats, not the Republicans, who were instrumental in this breakthrough in behalf of liberty (Burroughs 2021b).

The left is more libertarian on personal liberties issues, the right more so on economic matters, and both are exceeding horrid in terms of foreign policy. Both the Elephant and the Donkey are responsible for the fact that the U.S. has some 800 military bases in roughly 200 countries. This is as far as can be from the Ron Paulian notion of a military for defense, not offense and imperialism.

Now consider Hoppe's very critical views of left libertarians. He proceeds as follows:

> What ideologically unifies these left-libertarians is their active promotion of various 'anti-discrimination' policies and their advocacy of a policy of 'free and non-discriminatory' immigration.

A minor difficulty arises here. Hoppe is guilty of an oversight. As I understand academic propriety, all direct quotes require quote marks, and a source. This author offers a footnote at this point, but it is to offer parenthetical remarks, not to let the reader know whom he is quoting.

But this author also commits a far more serious blunder. In his view, there are but two possible defenses of an open borders position. He is adamant, and correct, in blisteringly dismissing both:

> The first is to place all current place occupants and occupations under moral suspicion. To this purpose, much is made of the fact that all current place occupations have been affected by prior State-action, war and conquest … however, from this undisputable fact it does not follow that any present place occupant has a claim to migrate to any place else.

Yes, well said. Exceedingly well said. Just because present property titles are based on actions incompatible with libertarianism, it by no means logically follows that an immigrant, a total outsider, has a right to any of this real estate. The proper way to address this injustice is for the aggrieved to demonstrate that they, not the present land holders, are the proper owners. Possession is nine tenths of the law. The burden of proof thus rests with those who wish to contest present property titles. If they cannot do so successfully, then the law should defend the actual owners. Immigrants have no warrant whatsoever to horn in on these activities:

> The second possible way out is to claim that all so-called public property—the property controlled by local, regional or central government—is akin to open frontier, with free and unrestricted access. Yet this is certainly erroneous. From the fact that government property is illegitimate because it is based on prior expropriations, it does not follow that it is un-owned and free-for-all. It has been funded through local, regional, national or federal tax payments, and it is the payers of these taxes, then, and no one else, who are the legitimate owners of all public property. They cannot exercise their right—that right has been arrogated by the State—but *they* are the legitimate owners.

Again, kudos to Hoppe. Roads, bridges, tunnels, parks, public buildings, were all put in place on properties seized from their rightful owners, and erected with funds further mulcted from their rightful owners, the long-suffering taxpayer. They are the licit proprietors, even though not the actual ones. All of this property should be privatized, and given[5] to those from whom it was stolen. Any immigrant who utilized any of this terrain should be considered a trespasser on property properly owned by others.

Whence, then, Hoppe's error? He also writes this: "A right to 'free' immigration exists only for virgin country, for the open frontier." In rejecting open borders, this author is implicitly declaring there is no virgin territory anywhere in the country. Because if there is, then the settler from outside the country may no longer be gainsaid from entering it.

Consider the following scenario. An immigrant from a far away place, maybe from Africa or India, or Mars for that matter, lands with his helicopter or space-ship in the middle of the Rocky Mountains, somewhere in Wyoming, or, in the middle of Alaska. He plucks down on terrain that had never seen a human being set foot on it. It was never before been occupied by anyone. He begins the homesteading process. He clears away brush and trees, plants some vegetables, builds a house. Along comes a Hoppean policeman who wants to arrest this person for immigrating into the country with no by your leave from anyone. This immigrant is operating on open borders principles, supported by Hoppe's target, the left libertarians.[6] But what libertarian law did he violate? None. None whatsoever.

The left-libertarians, Hoppe to the contrary notwithstanding, are thus correct in claiming that "free and non-discriminatory" immigration is legitimate. He is in effect asserting that there is not one single bit of completely virgin territory in these here United States. If he were correct in this, then his screed against the left-libertarians would be correct. However, as an obvious empirical claim, there most certainly are swathes, acres, entire square miles, of territory in this country that have never, ever, seen the imprint of the human foot.

What riposte could Hoppe offer in response? He might claim that immigrants rarely if ever "head for the hills." Instead, they aim for the cities, there better to collect government welfare. Of course this cannot be denied. But all we have to show is *one* plausible scenario in which an immigrant may enter the country entirely without permission to demonstrate that regulations of the sort Hoppe proposes would be invalid. This, we have done.

He might object on the utilitarian ground[7] that with open borders we would be overrun with all sorts of undesirables. What is the libertarian answer to this demurral? It is that we should privatize every square inch of the U.S. territory, land as well as water (Block and Nelson 2015). In that way, we can have our cake

and eat it too: adhere to libertarian principle, and, also, protect ourselves against incoming hordes. Hoppe, I fear, is so intent upon the latter desiderata that he is willing to jettison the NAP[8] in order to attain it.

However, there is a reason there is all this unclaimed land: it is sub-marginal. The economic results to be obtained from homesteading it will not defray the costs of doing so. But that was only before the issue of protecting ourselves from undesirables while strictly adhering to libertarian principle arose. Now that it has, we have one addition and important reason to occupy these lands and waters: safety. Under the fully libertarian society, voluntary charitable organizations would see to this homesteading as a way to maintain the NAP and private property rights vis a vis unwanted, would-be immigrants.

Do I expect that this will actually occur given the present state of affairs? Of course not. But my goal is not to safeguard us. It is, rather, to figure out the proper libertarian stand on immigration. This, I think, we have done. It is one of open borders.[9]

NOTES

1 Unless otherwise specified, all mentions of this author will refer to this one publication of his.

2 https://www.google.com/search?q=are+there+any+criticisms+of+Senators+Tom+Cotton+and+Mitt+Romney+favor+a+%2410+minimum+wage%3F&rlz=1C1CHBF_enUS724US724&oq=are+there+any+criticisms+of+Senators+Tom+Cotton+and+Mitt+Romney+favor+a+%2410+minimum+wage%3F+&aqs=chrome..69i57.20844j0j15&sourceid=chrome&ie=UTF-8

3 Below are two audio links of Dennis Prager in his role as warmonger. Here is the first sentence of this rant. Dennis Prager which cofounded Prager University, a non-profit media company that has just under 3 million subscribers on YouTube had this to say about American occupation in Afghanistan: "I cannot overstate how opposed I am of taking American troops out of Afghanistan." https://www.youtube.com/watch?v=oS1GHT-OWrA. The second audio link is Dennis Prager implying that Ron Paul's libertarian, non-interventionistic foreign policy views are stupid. Here is the link to that: https://www.youtube.com/watch?v=68yNBCSf900. Nor can anyone dismiss Prager as a non-intellectual, a mere politician. If he is not a conservative right-wing theoretician, then no one is. See also, Burroughs (2021a).

4 To be fair to Hoppe, he does concede that there is "one important caveat, however." The right does not favor reparations that are justified by prior theft: "Inequalities that are the result of violations of these rules, however, do require corrective action and should be eliminated. And moreover, the libertarian would insist that, as a matter of empirical fact, there exist quite a few among the innumerable observable human inequalities that are the result of such rule-violations, such as rich men who owe their fortune not to hard work, foresight, entrepreneurial talent or else a voluntary gift or inheritance, but to robbery, fraud or state-granted monopolistic privilege"

5 Not auctioned off, since the government would keep the money, and they already have all too many funds at their disposal. These properties should be given to those who paid for them in the first place. Only if they cannot be found should they be given to private homesteaders, people who have used them.

6 I am not a left libertarian; nor, yet, a right wing one. I am a centrist, or moderate, libertarian. I maintain that libertarianism, properly understood, is neither of the right nor the left, but something distinguishable from both.

7 This would be unlike him, in that he is a splendid rights-oriented philosopher-economist, not one given to pragmatic argumentation.

8 Which our Martian immigrant did not violate.

9 For the correct libertarian position on immigration, see Block 1998, 2004, 2011a, 2011b, 2013; Block and Callahan 2003; Gregory and Block 2007.

REFERENCES

BBC. 2020. US troops in Afghanistan: Allies and Republicans alarmed at withdrawal plan. November 18; https://www.bbc.com/news/world-us-canada-54980141

Birenbaum, Gabby. 2021. Tom Cotton and Mitt Romney are proposing a $10 minimum wage. Feb. 23; https://www.vox.com/2021/2/23/22297538/romney-cotton-10-minimum-wage-proposal

Block, Walter E. 1998. A Libertarian Case for Free Immigration. *Journal of Libertarian Studies* 13(2): 167-186.

_____. 2004. The State Was a Mistake. *Mises Daily*. http://www.mises.org/fullstory.asp?control=1522

_____. 2011a. Hoppe, Kinsella and Rothbard II on Immigration: A Critique. *Journal of Libertarian Studies* 22(?): 593–623.

_____. 2011b. Rejoinder to Hoppe on Immigration. *Journal of Libertarian Studies* 22(?): 771–792.

_____. 2013. Rejoinder to Todea on the 'Open' Contract of Immigration. *The Scientific Journal of Humanistic Studies* 8(5): 52-55.

Block, Walter E. and Gene Callahan. 2003. Is There a Right to Immigration? A Libertarian Perspective. *Human Rights Review* 5(1): 46-71.

Block, Walter E. and Peter Lothian Nelson. 2015. *Water Capitalism: The Case for Privatizing Oceans, Rivers, Lakes, and Aquifers*. New York: Lexington Books.

Burroughs, Dillon. 2021a. George W. Bush Warns Biden's Afghanistan Withdrawal Is a 'Mistake' That Will Cause 'Unspeakable Harm' Jul. 14. https://www.westernjournal.com/george-w-bush-warns-bidens-afghanistan-withdrawal-mistake-will-cause-unspeakable-harm/

_____. 2021b. Democrats Reveal Plan to Make Marijuana Legal at the Federal Level. https://www.westernjournal.com/democrats-reveal-plan-make-marijuana-legal-federal-level/

Gregory, Anthony and Walter E. Block. 2007. On Immigration: Reply to Hoppe. *Journal of Libertarian Studies* 21(3): 25-42.

Hoppe, Hans-Hermann. 2014. A Realistic Libertarianism. Sept. 30. https://www.lewrockwell.com/2014/09/hans-hermann-hoppe/smack-down/

Mangan, Dan. 2015. Romney: Obamacare grew out of Romneycare. Oct. 23. https://www.cnbc.com/2015/10/23/mitt-romney-admits-romneycare-had-to-precede-obamacare.html

Sanger, David E. 1995. Buchanan's Tough Tariff Talk Rattles GOP. Oct. 8. https://www.nytimes.com/1995/10/08/us/buchanan-s-tough-tariff-talk-rattles-gop.html

REVIEW

The Bloomington School, as seen from Virginia: Levels of Analysis; Social Ontology; Schools of Thought; and Policy Implications

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1. INTRODUCTION

The literature on the work of Elinor and Vincent Ostrom, and on the broader Bloomington School they founded, continues to grow. Recent years have seen the publication of several book-length studies (Aligica and Boettke 2009, Wall 2014, 2017, Tarko 2017, Nordman 2021) and edited volumes (Aligica et al. 2017, Herzberg et al. 2019) as well as a number of special issues of academic journals, including the *Journal of Economic Behavior and Organisation* (2005), *Public Choice* (2010), *The Good Society* (2011), and the *Journal of Institutional Economics* (2013). The volume under review here, namely *Elinor Ostrom and the Bloomington School: Building a New Approach to Policy and the Social Sciences*, which has been ably edited by Jayme Lemke and Vlad Tarko, is another recent addition to this burgeoning body of work (Lemke and Tarko [eds.] 2021). It consists of a brief introduction by the editors followed by nine chapters covering various aspects of the Ostroms' work and its relations to other traditions of thought. As the editors make clear in their Introduction (chapter 1), and as also indicated by the volume's subtitle, their goal was "to highlight the creative potential of the approach developed by Elinor Ostrom, Vincent Ostrom, and their colleagues in the Bloomington School", both substantively and methodologically (p. 2).[1] They sought to do so by soliciting contributions that would assist in "building disciplinary bridges by highlighting some of the most important ... connections" between the work of the Bloomington School and other approaches to economic and social analysis, including—as discussed below—Austrian and new institutional economics, constitutional political economy, behavioural economics, and the new economic sociology. By initiating a dialogue between the work of the Ostroms and other approaches to social science, the editors sought to imitate the Ostroms' willingness "to learn from a variety of different perspectives across the social sciences" (p. 2).

As the aforementioned list suggests, the interlocutors with whom the essays in this volume strike up a conversation tend mostly to be drawn from the Austrian, public choice and constitutional political economy traditions on which the Ostroms themselves drew. This no doubt reflects the backgrounds of the contributors to the volume, most of whom are closely associated with George Mason University, a prominent centre for Austrian economics, public choice theory and constitutional political economy.[2] Other schools of thought, such as radical political economy, complexity-theoretic approaches, and evolutionary perspectives, are not prominently represented, even though some of their

exponents have engaged seriously with the Ostroms' ideas (and notwithstanding also the fact that Elinor Ostrom in particular utilised and contributed to some of them).[3] This is less a criticism of the volume than an attempt to highlight the opportunity cost of the choices made by the editors, as well as the benefits they have produced. The selection of essays for edited volumes almost invariably involves trade-offs, for example between variety and coherence, and the volume under review here displays the benefits of a coherent set of perspectives, not least the way that the various chapters usefully complement each other (with points mentioned briefly in one being developed at length in others). The price that has been paid is, perhaps, a narrower set of conversations than might have been possible. The quality of the essays suggests overall that the price can be regarded as one worth paying.

The review is organised by reference to themes that are shared by the chapters discussed in the various sections found below. Section 2 focuses on two chapters that concentrate on the relations between the work of the Ostroms and that of Nobel Laureate James Buchanan. Section 3 explores how two of the chapters draw attention to the ontological presuppositions of the Ostroms' work (i.e., what their work presupposes about the nature of social reality). Section 4 considers two chapters that focus on the relations between the work of the Ostroms and other schools of thought, in particular behavioural and new institutional economics. Section 5 examines three chapters that focus on the relevance of the Ostroms' work for policy, focusing in particular on public administration and environmental issues. Section 6 concludes.

2. JAMES BUCHANAN AND LEVELS OF ANALYSIS

In 'Public Choice Theory: Reuniting Virginia and Bloomington' (chapter 2), Emil Duhnea and Adam Martin explore the connections between the work of James Buchanan and Elinor and Vincent Ostrom. In doing so, they provide very helpful summaries of several important aspects of the Virginia and Bloomington Schools, setting the scene for several of the chapters that follow. Noting that the Ostroms have long acknowledged taking inspiration from Buchanan's work, in particular *The Calculus of Consent* (Buchanan and Tullock 1962),[4] and also that they were founder members of the Public Choice Society, Duhnea and Martin focus on several key areas of common ground.

The first is self-governance, which Duhnea and Martin describe as "the key normative commitment and the central social-scientific object of inquiry that underwrites both traditions" (p. 13). Elinor Ostrom regarded her work on how communities are sometimes able to craft rules that enable them to avoid the tragedy of the commons as an attempt to follow the strategy used by biologists studying complex processes, namely that of "identifying for empirical observation the simplest possible organism in which a process occurs in a clarified ... form" because "the processes of self-organisation and self-governance are easier to observe in this type of organisation than in many others." By doing so, she believed, she would be able "to contribute to the development of an empirically valid theory of self-organisation and self-governance ... of relevance to a somewhat broader set of environments" (1990, pp. 26-29; also see p. 216). Her work on the commons was, therefore, an attempt to contribute to our understanding of the larger-scale problem that featured so prominently in the work of Vincent Ostrom, namely "whether societies of men are really capable or not of establishing good government from reflection or choice, or whether they are forever destined to depend for their political constitutions on accident and force" (Vincent Ostrom, quoted in Duhnea and Martin, p. 13).[5] Duhnea and Martin highlight the parallels between this approach and that adopted by Buchanan. In his 1959 essay on 'Positive Economics, Welfare Economics, and Public Policy', Buchanan inveighs against the common interpretation of welfare economics as a form of social engineering and argues that economists should think of themselves as advancing hypotheses about policies whose merits can be assessed only by their being put to the democratic test. Similarly, in his 1963 Presidential Address to the Southern Economic Association, "What Should Economists do?", Buchanan contends that the economist's field of study extends beyond market exchange to encompass the political exchanges through which people impose rules upon themselves in order to seek to enjoy mutual gains (Buchanan ([1964] 1979, pp. 31-34). In short, as Duhnea and Martin write, for Buchanan "economists should be citizens rather than technocrats"

(p. 14). The parallels with the Ostroms, for whom democracy involves people governing together rather than having a cadre of experts rule over them, are clear (V. Ostrom 1997, pp. 59-60, 84-86).

A second area of common ground lies in a shared emphasis on institutional choice (pp. 15-16). One of Elinor Ostrom's key criticisms of earlier analyses of common property resources, especially those which modelled such situations as a prisoners' dilemma, was that they portrayed people as passively accepting their circumstances. They therefore ignored the possibility that people might seek to transform their situation by devising sets of rules or institutions that would facilitate successful self-governance (Ostrom 1990, pp. 6-7). In developing this point, as Duhnea and Martin rightly note, Ostrom drew on the Buchanan and Tullock's distinction between different levels of analysis—whereby constitutional choice *over* the rules of the game is distinguished from the collective choices that take place *within* given rules—so as to devise her tripartite distinction between operational, collective choice and constitutional choice rules (1990, pp. 50-55).[6] This enabled her to analyse how certain kind of constitutional and collective choice rules facilitate, or impede, people's efforts to craft the operational rules needed for successful self-governance. For Duhnea and Martin, this distinction between different levels of rules is "the most distinctive *analytic* moves that separates Bloomington and Virginia from other schools of thought" (p. 16).

A third key area of common ground concerns polycentricity. Vincent Ostrom emphasised the importance of polycentric systems in some of his earliest writings (Ostrom et al. [1961] 1999), highlighting how the autonomy enjoyed by citizens and providers within federal systems of governance characterised by overlapping jurisdictions and fragmented authority can set in train a process of discovery that generates the information and incentives required for a better performance (in the provision of public services, for example) than is possible within more centralised (monocentric) systems (also see V. Ostrom [1991] 2014). Duhnea and Martin (p. 18) note the parallels with Buchanan's work on federalism, which he portrays as a system in which citizens and firms can move between competing jurisdictions in ways that serve to limit the government's potential to engage in predatory taxation (see, e.g., Buchanan 1995).[7] An awareness of the benefits of polycentricity is, of course, readily apparent in Elinor Ostrom's work on the commons; this emphasises the importance for the possibility of self-governance of constitutional and collective choice rules that afford people the autonomy to experiment with different combinations of operational rules until they discover those that enable them to manage the resource (Ostrom 1990, pp. 133-42, 182-216). The need for experimentation in the choice of operational rules reflects Elinor Ostrom's view that people seeking to identify such rules face a decision problem that is so complex that they will be unable to maximise their expected utility. They should therefore be portrayed as being boundedly rational and engaging in a trial-and-error effort to identify a set of rules that works well enough for their purposes (E. Ostrom 1990, pp. 34, 38, 58-59; 1999, pp. 496, 508-09).

This brings us to the fourth area of common ground between the Bloomington and Virginia schools, referred to by Duhnea and Martin under the heading of 'complex agents' (pp. 19-21). "Using rational choice models to understand politics is a *sine qua non* of public choice," Duhnea and Martin (p. 19) write. "But neither Bloomington nor Virginia apply these models in a mechanistic or uncritical fashion." In what is perhaps his most sophisticated analysis of the model of human nature required to understand constitutional choice, Buchanan (1979) draws on Vincent Ostrom's (1980) discussion of artisanship, and also on the work of Frank Knight (1947) and G. L. S. Shackle (1976), to portray people as artifactual beings who impose rules on themselves in order to cultivate new preferences and thereby forge a new sense of identity.[8] This is a striking departure from the standard rational choice account of people as seeking to satisfy given preferences. In her account of how people craft new rules, Elinor Ostrom also departs from the standard model of rational conduct; but her account sets much greater store on notions of bounded rationality than does Buchanan.

Vincent Ostrom arguably departs furthest from rational choice, when in his discussion of constitutional choice (not mentioned by Duhnea and Martin), he contends that "[a]greements about enduring human relationships are not simply exchange relationships but open-ended commitments best characterised as covenantal in nature" (V. Ostrom 1997, p. 285; also see V. Ostrom [1997] 2012, p. 101). Covenental rea-

soning involves people recognising an obligation to consider the interests and goals of others in deciding how to behave (V. Ostrom 1997, p. 188), a feature of decision-making that leads to a significant shift away from the standard model of man as a utility-maximiser: "Maximising utility … does not apply to epistemic choice or constitutional choice in the same way that such calculations might be thought to apply to the choice of substitutable alternatives in one-to-one comparisons of distinguishable but similar items. To rely on a single specifiable criterion of choice, such as Utility, is to treat human societies as one-dimensional realms in which the forest cannot be seen for all the trees that obstruct one's view" (Vincent Ostrom 1997, p. 279; also see pp. 98, 102).[9] What all this suggests is that potentially significant differences emerge both between Bloomington and Virginia, and also within Bloomington, as they adapt rational choice theory so as to apply it to issues of constitutional choice.[10]

Rosolino Candela's essay, which forms chapter 10 of the book, offers an insightful discussion of the Ostroms' views on the relationships between design and evolution and between polycentricity and federalism. Central to his argument is the point that while for the Ostroms "the institutional conditions of federalism are a human artifact, based upon choice and deliberation", they also acknowledged "a bi-directionality in institutional analysis" whereby a federal framework "facilitates learning and the adaptive potential of human beings, leading to unintended innovative institutional changes to reinforce social cooperation" (pp. 153-54).

Candela sets the scene for his discussion of the Ostroms by considering the contrasting views of James Buchanan and Friedrich Hayek on the significance of design and evolution in the development of an institutional framework that can sustain individual freedom and mutually beneficial interactions between people. As a contractarian, Buchanan sets great store by the deliberate choice of constitutional rules. He was correspondingly sceptical of Hayek's growing commitment after 1960 to the view that social rules develop through a spontaneous, evolutionary process (Hayek [1968] 2014), arguing—in a letter to Vincent Ostrom—that his and Ostrom's view that institutions can be designed "face[s] opposition" from exponents of evolutionary thinking such as Hayek (Buchanan, quoted by Candela, p. 155; also see Buchanan [1977] 2001). However, as Candela (pp. 155-56) rightly notes, the differences between Buchanan and Hayek can be over-stated, because—as Buchanan ([1986] 2001, p. 313) observed—Hayek continued to acknowledge a role for design in the development of an appropriate institutional framework:

> Government is of necessity the product of intellectual design. If we can give it a shape in which it provides a beneficial framework for the free growth of society, without giving to any one power to control this growth in the particular, we may well hope to see the growth of civilization continue (Hayek 1979, p. 152).

The distinction between different levels of rules is again important here. For whilst emphasising in his analysis of the common law the importance of evolutionary forces in shaping the *operational* rules governing people's interactions, Hayek continued to allow an important role for reasoned choice and the design of an over-arching constitutional framework that would make it possible to harness the forces of spontaneous order for the common good. In arguing for his model constitution, for example, Hayek attempted to identify a set of higher-level, constitutional and collective choice rules within which the forces of spontaneous order would work to good effect at the operational level.[11] In this way, to paraphrase Candela, "distinguishing between different levels of analysis ... allows [Hayek] to incorporate both exogeneity and endogeneity to understanding institutional change that is *both* evolutionary and deliberative", thereby providing "a distinct analytical framework that bridges James Buchanan's emphasis on institutional choice over the rules of the game ... and F. A. Hayek's emphasis on institutional evolution" (pp. 157, 155).[12]

Candela further explores the relationship between design and evolution in his discussion of the Ostroms' views on the relationship between polycentricity and federalism (pp. 158-64). For Candela, "federalism, as understood by the Ostroms, is a particular manifestation of polycentric order that is institutionally contingent on adherence to predefined constitutional rules". It "facilitates spontaneous-order pro-

cesses, generated by evolutionary competition" that yield mutually beneficial ("positive sum") outcomes (pp. 160-61). However, in polycentric systems where because of the absence of federalist institutions the requisite "conditions of civil association" (p. 154) do not hold, however, negative-sum outcomes can arise, a possibility Candela illustrates to good effect through a case study of the impact of Italian unification on Sicily (pp. 164-70). Once again, the similarities between Hayek and the Ostroms are apparent because, like them, Hayek sought to identify an over-arching institutional framework that would enable people living in modern societies, whose complexity is such that they "cannot acquire the full knowledge which would make mastery of the events possible", nonetheless to exploit the forces of spontaneous order so as to "make circumstances more favourable to the kind of events we desire" (Hayek [1975] 2014, p. 371; [1955] 2014, p. 201).[13]

3. SOCIAL ONTOLOGY

In their essay on "Foundations of Social Order: The Ostroms and John Searle" (chapter 6), Adrian Miroiu and Adelin Dumitru contribute to the small but growing literature on the ontological presuppositions of the Ostroms' work (that is, what their work presupposes about the nature of social reality).[14] As Miroiu and Dumitru observe (pp. 88-92), the Ostroms viewed the social world as being composed of 'institutional facts' in the sense in which that term is used by Searle (1995) (E. Ostrom 2006, pp. 6, 8; V. Ostrom 1987, pp. 235-36, [1991] 2012, pp. 260-62 and 1997, pp. 25–26). Institutional facts are created through speech acts that see groups of people assign collectively-accepted functions to people and/or objects. It is through such speech acts that we, the members of a particular community, collectively accept that certain people will be accorded the status of 'authorised user' or 'monitor' of a common property resource, and that as a result their behaviour will be governed by certain collectively agreed rules. If the institutions thereby created are well-designed, then people will be afforded the incentives and the information needed to avoid the tragedy of the commons (Ostrom 1990, pp. 19-20, 91-100, 136-42, 185-88; 1999, pp. 508-19).

There are three key elements to the creation of such institutional facts (Miroiu and Dumitrou pp. 88-90). The first centres on people's capacity to assign functions to other people or objects. For example, the members of a community may assign to certain individuals the function of 'monitor', charged with the task of checking that the users of the CPR comply with agreements governing consumption of, and investment in, the resource. Second, this assignment of function is achieved collectively, by the members of the community acting together. A lone individual cannot unilaterally declare herself to be a monitor; that status must be bestowed by the other members of the group. Searle captures this point through the notion of 'collective intentionality', whereby the members of a community declare that a particular person will act as a monitor. Social facts, for Searle, are those involving such collective intentions. Third, institutional facts are a particular kind of social fact, namely those whose existence depends upon *constitutive* rules (Searle 1995, pp. 40, 43-51). Such rules typically take the form "X counts as Y in context C", where X might be a particular person, Y is the status or function of being a 'monitor', and C is 'a particular community'. That a particular individual taking on certain duties and enjoying particular powers counts as a monitor in a certain community is an institutional fact. For Searle, therefore, and for Elinor and Vincent Ostrom, institutional facts arise through particular kinds of speech acts whereby a group of people agree to follow certain (constitutive) rules specifying the functions to be (collectively) assigned to particular people (Ostrom 1990, p. 185; 2005, pp. 132-33, 144; also see Lewis 2021, pp. 630-31).[15]

What this account of the creation of institutional facts also indicates, as Miroiu and Dumitru (pp. 98-101) observe, is the foundational role of language in the Ostroms' account of self-governance: "the political artisan …is concerned with the use of language to order relationships among human beings", Vincent Ostrom (1987, p. 19) writes, so that language becomes "the fundament of order in all human societies" (Vincent Ostrom 1997, p. 86, quoted by Miroiu and Dumitrou p. 101): "languages are the most fundamental institutions in human societies" and, because they are the medium in which the rules that bind people together into societies are expressed, they "serve as the essential matrices in all systems of social and po-

litical order" (V. Ostrom 1997, p. 63; also see pp. 151-74) Another implication is that the degradation of our language can quickly lead to the erosion of the basis of self-governing societies, whereby "glittering generalities, slogans and sonorous phrases are used to ... create the illusion that people can be spared all the care of thinking and all the trouble of living" (V. Ostrom 1997, pp. 55, 56-57; also see pp. 61-87, 162-63, 167). The relevance of all this to our current predicament is too obvious to require elaboration here.

Ontological issues also feature prominently in Alice Calder and Virgil Storr's essay on "New Economic Sociology and the Ostroms" (chapter 5), albeit without being explicitly described as such. Storr and Calder seek to explore the parallels between the Bloomington School and the new economic sociology (see, e.g., Granovetter [1985], Swedberg [2003] and Burt [2004]). They highlight several areas of common ground, of which three will be mentioned here. First, both approaches portray people as social beings who are embedded (Granovetter 1985) in networks of social relations that shape, without entirely determining, how they act (pp. 72, 77-78). Thus, like the Ostroms, advocates of the new economic sociology seek to navigate a course between "an over-socialised conception of economic actors who are entirely beholden to the norms and values of the social system they exist in" and portrayals of actors as "socially isolated creatures" and "under-socialised decision maker[s] using utilitarian calculus to determine every choice" (p. 72; also see pp. 77-79).[16]

Another common theme is an emphasis on the importance of social capital (pp. 79-83). Understood as "the resources that an individual can access through her social connections and the value and quality of those resources", as well as norms in the sense of "rules that govern the behaviour of members of the social network" (p. 79), social capital is a resource upon which people draw in their efforts to accomplish joint activities, in particular by overcoming free-riding (pp. 81-82; also see Ostrom 1994). An insightful paper, which nicely complements Calder and Storr's, is that penned by Chamlee-Wright (2008), who uses Austrian capital theory, in particular the work of Ludwig Lachmann ([1956] 1978, 1977), to develop a distinctive perspective on the nature and significance of social capital that builds on Ostrom's work. There are clear parallels between Lachmann's ideas on the complementarity of different kinds of capital goods and what Elinor Ostrom refers to as the configurational nature of operational rules, whereby "the way one rule operates is affected by other rules" (Ostrom [1986] 2014 , pp. 108, 110; also see 2005, pp. 255–57). In both cases, elements—capital goods or operational rules—are viewed as forming complex structures possessing distinctive emergent properties (to facilitate enhanced productivity and the successful management of common property resources respectively).[17]

Chamlee-Wright highlights two important implications of these features of social capital, namely (i) the uncertainty associated with efforts to develop and utilise it to achieve desirable outcomes and (ii) the role of entrepreneurs in dealing with that uncertainty by experimenting with new combinations of the elements (e.g., the rules) of which it is composed. For Ostrom, one of the main merits of polycentric systems is that they enable people to deal with the epistemic (computational) problems posed by the configurational nature of social rules by experimenting with different rule combinations, and learning from the efforts of other groups to do so, thereby helping them to develop rules that are more conducive to self-governance than would otherwise be the case. This emphasis on polycentricity is, Calder and Storr (pp. 82-83) contend, a third area of common ground between the Bloomington School and the new economic sociology, being emphasised in the case of the latter by Granovetter's (1973) well-known work on the strength of weak ties and by Burt's (2004) discussion of structural holes.

One interesting and important point made by Calder and Storr concerns Elinor Ostrom's "call for a more nuanced and real-world reflective approach to studying how people solve their problems" (p. 73). This requires social scientists to acknowledge and address various forms of complexity in the real world. In her Nobel Prize lecture, Ostrom contrasted her approach with the "earlier world view of simple systems" which sought to "fit the world into simple models" (E. Ostrom [2009] 2014, p. 168). The simplicity of those models manifested itself in their reliance on conceptual dichotomies that are in Ostrom's view too crude to capture the richness of social reality. One, noted by Calder and Storr (p. 73), is the common reliance on the assumption that people are self-interested in the narrow sense of seeking to maximise their own narrow

material well-being (or are simply irrational). Another, mentioned in a later chapter by Aligica (p. 139), involves an exclusive reliance on the categories of 'pure private goods' and 'pure public goods'. A third, also mentioned by Aligica (p. 145), is the use of the all-encompassing, mutually exclusive categories of 'state' and 'market'. In all these cases, a satisfactory understanding of the diversity of phenomena in contemporary society requires the use of a "more complex" (E. Ostrom [2009] 2014, p. 167) set of categories that can do justice to: the complexity of people's motivations, which extend beyond a concern for one's own material well-being; to the variety of goods in the real world, which display to varying degrees the attributes of non-rivalry and non-excludability; and to the correspondingly varied institutional arrangements used to deliver public services and manage shared resources (E. Ostrom [2009] 2014, pp. 167-85). "To explain the world of interactions and outcomes," Elinor Ostrom ([2009] 2014, p. 197) concludes, "we also have to be willing to deal with complexity instead of rejecting it." This concern to adopt sets of categories that capture the complexity of the real world, to which both Calder and Storr and Aligica rightly draw attention, is arguably an example of what has been described as Elinor Ostrom's 'realist orientation', that is her concern to adopt methods and concepts that do justice to certain key features of social reality (Lewis 2021).

4. SCHOOLS OF THOUGHT

Vlad Tarko (chapter 4) examines the affinities between the work of Elinor Ostrom and behavioural economics. In doing so, Tarko (pp. 48-50, 56-59) elaborates in an interesting and insightful way on a feature of Elinor Ostrom's work briefly mentioned above, namely her belief that in order to explain observed instances of self-governance it is necessary to acknowledge that people have "complex motivational structures" ([2009] 2014, p. 167; also see E. Ostrom [1998] 2014, p. 123). As Tarko writes, Ostrom "argues that a broader concept of rationality is needed for understanding the complex reality of collective action" (p. 50). That broader conception of rationality entails that in deciding how to act, people take into account not just external material incentives, such as those provided by the prospect of consuming a particular quantity of a resource, but also the intrinsic satisfaction to be had from adhering to social rules and from promoting other people's welfare (Ostrom 1990, pp. 35–36, 205–6; [1998] 2014, pp. 123, 129–38; 2005, pp. 109–13, 116–19). For Ostrom, people certainly can act opportunistically; but they can also possess attributes, such as intrinsic and other-regarding preferences, that enable them to overcome their propensity for opportunism and thereby sustain cooperative outcomes (Tarko pp. 48-50, 67). The lesson Ostrom gleans from her fieldwork on self-governance and from laboratory experiments is that "human beings are neither all-knowing saints nor devilish knaves ... humans have complex motivations including narrow self-interest as well as norms of proper behaviour and other-regarding preferences" (2005, pp. 132, 119; also see E. Ostrom [1998] 2014, p. 136).

Such pro-social motivations, which are of course intensively studied by behavioural economists, are important in encouraging people to moderate their consumption of shared resources and to invest adequately in them, thereby helping those people to solve the first-order collective action problem associated with managing the commons. But as Tarko (pp. 59-62) rightly observes, such motivations are also important in enabling people to enforce the rules upon which the possibility of self-governance depends. The monitoring and enforcement of those rules gives rise to a second-order collective action problems; opportunistic individuals may be tempted to free-ride on others' efforts to sustain and implement the rules in question, leading to the possibility that inadequate monitoring and enforcement will undermine the potential for those rules to sustain successful outcomes (Ostrom [1998] 2014, pp. 134-36; Ostrom 2000, pp. 3-4). But the presence of some people who gain satisfaction from following rules, from punishing those who break rules, and from seeing their fellow citizens benefit from successful self-governance, can help to ensure that this second-order dilemma can be solved (Tarko p. 63).

In considering Ostrom's use of behavioural insights, Tarko (pp. 49-50, 64-65) argues, similarly to Calder and Storr, that she sought to navigate a course between over-socialised approaches that simply assume that people will do whatever is required to solve collective action problems and under-socialised

perspectives that portray people as being motivated only by considerations relating to their material well-being. On Tarko's account, central to Ostrom's efforts to negotiate these extremes is the way that, while acknowledging the causal and explanatory significance of social-structural factors, she portrays them as influencing the possibility of cooperation only through their impact on people's conduct. This is an important point long emphasised by the Ostroms. An early statement can be found at the outset of Vincent Ostrom's *The Intellectual Crisis in American Public Administration*, where he urges social scientists to "distinguish between a determinate causal ordering and a quasi-causal ordering":

> In a determinate causal ordering a cause impinges directly upon and determines an effect. A quasi-causal ordering depends upon the intervention of human actors who are capable of thinking, considering alternatives, choosing, and then acting ... In such circumstances we are required to take account of how individuals view themselves, conceptualising their situation, and choose strategies in the light of the opportunities available to them. Analysis in the social sciences requires recourse to strategic thinking in quasi-causal orders. The rule-ordered relationships that are constitutive of human organisation function as soft constraints that are themselves subject to choice (V. Ostrom 2008, p. 2).[18]

Similarly, Elinor Ostrom maintains that understanding the possibility of self-governance requires analysts to relax the assumption that the social world is a determinate or closed system (that is, one in which the relations between structural conditions and outcomes can be expressed as regularities of the form, 'Whenever these structural variables, then that set of outcomes'). For Ostrom, creative human agency of the kind that enables people to develop new social rules presupposes that the world is an open system, in which such regularities are few and far between. As Ostrom and her co-authors write, "If agency is taken seriously, we must allow for both creativity and differences in perspective. But creativity and differences in interpretation mean that lawlike social patterns are unlikely to arise" (Poteete et al. 2010, p. 9). Structural variables shape and influence people's actions, and so exert a causal influence over outcomes, but without determining them, because people have the capacity—the agency—to interpret and respond creatively to the social-structural context in which they find themselves. For the Ostroms, therefore, both social-structural factors and human agency exert a causal influence over overcomes and are therefore explanatorily significant. Hence Ostrom's remark that she sought to "allow scholars who stress structural explanations of human behaviour and those who stress individual choice to find common ground, rather than to continue the futile debate over whether structural variables or individual attributes are the most important" (E. Ostrom [1998] 2014, p. 124; also see Lewis 2021, pp. 625-26, 629-32).

One final point, well made by Tarko, is worth emphasising. While in developing these insights Ostrom "builds on the work of behavioural economics" (p. 67) (see, e.g., E. Ostrom [1998] 2014, pp. 123-24, 128-33; 2005, pp. 69-133), she also departs from certain important strands of behavioural research, in particular work—associated with what Tarko refers to as the 'new paternalism'—suggesting that policy-makers should seek to 'nudge' people into taking particular courses of action (e.g. Thaler and Sunstein 2009). "Ostrom's work," Tarko (p. 48) argues, "is very strongly anti-paternalistic, focused instead on people's abilities to self-govern." Accordingly, the Ostroms emphasise that people need the ability to practice "the arts and science of association" (that is, to create and maintain the rules that facilitate self-governance): they require the intellectual resources—the ideas and the imagination—to conceptualise the possibility of governing the resource themselves; they need the courage to take assume responsibility for managing it; and they need to be able to identify, agree upon, and resolve conflicts over the requisite rules (E. Ostrom 1990, pp. 7, 14; V. Ostrom 1997, pp. 271–302). This view of people as co-creators of the rules that govern them, rather than as passive pawns to be manipulated by technocratic experts, lies at the heart of the Ostroms' vision of a democratic society (Tarko, pp. 48-49, 66-67; also see Aligica 2019, pp. 97-117).

Michael McGinnis's contribution compares the Bloomington School with the New Institutional Economics (chapter 3).[19] He argues that the two approaches have shared foundations, in particular a com-

mon emphasis on methodological individualism and bounded rationality (pp. 26-29). However, they also diverge in important ways. While new institutionalists tend to "conceptualise politics as exchanges between public officials and private actors", the Bloomington school scholars counter that politics "encompasses a far broader range of experience than mere exchange" (p. 29).

> A basic tenet of the Bloomington school is that governance should be understood as co-production, a form of collective action in which the governed see themselves as an integral part of the governing process (ibid.).

McGinnis goes on the argue that this perspective encourages Bloomington scholars to be more willing to acknowledge the complexity of people's motivations, quoting Elinor's Ostrom's remark that rather than designing institutions on the basis that people are always and everywhere self-interested, "a core goal of public policy should be to facilitate the development of institutions that bring out the best in humans" (p. 30, quoting E. Ostrom [2010] 2014, p. 197).[20] These differences also reflect the way that while new institutionalism focusses on the principal-agent problems that arise within hierarchically-order, top-down political systems, Bloomington school scholars "emphasise bottom-up processes of joint participation in crafting, monitoring, enforcing, evaluating, and revising rules and the shared norms which support the legitimacy of those rules" (p. 42).

One might add to McGinnis's insightful comparison by highlighting how, in developing her theory of collective action, Elinor Ostrom sought to analyse and explain not only how people are sometimes able to develop institutions that facilitate successful self-governance, but also why—perhaps because they fail to solve the relevant second-order collective action problems—they sometimes fail to do so (E. Ostrom 1990, pp. 58-181). As she writes in *Governing the Commons* "'getting the institutions right' is a difficult, time-consuming, conflict-invoking process" that does not always end in success, which is why "the cases to be discussed in this book illustrate both successful and unsuccessful efforts to escape tragic outcomes" (1990, p. 14). In portraying the processes through which people attempt to develop such institutions as contingent, in the sense of not always yielding institutions that are conducive to successful self-governance, Ostrom avoids the charge of functionalism that is sometimes levelled against other exponents of new institutional economics (see, e.g., Granovetter 1992, pp. 4-7). Put slightly differently, Ostrom shares with critics of new institutional economics such as Mark Granovetter a concern to examine the contingent, dynamic processes through which beneficial institutions do—or, sometimes, do not—arise (Granovetter 1992, p. 9). This is, of course, an illustration of Calder and Storr's point that both Ostrom and new economic sociologists like Granovetter portray people as being embedded in networks of social relations that, by affording or denying them access to various kinds of resources, shape their capacity to engage successfully in collective endeavour.

5. POLICY

Paul Dragos Aligica (chapter 9) focuses on the instrumental role played by the Ostroms in the development of a political economy perspective on public administration, whereby they sought "to promote public choice [theory] as the theoretical foundation in public administration and public administration as the applied domain of public choice" (p. 138). This paradigm shift involved a move away from portrayals of public administration as involving a hierarchy of professionally-trained public servants with a single centre of power (Wilson 1956; Gerth and Mills 1946) towards a 'political economy' approach, inspired by the work of scholars such as Olson (1965), Tullock (1965) and Buchanan (1969), that deployed economic reasoning to analyse the behaviour of the public sector in ways that subverted traditional Wilsonian and Weberian perspectives (V. Ostrom and E. Ostrom 1971; V. Ostrom 2008, pp. 20-31, 42-64). Explicitly invoking the work of Thomas Kuhn, Vincent Ostrom in particular argued that the discipline of public administration was

undergoing an intellectual crisis whose resolution required a shift to the new political economy paradigm (2008, pp. 5-19, 87-115).

In the early 1970s, in contrast to the then mainstream Wilsonian approach, the new political economy paradigm suggested that the multiplicity of political unit, duplication of functions, and overlapping jurisdictions that characterised American metropolitan government did not necessarily indicate inefficiency. For the Ostroms, as Aligica (pp. 140-42) makes clear, the tools of economic analysis could be used to show that what the mainstream saw as signs of chaos and inefficiency in the provision of public services could actually be features of a polycentric system of provision whereby a "multiplicity of governance units was functioning as a competition-generating structure" (p. 141).[21] Competition between multiple producers of public services, between which consumer-citizens could choose in a quasi-market setting, might serve to generate both the incentives and the information needed to allocate resources more efficiently than under a monocentric regime in which an area was served by just a single monopoly producer (pp. 142-50). As the Ostroms wrote, "Competitive pressures are the key factors in maintaining the viability of a democratic system of public administration ... The characteristics of public services and the important role for diverse organisations, including private enterprises, in the delivery of such services dictate the nature and structure of a public economy. The public economy need not be an exclusive government monopoly" (V. Ostrom and E. Ostrom [1977] 1999, p. 99, quoted in Aligica, p. 146).[22]

One question that arises in the case of polycentric systems concerns the feedback mechanism through which people learn how to allocate resources more effectively within public economies or quasi-markets. This issue is considered not only by Aligica (pp. 142-44) but also by Peter Boettke in his contribution, entitled "Learning from the Socialist Calculation Debate: Is Efficiency in Public Economies Possible?" (chapter 8). Boettke considers the Ostroms' work on the provision of public goods through polycentric systems of governance in light of the following question: what are the analogues in such systems of the freely-formed market prices, and the calculations of profit and loss they facilitate, that help people learn enough to ensure that the needs of citizens are met at the lowest possible cost (pp. 124-25, 129-35)? Like Aligica, Boettke invokes the path-breaking work of Ostrom et al. ([1961] 1999, pp. 42-46), in which it is argued that the gain or loss of contracts, and the movement of people within jurisdictions as they 'vote with their feet', can generate the error-correcting negative feedback required to ensure that "much of the flexibility and responsiveness of market organisation can be realised in the public service economy" (Ostrom, et al. [1961] 1999, p. 45; also see pp. 42-46 and V. Ostrom and E. Ostrom [1977] 1999, pp. 92, 94-99).[23]

In their essay on 'Environmental Policy from a Self-governance Perspective' (chapter 7), Jayme Lemke and Jordan Lofthouse explore the relevance of the Ostroms' work for environmental policy. As they write at the outset of their essay, "[b]y taking an interdisciplinary approach that incorporates political economy into environmental studies, the Bloomington School developed an approach that combines the study of economics and politics to help scholars and policy-makers understand the root cause of environmental problems and find real, viable ways to address them" (p. 106). Lemke and Lofthouse first outline Elinor Ostrom's work on the governance of common property resources (pp. 107-10), arguing—in an echo of Duhnea and Martin (pp. 14-15)—that her emphasis on the possibility of local communities devising by and for themselves rules that facilitate successful self-governance is "at its core deeply democratic in that it insists on deliberation, cooperation, and compromise as important tools for solving social problems' (p. 110; also see p. 120).

Lemke and Lofthouse then consider the implications of Ostrom's approach for global environmental problems such as climate change. They argue, consistent with the democratic nature of the Ostroms' approach, that dealing with such problems requires much more than global agreements negotiated by governments: "global solutions are unlikely to succeed unless they are accompanied by national, regional and local solutions to the same problems". The reason is that "creating long-term solutions to climate change involves changing the day-to-day activities of individuals, companies, communities, and government at multiple levels" (p. 111; also see E. Ostrom 2014). It requires, in other words, a polycentric system that affords people and organisations opportunities to begin to find solutions to environment problems as part of, and indeed

in anticipation of, global initiatives to tackles such challenges. And as already noted, a polycentric system also facilitates a process of experimentation and discovery that "will help us to learn which sets of actions, technologies, and institutions are the most effective at reducing the threats of climate change" (p. 112). As Ostrom writes, "The advantage of a polycentric approach is that it encourages experimentation by multiple actors, as well as the development of methods for assessing the benefits and costs of particular strategies adopted in one setting and comparing these with results obtained ... Rather than only a global effort, it would be better to self-consciously adopt a polycentric approach to the problem of climate change in order to gain benefits at multiple scales as well as to encourage experimentation and learning from diverse policies at multiple scales" (E. Ostrom 2010, pp. 555-56, quoted in Lemke and Lofthouse, pp. 112-13; also see Ostrom 2014, p. 116).

On this view, especially when one is dealing with highly complex problems, the appropriate solution, including the scale at which it is provided, cannot be determined *a priori* but needs to be discovered. As Lemke and Lofthouse write, "The complex nature of most environmental problems means that one-size fits all solutions are unlikely to work." For example, rather than assuming from the outset that a global, top-down solution to large-scale environmental problems is required, it should be acknowledged that solutions might emerge from the bottom-up as "organisations across many different communities ... work together" (p. 118) in ways that might, but need not, involve them according a role to central government: "The critical point is that government is not presumed either necessary or unnecessary, but instead involved to the extent that individuals on the ground determine that government action is the most effective way to proceed." And, of course, the strength of polycentric systems is that they facilitate the experimentation needed to set in train a process of discovery that will enable people to learn what approach is best suited to solving the particular environmental problems they face.

Vincent Ostrom sometimes expressed this point by referring to Ross Ashby's 'law of requisite variety', according to which in order "to realise specified effects, there must exist as much variety in the strategies available as there is variety in the conditions that obtain" (V. Ostrom [1993] 1999, p. 182; also see Ashby 1956, pp. 206-13):

> There can be no universal problem-solver capable of addressing diverse problems as applying to societies as wholes. Rather, human societies require diverse patterns of association to cope with problems of varying scales under variable time and place exigencies. Principles of heterogeneity and complementarity imply that all human associations occur in the context which W. R. Ashby (1956) has identified as a law of requisite variety. Given time and space specificities, achieving complementarity among heterogeneous and diverse elements implies that uniform laws of association are not appropriate for the governance of all associated relationships in human societies (V. Ostrom [1990] 1999, p. 411).

In other words, by affording people the opportunity to devise their own operational rules, polycentric systems constitute a mechanism for generating the variety needed for people to be able to identify rules that are well-adapted to dealing with the particular kinds of problems they face (V. Ostrom 1997, pp. 121-22, 222-23; 2008, p. 48, 190 n. 6).

6. CONCLUSION

The essays contained in this worthwhile volume illustrate how Elinor and Vincent Ostrom drew on a wide range of sources in their efforts to develop a framework for understanding the possibility of self-governance in a variety of settings. Their efforts at intellectual artisanship bore fruit in a host of applied studies, encompassing not only the governance of environmental resources and public services, as discussed in several of the essays in the volume under review here, but also of knowledge creation in a digital world and the political economy of development aid (Hess and Ostrom [ed.] 2011, Gibson et al. 2005). Their ideas have

continued provide inspiration for other scholars, who have deployed them to good effect in a host of studies, including—to name but a few topics that have been thus illuminated—theoretical analyses of citizenship (Aligica) and of the firm and innovation (Deakin 2012, Potts 2018), as well as more applied work on recovery from natural disasters (Storr et al. 2017) and responses to the pandemic (Paniagua and Rayamajhee 2021). Such work testifies to the continued creative potential of the Ostroms' ideas. The essays contained in this very useful collection, by discussing the Ostroms' main ideas and comparing and contrasting their work with that of several other approaches to social science, provide a very helpful resource for those interested in learning more about the Bloomington School, its relations to other schools of thought, and how it can be used to advance our understanding of important issues in political economy. The editors and contributors are to be congratulated on a fine achievement.

NOTES

1 All otherwise unattributed page references are to the volume under review.

2 GMU is, of course, located in Fairfax Virginia. Hence the reference to that state in the title of this essay. In the interests of full disclosure, it should be mentioned that the author of this review is amongst other things an Affiliated Fellow at the F. A. Hayek Program for Advanced Study in Philosophy, Politics, and Economics at GMU.

3 See, for example, Wall (2017) for an example of a radical political economy perspective on the Ostroms' work, Colander and Kupers (2017) and Gaus (2021: 15, 198-206) for analyses that engage with it from the vantage point provided by complexity theory, and Wilson (2015) for an evolutionary analysis. For Elinor Ostrom's use of complexity and evolutionary theory, see Ostrom (1999) and Wilson et al. (2013).

4 See, for example, V. Ostrom ([1997] 2012) and E. Ostrom (2011).

5 This is a point to which Boettke also alludes in his contribution to the collection (pp. 123-24).

6 Ostrom acknowledges her indebtedness to Buchanan for the notion of distinct levels of analysis in, for example, Ostrom (2004, p. 39).

7 For an interesting discussion of some differences between Buchanan and the Ostroms on these issues, see Boettke and Lemke (2018, pp. 68-69).

8 See Dold and Lewis (2020, pp. 1162-66) for a more detailed account.

9 "In my judgment, we are left with the circumstances that the model of *Homo economicus* used in neoclassical theory does not supply an adequate basis for informing choices at the constitutional level of analysis or for establishing the logical foundations for constitutional democracies" (V. Ostrom [1997] 2012, p. 94; also see pp. 92-94, 97). For an insightful discussion of the role played by the notion of 'covenant' in the thought of Vincent Ostrom, see Malik (2017).

10 We return to this point below, in discussing McGinnis's chapter.

11 A similar argument can be found in the context of Hayek's work in Lewis (2022).

12 For an interesting discussion of related issues, see Boettke and Lemke (2018).

13 Hayek wrote most explicitly on federalism in the context of his discussions of a liberal international order (see Hayek [1939] 2022). For a discussion, see Lewis (2022).

14 For other contributions, see Malik (2017) and Lewis (2017, 2021).

15 This account is closely related, for Vincent Ostrom in particular, to the notion of covenental reasoning. The latter suggests that people who are seeking to devise and implement a set of rules for governing their interactions recognise an obligation to consider one another's interests and goals (see section 2 above). The linguistic expression of their recognition of this obligation is the use of the collective ('we') rather than the singular ('I') form of intentions (for more on which see Lewis and Peterson 2021). That people have the capacity to engage in covenantal reasoning is another important feature of Vincent Ostrom's ontological commitments (V. Ostrom 1991, pp. 62-66, 252-53, [1996] 2012, p. 75, [1997] 2012, pp. 93-94, 100-1, 1997, pp. 188, 292-95).

16 For more on the ontological presuppositions of the new economic sociology, see Lewis (2004).

17 It is also worth noting in this context that Vincent Ostrom draws on Lachmann's analysis of capital as consisting of heterogeneous goods that stand in relations of complementarity and substitutability to each other in his analysis of rule-creation-as-artisanship (Ostrom [1991] 2012, p. 280, 1997, pp. 66, 85, 205-06, 222-23).

18 The similarities with Hayek's compositive method, according to which social scientists seek to show how the subjective beliefs held by individual people lead them to act in ways that give rise, unintentionally, to the structures that help to make up the social world, are obvious (Hayek 2010, pp. 91-107).

19 For McGinnis, the new institutionalism is exemplified by the work of Ronald Coase, Douglas North and Oliver Williamson.

20 Hence also her remark that "institutions ... differentially reward or punish [people] over time so that intrinsic and extrinsic motivations are learned and develop over time ... Learning to craft rules that attract and encourage individuals who share norms of reciprocity and trustworthiness, or who learn them over time, is a fundamental skill in all democratic societies" (2005, p. 133). Also see the discussion found earlier in this review of Vincent Ostrom's notion of covenental reasoning.

21 Also see Lemke and Lofthouse's essay in this volume (chapter 7, pp. 114-15).

22 For empirical studies of the beneficial effects of polycentric governance in the provision of public services, see for example Ostrom (1983), Ostrom and Parks (1987) and Oakerson and Parks (1988).

23 Also see the very useful discussion of federalism and polycentricity provided by Candela in the final chapter of the volume under review (pp. 159-62). Chamlee-Wright and Myers (2008, pp. 138-61) provide an insightful discussion of analogues to market-based discovery in non-market environments.

REFERENCES

Aligica, P. 2019. *Public Entrepreneurship, Citizenship, and Self-Governance*. Oxford: Oxford University Press.

Aligica, P. and P. Boettke. 2009. *Challenging Institutional Analysis and Development: The Bloomington School*. London and New York: Routledge.

Aligica, P., P. Lewis and V. Storr (eds.) 2017. *The Austrian and Bloomington Schools of Political Economy. Advances in Austrian Economics*, volume 22. Bingley: Emerald Publishing.

Ashby, W. R. 1956. *An Introduction to Cybernetics*. New York: Wiley.

Boettke, P. and J. Lemke. 2018. Constitutional Hopes and Post-Constitutional Fears: The Role of Rational Construction in Skeptical Public Choice. In: P. Boettke and S. Stein (eds.), *Buchanan's Tensions: Reexamining the Political Economy and Philosophy of James M. Buchanan*. Arlington: Mercatus Center.

Buchanan, J. 1959. Positive Economics, Welfare Economics and Political Economy. *Journal of Law and Economics*, 2: 14-38.

_____. [1964] 1979. What should economists do? In: J. Buchanan, *What Should Economists Do?* Indianapolis: Liberty Fund.

_____. 1969. *Cost and Choice: An Inquiry in Economic Theory*. Chicago: Markham.

_____. [1977] 2001). Law and the Invisible Hand. In: *Federalism, Liberty, and the Law, Vol. 18 of The Collected Works of James M. Buchanan*. Indianapolis: Liberty Fund.

_____. 1979. Natural and Artifactual Man. In: J. Buchanan, *What Should Economists Do?* Indianapolis: Liberty Fund.

_____. 1986] 2001. Cultural Evolution and Institutional Reform. In: *Moral Science and Moral Order, Vol. 17 of The Collected Works of James M. Buchanan*. Indianapolis: Liberty Fund.

_____. 1995. Federalism as an Ideal Political Order and an objective for Constitutional Reform. *Publius* 22: 19-27.

Buchanan, J. and G. Tullock. 1962. *The Calculus of Consent: Logical Foundations of Constitutional Democracy*. Ann Arbor: University of Michigan Press.

Burt, R. 2004. Structural Holes and Good Ideas. *American Journal of Sociology* 110: 349-99.

Chamlee-Wright, E. 2008. The Structure of Social Capital: An Austrian Perspective on its Nature and Development. *Review of Political Economy* 20: 41-58.

Chamlee-Wright, E. and J. Myers. 2008. Discovery and Social Learning in Non-priced Environments: An Austrian View of Social Network Theory. *Review of Austrian Economics* 21: 151-66.

Deakin, S. 2012. The Corporation as Commons: Rethinking Property Rights, Governance and Sustainability in the Business Enterprise. *Queen's Law Journal* 37: 339-81.

Colander, D. and R. Kupers. 2014. *Complexity and the Art of Public Policy: Solving Society's Problems from the Bottom Up*. Princeton: Princeton University Press.

Gaus, G. 2021. *The Open Society and its Complexities*. Oxford: Oxford University Press.

Gerth, H. and C. W. Mills (eds.) 1946. *From Max Weber: Essays in Sociology*. New York: Oxford University Press.

Gibson, C., K. Andersson, E. Ostrom, and S. Shivakumar. 2005. *The Samaritan's Dilemma: The Political Economy of Development Aid*. Oxford: Oxford University Press.
Granovetter, M. 1973. The Strength of Weak Ties. *American Journal of Sociology*, 78: 1360-80.
Granovetter, M. 1985. Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology* 91: 481-510.
_____. 1992. Economic Institutions as Social Constructions: A Framework for Analysis. *Acta Sociologica* 35: 3-11.
Hayek, F. A. [1939] 2022. The Economic Conditions of Inter-state Federalism. In: F. A. Hayek, *Essays on Liberalism and the Economy: Volume 18 of the Collected Works of F. A. Hayek*, ed. P. A. Lewis. Chicago: University of Chicago Press.
_____. [1955] 2014. Degrees of Explanation. In: F.A. Hayek (2014).
_____. 1968] 2014. Notes on the Evolution of Systems of Rules of Conduct. In: F. A. Hayek (2014).
_____. [1975] 2014. The Pretence of Knowledge. In: F. A. Hayek (2014).
_____. 1979. *Law, Legislation and Liberty, Volume 3: The Political Order of a Free People*. London: Routledge.
_____. 2010. *Studies on the Abuse and Decline of Reason: Texts and Documents*, ed. B. Caldwell, vol. 13 (2010) of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press.
_____. (2014). *The Collected Works of F.A. Hayek, Volume 15: The Market and other Orders*. Ed. B. Caldwell. Chicago: The University of Chicago Press.
Herzberg, R., P. Boettke and P. Aligica (eds.). 2019. *Ostrom's Tensions: Examining the Political Economy and Public Policy of Elinor C. Ostrom*. Arlington: Mercatus Center.
Hess, C. and E. Ostrom (ed.). 2011. *Understanding Knowledge as a Commons: From Theory to Practice*. Cambridge, MA: MIT Press.
Kieser, L. and E. Ostrom [1982] 2000. The Three Worlds of Action: A Metatheoretical Synthesis of Institutional Approaches. In: M. McGinnis (ed.), *Polycentric Games and Institutions: Readings from the Workshop in Political Theory and Institutional Analysis*. Ann Arbor: University of Michigan Press.
Knight, F. 1947. The Planful Act: The Possibilities and Limitations of Collective Rationality. In: F. Knight, *Freedom and Reform*. New York: Harper and Brothers.
Lachmann, L. [1956] 1978. *Capital and its structure*. Kansas City: Sheed, Andrews and McMeel.
_____. 1977. *Capital, expectations and the market process: Essays on the theory of the market economy*. Kansas City: Sheed, Andrews and McMeel Inc.
Lemke, J. and V. Tarko (eds). 2021. *Elinor Ostrom and the Bloomington School: Building a New Approach to Policy and the Social Sciences*. Bath: Agenda Publishing Limited.
Lewis, P. 2004. Economics as Social Theory and the New Economic Sociology. In: P. Lewis (ed.), *Transforming Economics: Perspectives on the Critical Realist Project*. London and New York: Routledge.
_____. 2017. The Ostroms and Hayek as theorists of complex adaptive systems: commonality and complementarity. *Advances in Austrian Economics* 22: 35–66.
_____. 2021. Elinor's Ostrom's 'Realist Orientation': An Investigation of the Ontological Commitments of her Analysis of the Possibility of Self-Governance. *Journal of Economic Behavior and Organisation* 189: 623-36.
_____. 2022. Editor's Introduction. In: F. A. Hayek, *Essays on Liberalism and the Economy: Volume 18 of the Collected Works of F. A. Hayek*. Chicago: University of Chicago Press.
Lewis, P. and M. Dold. 2020. James Buchanan on the Nature of Choice: Ontology, Artifactual man, and the Constitutional Moment in Political Economy. *Cambridge Journal of Economics* 44: 1159-79.
Lewis, P. and M. Peterson. 2021. Amartya Sen and Elinor Ostrom on Choice, Collective Action and Rationality: A Comparison. Unpublished paper, Department of Political Economy, King's College London.
Malik, A. 2017. Covenant and Moral Psychology in Polycentric Orders. *Advances in Austrian Economics* 22: 107-32.
Nordman, E. 2021. *The Uncommon Knowledge of Elinor Ostrom: Essential Lessons for Collective Action*. Washington, DC: Island Press.
Oakerson, R. and R. Parks. 1988. Citizen Voice and Public Entrepreneurship: The Organisational Dynamic of a Complex Metropolitan County. *Publius* 18: 91-112.
Olson, M. 1965. *The Logic of Collective Action*. Cambridge, MA: Harvard University Press.
Ostrom, E. 1983. A Public Choice Approach to Metropolitan Institutions: Structure, Incentives, and Performance. *Social Science Journal* 20: 79-96.
_____. [1986] 2014. An agenda for the study of institutions. In: Sabetti, F. and Aligica, P. (eds.), *Choice, Rules and Collective Action: The Ostroms on the Study of Institutions and Governance*. Colchester: ECPR Press.
_____. 1990. *Governing the Commons*. Cambridge: Cambridge University Press.
_____. 1994. Constituting Social Capital and Collective Action. *Journal of Theoretical Politics* 6: 527-62.
_____. [1998] 2014. A Behavioral Approach to the Rational Choice Theory of Collective Action. In: Sabetti, F. and Aligica, P. (eds.), *Choice, Rules and Collective Action: The Ostroms on the Study of Institutions and Governance*. Colchester: ECPR Press.
_____. 1999. Coping with Tragedies of the Commons. *Annual Review of Political Science* 2: 493–535.
_____. 2000. Crowding out Citizenship. *Scandinavian Political Studies* 23: 3-16.
_____. 2004. The Ten Most Important Books. *Tidsskriftet Politik* 7: 36-48.

_____. 2005. *Understanding Institutional Diversity*. Princeton and Oxford: Princeton University Press.
_____. 2006. Converting Threats into Opportunities. *PS Political Science & Politics* 39: 3-12.
_____. [2009] 2014. Beyond States and Markets. In: F. Sabetti and P. Aligica (eds.) (2014), *Choice, Rules and Collective Action: The Ostroms on the Study of Institutions and Governance*. Colchester: ECPR Press.
_____. 2010. Polycentric Systems for Coping with Collective Action and Global Environmental Change. *Global Environmental Change* 20: 550-57.
_____. 2011. Honoring James Buchanan. *Journal of Economic Behavior and Organization* 80: 370-73.
_____. 2014. A Polycentric Approach for Coping with Climate Change. *Annals of Economics and Finance* 15: 97-134.
Ostrom, V. 1987. *The Political Theory of a Compound Republic: Designing the American Experiment*. Lincoln: University of Nebraska Press.
_____. [1990] 1999. Problems of Cognition as a Challenge to Policy Analysts and Democratic Societies. In: M. McGinnis (Ed.), *Polycentricity and local public economies: Readings from the workshop in political theory and policy analysis*. Ann Arbor: University of Michigan Press.
_____. 1991. *The Meaning of American Federalism: Constituting a Self-Governing Society.* San Francisco: ICS Press.
_____. [1991] 2012. Some Ontological and Epistemological Puzzles in Policy Analysis. In: *The Quest to Understand Human Affairs, Volume 2: Essays on Collective. Constitutional, and Epistemic Choice*. Lanham: Lexington Books.
_____. [1991] 2014. Polycentricity: The Structural Basis of Self-Governing Systems. In: F. Sabetti and P. Aligica (eds.) (2014), *Choice, Rules and Collective Action: The Ostroms on the Study of Institutions and Governance*. Colchester: ECPR Press.
_____. [1993] 1999. Crypotimperialism, Predatory States, and Self-Governance. In: M. McGinnis (Ed.), *Polycentricity and local public economies: Readings from the workshop in political theory and policy analysis*. Ann Arbor: University of Michigan Press.
_____. [1996] 2012. Some Conjectures about the Shape of the Political Science to Come. In: *The Quest to Understand Human Affairs, Volume 2: Essays on Collective. Constitutional, and Epistemic Choice*. Lanham: Lexington Books.
_____. 1997. *The Meaning of Democracy and the Vulnerability of Democracies: A Response to Tocqueville's Challenge.* Ann Arbor. University of Michigan Press.
_____. [1997] 2012. Buchanan's Opening to Constitutional Choice and Meta Levels of Analysis. In: *The Quest to Understand Human Affairs, Volume 2: Essays on Collective. Constitutional, and Epistemic Choice*. Lanham: Lexington Books.
_____. 2008. *The Intellectual Crisis in Public Administration*. 3rd edition. Tuscaloosa: The University of Alabama Press.
Ostrom, V. and E. Ostrom. 1971. Public Choice: A Different Approach to the Study of Public Administration. *Public Administration Review* 31: 203-16.
_____. [1977] 1999. Public goods and public choices. In: M. McGinnis (Ed.), *Polycentricity and local public economies: Readings from the workshop in political theory and policy analysis*. Ann Arbor: University of Michigan Press.
Ostrom, E. and R. Parks. [1987] 1999. Neither Gargantua nor the Land of Lilliputs: Conjectures on Mixed Systems of Metropolitan Organization. In: M. McGinnis (Ed.), *Polycentricity and local public economies: Readings from the workshop in political theory and policy analysis*. Ann Arbor: University of Michigan Press.
Ostrom, V., C. Tiebout and R. Warren. [1961] 1999. The Organization of Government in Metropolitan Areas. In: M. McGinnis (Ed.), *Polycentricity and local public economies: Readings from the workshop in political theory and policy analysis*. Ann Arbor: University of Michigan Press.
Paniagua, P. and V. Rayamajhee. 2021. A polycentric approach for pandemic governance: nested externalities and co-production challenges. *Journal of Institutional Economics*, https://doi.org/10.1017/S1744137421000795
Poteete, A., M. Janssen and E. Ostrom. 2010. *Working Together: Collective Action, the Commons, and Multiple Methods in Practice*. Princeton and Oxford: Princeton University Press.
Potts, J. 2018. Governing the innovation commons. *Journal of Institutional Economics* 14: 1025-47.
Searle, J. 1995. *The Construction of Social Reality*. London: Penguin Books.
Shackle, G. L. S. 1976. Time and Choice. *Proceedings of the British Academy* 62: 306-29.
Storr, V., L. Grube and S. Haeffle-Balch. 2017. Polycentric orders and post-disaster recovery: a case study of one Orthodox Jewish community following Hurricane Sandy. *Journal of Institutional Economics* 13: 875-97.
Swedberg, R. 2003. *Principles of Economic Sociology*. Princeton: Princeton University Press.
Tarko, V. 2017. *Elinor Ostrom: An Intellectual Biography*. London and New York: Roman and Littlefield.
Thaler, R. and C. Sunstein. 2009. *Nudge: Improving decisions about health, wealth, and happiness*. London: Penguin.
Tullock, G. 1965. *The Politics of Bureaucracy*. Washington, DC: Public Affairs Press.
Wall, D. 2014. *The Sustainable Economics of Elinor Ostrom: Commons, Contestation and Craft*. London and New York: Routledge.
_____. 2017. *Elinor Ostrom's Rules for Radicals: Cooperative Alternatives beyond Markets and States*. London: Pluto Press.
Wilson, D. 2015. *Does Altruism Exist? Culture, Genes and the Welfare of Others*. New Haven: Yale University Press.
Wilson, D., Ostrom, E., & Cox, M. 2013. Generalizing the core design principles for the efficacy of groups. *Journal of Economic Behavior and Organization* 90S, S21–S32.
Wilson, W. 1956. *Congressional Government: A Study in American Politics*. New York: Meridian Books.

REVIEW

Matus Posvanc, *The Evolutionary Invisible Hand. The Problem of Rational Decision-Making and Social Ordering over Time*

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> *Et haec cum dixisset, voce magna clamavit: "Lazare, veni foras!"*
> —(Evangelium secundum Ioannem, 11:43).

This episode from the Gospel according to John is probably one of the most well-known passages in the Christian holy scriptures. Well, when I first read Matus Posvanc's *The Evolutionary Invisible Hand*, I pictured in my mind the image of the author, who is the President of the F. A. Hayek Foundation in Slovakia, shouting "Ludwig Lachmann, veni foras!" After a while, however, I figured out that "Don Lavoie, veni foras!" was probably the most appropriate expression, as the book appears to be solidly grounded in that virtuous interconnection between hermeneutical philosophy, economics and history of ideas so decisively, although briefly, championed by Lavoie, the first prophet of the interpretative turn in economics advocated by Ludwig Lachmann (1971), with its reprise of Max Weber's methodological research programme (see, in particular, Lavoie 1986 and 2011 and Lavoie and Storr 2011).

This is not the place to discuss the influence of Lachmann and Lavoie on the evolution of the Austrian School, but recently Storr (2017, p. 3) stated that there:

> are at least two areas where Lachmann has, arguably, won the day, where Lachmann's views appear to be the dominant ones, where Lachmann either directly inspired these advances in Austrian economic thought or anticipated them. The first is Lachmann's insistence on the thoroughgoing application of subjectivism to our theorizing about action in the world and the second is Lachmann's emphasis on the importance and key role that institutions play in guiding our actions in an uncertain world. Whether we admit it or not, we are all Lachmannians now. Or to be more precise, we are pretty much all radical subjectivists and Austrian institutionalists.

We are all Lachmannians now is a pretty strong statement, and I would guess that many at the Ludwig von Mises Institute would like to disagree. However, it is indeed fair to admit that Lachmannian ideas are at the root of many positive developments within the contemporary Austrian school of economics. He and his first disciple, Don Lavoie, influenced an important group of contemporary Austrian economists: Peter Boettke, David Prychitko, Richard Ebeling, the late Steve Horwitz, Peter Lewin, to

name a few, while Deirdre McCloskey (2017, 2021) explicitly refers to the interpretative turn when presenting her idea of *humanomics*.

Lachmann's emphasis on meaning and interpretation is not disconnected from some of the most important definitions brought out by Ludwig von Mises. In fact, after having stated that the task of economics is "to investigate the market phenomena, that is, the determination of the mutual exchange ratios of the goods and services negotiated on markets, *their origin in human action* and their effects upon later action" (Mises 1949, p. 233, emphasis added), Mises clarified that "Human action is *purposeful behavior*. Or we may say: Action is *will* put into operation and transformed into an *agency*, is aiming at ends and goals, is the ego's *meaningful* response to stimuli and to the conditions of its environment, is a person's conscious adjustment to the state of the universe that determines his life" (1949, p. 11, emphasis added). This means that action cannot be isolated from the meaning it has for the subject who is doing it.

In this light we can understand Storr (2017), when he stated that to be "an Austrian economist is to be concerned with meaning. If we hope to understand human action, then we must pay attention to the meanings that individuals attach to their actions, and to the actions of others, and to the various choices that they are considering, and to the possible outcomes of those choices. Ours is at root a science of meaning"

In fact, if the most important contribution of the Austrian school of economics is the definition of economics as the science of human action, and if human action is purposeful behaviour, it becomes obvious that the task of the economist is to interpret those actions and try to understand their meaning, since every action is meaningfully connected with the final end it tries to achieve (Ferlito 2019). In this regard Mises (1949, p. 92) clearly stated that economics:

> is not about things and tangible material objects … [on the contrary] it is about men [sic], their *meanings* and actions. Goods, commodities, and wealth and all the other notions of conduct are not elements of nature; they are elements of human *meaning* and conduct. He who wants to deal with them must not look at the external world; he must search for them in the meaning of acting men.

By introducing the category of *meaning* we reconnect with the world of interpretations (Lachmann 1971), or *verstehen* (understanding), central to the analysis of human action (Antiseri 2011, p. 7) and which is the most important novelty introduced by Lachmann and his followers. Indeed, *interpretative* processes must be seen as the necessary subjective link between different objective facts and events. Human actions are objective facts; they are responses to other objective facts, constituting the elements of reality. However, how such responses are defined is totally subjective, the outcome of interpretation processes, which I defined as 'hermeneutical actions' (Ferlito 2016 and 2018). This is what Lachmann called the subjectivism of active minds. Such a perspective does not deny the objective nature of reality; however, the nature of the response to objective elements is exquisitely subjective and ontologically hermeneutical.

It is now clear how subjective hermeneutical processes constitute the necessary link between objective facts. Without the interpretative moment, reality could not take shape because no action would be decided. Furthermore, while market players are continuously involved with interpretative processes in an attempt to understand reality, economists themselves must deal with a different type of hermeneutical activity: the understanding of the meaning of human actions in the market and of the unintended consequences which go beyond players' intentions. Therefore, understanding is not limited to how players act. Their actions certainly involve hermeneutical processes, but we should add, as explained by Prychitko (2018, pp. 162-163), that so do economists' interpretations and their subsequently emerging visions.

Posvanc's book is fully embedded in this way of analysing essential points of economics: meaning, understanding and interpretation. And he seems to do so in a way which is even more Lachmannian than the method adopted by Lachmann himself; this is the reason why I mentioned the link with Don Lavoie, who was the most radical among Lachmann's followers. Furthermore, in Posvanc's work we find the philosophical spark that was so present between the 1970s and the 1990s in the works of the young Austrian econo-

mists, who from South Royalton onward were imbued with the German economist's teaching. I have in mind in particular David L. Prychitko, Richard Ebeling, Karen Vaughn and Mario Rizzo.

The book is an ambitious work, aiming at redefining the very foundations of the discipline, including the subjective value theory in a way which I will discuss in a moment, and it appears to be indeed inspired precisely by Lachmann and Lavoie. I will not undertake the task of checking if his various ambitious targets were achieved; in order to do so, the book would need to be read over and over again, so as to fully grasp and appreciate the depth that can be only superficially tasted when it is read only once. Furthermore, the author's erudition—typical of the high tradition of Continental Europe—allows him to navigate through different disciplines in a way that contemporary economists have lost, while it was very familiar to the masters who built the history of our discipline.

Posvanc's opening claim (p. 2) is that the book solves a fundamental problem: how do we correctly estimate for the future, so that we can learn from realized mistakes and be economically successful? Uncertainty and the fact that—despite it, thanks to it or beyond it—coordination emerges, is probably the most striking fact in the analysis of human action—and one which is at the root of Austrian theorizing. Shackle, Knight, Lachmann, as well as Mises and Huelsmann, are some of the companions in Posvanc's journey.

The author is well aware that, if he wants to properly address the matter, he needs to be equipped with a "realistic and meaningful description over time", which "is one of the basic preconditions for the success of any economic theory" (p. 1).

And yet, according to my impression, these are not the most important features or strengths that the book offers the reader. The two crucial aspects in the book are instead, in my view, the following:

1) The modification of the theory of subjective value in the form of the claim that one perceives the satisfaction of one's needs in the context of one's overall individual portfolio of goods.
2) Anchoring this modification in evolutionary (intersubjective) apriorism.

The central element with regard to point 1 is that the author, discussing Menger's classical link between one good and the subjectively perceived satisfaction the good delivers, shifts that satisfaction from the one good to a group of goods which satisfies a sum of needs. The author brings out the interesting—and appropriate—concept of a sum of needs satisfied by a portfolio of goods; this is not in contradiction with the traditional version of the subjective value theory but an extension in the direction of complexity and realism. Furthermore, the author adds that the portfolio of goods is a formally logical, homogeneous construction of the mind, which is applicable over time.

Posvanc (paragraph 2.2.3) explains that the concept that "man prefers more, rather than fewer goods of the same kind and quality" is not applicable over time "since the valuation of goods can change over time and there need not exist, in value terms, the same goods a few moments later". It is only possible to claim that "man prefers a higher rather than a lower satisfaction of needs". Therefore, the author aims to introduce a time-invariant version of the theory of subjective value, where the crucial point is the attribution of value over time.

The explanation of the modified value theory (p. 64) is worth quoting in its entirety:

> The traditional interpretation of the theory of subject value usually describes this causal link between a particular need satisfied by a particular economic good who writes generally about the issue … The specific need satisfied by a particular good that exists today may not exist tomorrow or theoretically speaking, in a few seconds, *in value terms*. The specificity necessarily causes a perception of value heterogeneity. … The problem is not a time or a change per se; a time flow is given; we must deal with it. Change has its endogenous (action-based) as well as exogenous (outer reality-based) character. The problem is to explain how a person assesses goods over time without any auxiliaries such as the *ceteris paribus* concept or a concept such as goods of the same kind and quality or any other model-static constant presuppositions about an agent's valuation over time.

How might one define a subjective value theory which is valid over time? (p. 65, emphasis added):

> The modification consists of a slight adjustment and a deeper differentiation of the concept of the theory. It states that man always satisfies some perceived factual and expected (counterfactual) *sum of needs* by some *sum of goods* (portfolio); but it is not the whole picture. There is always a combination of some needs. It is a kind of mental concept which has its own structure (thoughts structure) and which is based on a relational character—ideas of needs are combined together. It is thought by man that the needs (as a sum of combination of them) are met through the second mind concept—some sum and combination of means. It is also a kind of mental concept with its own relational structure, which we can refer to as a concept of portfolio today. It means that there are two mental concepts—a sum/combination of needs and a sum/combination of means and a Mengerian *value* causality which is not realized on the particular level of the need-good relationship but on the conceptual level of some thought structures of needs and means which have a consequent reflection into reality in the form of a real combination of items of reality which we call economic goods and which constructs our portfolio of real goods.

This passage is very important and dear to me, because it introduces needs and means as two mental concepts. The recognized causality is the value. This is in line with what I affirmed about capital in Ferlito (2016, 2018), and in fact I argue that there is a strong continuity between the works I published on the *hermeneutics of capital* and the extension of those ideas that I find in Posvanc's book.

The main reflection in Ferlito (2016) started from Menger (1871, p. 53), which clearly identified four prerequisites that need to be present simultaneously in order for a thing to acquire the status of a *good*:

1) A human need;
2) Such properties as render the thing capable of being brought into a causal connection with the satisfaction of this need;
3) Human knowledge of this causal connection; and
4) Command of the thing sufficient to direct it to the satisfaction of the need.

These four points stress the subjective and hermeneutical nature of goods. In fact, if a thing does not respond to a *subjective* need, it cannot be classified as a *good*; it simply remains a thing. Prerequisite 1, therefore, can be identified with expectations. It should be followed by prerequisite 3, which can be seen as the choice of the ends/means framework defined by expectations. From my perspective, moreover, prerequisite 3 is hermeneutical, or interpretative: The possibility for a thing to satisfy a need is not primarily objective; initially, the thing is *thought* to be suitable for a need satisfaction. The human mind subjectively *interprets* the object, imagining that it is able to meet the need under examination. Only then can prerequisite 2 be taken into account: Things reveal their ability to satisfy needs through a discovery process, the result of a procedure to test the previous hermeneutical decision. Prerequisite 4 is the implementation of a plan and cannot be separated from prerequisite 2. Once expectations are formed and a certain ends/means framework is thought to be consistent with them, the choice of the framework is tested through implementation processes revealing, in time, the correctness of our hermeneutical intuitions or the necessity for a revision. In order for a thing to become a 'good', therefore, it is necessary primarily to be thought of as suitable for satisfying a need, and afterward such suitability needs to be tested in reality. The initial hermeneutical process may find confirmation or denial: Subjective processes need always to find confirmation in factual reality. I am free to think of a watch as suitable to cut a steak, but the practical test of my hypothesis would frustrate my expectations. Subjective and objective sides of reality complement each other.

It must be noted that this testing process is never at rest. In fact, a thing could lose, or acquire, goods status if circumstances change. The important elements remain unchanged: expectations, interpreting some means as suitable to achieve desired ends, testing the intuition through a plan implementation, and revising plans as a consequence of information acquired during plan implementation. Now, how does one

distinguish between goods and capital goods? I believe that the Mengerian distinction between higher- and lower-order goods is not enough. Similarly, Lachmann's heterogeneous stock of material resources does not help, as it seems to be recursive. What are material resources, then? Lachmann (1956, p. xv) added confusion in arguing that certain *goods* "are capital not by virtue of their physical properties but by virtue of their economic functions. Something is capital because the market, the consensus of entrepreneurial minds, regards it as capable of yielding an income". While I can agree with the first part of the statement, the second part, linking capital and income, sees Lachmann dangerously sliding into a Böhm-Bawerkian or neo-Ricardian trap, which he so vehemently criticized (Lachmann 1973).

The solution I proposed in Ferlito (2016) and further explained in Ferlito (2018) points in the same direction toward which Posvanc is developing his way of thinking: goods and needs as the result of mental (hermeneutical or interpretative) processes. That is why I distinguished between potential capital goods and actual capital goods. Potential capital goods are goods that, in a specific moment in time, are *thought* to be suitable for generating a certain output when combined with other goods in a production process unfolding in time. Instead, actual capital goods are goods that, in a specific moment in time, after being thought of as suitable for generating a certain output when combined with other goods in a production process unfolding in time, are actually implemented in such a production process. *Physically speaking*, then, we might say that, at any given moment, *potential capital* is the set of potential capital goods, which means the set of goods that will be combined into production processes because they are thought, in a specific moment, to be suitable for implementing plans imagined as achieving ends dictated by expectations. *Actual capital* consists, on the other hand, of the set of goods that, in a specific moment, are goods that are combined into productions processes in order to achieve desired ends. In both cases, capital is therefore not simply a set of goods. And, at the same time, it is not simply a set of productive combinations of goods. We are talking about a set of productive combinations of goods consciously implemented because they are the logical outcome of plans set in motion by the thought that they will fulfill expectations.

It might seem that there is no difference between potential and actual capital. However, the first difference lies in the distinct moments in time at which the two entities come into being; Potential capital refers to the moment at which the ends/means framework, following expectation formation, is generated in the economic actor's mind (the hermeneutical moment); actual capital, on the other hand, appears when plans thought to be consistent with the ends/means framework are implemented (the operational/implementation moment). But potential and actual capital can also be distinguished for another reason: The hermeneutical moment could identify as capital goods some things that are not actually at the disposal of the individual for several reasons; a second hermeneutical process would be needed, at a separate moment, in order to identify an alternative. Thus, the formation of actual capital (the implementation moment) could happen, theoretically speaking, only after several hermeneutical moments take place.

It is now clear what I have in mind when I talk about the *hermeneutics of capital*. The identification of capital goods is, first of all, a hermeneutical process in which active minds operate on objects after expectation formation has already happened. Capital without expectations cannot exist, therefore, precisely because capital is a characteristic attributed to objects by the subjective interpretation processes carried out by individuals who try to fulfil expectations. Plan implementation is the link between potential and actual capital.

In a very similar way, Posvanc insists that "there are thought structures (a concept of means and a concept of portfolio) and there are real items of reality which we call goods and combination of goods "a portfolio" (p. 66). The author also emphasizes that it is not possible to isolate a single need per se. The need is linked to a way to satisfy it (via mental processes).

The author also expresses a view which is similar to the one I expressed regarding the distinction between potential and actual capital. At page 68, in fact, Posvanc explains that the "value scale is simple: one, factual (the sphere of a present urgent combination of needs) and, two, counterfactual (the sphere of the possible and the impossible combination of needs). The complexity of counterfactually perceived expected needs can have a real character—these needs are met by a combination of means (the mind concept of the

portfolio) acquired by planned actions that can realistically happen and they can also have an unreal character—only imaginary, where the given need may never be satisfied or may not be attainable".

In this regard it is important to place each choice within its temporal framework, which makes that choice unique. The temporal nature of each choice makes that choice unique. The ontology of goods as the outcome of mental processes is stressed again in two important passages. At page 69 we read:

> It has to be stressed that there is no scale of goods (items of reality). It is only the two-leveled complex of factual and contrafactual needs as a mind concept which is thought to be satisfied by a sum of means and transformed into the individual real actions, reflexed by (a) the existing or current portfolio of goods (real items of reality) and/or (b) the expected portfolio concept (as a mind structure of the sum of means) which is either (b1) realistically planned and achievable by some (new) combination of (appropriate, exchanged or produced) means-goods—some potential portfolio, or (b2) which could be only desired and never achieved—a desired portfolio.

And at page 70:

> The mental concept of the portfolio (the combination or sum of means) has an overlap into reality in the form of a real accumulation, production, and exchanging of the real items of reality we call goods. The actual, perceived combination of needs is always satisfied by action … the combination of needs is purely a mental structure of both the factual and the contrafactual, (real and unreal) needs. Then, we have three kinds of thought concepts of portfolio—some actual or current portfolios, some potential portfolios (thought concepts which are possible and attainable and where we focus our planned actions) and some desired portfolios (thought concepts of what we desire, if…).

According to the author, to deal with a *sum* of needs satisfied by a *sum* of goods allows the concept in the interpretation of economic phenomena to be applicable in a time continuum: the sum is a mathematical construct of the mind that is formally time-invariant:

> The concept enables us also to claim that a person will always prefer to achieve a higher (rather than a lower) satisfaction for the combination of their needs through their portfolio over time. They will prefer to achieve satisfaction sooner rather than later; therefore, the creation of their desired portfolio will be subject to their actions (p. 72).

In a nutshell: the imputation of value takes place at the level of thoughts or mental concepts; the *concept* of the *sum* of needs is linked to the *concept* of the *sum* of means. The portfolio is first constructed as the thought concept and only then it is reflected in empirical reality in the form of goods (real items). And here again I read an analogy with my theory of capital.

In this way, there is the possibility of reaching a workable concept of subjective evaluation in time, because we evaluate *homogenous concepts*, meaning, the *sum* of needs and the *sum* of goods (portfolio), although the portfolio is formed from different goods at different times.

From here, we move to the second important contribution of the book. The author wonders:

> How do we estimate the future? Why are we economically successful? I believe that, while the part of the book described so far excels in clarity, originality and insight, the answer to the above questions struggles to emerge from an analysis that probably develops over too many pages. At first read, I must admit, I was lost.

In his analysis of the future, uncertainty and economic success, Posvanc relies on the contributions of many authors but a clear synthesis, so brilliantly presented with reference to the modified subjective value

theory, does not seem to emerge so clearly. The author reminds us that, according to G. L. S. Shackle, the future is empty and thus we never can make fully informed decisions. Should we conclude then that decisions can never be rational, they can only be speculative, grounded on imagination? Posvanc agrees that the only way to know the future is imagination, but the author adds to Shackle's view: "we need the existence of time-invariant certainties that are applied yesterday, today and tomorrow, and will be valid at any time in the future". The author says that the first certainty we have is the existing uncertainty: 'future' is a fluid concept. "But the second kind of certainty we have is that our actions and thinking are based on certain abstract, and mutually shared and time-invariant concepts. The third certainty is society: we are sociable beings". Furthermore, the practical certainty associated with knowing reality, and at the same time expanding knowledge significantly, helps people to anticipate and grasp the future. Also, statistical tools, insurance and institutions help.

In this framework, the author presents us the entrepreneur as someone who creates combinations. This expression echoes more Schumpeter's new combinations rather than Kirzner's alertness (Ferlito 2015). Posvanc (p. 80) explains that it "is the specific form of the goods which it is possible to produce under some knowledge and resource restrictions which are offered to the market by entrepreneurs in some particular form. It is precisely this particular form where entrepreneurs' trial and error processes take place. It is clearly possible to achieve something through trial and error, while the basic criteria of recognizing success is that a specific form of the good must somehow meet the defined abstract needs".

It may not be clear from the way in which Posvanc puts it, but the combinations he has in mind indeed present a Schumpeterian flavour; in fact, he defines entrepreneurs as "combinators of knowledge with regard to how to meet other people's needs, by some combination of means (goods). The combination of these circumstances also implies the possibility of learning from economic success or error". Schumpeterian entrepreneurs also embark on projects combining knowledge with regard to new products, production processes, markets, etc, in the attempt (success or failure) to meet other people's needs.

What are the guidelines used by entrepreneurs in order to decide which output (combinations) to try to produce and which goods to combine together into the production process in order to obtain, in time, the desired output? The general belief is that their main beacons are profit expectations and the price system. Horwitz (2019, p. 22) explained that the "fundamental challenge of economic production involves answering the twin questions of "what should be produced?" and "how should we produce it?" The first of the two questions relates to consumer preferences: what is that people wish to buy, or might wish to buy if it were available to them? The second question, which is the one that is often overlooked, especially by critics of capitalism, is the harder one: if we are to make this product, which combination of inputs should we use to make it such that we use the least valuable inputs possible? This question is what economists mean by "economic efficiency"".

How do entrepreneurs compare alternative goods and alternative processes of production to determine that they are creating value rather than destroying it? Here it is enough to say that what "enables us to engage in these comparisons of value are market prices determined by the exchange of goods and service against money" (Horwitz 2019, p. 22). Market prices exist thanks to private property, "which enables people to exchange and form markets, which in turn leads to the emergence of market prices" (Ibid.). Market prices are, thus, the objective synthesis of billions of subjective evaluations, arising from market interactions; thanks to the guidance provided by prices—which give information about consumer preferences and scarcity, for example—entrepreneurs can effectively decide what to do and how. Similarly, market prices allow determining if a production process generated or destroyed value, thanks to the comparison between outlays and receipts; as Horwitz (2019, p. 23) put it, "monetary calculation of profits and losses provides producers with ex post feedback about the wisdom of their past choices that, without market prices, would be unavailable".

Considering that these decisions and production processes happen in a context of uncertainty generated by the passage of time and by the limited content of information available to each individual, the role of

entrepreneurial choices appears even more important (Horwitz 2019, p. 24). Successes and failures become an important signal for the entire economic community (Ferlito 2020).

Posvanc recognizes that there is:

> a combination of different types of needs to which the entrepreneur always responds with a specific product … It is precisely the constant discovery of the given abstract constructions of some complex or sum of needs, which in turn causes the one who reveals them to be more successful and vice versa. This is no other principle than the one described by the invisible hand of the market" (p. 85).

However, in his discussion of how such coordination happens in time, it seems to me that an adequate discussion of the role of prices—or, better yet, an adequate price theory—is missing. This is the same flaw that was present in my works on capital, as emphasized by Boettke (2018) and Prychitko (2018). I am now working on filling in that gap.

Hopefully the common ground between mine and Posvanc's works can be an occasion for the elaboration of an adequate price theory consistent with the challenge posed by the interpretative turn in economics.

REFERENCES

Antiseri, D. 2011. *Contro Rothbard. Elogio dell'ermeneutica*. Soveria Mannelli: Rubbettino.

Boettke, P. J. 2018. The Assumption of Heterogeneity in Political Economy. *StoriaLibera* IV(7):157-165.

Ferlito, C. 2015. Entrepreneurship: State of grace or human action? Schumpeter's leadership vs Kirzner's alertness. *European Journal of Economic and Social Systems* 1-2: 11-36.

_____. 2016. *Hermeneutics of Capital. A Post-Austrian Theory for a Kaleidic World*. Hauppauge: Novinka.

_____. 2018. For a New Capital Theory: A Hermeneutical Approach. *StoriaLibera* IV(7): 11-61.

_____. 2019. A meaning discovery process: the unique contribution of the Austrian School of Economics and its relevance for contemporary economics curricula. *International Journal of Pluralism and Economics Education* 10(2): 190-207.

_____. 2020. The Entrepreneur: One, No One and One Hundred Thousand. CME EduPaper Series, 2, Subang Jaya, MY, Center for Market Education.

Horwitz, S. 2019. Ludwig Lachmann as a Theorist of Entrepreneurship. *Studies in Logic, Grammar and Rethoric* 57(70): 19-40.

Lachmann, L. M. 1956. *Capital and Its Structure* (1978). Kansas City: Sheed Andrews and McMeel.

_____. 1971. *The Legacy of Max Weber*. Berkeley: The Glendessary Press.

_____. 1973. *Macro-economic Thinking and the Market Economy. An essay on the neglect of the micro-foundations and its consequences*. London: The Institute of Economic Affairs.

Lavoie, D. 1986. *Euclideanism versus Hermenutics: A Reinterpretation of Misesian Apriorism*, in *Subjectivism, Intelligibility and Economic Understanding*, pp. 192-209. Ed. Israel M. Kirzner. London: Macmillan.

_____. 2011. The interpretive dimension of economics: Science, hermeneutics, and praxeology. *Review of Austrian Economics* 24: 91-128.

Lavoie, D. and Storr, V. H. 2011. Distinction or dichotomy: Rethinking the line between thymology and praxeology. *Review of Austrian Economics* 24: 213-233.

McCloskey, D. N. 2017. Lachmann practiced humanomics, beyond the dogma of behaviorism. *Review of Austrian Economics* https://doi.org/10.1007/s11138-017-0404-1.

_____. 2021. *Bettering Humanomics. A New, and Old, Approach to Economic Science*. Chicago and London: University of Chicago Press.

Menger, C. 1871. *Principle of Economics* (2007). Auburn: Ludwig von Mises Institute.

von Mises, L. 1949. *Human Action. A Treatise on Economics* (1998). Auburn: Ludwig von Mises Institute.

Prychitko, D. L. 2018. Levels of Interpretation in a Hermeneutical Economic Theory: Comment on Ferlito. *StoriaLibera* IV(7): 157-165.

Storr, V. H. 2017. Ludwig Lachmann's peculiar status within Austrian economics. *Review of Austrian Economics* https://doi.org/10.1007/s11138-017-0403-2.

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