Approaches to currency targetting: insights from cybernetics

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Abstract

Building upon insights from the Conant-Ashby Theorem and the Law of Requisite Variety (Ashby's Law), we introduce the concept of M*oral Modalities*, an embryonic[1] framework with which to categorize the full range of human activities, using this in part to describe and compare some approaches to the targetting of currencies to address specific problems. The problems to be addressed include the disconnection between what we know and what we do; the holistic involvement of humankind in its protection and nurture; natural mechanisms causing misdistribution of resources; and factors which constrain the subsequent application of productive effort. Example solutions are described within the *moral modalities* framework. The same cybernetic[2] principles suggest the outline of a holonic governance structure. Finally we identify some essential requirements of future technology.

Keywords: *currencies, categorization, cybernetics, targetting, allocation*

About the authors

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Trevor graduated in Theology & Philosophy after Initially studying Theoretical Physics. He pioneered corporate ICT training, use of micro-computers in business and PC-hosted database systems, subsequently managing numerous large scale ICT projects for diverse businesses.

Since learning Systems Thinking from Stafford Beer, the founder of Management Cybernetics, he has applied it to complex problems with carefully selected small teams.

He has a deep interest in the history of science, religion and technology and how the relationship between these has evolved over the past 5,000 years ago, closely following developments in ICT with a particular interest in how emerging technologies are laying foundations for future networked generations, the global financial system, education and work.

CEO of Nail Soup Ltd. Founder of Web of Wealth.

John Waters

After several years designing both hardware and software for secure communication equipment and specialized instrumentation, John turned his attention to more diverse activities.

Many years exploring several aspects of complementary currency systems and their potential synergy with more conventional community economic tools (especially credit unions and CDFIs) and has designed novel targetted systems incorporating concepts from cybernetics and control theory. Currently developing a holonic governance framework for progressively localized targetted currency clusters; metasystemic measures and indicators; and experimentally integrating heterogeneous ICT systems.

Prefers to live mostly in the Learning Network and Unconditional Care Modalities, but spends much time halfway up the Guardianship Modality in his role as Chair of an innovative CDFI helping to establish community renewable energy installations.

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1 We use the term embryonic because it remains to be developed to anywhere near its potential.

2 Cybernetics was defined by Norbert Wiener (1948) as “the study of communication and control in animals and machines”. For the purposes of this paper we prefer Stafford Beer's later redefinition: “the science of effective organization”.

Introduction

There is arguably little variation between the many currencies we term “money”, unsurprisingly given traditional technological constraints. Early money was embodied in physical objects of one kind or another, exchangeable, under mutually agreed terms, for goods or services of just about any kind. Given the great distances over which scarcer resources had to be transported, and given the restrictions on the flow of information over any distance, it was perhaps inevitable that the simple design we have inherited should have been adopted globally. Exchanges would progress step by step, merchant to merchant, in chains of varying length and through networks the ramifications of which would have been futile to map, prescribe, constrain or quantify. It allows anything to be exchanged for anything else, generally carries no information about how its current holder acquired it, and enforces no restrictions on how it will be used subsequently.

The recent shift from physical money to digital money has changed little. Minimal meta-information is attached to facilitate audit trails and to detect tax evasion or money laundering activities, but little else. Such “unconstrained” money invariably results in a power law (or comparably skewed) misdistribution of resources, so there is little incentive for those who benefit from this to attempt to change it, and it seems reasonable to assume that no politician or banker would dare to put forward such a suggestion, but there are problems to be addressed that may remain intractable until some fundamental changes are made to the way we match resources to needs.

This paper resulted from the serendipitous discovery of a shared perspective and convergence of ideas. The section on the Moral Modalities Framework was written by its originator, Trevor Hilder. Most of the rest was outlined by John Waters. However, each author reviewed and, in many places, revised the other's sections and the end product is therefore very much a collaboration.

Objectives

We start with the assumption of a set of objectives. It is clear that not everyone shares these yet, as they remain to be reframed within the constraints of established belief systems.

- The essential needs of everyone must be met. By extension, so must those of the wider biosphere on which everyone depends.
- Individual autonomy should be respected, encouraged and nurtured. Everyone is best placed to identify her/his most effective means to contribute to collective well-being and to maximize her/his eudemony. That includes establishing her/his individual values, goals, relationships and strategy within the broader constraints imposed by the objectives of planetary well-being.
- The exploitation of finite, non-renewable resources must be reduced progressively and ultimately eliminated.

We also wish to address many problems which neither fiat legal tender nor complementary currency systems have satisfactorily solved. Obvious and pressing examples include: shortage of housing; starvation; crippling poverty; resource depletion; pollution; environmental degradation; and sufficient and appropriate resource allocation.

We regard these as urgent practical problems, well within our potential capacity to address with the aid of appropriately designed currencies.

Assumptions

This paper is too brief to permit more than terse justification of our assertions. To the authors they seem self-evident, but we must leave most of the detail for expansion in subsequent essays[3]. For now, we start by listing a few points:

- Earth can provide more than sufficient resources to meet the needs of all of its inhabitants, and yet millions are starving, homeless and otherwise suffering unnecessarily as a consequence of resource misdistribution.

[3] If we sometimes appear here to be balancing less than sure-footedly on the shoulder of giants, we intend to address the detail in subsequent publications. If some sections read somewhat like a manifesto, we are content for them to be taken as such.

- Any politician or government claiming to serve the interests of all citizens while acting to preserve currently dominant economic structures is in a state of "double-think". Currently individuals are treated largely as expendable, competing organisms within an ecosystem rather than as organs to be nurtured within a body[4].
- The only "laws" that matter in the longer term are those of physics, mathematics, logic and the diverse *natural laws (*chemistry, biology, ecology, etc.) that follow from them. In contrast, *human laws,* those artificially constraining human activity, may be viewed as temporary fixes, often remnants of responses to emergent consequences of prior situations.
- Development of designoid systems (produced through evolution by natural selection) is a very slow process involving single-step state transitions. Although very effective where sufficient time allows, it is an inefficient process and necessarily uncaring, all individual elements (including people) being expendable.
- In contrast, design is a faster and more efficient process, a function of an arbitrarily large set of previous systemic states. A system designed to accommodate the needs of all individuals can be constrained to be nurturing.
- The "trickle down" effect is a myth. Dominant economic structures currently ensure that resources are drawn "upwards" from those with least to those who already hold and control most.
- Any exchange between two parties involves a negotiation, each having to be satisfied that the exchange is not disadvantageous in context. The *value* of the exchange to each party is whatever s/he is willing to give up given the full set of relevant conditions at that specific place and time, and is therefore a function of that set of conditions, which includes those determined by the interaction of each party with an arbitrary set of other parties. Therefore the *value* is subjective, conditional, contextual and ephemeral, and consequently impossible either to quantify or compare; the concepts of *store of value* and *flow of value* therefore are generally unhelpful. The word *value* itself has several distinct interpretations the conflation of which is not always precluded by context; e.g. the expression *store of value* is often used to label a conventional property of money, but the meaning remains unclear. The term *flow of value* is used by extension, and the assumption implicit here seems to be that the word *value* has the same meaning in both cases - something which cannot be true given that storage of *value* requires that it remain unchanged over time whereas the *flow of value* can only refer to a ramified chain of exchanges acceptable at each step to two parties given conditions affecting each at that specific time and place. The former is something achievable only when pegged to an unchanging but convertible physical measure[5] or to a human-defined but equally unchanging artificial measure (equally-valued human time - as used with time-banks/-networks).
- The term "wealth" has lost its essential meaning through catachresis. Henry George [16] has much to say on the subject, including: "The original meaning of the word wealth is that of plenty or abundance; that of the possession of things conducive to a certain kind of weal or well-being" and "as social health must mean something different from individual health, and social strength something different from individual strength; so social wealth, or the wealth of the society, the larger man or Greater Leviathan of which individuals living in civilization are components, must be something different from the wealth of the individual." This disconnection remains to be addressed.
- Our planet has finite resources and finite capacity to tolerate the unconstrained expansion of human extractive activity. Although the biosphere it supports has considerable capacity for self-repair and the maintenance of a temporary homeostatic condition, that capacity is finite. Humankind may become an intolerable irritant to be shrugged off by a transition to a very different homeostatic state. Collective and co-ordinated remedial action is needed to minimize the risk.

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[4] This analogy obviously must not be stretched too far. Cells and organs must function or be replaced in order to maintain the heath of any organism; the point here is that they must not be denied the opportunity to do so.

[5] Something for which energy is arguably the most, and perhaps only, appropriate option - see e,g, Turnbull [27]. The word "energy" has many legitimate uses, but here refers only to a physical quantity of dimensions ML^2T^{-2}.

- Despite the many invariants (which outweigh the differences considerably) humans are diverse in belief, motivation, interests, aptitude and connectedness. They are exposed to very different influences and provided with very different opportunities, but almost everyone has the potential to contribute productively to the well-being of humankind collectively (and there are good reasons beyond altruism to help the very few who cannot) and should be empowered to do so in a way most comfortable and personally rewarding to each: maximization of eudemony[6].
- The fate of humanity is inextricably coupled to that of all other life, to an extent we can still only begin to observe. Even if biophilia were not an intrinsic value to many, the health of the biosphere to which we are structurally coupled must be valued as greatly as our own. There are inescapable limits on the extent to which causal relationships between human activity and environmental impact can be understood. Most ramifications are still barely understood and this disconnection needs to be accommodated.
- Any assumption that certain individuals or groups of individuals have an absolute right to prosper at the expense of others is ultimately incompatible with the requirements of a connected and self-preserving global population.
- Whatever its utility as a driver of innovation, conflict is counterproductive from a holistic viewpoint.
- Economic entities (including corporations) which maximize self-interest through externalization of costs are essentially cancerous growths within the larger but finite planetary system.

We also make the assumption that for many readers we must present at least a terse description of some foundational concepts. These follow here.

The Law of Requisite Variety

The immediate relationships we each share with others are finite in number and limited in depth. There is inevitably a trade-off to be made between the depth of interpersonal relationships and the number we have to manage. The balance will vary between individuals, and each will be constrained by different capacity, but as a general pattern this will hold. This is an example of the *Law of Requisite Variety* (LRV, a.k.a. Ashby's Law), variety being a term use to quantify (relatively if not always very precisely) the capacity of any individual (or organization or system) to cope with whatever it must within a specified context. An intuitive example would be the difficulty faced by a sports team having fewer players (of comparable skill) than its opponent. Similarly an under-resourced department within an organization will be unable to carry out its required functions, and these will (often surreptitiously) have to be addressed elsewhere within the organization (variety diffusion).

Although *variety* can be defined precisely in theory, in practice it is more useful to think of it as a rather fuzzy measure. Sometimes described as a measure of complexity expressed in terms of the number of possible states of a system, this is really too simplistic a description to express the power of this concept. LRV[7] is derived meticulously from elementary principles in [2] and [3] but its implications are explored further in [4], [5], [6], [7], [8], [12], [14] and [15]. It is generally expressed as “only variety can absorb variety”[8,9].

Conant-Ashby Theorem

Roger Conant and Ross Ashby built upon LRV to derive the *Good Regulator Theorem (Conant-Ashby Theorem*). We shall not attempt to simplify the dense but elegant argument laid out in their paper [13], and for our purposes its title is almost sufficient in itself: “Every good regulator of a system must be a model of

[6] n. Happiness as understood by Aristotle, namely, as consisting, not in pleasure except as a sign of perfected activity, but in the activity which befits a human being, that is, in virtuous activity, of which the highest and best kind is that which is self-controlled through reason, the virtuous activity of the soul in a completed life. (The Century Dictionary and Cyclopedia)

[7] Given prescribed constraints, LRV can be viewed as a generalization of Claude Shannon's *Tenth Theorem* of Information Theory (Claude Shannon “A Mathematical Theory of Communication”, 1948, Bell Systems Technical Journal).

[8] The words “destroy” or “force down” are sometimes substituted for “absorb. The significance is unchanged.

[9] In control engineering the twin concepts of "observability" and "controllability" are probably more familiar terms. However, they are essentially formalizations of similar problems.

that system". The essential points to keep in mind here are the meaning of words such as "system" and "regulator", and the care taken in interpretation of the theorem.[10]

The Viable System Model

Stafford Beer built upon LRV and the Conant-Ashby Theorem to explore in detail many consequences of "varietal imbalances" within organizational relationships. Reducing these to the simplest adequately useful model, Beer describes a set of *Principles of Organization* and *Axioms of Management*, first described in detail in [4] but presented more accessibly in [6], [12] and [20] among others.

The Viable[11] System Model (VSM) is a holonic[12] organizational model. It is not something trivial either to understand or to explain, but fortunately our requirements here can be met with a very simple summary of six components essential within our system in focus[13]:

System(s) 1 The elements that produce the system - e.g. manufacturing departments within a factory, classrooms within a school, most vital organs within a body, the engine room in a ship, etc.

System 2 The autonomic system. The *co-ordination* elements that enable the System(s) 1 to work together harmoniously according to fixed[14] rules - e.g. a school timetable ensures each class has a room, adherence to the Highway Code enables roads to be shared safely, and the autonomic nervous system enables the most routine process within our bodies to be regulated as locally as possible.

System 3 **Inside & Now** - elements that keep the system doing what is expected; the internal model and all monitoring and corrective processes around it. A company's business plan or an aircraft's flight plan. System 3 is the first level of reference when System 2 cannot resolve a conflict between the priorities of two or more System(s) 1.

System 3* **High variety monitoring and sporadic audit channel** - investigatory and troubleshooting functions. E.g., you feel a sudden pain in your leg but cannot identify its cause? Was it a nail? Have you been bitten? You have to take a look (or get someone else to). System 3* acts autonomously with the authority of System 3 but within constraints set by System 5.

System 4 **Outside & Then** - the connection to the environment; gathering information about threats, opportunities, actual and potential changes; modelling, simulation. The R&D department of a company. The crew on the bridge of a ship. System 4 can "see" what System 3 cannot, so System 3 needs to take notice of what System 4 tells it.

System 5 **Policy & Identity** - what keeps the system in focus being *that* system? What is the ultimate arbiter when the priorities of Systems 3 and 4 conflict?

We shall refer to these concepts further down.

POSIWID

In [12] Barry Clemson asks: "What is the real purpose of the system? What purposes of the system might we infer if we looked at what the system is actually *doing* rather than thinking about the rhetoric on purposes? What purpose would we like the system to have?"

The purpose of a system is what it does. This may appear at first glance to be an unhelpful tautology, but it is actually a powerfully liberating concept that helps to eliminate futile misdirection of attention. It is important always to focus upon what a system (whatever that may be - an individual, an organization, a machine or anything else that fits the definition) actually does, not upon what one imagines it should be doing or what someone claims it does. As long as it continues doing it and continues maintaining its own ability to do it, whatever it is doing is its *purpose*.

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10 See for example Roger Harnden "Outside and Then: An interpretive approach to the VSM" in [15])

11 The word *viable* is used here strictly to mean able to maintain its distinct identity within its changing environment.

12 Recursively self-similar. The term holon was coined by Arthur Koestler and includes fractals as a subclass.

13 The system in focus is that of interest, and immediately visible, to us at a particular level of recursion. For a quick and accessible explanation see [20].

14 These rules may be modified from time to time within some systems, although not in the case of a healthy organism.

This disconnection, a self-referential property of systems generally, was first identified by Stafford Beer [4] who encapsulated it in the expression “the purpose of a system is what it does”. Its significance has since become so widely recognized that it is generally abbreviated to POSIWID. Beer wrote [9]: “According to the cybernetician, the purpose of a system is what it does. This is a basic dictum. It stands for bald fact, which makes a better starting point in seeking understanding than the familiar attributions of good intention, prejudices about expectations, moral judgment, or sheer ignorance of circumstances." Patrick Hoverstadt [21] added: “This apparently simple mantra has huge ramifications. It forces us to look seriously at what our organizations actually do and not just hide behind the mantra of our good intentions.”

"Money" as a self-preserving system

People often speak of the “money system”. As a system[15], money is self-preserving in that it both facilitates and incentivizes its users to collaborate in its preservation. In that sense its purpose can be considered to be whatever effect it has upon its users: for the richest[16] its purposes include maintaining their relative power advantage (for it certainly does that) and for the poorest its purposes include suppression of their opportunities (for it certainly does that too). However, when just about anyone is asked what the purpose of money is they will often regurgitate three properties listed in standard textbooks (a unit of exchange, a unit of account, or a store of value) or the insultingly naïve suggestion that it is a reward for effort (as if a banker paid millions is somehow capable of orders of magnitude more effort than a manual labourer).

Misdistribution of resources and influence

The unequal distribution of money is a recurring theme through history and the media of exchange available for use by those who actually do productive work are restricted to whatever those with a coercive advantage allow. Such restrictions are applied by diverse threats, either explicit or implicit.

The ability to conduct immediate exchanges is a priority for those with limited resources but, in contrast, confidence in having the ability to conduct future exchanges on relatively advantageous terms is something valued, cultivated, secured and monopolized by those who have, by one means or another, already secured or inherited a controlling advantage; they set the terms by which those already at a comparative disadvantage can be controlled with minimum effort.

The ability of a minority to exert an almost irresistible influence over the majority requires a hierarchical distribution of power and control - from rulers (many varieties, but arranged in strata) through layers of enforcers (army, police and bureaucrats) down to those who exist in sufficient comfort and security to carry out the productive activities needed to support themselves and the strata above. At the base of this pyramid lie the layers of disempowered, sometimes homeless, needed to ensure that the threat of something worse remains visible and tangible. By this means, security and influence are distributed most unequally (often, but not necessarily, in a power law distribution[17]); the interactions and tensions that lead to “Pareto optimality” in income distribution produce similarly unequal distributions of control and security.[18]

This leads very efficiently to a system in which individuals enslave themselves while colluding in the slavery of others in an even more disadvantaged position, and whose access to essential resources they influence, directly or indirectly.

Although the exponential compounding of debt interest is an enabling factor in support of the most advantaged, it is insufficient in itself. Conflation of the exchange and store-of-value functions of money is another contributing factor; a single fiat currency imposed by coercion favours those already at a comparative advantage[19]. In any unconstrained monetary system comprising a single fiat currency, wealth and power drain away from the most disadvantaged towards those already in the most advantageous positions. Whatever their position within the hierarchy, few are willing to risk erosion of their tenuous security. Therefore the pyramid of power self-organizes in a characteristically "Pareto optimal" distribution. Such a

[15] The extent to which money can be described as a system is far beyond the scope of this paper.

[16] We resist the temptation to use “wealthiest” in place of “richest”. Although context should preclude confusion, we prefer to reserve the term “wealth” to refer to prerequisites for well-being.

[17] See for example Brzezinski, Michal (2012) “Do wealth distributions follow power laws? Evidence from 'rich lists'” - http://www.ecineq.org/ecineq_bari13/filesxbari13/cr2/p98.pdf

[18] This may help to answer a question raised by Ross Ashby [2] regarding the entelechy of dictatorship.

[19] See for example https://www.newscientist.com/article/dn7107-why-it-is-hard-to-share-the-wealth/ and www.theguardian.com/commentisfree/2011/nov/11/occupy-movement-wealth-power-law-distribution

distribution is far from optimal from the perspective of those at or near the base of the pyramid. Single currencies are information-lossy and unsuitable to match resources to needs in a way that serves the needs of resilience, sustainability or equality.

Other consequences include the attenuation of adaptive variety (always a threat to survival) and the prioritization of immediate responses over considered long-term planning. Unfortunately we do not have space here to consider how these might suggest alternative approaches to design.

Most currency schemes in widespread use are essentially variations on, or additions to, legal tender systems. Their objectives include:

- Reduction of leakage or extraction of wealth from the region in which it is generated to benefit others with greater resources or less need (regional currencies). Some examples include a pump mechanism (the bonu-malus mechanism of Berkshares) while others lack such a pump. Their comparative effectiveness remains to be assessed.
- Freeing resources otherwise locked up by a lack of liquidity (mutual credit systems).
- Elimination of the need for trusted third parties (cryptocurrencies).

These unconstrained, all-purpose currencies do not differentiate between use categories. They are unable in themselves to provide a basis for regulative feedback loops or the measurement and control elements required[20]. Although each can serve a useful purpose, their applications are limited and a far more sophisticated approach is required if many fundamental problems are to be addressed.

An obvious exception exists in timebanks and time networks where an hour of one person's activity is specified to be of equal value[21] to that of any other, making such schemes unsuitable for exploitation for profit by third parties. For this reason, activities recorded in egalitarian time are exempt by law from consideration in benefits calculations or taxation in some countries. This may be the only truly complementary currency category in widespread use currently, but it illustrates at least some advantages gained from defining a tightly constrained value to a unit rather than relying upon sequences of *ad hoc* negotiation to agree a conditional, subjective and ephemeral value.

Broader categorization of money types

There are numerous ways to categorize currency types, for example by issuance (fiat or mutual credit); by the way in which units are defined - conditional (mutual agreement between parties in an exchange) or absolute (defined against a commodity); whether unconstrainedly fungible or restricted in application. Some may decay in “value” (demurrage). Some may be purchased at a bonus for use within a constrained region (e.g. Berkshares) and sold back with a malus. However, one characteristic which does not seem to appear in most typologies is whether it is worth taking (or possible to take) from another through theft or extortion. This seems to us to be an essential characteristic of unconstrained currencies (those for which the price of a loaf or a murder differ only in magnitude).

Another characteristic that has received little attention so far is information retention. A distinction can be made between *scalar currencies* (which have a single value) and *vector currencies* (which may carry a number of distinct values defining constraints and characteristics). These might include such factors as demurrage rate, demurrage conditions, delays, expiry dates, conditional exchange constraints (trigger conditions), usage constraints, origins and flow trajectory.

Closed-pool currencies for local economic cycles (e.g. Fertility cycle: putrescible waste → compost → food or biomass fuels → putrescible waste) may incorporate conditional conversion to address energy and transport needs within this cycle and might be triggered conditionally as mandated by the governance system (an obvious use case for smart contract technology).

Holonically nested clusters of diverse targetted and constrained currency pools (including time credit system, energy tokens, interest-free mutual credit systems - anything that has a use in a particular context) can be supported with a shared metasystemic framework (VSM). Such an approach could be used to maximize

[20] As such they enable only crude regulatory mechanisms such as variations in taxation or interest rates, something analogous to using the endocrine system to control muscle movements.

[21] Although the term “value” is generally problematic, we believe its use here is acceptable in context.

localization while minimizing resource wastage, pollution, etc. This is the essence of the second author's AIM framework, a more detailed description of which is beyond the scape of this paper.

Approaches to constraining the *downstream* use of currency tokens have also been considered by the second author, and problems which once seemed technologically insurmountable now appear realistically within reach given developments in blockchain technology and smart contracts.

These examples are beyond the scope of this paper. Here we choose to focus our attention upon a framework to help in binding together several of the concepts already covered.

Moral Modalities Framework

The Conant-Ashby Theorem implies that the financial system, in order to manage wealth creation, needs to be a model of the processes that create wealth, with requisite variety to model those processes. In discussions about, say, the economy of the United Kingdom, commentators worry about whether disruptions to the global financial system which occurred in 2007-2008 affected the “real economy”, and it is generally agreed that they did. Everyone seems to know what “the real economy” means, but nobody ever talks about “the unreal economy” which would be expected to be contrasted with this. We have discussed above the question of what wealth is, and suggested that it must encompass all aspects of human prosperity. This brings us to the question of what human prosperity actually is.

Classical economics addresses this question by assuming that human beings are rational pursuers of their self-interest, and that this rational self-interest can be easily measured by examining what people will pay for things in exchanges within a free market. Once this is assumed, economics can proceed as if it were a science modelled on Newtonian physics.

This model of the human being reflects the deep ignorance of psychology which characterised Western culture until very recently. The question of how human beings come to adopt beliefs about themselves was hardly examined formally until US servicemen shot down during the Korean War in the early 1950s were seen denouncing the USA, at which point research funds were devoted to finding out how "brainwashing" works. This led to a wave of research on social psychology by the likes of Asch [1], Zimbardo [18] and Milgram [25], which revealed the extent to which our beliefs and behaviour are conditioned by conformity to our social groups and their authority figures. These findings have been reinforced by the work of anthropologists and the work of behavioural economists such as Kahnemann [23] and Tversky, but mainstream macro-economics largely continues in blissful ignorance of these findings and continues to operate on the basis of a discredited belief in "rational, freely willing, economic agents".

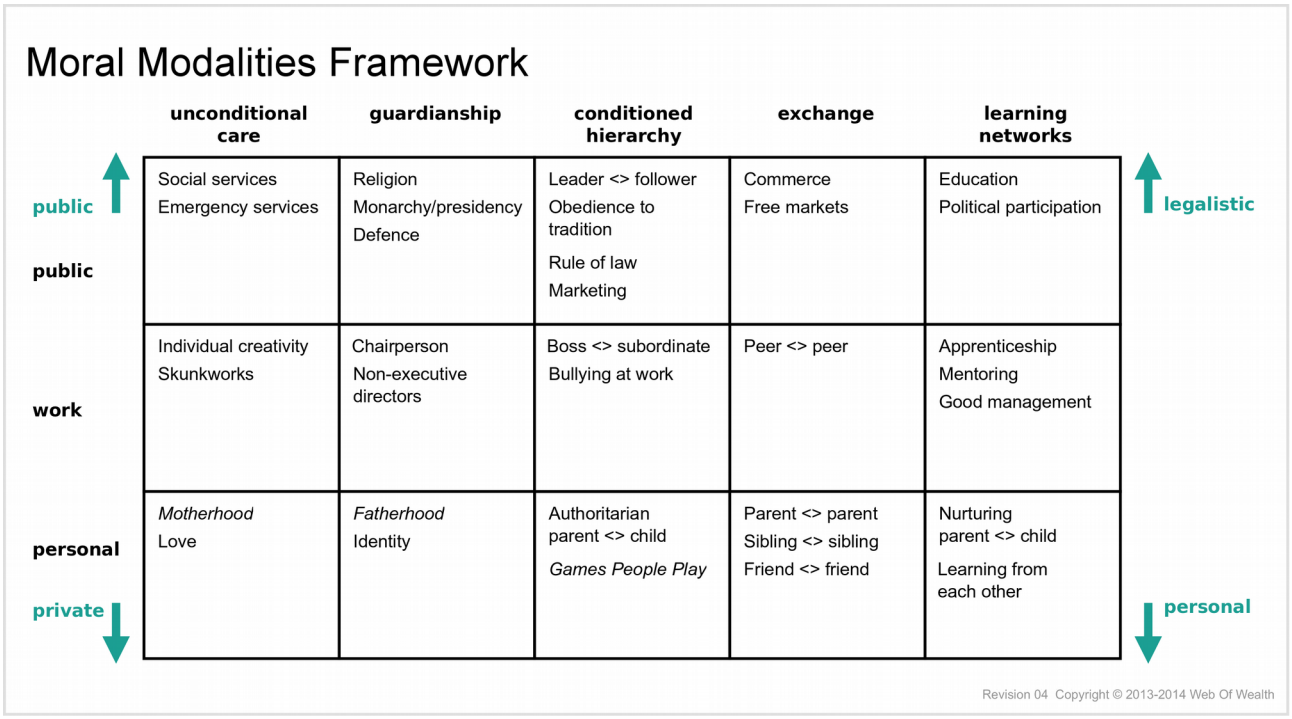
Many of the participants in the conference to which this paper is submitted are probably familiar with David Graeber's "Debt - The first 5,000 Years" [17], which brings an anthropologist's perspective to the history of the concept of debt and its relationship to the evolution of civilisation. We therefore introduce the Moral Modalities Framework (MMF) with reference to Chapter 5 of that book, entitled "A Brief Treatise on the Moral Grounds of Economic Relations".

Graeber says: "Anthropology has shown us just how different and numerous are the ways in which humans have been known to organise themselves. But it also reveals some remarkable commonalities - fundamental moral principles that appear to exist everywhere and that will always tend to be invoked wherever people transfer objects back and forth or argue about what other people owe them.". He then goes on to articulate three Moral Modalities, which he calls *Communism*, *Exchange* and *Hierarchy*, then explores how we constantly shift between these, not necessarily consciously, with a range of fascinating illustrations.

The following diagram includes the three modalities which Graeber discusses, but also uncovers two others which he does not make explicit. We have modified his terminology to avoid using terms which for some might seem unacceptably provocative (e.g. Communism). In addition to being identifiable from anthropology, the MMF incorporates the key insights of the social psychologists and behavioural economists mentioned above, but can also be derived from the VSM mentioned earlier in this paper. The element which the MMF shares with the VSM is its recursive nature, an aspect which is not made explicit in the other literature.

The diagram below shows three levels of recursion, which apply to life in a modern "Developed Society". The model could be applied with differently labelled levels of recursion, but the ones shown are intended to illustrate the principles with reference to life as lived by the participants in the conference being addressed.

We contend that a prosperous life is one which enables us to participate consciously in all the cells in the MMF diagram. Therefore, living in such a way constitutes the "real economy" of a properly functioning community. Such a community therefore requires a range of monetary instruments which reflect the value of all the activities shown in the diagram.



We will now briefly describe each of the five Moral Modalities, with reference to Graeber's account and their derivations from functions in the VSM:

Unconditional Care – the foundation of being human

The Unconditional Care Modality underpins everything else in human life. Its *archetypal symbol* is a mother breast-feeding a baby.

In this modality, we recognise something that needs to be done and act without consideration for whether we will be rewarded or punished for it. We can see that it needs to be done, so we do it.

Graeber used the term Communism for this modality, in the original meaning of the term, which can be summed up in the phrase "From each according to his ability, to each according to his needs".

At the personal level this expresses itself in caring for those we love. We do not do so for what we can get out of it, but because that is what it means to be human. Traditionally this modality is associated in private life with motherhood even though, as a function, there is no reason why it should be associated with any specific gender.

In the world of work, this expresses itself as creativity. Most creativity takes place inside individual minds, but there is a form of social organisation that can scale this up without losing the creative spark. We call this *Skunkworks,* an expression used to describe small teams with no fixed social hierarchy, very precisely delineated in the books of William L Livingston [24], an inventor whose whole career was spent working in such teams.

In the public sphere, this expresses itself in emergency services, social care and health services.

In terms of Beer's VSM, this modality corresponds to System 1 (Operations) and the algedonic signalling system, which alerts System 5 (the Identity function) to an emergency situation and "wakes it up" to respond.

Guardianship – deciding who we are

This modality is about establishing the boundaries around the social group. Who is inside and who is outside? The archetype of this is the stern father, who disciplines the members of the group and ensures that they live up to the values that make the group who they are. As is the case with *motherhood* in the Unconditional Care modality, the traditional association with a gender need not apply, but the function itself is necessary.

Graeber uses the term *Hierarchy* for this modality, but conflates this with another which we call *Conditioned Hierarchy* (see below). We think this distinction is important, but Graeber does not make it.

At the level of work in a typical Western-style environment this is the job of the Chairman and Non-Executive Directors, or the founding entrepreneur.

At the level of public life, this guarding of identity is in the hands of priesthoods, monarchs or presidents and the defenders of the realm.

In Beer's VSM, this modality corresponds to System 5 (Identity and Policy function).

Conditioned Hierarchy – keep on keeping on

In Conditioned Hierarchy Modality, we are going about ordinary life, mostly without reflecting on what is happening. We get up when the alarm goes off, walk the dog, commute to work, do what we need to do, come home to the family, get the kids to do their homework, watch the TV, and check in on Facebook.

We are following our training, operating almost on auto-pilot.

Conditioned Hierarchies have fixed value systems. If we stray from the path, we feel guilt or shame. There are leaders and followers. There is a hierarchy of prestige, with reassuring authority figures who will guide us and keep us safe. There are accepted assumptions that must not be challenged.

There is also competition. If we work for General Motors, we know that Ford is the enemy. If we follow Manchester United we know that Liverpool is the traditional foe. We get immense pleasure out of belonging to our side and the competition with the "enemy" is a great source of emotional stimulus for all participants.

At the level of personal life, this modality is associated with authoritarian parenting. Children subjected to this resort to playing complex "games" to get their real needs met, as described in Eric Berne's classic book "Games People Play" [10].

In the field of commerce, the dark arts of marketing are used to make sure we keep buying the right brand. After all, Coca-Cola is "The Real Thing", is it not? When marketing works, buying the product is a "no-brainer".

Conditioned Hierarchies are a powerful way to "deliver the goods", as long as the environment does not change. But when it does, they can become dangerous. When the environment changes, it is likely that nobody in the Conditioned Hierarchy will realise this. When things start to go wrong, they will assume that this is because people are not working hard enough. The authority figures will "crack the whip" and demand more obedience, often continuing to do so until the organisation collapses.

This modality falls within Graeber's *Hierarchy*, but he makes no attempt to distinguish between the necessary function of defining the boundaries of a system (Guardianship) and the less legitimate method of applying conditioning by the threat of punishment and the offer of reward to enforce conformity to a social group.

In Beer's VSM, this modality corresponds to the resource bargain between System 3 (Management) and System 1 (Operations), by which a viable system at a lower level of recursion is "encouraged" to do its bit to fulfil the purpose of a viable system at a higher level of recursion.

Exchange – let's do a deal

In the Exchange Modality, A has something that B wants, B has something that A wants, and they figure out a deal to exchange one for the other. This is the world of "free market economics", although free markets are less common than most of us imagine.

The modern world since the eighteenth century has grown out of an emphasis on the combination of Conditioned Hierarchies and Exchange. Adam Smith, who is credited with being the founder of free market

economics, described a pin factory, which increases productivity by division of labour (a classic Conditioned Hierarchy), and producers competing in a free market (Exchange), as examples of how a free market economy creates increasing wealth.

The Exchange modality appears in Graeber's work under the same name.

It corresponds to System 2 (Coordination) in the VSM.

Learning Network – the organ of evolution

The Learning Network Modality is subtle, but important. In this modality, people learn from each other without any assumptions of higher or lower prestige. Authority flows according to who at any moment knows more than anybody else. Those who wish to learn have to be prepared to subordinate themselves to whoever is teaching them, but success in the interchange abolishes the authority hierarchy, because the participants become peers in that particular aspect of knowledge.

Learning Networks enable new knowledge to be developed and distributed throughout a social group, enabling them to evolve and adapt to changing circumstances.

Historically these are vitally important, but they are also poorly documented and hard to see because they tend to dissolve once a new level of learning has been reached and get replaced with a Conditioned Hierarchy which then takes the credit for what happened.

Graeber fails to identify this modality, but this should not surprise us; Learning Networks are not a common feature in societies typically studied by anthropologists - mostly societies living in hard circumstances, where life expectancy is short, and the environment is tough but does not undergo rapid changes. Children in such societies typically undergo an initiation rite at puberty during which they learn the knowledge that their society relies on and thereafter are expected to live in accordance with it, having no spare capacity to learn more.

In the personal sphere, the Learning Network modality is represented by nurturing of children by parents and people learning from each other.

In the workplace, this is associated with good management, mentoring and apprentices learning by working to absorb the atmosphere around mastery of a domain, rather than being lectured and tested on formal knowledge.

In the public sphere, this modality ought to be associated with education and political participation, but most educational systems appear to be stuck in a pattern of inducting people into Conditioned Hierarchies, and political participation seems to be at a very low ebb.

Modern society is undergoing a significant shift away from the predominant Conditioned Hierarchy modality towards the Learning Network modality, but our institutions are struggling to understand this. This shift is occurring because much of the work that used to be done by humans working in Conditioned Hierarchy modality can now be done by programming computers instead, throwing into doubt the association between earning money and having a job.

In Beer's VSM, the Learning Network modality corresponds to System 4 (the Intelligence function).

Current monetary instruments

Our current range of monetary instruments has grown up by a process of natural selection, mostly in the service of certain powerful vested interests. This range of instruments does not have requisite variety to reflect the full range of wealth-creating activities that we participate in. Below, we make some suggestions for areas of exploration which might be fruitful in understanding how to build an architecture of monetary instruments that would do a better job.

Learning Network currencies

Learning networks are the "organ of social evolution", where innovation and adaptation to changing circumstances become possible. The closest existing currencies in this modality are methods of registering and valuing intellectual property, such as copyright and patent laws. These are currently poorly designed and open to abuse. Could we design a better way of handling these matters? Would Distributed Ledger Technology (DLT) help? If so, how would we use it?

Guardian and Unconditional Care currencies

Government bonds were invented in Florence during the Italian Renaissance to finance mercenary armies to defend Florence against its competitors for dominance of Italy. Defence of the Realm is a key function of the Guardian Modality, so it could be said that government bonds are a form of Guardian currency.

John Maynard Keynes rightly observed, in the 1930s, that people who did not approve of war should not own government bonds, since warfare was the major part of government expenditure at the time, as had always been the case. However, since the end of the Second World War, government bonds mostly fund social services, which are in the Unconditional Care Modality. It therefore seems strange that our existing financial system fails to make any clear distinction between these fundamentally different social functions and the necessary instruments to fund them.

Could we do better? If so, what would these revised forms of currency look like? These are questions to which we intend to return in subsequent writing.

Other currencies

The set of modalities identified above is not sufficient in itself to categorize currencies, but it does help to define boundaries around the application of existing and as yet undesigned currencies. We have made no attempt here to define characteristics of distinct currency types; to do so would be far beyond the scope of this paper.

Technological considerations

We already have technology adequate to solve many broad classes of problem. The real constraints are imposed by its users for whom, if they are to participate effectively in the governance of their own economic tools, must be provided with effective metasystemic tools - for measurement, filtering, modelling and simulation - matching the technological framework to the real world problem (Conant-Ashby again). Participation needs to be encouraged, simplified and facilitated, and inclusions needs to prioritized.

We shall also need the ability to create arbitrary currency channels to describe, negotiate, define and qualify relations between actors. For this reason we wish to draw attention to synergies identified with the CEPTR project.

The MetaCurrency Project and CEPTR

There is much discussion about the potential of Distributed Ledger Technology (DLT) and so-called *smart contracts* to provide an ICT infrastructure for future forms of currency. However, platforms such as Bitcoin and Ethereum appear to remain trapped in a Newtonian paradigm, where there is only one truth irrespective of the observer, and that truth can be recorded in a shared ledger.

Einstein published his paper on the Special Theory of Relativity in 1905 and his General Theory in 1915, so this Newtonian view is more than a hundred years out of date. Most thinking about new forms of currency, however, appears to remain trapped in this paradigm.

We have no doubt that many other DLT platforms will make their mark, but we believe that the MetaCurrency Project and its CEPTR ICT infrastructure holds great promise for the longer term future, being in complete alignment with our thinking as expressed in this paper.

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