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SCIENTISTS' WARNING ON MONEY

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ABSTRACT:

We—scientists, economists, philosophers, and policy specialists—shift from warning to action. Humanity is in ecological overshoot, consuming resources and generating waste beyond Earth's regenerative capacity. We have failed to meet the goals of the United Nations Framework Convention on Climate Change, and civilization stands at a crossroads. A different path remains possible, but it requires transforming the money–economics complex that shapes modern life. Drawing on historical analysis, we call for a move away from mainstream neoclassical economics toward locally rooted, community-based approaches. Building resilience demands money plurality: diverse, interlocking systems such as commoning, Universal Basic Income (UBI), Universal Basic Guarantee (UBG), community currencies, barter networks, and local economic loops. These mechanisms can substitute for or evolve beyond dominant monetary structures, fostering virtuous cycles aligned with planetary boundaries. We urge investment in innovative monetary practices that uphold both ecological balance and a dignified social foundation. Ethical, community-based currencies can function as communication media that embed social, cultural, and environmental values in economic exchange. Advancing from financial literacy to financial capability will enable societies to create regenerative economies grounded in ecological wisdom, repairing past harms while strengthening resilience for the future.

KEYWORDS:

Ecological turn, environmental economics, resilience, polycrisis, forward resilience, transformative sustainability

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1. INTRODUCTION

The history of money[1] can be traced from communal sharing in networks throughout the world through to temple accounting systems (originally of agricultural crops and commodities) in the Near East, which later led to coinage as money tokens (Laum, 2023[1924]), and in modern times, to digital tokens and cyborg money in a complex of trade and culture. A significant change in the spiritual side of money is seen in the etymology of money itself. The word money is derived from Iūnō Monēta (Juno) and her temple, where the Romans made use of tokens (money) for financing their military.

The Roman military was not an army apart from society. Rather, it was a large force with supportive garrison populations that were responsible for driving the early expansion of the empire. Along with this expansion, regional trade was augmented with a geographically distant natural resource-based economy that over time became increasingly based on money (Fulford, 2010). It was very much a military-industrial complex that grew in terms of consumer goods, urbanisation, cultural and financial sophistication. "Roman military [in] running major industrial enterprises, particularly large scale metalla mining and quarrying operations [within] … the context of the imperial economy … cannot be understated, ensuring the success [of] these industries on a scale not seen again for at least 1,400 years" (Elliott, 2017:134).

In contrast, to territorial expansion for slaves of the Roman times, today the growth imperative leads to the accumulation of goods and capital (Leonard, 2010), both as over-abundance and in waste mountains due to increased throughput, and services along with the power dynamic of growthism (Daly, 2019; Vastenaekels, 2024); growthism is a function of contemporary capitalism. The imperative leads to vicious circles of global flows and not virtuous local flows (see Petz, Bonelli and Eskelinen, 2024). Growthism leads to a linear economy and wealth concentration with "affluent overconsumption" (Wiedmann et al., 2020). Linear operations mean waste mountains. Such growth tends to a poverty of production, with external provision being fragmented, along a strung-out chain.

In contrast to global growth and extractivism, the path of degrowth leads toward local growth at the expense of global flows, a process which may be termed as postgrowth. Both global and local growths depend on creative destruction (cf. Schumpeter, 1947 for creative destruction) from our current standpoint. The former to global growth and extractivism; the latter to localised interdependence and a circular economy (N.B. the type of circular economy is important, see Berger, 2008; Daly, 2019; Iagăru et al., 2023; and Petz, 2023 for explorations), with an arts and crafts self-sustainability, which is more holistic and enriched. Circular economies thus engender different practices.

Different practices may be non-monetary. Family sharing, collectives, and commons, see the unit of production varying too. Variation in praxis leads to different kinds of money, such as social, art, cultural, et cetera monies. Varied monies show and celebrate different flows, e.g. the Hudson Valley Current, with local natural sites and wildlife visually honoured on their paper currency notes (hudsonvalleycurrent.org); SunMoney (sunmoney.org) as part of The Children's Eternal Earth Art Contest (kind.voyage/contest.html) with its connection to local crafts; and light-color money that explicitly shows different dimensions (Nishibe, 2019, 2021). Money is no longer seen as neutral (Włodarczyk, 2014), but transparently connected to communities and their values.

Varied money concepts are enabling different financial flows (Petz and Finch, 2023): inspired by mycelial networks, MycoFi (Emmett, Zartler and Morris, 2024); Regenerative Finance (ReFi) (Fullerton, 2015; Singh, 2025) in Collaborative Finance, CoFi (Fleischman, Dini and Littera, 2020; Informal Systems, c2021); Decentralised Finance, DeFi (Lewis, 2023); Relationized Finance (Bollier and Hurst, 2025); Bioregional Finance, BioFi (Power and Seefeld, 2024), which has commonalities with the Blue Economy (Pauli, 2010; Klinec, 2015) and the Symbiotic Economy (Uchihashi, 2009; Flyer, 2026); and Syntropic Finance, SyntroFi (this paper) interactions are contemporary examples.

All of the above enable different relations along a value chain or within a value network. They are embedded in social systems that are making use of mutual aid networks (Darby and Slater, 2023). Tighter relationships with the bioregional and the social technologies that vary across cultures result. These social technologies are using different accounting systems: barter of vouchers in commitment pools (Ruddick, 2023), REA[2] (Laurier et al., 2018), and favours, such as in the Japanese fureai kippu system (Hayashi, 2012).

These new technologies share characteristics with those traditional and indigenous practices, which are better integrated into the rhythms of the natural world, e.g. talkoot (Eräsaari, 2020), dugnad (Ługowska, 2020), and mweria (Ruddick, 2023). From a new human ecology perspective (Gilbert et al., 2023), their ways of operating are closer to an embedded-within-the-ecosystem way of being, which are operationalising a different relationship between the human and nonhuman. Drawing inspiration from these practices (the aforementioned traditional with the new modes of financialization and accounting systems) is useful in the pursuit of restoring humanity's 'balance with nature'[2].

Hopefully, all will act in combination as part of "a transition to a mutually enhancing human-Earth relationship" (Garver, 2019). To respond to anthropogenic climate change, such an economic paradigm shift is needed. Such a shift is a response to the inclusion of more and more aspects of social life into the logics of the market by (mostly) means of monetization (Polanyi, 1971[1944]). This process has created the "market pattern" (ibid.) which has performed "a transformation … of the natural and human substance of society into commodities [which]... disjoint man's relationships and threaten his natural habitat with annihilation" (42).

Polanyi proposed there is a "double movement … a countermovement for the protection of society" as a response to this market pattern, yet it is insufficient to protect the natural world or even society; something else is needed as an alternative to the "dynamic" of "bank money" (130). One way to look at bank money's effects is to take a multiple capitals approach (Coulson et al., 2015) and look at the flows of different capitals attached to that dynamic. We may speak of natural flows, as the flows of resources as they occur in an ecosystem before intervention of the market pattern, which commodifies and abstracts from these natural flows. By extension we can consider all the valuable things in a system as capitals, such as knowledge capital, e.g. knowhow and wisdom; social capital (note that social capital conceptualisations vary, see Claridge (2020) for a typology, e.g. relational, social connections, habitus; emotional, sharing, future obligations; and ecological capital, such as flood resilience). To properly take these flows into consideration we need to make ourselves aware of them. To do that we can use ledger systems which can record the flows of these capitals as "current-sees" (Petz, 2023), which are "the symbol systems to make flows at different levels visible" (Brock, 2011:m20:25). And then, once transparent, they can be managed differently… .

The world can be split conceptually into a natural world: described by Lamoreux and Bennett (2023) as a biosystem, which is "a collection of elements that interact together with a common, evolved function in support of life"; and a human world, that includes a corposystem, which is a "commercially oriented system of corporations and social structures", (ibid.). The two worlds are so severely out of balance, that the human world is destroying the natural world. Reaction to the destructive effects has led to a series of warnings. Images have been given as "warning signs" arising through "trespassing planetary boundaries" (Crépin and Folke, 2015). The most egregious— the threat to the climate—prompted the IPCC to publish a series of impactful reports, (e.g. IPCC, 2018). These mobilised civil society to call for action. The UN also released reports around biodiversity loss (IPBES, 2022). These various threats can be subsumed under the term polycrisis, and the human-caused effects called the Anthropocene (Sklair, 2020; Lawrence et al., 2024).

While there are responses across society to these UN publications, the warning approach[3] extends to concerned scientists (Ripple et al., 2017). Not content with merely reporting or theorising around the Earth's perils, various scientists take more direct action. Some are constrained by their cultural conditioning (Cuhra, 2019) from risking jail or fines by activism, but not all. Others feel their duty is only to warn and advocate scientists take more action in a general way (Gardner and Wordley, 2019). Yet others are moving from issuing general calls for education and action, to calling for specific action on various topics (Herzog et al. 2023).

In this paper, we identify as part of the latter group: we are thus publishing a Scientists' Warning on Money. Being concerned with money and its implications we want to consider how money and money relations are implicated in the current problems. Furthermore, we do not want to sit idly by and speculate, but rather to encourage and call for practical action. Such action can be facilitated by policy. We believe in science-led policy. This means that the evidence-base, experimentation, and theory all need to be developed. We will first proceed by exposing the methods we have used to be able to issue this Scientists' Warning.

2 METHODS

Our methods come from observing different money systems in use over several years. We have looked philosophically at the effects of different monetary systems. We have enquired into the philosophical roots of the current hegemonic system, dominated by the dollar and neoliberal capitalism. This has included involvement in the Research Association on Monetary Innovation and Community and Complementary Currency Systems (RAMICS), the Credit Commons Society, and scholarly circles' milieux with perspectives from Marxist economics (Heikkurinen and Ruuska, 2021), green economics (Read, 2015), ecological economics (Costanza et al., 2015), evolutionary economics (Nishibe, 2024), and mainstream economics' environments to build our collective wisdom.

Our analysis is informed by observing a historical perspective of how the hegemonic money system developed in the Western world (for an exploration of other cultural influences on money see Tinguely, 2024). The Western economic system has expanded to dominate globally in the form we have today. This process of colonization has squeezed out the plurality of economies, which has destroyed the fabric of communities both natural and human. The human-natural interaction is severely limited, so that the love of money has taken over from the love of vitality.

More recently, we have been interacting with the CoFi community (by attending conferences, retreats, and using Telegram discussion groups) and its bridging between older conceptions of community currency praxis with practitioners around mutual aid networks, timebanking, community currencies such as the regiogeld Chiemgaur (Thiel, 2011), and traditional cultural practices. CoFi is related to the blockchain for good movement that has grown from crypto currency over the last decade[4]. Due to this critical movement's recent formulation, it gives largely a revelationary perspective on the problems raised by contemporary money rather than clear paths and solutions. This CoFi community subculture, and how it operates, is still partially path dependent on libertarian, individualistic conceptions of society. The CoFi community has not yet fully matured an awareness (and enactment) of communitarianism or collective ways of being. We do not explore this anthropological economics aspect of CoFi more here, though its development could be interestingly contrasted with how other money-economics systems operate in human cultures, thus giving a sub-cultural rather than an individualistic or household perspective. Thus, we are taking a systems, substantivist rather than an individualistic, formalist positioning (Bălan, 2012; Bălan and Vreja, 2017).

To analyse the money-economics complex, looking at money alone is not enough. The effects on associated systems must be considered too. Taking only mainstream economic approaches will not do. They are framed to exclude as externalities the effects of the money system on our human societies, and even wider the planetary health on which societies are founded. Only by taking philosophical approaches, which consider the effects on society of the technologies unleashed by the complex, can we consider if money is serving our needs and what cautions need to be given over the technology of money.

Money is a technology, which, while it has upsides, certainly has downsides (cf. Roos, 2021 for materialism and semiotic views on technology and the biosphere, which are relevant to evaluation of money as a technology). It is the downsides that leads our analysis to severely question money-as-we-know-it and leads us to suggest alternatives more in tune with the evolved cultural and ecological practices for sustainable, resilient futures (cf. Visser, 2021). Here we consider the philosophical aspects of money under a Kantian (Kant, 1797[2017]) and Spinoza (Douglas, 2018; Spinoza, 1677[2016], 1670[1996]) influenced dialectic.

In discussions around money, we explored from different disciplinary perspectives in a way that juxtaposes and proposes via deliberate half-understandings possible new ways of looking at 'the problem of money'. From this we have extended our considerations to cyborg money as inspired by the work of Haraway (1985[1991]; 2004). This mix of disciplines falls under new human ecology (Shepard, 1967) which seeks to "formulate, synthesize, and apply theory to bridge the widening schism between man and nature. This new human ecology emphasizes complexity over reductionism, focuses on changes over stable states, and expands ecological concepts beyond plants and animals to include people" (Wikipedia contributors, 2025). It is an integral science perspective, that goes well beyond one discipline. Our presentation here is thus a working paper, where elements could and should be more developed theoretically.

We are aware that critics may accuse us of being armchair anthropologists, amateur historians, or generally armchair scholars who do not deeply explore the areas we touch, such as the origins of proto-money / money, social-

ecological systems, cyborg money or different modes of finance. However, this characterization of superficiality is not correct. Here we are necessarily brief, but we are following a methodology inspired by integrative review (cf. Tomlinson et al., 2024) which "reviews, critiques, and synthesizes representative literature on a topic in an integrated way such that new frameworks and perspectives on the topic are generated." (Torraco, 2005). Nevertheless, the result of our explorations is not an empty polemic, but an exhortation to thinkers for change, practitioners, activists, and scientists to take action.

3. THE HISTORICAL ORIGINS OF THE GLOBAL MONETARY SYSTEM

Having elaborated on the methods we have used for the study of money, we now proceed to give here a brief overview of the history of the current global monetary system, in which we try to avoid myths such as "the barter myth" (Petz, 2020:3; Wray, 1998) or more modern misapprehensions such as "the theory of static equilibrium" (Schumpeter, 1964[1939]:183). This analysis will pave the way for the study of alternative community economics and community currencies.

Money, currency, and the monetary system are all creations of humans. However, the fossil record suggests "modern cognition" (Tattersall, 2023:11) developed around 100 000 years ago. Talking, representational art, and social technologies must have existed shortly after that time. Humans began to make settlements during the Upper Palaeolithic (c. 50 000 – 12 000 BP).

Prior to settlement niche construction (Riede, 2011), interpretive reconstructions suggest there were multilevel social networks that engaged in cultural interchange, (e.g. Sikora et al., 2017 who back up DNA evidence with an interpretation based on modern hunter gatherer practices). So it would be possible to imagine an accounting system, perhaps with an agreed representational element, to have existed as part of different techno-complexes evidenced by material culture findings from archaeology (cf. Finlayson, 2010 as to why both are needed).

Yet we have scant evidence from archaeology (cf. Marshack, (1972) for tally sticks; Sweatman, (2024) for lunisolar calendars suggestive of earlier origins regarding accounting). We have inferred knowledge of what kind of social technologies were employed; we can speculate by looking at non-literate peoples via anthropology (Eriksen, 2015). Histories and stories from once writing developed can give clues. Material culture, such as painting, can take us back 51 200 years (Oktaviana et al., 2024) or petroglyphs to a similar age (Zarandona, 2020).

We can speculate that some traditional systems like Kula rings (Kuehling, 2005), or varied uses of shell money (Barclay et al., 2018) operated more widely than Oceania, where they still operate. There is strong evidence that shells were traded and could have acted as monies 100 000 years ago (Fauvelle, 2024) if not more if Neanderthals used them too (Zilhão et al., 2010). However, trading shells are not money, as we know it today, as their sphere of use is narrower (see Eriksen (2015) for the sphere concept). Some argue shell monies were special purpose monies or limited commodity monies (Graeber, 2012). Similarly, shell systems do not serve, in the way that the modern monetary system and banks serve, that is with anonymous relations surrounded by neutral money idealism only partially mitigated by legal systems and cultural mediation (Fauvelle, 2024).

It appears that the origins of conventional money and the money system both lie in the fertile crescent of Mesopotamia as a result of the Neolithic Revolution. The various elements developed from a syncretism between city-state power and temple-based religions in the Near East (Bromberg, 1942; Harris, 1975). Temples (and palaces which were often in conflated complexes in terms of governance and location) tithed, stored valuables, and empowered trade along with taxation, which gave them power with the population to engage in mercantilism, resilience against crop failures, crucially to support legal systems and control via militarism.

Leaders, some of whom claimed divine status, used the technology of money (but not coins) as part of systems of control. The first metal coinage[5] (made of electrum) came from Lydia (Melitz, 2017) and "the Greeks were building on ancient near eastern experience" (Snell, 1995:1490). Much like Bitcoins, these first coins were of such high value that they could not be used in day-to-day trade, say for victuals. It is believed the first gold coins were issued by the Lydian king, Croesus, who began the use of coins for general purpose money (Melitz, 2017). See Peacock (2013) for an exploration of these ancient origins of money.

However, the early coined money created was largely confined to local use. This changed with silver used by Greek merchants (Davis and Albarède, 2023) in wider spheres in inter-regional trade and even more so with the

development of city-state silver coinage (Meadows and Shipton, 2001). It seems another significant change happened when the Romans needed to finance war (Reden, 2012). For this purpose, money was created in a mint (from where we get the term money) that was connected with Iūnō Monēta; this Roman goddess is appropriately adorned with a cornucopia of wealth, and linked with the shadow-side of the Greek goddess Hera. There is much disagreement over her complicated persona[6]. Hera is the Greek name of the equivalent Roman goddess, who was often vengeful and jealous of threats to her by Zeus (her brother and partner)'s infidelity. This leads to a possessive, selfish aspect rather than a communal sharing one. The Roman equivalent Monēta was a war goddess, signified by clothing, carrying a spear. Monēta birthed the war deities Mars and Bellōna. The relevance to our Warning on Money is that these changes are reflected in money relations over time and cultures. Money is a transitional object and / or a quasi-object (Carr and Downs, 2004), the implications of which we explore below as cyborg money.

With the Roman use of money (imperial money), the modern form of a system beyond one temple or city-state, but on an imperial scale became manifest (Reden, 2012). Money is the representation of an asset. It can be commodity money, where it is also an asset. Or it can represent material concrete assets; land, goods, or intangible, abstract assets; service promises, future deliveries, debts. When the money begins to move, it becomes currency. Note that some reject the use of the term "currency" and regard non-physical representations, such as bank deposits, as not being money (Walker, 1891). To take this historical rejection into account there are banking conventions that split money into M1, M2, etc. (cf. Friedman and Hahn, 1990). Here we take the position that to recognize assets as money a process of tokenisation takes place. These tokens manifest the properties and functions of money. When used collectively they form a monetary system.

The form of the system affects how our civilisation operates and what is probable via monetary relations. The evolution from foraging, distributed networks to temple-controlled local and regional monies to centralised Roman military monies and then to a global hegemony (the place of banks and banking is important in this process and can be explored via Gilbart, 1833[1822]; Howe, 1915; Hellyer, 2014; Sangster, 2016; Scott, 2022) has seen the creation of a dominant world view about how relations (with the wider natural world, in the social domain and in terms of business relations) should function. However, this form of economy from oikos—household management—is not the only form of economy that can exist.

Evolution is a bush rather than a line, so for example the tally sticks mentioned above could have evolved into a money system based on the sharing of favours, the lunisolar calendar could have evolved into a money system based on time or seasonality, rather than the current money system based on commodity money (agricultural crops) for resource sharing. The current system's money is called bank money by Polanyi, imperial money in the Roman case, and nowadays forms the dominant way to meet our resource sharing needs. It is commonly known as fiat currency.

In concrete terms, we can think about how different "economic" needs might be met other than by a system of asset representation using a neutral money and anonymous banking delivered via corporate capitalism. Values-based banking is a step toward a different way (Boitan and Shabban, 2024), yet to support the resistance to the status quo we need a good technology-task fit with the tool of money in the money-economics complex. Here we can look to see what dimensions are missing in the process of anonymisation and abstraction - the monetisation and commodification which have taken place to alienate our systems from reciprocity, and Earth responsibility.

Having examined the historical origins of the prevalent monetary system, we can now begin to look at alternative systems which challenge the standard narratives and which also respect the Earth and the humans more than the dominant system does.

3.1. Community economics

If we consider the pre-Holocene humans, the prevalent belief is that they existed in small groups and considered things collectively in these small groups (Groeneveld, 2016). There is increasing evidence of large and complex societies of foragers wherein these small groups were connected via larger cultural interactions for trade, ideas, and mobility (see the works of Jean M. Auel for some imaginings of these ways of being[7]; and Apicella et al. (2012), for a study of contemporary hunter-gatherers and networking implications from gift exchange). Human evolution has not dispensed with a small group approach. We can see examples of small group economic systems, around harvest or agricultural work and even with hunting or foraging expeditions. In Finland, 'talkootyö' is an example of such a practice (Eräsaari, 2020; Määttä and Manninen, 2018); each instance of, as a collective work project, is a talkoot,

which, when considered collectively, makes a system. Other commitment pools can be seen, e.g. in modern equivalents based on traditional practices, facilitated by the Grassroots Economics NGO in East Africa, such as mweria (Ruddick, 2023).

However, there is a system that has recently gained the interest of monetary scholars. This is the imaginary of the commons. It has become more prevalent in recent times via a process of commoning. Particularly noticeable is the extension of what the commons includes under the banner of the "new commons" (Hess, 2008; Meyer and Hudon, 2019). Ostrom's Eight Design Principles for Sustainable Governance of Common-Pool Resources (Wall, 2017; Ostrom, 1990[2015]:90), which identify what a commons is and how a commons operates, are now being applied in prosocial frameworks.

Barinaga's (2024) book directly contrasts the commons with the neoclassical economics system. Finch's (2024) book on the Bristol Pound, calls for a more commons-based, less money-based system. The Credit Commons Society is developing ideas for commons functioning via mutual credit to remove the influence of money from trade at local, and globally interacting economic circles. In 2024 members promoted the commoning philosophy (Perperidis, 2024) via a Festival of Commoning and networking. The Commons Hub has created a Commons Economy Roadmap project that "is a Knowledge Base and Promotion Protocol to highlight and empower what we consider to be the most important 20 projects in the current economic stage: companies and ecosystems that are building open infrastructures to regenerate society, to support the struggle of citizens, farmers, activists, scientists, tech experts and entrepreneurs on the ground at the dawn of global collapse" (Quarta, 2024).

There are others considering how we can implement the lessons of the commons too. The Ecohana platform (https://ecohana.mn.co) and Joe Brewer's Earth Design School have advocated moving towards BioFi (Brewer, 2021). This financing will operate in a more commons-oriented way. It will lead to a nested hierarchy from hyperlocal, to local, to bioregional, to global. Yet the emphasis is on using finance to bootstrap the locally embedded system, not to maintain the global one.

One way to bring change is via Universal Basic Guarantee (UBG). UBG is a local and regional resource-based system that guarantees the basics of life are provided via communal work (Petz and Hoppe, 2022). By implication, UBG extends to something like the medieval system, wherein precious metal money was only used for extraordinary purchases and not everyday needs (Kokabian, 2020). UBG is a low-money system, rather than a no-money system. It is not Universal Basic Income (UBI) as it can operate as a money-free system. UBI may act as a stepping-stone to UBG, but has issues with how it distorts money relations (Schmidt, 2022). Adaptive Basic Income (AuBI), another variation on UBI, is "an innovative system that merges AI, decentralized infrastructure, and active inference theory to create a more adaptive and personalized approach to resource distribution" (Die Schwarze Katze et al., 2025) which is moderated under a command economy like approach.

The Earth is being cherished with these possible ways of operating. Recomony looks to do this via the creation of local economic circuits of production and consumption around craft and productivist groups. "Organizations issuing local currency can back the issue with actual resources that can be purchased with the currency…And to multiply power of local currency, adjacent community marketplaces can accept each other's local currency; and all willing local marketplaces can collaborate to provide for needs that cannot be met locally" (sunmoney.org). This reconomy system nevertheless uses money as a representation of an asset. It is not a no money system. Here the asset backing is a form of collateral. In many cases collateral is provided by land or fiat currency, but it does not have to be. For example, warehouse receipt financing (FAO, 2024) is an alternative as is Artmoney (Banks, 2011).

3.2. Community currencies

As hinted at above, there is a history of local and alternative and parallel currencies and systems, which operated in a complementary way to the dominant monetary system (Blanc, 2024). However, their recent success has been mixed. Some have lasted longer due to ideological commitment, such as the Chiemgauer (Thiel, 2011); or legal facilitation, such as the French local currencies (Monnaies locales complémentaires et citoyennes), which are integrating with rather than challenging the dominant bank money (Cauvet and Fabert, 2018). Most, however, have failed to establish themselves as enduring monies[8]. They may have served other useful purposes, for example bringing a community together, marketing a festival, engaging in economic literacy and capability as part of

community education. And even those, which ultimately have not succeeded, have mobilised capital flows in the forms of grants and knowledge into the small communities where they operated.

The short lifespan of these alternatives is not only due to the hegemonic economic system's power. Longevity is also dependent on the design of the social technology applied alongside a currency; e.g. September and Kobayashi (2022), wrote about the importance of "leadership continuity". Alternatives must be sought that are appropriately designed for a different economic system. To have a good task technology fit the alternative task (economic behaviours) must be considered too. One technology provisioning an alternative framing, to change the social scripts around money relations, by giving a different affordance is light-color money.

Light-color money represents, via colour metrics, different characteristics (features) within one money in a way that is multidimensional (vector), rather than the scalar way of most monies' operation. It can then act as a special purpose money. Such a special purpose can limit where the money can be spent, by who, and on what. As money is created into a system it can be destroyed by spending it out of the system. This is analogous to fractional reserve lending, which occurs in the conventional banking system via loans. So money could be intergenerational; or given to those with special needs; or for special purposes, such as buying educational services as voucher schemes do.

While light-color money is only a thought experiment, it is possible to model its essential elements in a game world. The game Le Grand Jeu (Petz, Bonelli and Eskelinen, 2024) modelled a red currency for knowledge and a green currency for ecological value, which were both required, along with a white currency for finance in that game world, to carry out certain actions, like building a safe genetics lab. The 3 currencies were not mutually fungible.

Experiments have also been made on alternative accounting systems, forming a kind of money with purpose. Timebanks are such an example. Timebanks promote community building and egalitarian principles by matching people with corresponding skills and needs, and a time-based accounting system balancing at zero (Cahn, 2009). Time is then used as money as time units are debited to and credited from users' accounts, but there is no money in the sense that any tokens would circulate, or that time currency could accumulate. To prevent accumulation, most timebanks have determined upper limits for time credits.

While many other complementary currency systems involve circulating tokens, therefore more resembling mainstream money, timebanks demonstrate the political underpinnings of monetary systems, and thereby also the potential of complementary currencies in generating social change. This is emphasised by the fact that timebanks are often incorporated into organisations using them to promote organisational purposes. Beyond individual organisations, purposes promoted in timebanking can be seen to be organizing the economy through co-production rather than service provision (Boyle and Harris, 2009), promoting the role of the household, community, and generally the reproductive "core economy" (Cahn, 2009), along with equality and sustainability more broadly.

Fungibility and commensurability depend on the features embedded into a created money (tokenisation). To tokenise effectively, with vector matching of features, a greater use of information technology is needed. Note that light-color money is a progression on informationalisation seen with money forms over time (Nishibe, 2022). Some systems are encoding more information by using blockchains. The Decentralised ID Alliance, which aims to bring in verified decentralized credentials (decentralized-id.com/resources/getting-started/) is one. Decentralized IDs could act as on demand promissory notes for special purpose money. We can see a usage case for product quality labels (Meixner and Haas, 2016). Extra information is demanded by regulators (for purposes of food authenticity) and consumers (what they value, such as organic, local, or ethically produced). These lead to labelling, and encoding labels on blockchains is certainly possible (Treiblmaier and Garaus, 2023).

4. ANALYSIS OF THE ESSENCE OF MONEY

In this section we provide some remarks about the ontology (fundamental nature) of money, which offers a theory about what money 'is'. Based on this theory, we will attempt to answer the question: What, if at all, would it take for conceptions about money and its 'nature' to change or for it to disappear altogether from the relationships between human beings on planet Earth?

The theory that we propose as to the nature of money is that it is a social kind, that it is in the same category of things such as 'gender' and 'social groups' (Epstein, 2024). Social entities and kinds differ from natural kinds and entities (such as goats or mountains or water) because they exist primarily due to agents (people) having certain

beliefs about them. To give an example specifically about money, a coin of 1 euro is a 1-euro coin if a community of users believes it is, uses it socially as such, and collectively trusts it to maintain its value and status as money. If an alien being sees the 1-euro coin as a metal disk, and does not have any beliefs about prices, the European Union, central banks (by the way, all social institutions), then the 1-euro coin for them is nothing but another metal disk.

This social ontology of money as an institutional fact (Larue, 2024) means a community of use can regard something as money, with no physical presence, e.g. bitcoins or the rai stones of Yap lost in the ocean, yet still valued (Fitzpatrick and McKeon, 2020). Social kinds may be contrasted with, as above, to natural kinds, e.g. chemical kinds: a molecule of H_2O is (perhaps) an H_2O molecule, irrespective of the beliefs of any human or alien.

The social kinds conception of money would be opposed to an essentialist theory of money - such a theory would treat money akin to a commodity (a piece of gold, for example) with an intrinsic value and objective relations to other commodities or things. Commodity money, e.g. gold, tobacco, and skins, has existed in various places and times in human history; however, the fiat money we use now is not of this kind.

Now, having laid out a theory of money, we could move on to a second question: What would it take to change the whole money system into something better for the whole of the planet? The answer to this, may, surprisingly, be: Quite little!! If money is a social kind and hence its whole allure and grip over people lies purely in their individual and collective minds, then all that is required is a collective change of attitude towards it.

Again, an example may be instructive here: if one feels they are categorised in a gender and they disagree with that categorisation, their mere disagreement may be sufficient to 'reassign' their gender. Perception is reality, a socially constructed perception is a socially constructed reality via mutualism. Their 'believing' their own categorisation and acting on this belief is all it takes to change their gender category. Whereas when one disagrees with the fact that what they have in the glass in front of them is H_2O despite all chemical and other experiments showing this to be the case, then they do not have much room for manoeuvre.

So, realising that money is not an inherent feature of the furniture of the world (essentialism), nor even of the world of humans, or even the weaker belief that even if there have been many forms of money all through history, the assumptions, practices and beliefs around its use are contingent and multifarious, and none of them more 'correct' or 'universal' or 'right' than any other, would take one significantly close to the entertainment of other beliefs, assumptions and ways of obtaining goods through exchange or through any other way that would fit better with their worldview. And if that worldview would include something like a wider conception of life on planet Earth and what it takes to live in a regenerative and sustainable way during our time amongst the living, then all the better.

Thus, by choosing a different encoding of information and mental construction, we could change the idea of what any money is. What money is, then, becomes a question of the entitlements and obligations that a given society has agreed to about its use, as well as the other narratives and knowledge related to it. There is something of this idea expressed by Polanyi's (1971[1944]) great transformation whereby the money idea has wrapped up and changed people into commodifying every transaction and interaction. Thus, childcare, domestic work, and potentially human relationships are reduced to extensions of the money ideal and monetized. We now have the problem of knowledge by acquaintance, where people have accepted the beliefs encoded in their and society's semantics around money relations.

There is an interesting aspect that develops from this extension of money by acquaintance. That is cyborg money. We are currently engaged in a social constructivist perspective. This leads to the idea that cultural transmission and mimetics are important facets in approaching items with money relations. So it is, as with commodity money, which encapsulates artificial features of 'money' alongside the social-natural components of the 'commodity' (cf. Haraway, 1985[1991]; 2004; Brey and Søraker, 2009, on cyborgs). Marx regarded this process of extension as commodity fetishization, whereby money becomes a fetish, (a commodity fetish). Commodity fetishization of money happens when money separates from the social relations in production, which you may find in a commodity (Hornborg, 2011; 2024). Thus, alienated from social and natural systems, money becomes a thing without the commodity aspects. This fetishized money is then related to as a thing (further transformation than Polanyi's commodification). Money itself then affects, via the money system, goods and services. They become products infected with artificial money relations embedded in them.

Products that have gotten standardized and infected with the agency from fetishized money act to alter our reality further, e.g. McDonaldization (Ritzer, 2012). We thus end up with "cyborg money", which is a mix of a natural good and or service, as a product with artificial money relations embedded inside, animated with agency by human usage. Thus, Coca-Cola and Netflix are cyborg money. Their use embodies knowledge as flows of information. This embodied knowledge is an extension of the money realm. They are quintessential products of the current system. Thus, it can be imagined that abandoning that system might mean abandoning or at least transmuting their form.

The hegemonic money views can be seen in the work of Adam Smith (1904[1776]), which the philosopher Kant (1797[2017]) expounded on:

> *What is Money?*
>
> *Money is a thing that can be used only by being alienated. This is a good nominal definition' of it (as given by Achenwall);* that is to say, it is sufficient for distinguishing this kind of object of choice from any other, though it tells us nothing about the possibility of such a thing. Still, from the nominal definition one can see this much: first, that the alienation of money in exchange is intended not as a gift but for reciprocal acquisition (by a pactum onerosum); and second, that money represents all goods, since it is conceived as a universally accepted mere means of commerce (within a nation), having no value in itself, as opposed to things which are goods (i.e. which have value in themselves and are related to the particular needs of one or another in the nation). (69)*

Kant viewed money as having developed from powerful rulers carrying out taxation in terms of goods leading to the alienation (ibid.:70). This is known as a chartalist position, whereby chartalists see universal money being born exactly out of taxation: where there is a need to obtain the common currency in order to pay the required taxes (Kitamura, 2022; Wray, 1998; Knapp, 1924). Kant thus regarded money's conceptions to be culturally mediated. So, if we alter the cultural mediation, we can alter the money conception. In the age of the internet, it may be easier than ever before to change one's worldview through cultural immersion established via spending hours browsing online and associating with like-minded people in a seemingly endless universe of information, beliefs and memes. Or at least to find cracks in reality (Holloway, 2010), which we can grow another culture from.

It is Spinoza (1677[2016]) who prompts just such another foundation for a philosophy we can base money and the money system on. One that is less based on utilitarian humanity, and more based on nature. Spinoza argues that we are dependent on nature and careful study of it is needed to yield the knowledge that beats the path we must follow (Nadler, 2024). Such study gives the mimetics of money in society (Douglas, 2018), which contributes to the proclivity "to give mutual assistance to one another" (Spinoza, 1670[2016]).

5. DISCUSSION

Humanity is in the situation of creating a Cursed Earth, as found in the fictional world of Judge Dredd, where civilisation is confined to narrow enclaves surrounded by a hostile wasteland (Wagner, Mills and Bolland, 2016). To try and rebuild the areas of devastation, we authors warn that not only is a new cultural (technological) approach needed; both social and material technologies are important, but additionally humanity needs to consider a different path. The path humanity has followed has led to a money-economics complex (with strong shades of a military-industrial complex). "The money is sick. [We must recognize too that,] ... the entire economic body is sick and that the source of the illness is to be sought outside the monetary sphere." (Hantos, 1921). A century after Hantos wrote, this complex has taken over many of our relations and transmuted them, à la Midas, from something of intangible value, into useless (when it comes to sustaining vitality) gold. Just as Midas found that all that turned into gold could not be eaten, drunk or even loved, so we have found that all touched by rotten money suffers from an insidious monetary infection.

Philosophically, money has become a pharmakon, both a cure (to lack of liquidity) and a poison (as it hoards and pools and no longer flows as a currency; or when it flows in too strong a current as hot money). Money (bank money or imperial money historically derived via commodity money) is a representation of an asset; and currency is a flow of value. We must consider what values we are enabling and if our assets are being removed from a system where vitality is needed. Just as corporations are problematic, if they have too much power, so is money. Corporations can be limited in time and scope. Likewise, we can consider monies with currencies and how they can be deliberately purposed as appropriate technology by careful design limitations.

We must consider an economics which follows a path symbiotically aligned to ecological ways of being (Nishibe, 2024). Such an approach will necessarily value the local and small. An approach overly relying on export-led growth will destroy the local economic ecosystem and is the very opposite of import substitution industrialization, which will instead build resilience from the local to the meso and ultimately macro level. Along with local market resilience comes local ecological resilience, sustainability and virtuous circles which value people and planet.

We must consider how we replace money, cyborg money, along with their concomitant interactions and flows with us and the natural world. The biosystem needs to be worked with so that we abandon the corposystem. There are 3 broad aspects that seem apposite.

The first is technological substitution. Here we would replace imperial money with other monies, with monetary plurality in an ecology of different monies and protomonies. Community currencies, near monies (Chan et al., 2016), timebanking or even more technologically advanced monies such as light-color money, or blockchain-based currencies all co-existing to create a resilient diversity.

Second is undesign. With undesign there is an "explicit and intentional negation of technology" (Pierce, 2012), wherein is the "articulating the value of absence" (Baumer and Silberman, 2011). Thus, design tools are used to propose "alternative courses of action that do not entail continued use of a technology. Undesign, at its essence, questions the need for a technological intervention at all; as such, while it resembles one half of the substitution process, it involves a much stronger commitment to obviating technological complexity from a particular system, rather than just swapping in a new technology for the old one" (Tomlinson et al., 2024).

Undesign reaches into governance systems. It questions if we can exist outside of money relations. We might purposively adopt no-money societies, based on reciprocal commitments. Commitments to ourselves and a broader us-within-the-world rather than us doing something to it or taking from it.

The third approach is money evolution, to evolve beyond money, for example toward an economy of abundance with an ecology of diverse sharing practices. "The goal instead [of simply abolishing money] is to develop new systems that people naturally turn toward to gain a healthier, more sustainable, and more attractive way of life; money becomes obsolete only as a result" (Holten, 2022: 116). The authors of this paper all use money, yet we warn that the world has existed without this technology, and it can again. We can commit to constructed communities in which we are an integral part in a way that the current corposystem thinking discourages.

So how might we get there? The different financing mechanisms mentioned earlier have all been taking into consideration how to change relations for more resilience, biologically-based existences, and distributed realities. Similarly, economics scholars have touched on heterodox economic relations with schools of thought around evonomics, ecological economics, and feminist economics particularly noteworthy. But here we propose a combination between theory and praxis under a new term, SyntroFi.

Syntropic Finance (SyntroFi) is inspired by the ideas around forest succession (cf. Klinec, 2015). In brief, the idea of succession results when a bare patch of forest occurs; perhaps trees are blown over in a windthrow or a forest fire turns a verdant grove into an ash wasteland. Under natural conditions, pioneer plants will grow, and these will be later replaced by bushes, and eventually a verdant climax community results. Forest succession was conceived by Clements as taking only one form, yet Tansley suggests instead multiple forms of succession can occur and that there is not only one pathway (van der Valk, 2014). The successional approach can be applied economically. We might think of an economic succession going through stages from poverty to economic dependency to autonomous financial capability to autarchy and finally to natural abundance. Where there is a civilisation that has destroyed the social fabric, often the natural world is destroyed too. To 'rebuild' is thus a combined process.

Just as replacement and regeneration, along a chain of succession in a biome, require different plants, so different economic tooling, methods and technologies are required in a socio-economic system. It can be imagined that seed money as a grant, followed by a simple dependency, followed by a more market-oriented economy with commitment pooling developing toward a less money-focused way of running an economy, could be such an economic succession. In this process, financial capacity, capability, and resilience would all be built.

If land is considered a crucial factor of production, then ecological succession will also take place along with economic succession. This linking is being tried now by the AgroforestDAO in Brasil[9], where they are explicitly

thinking syntropically. Syntropically means that there are different levels of complexity in each stage of the succession. As ecological complexity increases toward a climax ecosystem, so does economic complexity, and governance develops too. The AgroforestDAO is monitoring the financial flows along with ecological succession by use of blockchain technology. Founded by Diogo Jorge, their syntropic process has come from the Earth Regenerators' incubation for bioregionally-based regeneration combined with syntropic forestry traditions of Brasil.

Another example where SyntroFi is "described what we see as our model, that we want to actually try out this year" (Rearick, pers. comm., 2024) is being carried out by HUMANS in Madison, Wisconsin (see: mutualaidnetwork.org: "Humans United in Mutual Aid Networks: The HUMANs - a cooperative network of peer support for building and living a mutual aid economy, open to members around the world"), with more of a focus on the social and governance dimensions than the ecological. In these 2 examples, we have described how the ESG lens (Gillan et al., 2021) is revealed with governance structures, ecology is thought about, and the social is considered. A multiple capitals approach could consider more facets, and syntropic agriculture would elucidate more of the elements on the biological side.

Now we turn to explicitly dealing with money—the topic of this paper. Money has been considered as to how it can be applied as an agreement of social contract. Here the use of technology allows for different narratives (stories) to be told and enacted through altered social scripts. Money has historically been tied to materiality with commodity money or tokenization via coinage and associated infrastructure. However, the physicality of money can be imagined, yet is absent, with "money of account" (Colwell, 1859:2). Now with digital currencies, it is possible to make intangible cultural heritage more explicitly represented in money and money systems.

We can—and should design different monies and different systems. Governance and usage can be different. We can change the narratives and social scripts around money. Money is polymorphous and can be earmarked for different purposes (Zelizer, 2000). These different monies can be made transparent and manifest. We can use them as special purpose monies which are restricted for our designated purposes. Light money is one possible way to do that; thus a real money plurality is possible. We can also apply design considerations to those things money is used for. With care we can label and control how products and services relate to particular monies, in a similar way to a lock and key.

6. CONCLUSION

We have postulated the way that the current money and money system originated. We have indicated that the path dependency (cf. Goldstein et al., (2023) for more on path dependency) it has created is damaging and reform is needed. We call for deeper investigations to develop normative money to help create a different society, one with resilient social-ecological systems (cf. Bots, Sendzimir and Schlüter (2014) for a framework for SES investigations), to replace the existing growth dynamic. While we propose both substitution and replacement, as viable technological strategies, we caution that more work needs to be done.

Instead of individual affluence, we want to see collective commonwealths. Instead of centrally controlled monies, prompting hoarding and exploitation, we want to see locally mediated media of exchange that promote inclusion and sharing of vitality. Instead of centralised governance and control, through imposed taxation systems, we want to see resources shared via localised decision-making through cooperative engagement in communities of mutualistic praxis.

Rather than monies and a system of exclusion (externalities), we want to see the inclusion of nature, respect for the future indigenous peoples of the Earth, and natural processes internalised. We see examples of such future resilience under the new commons, prosocial behaviour and the many experiments done on complementary and community currencies. Some traditional and indigenous practices offer the chance to use undesign rather than substitution, and these should be better explored to meet our human and planetary needs. In short, we warn that money, as we know it, is not compatible with solving the polycrisis we find ourselves in at present.

NOTES

[1] *Strictly, history begins with writing systems. As the proto-writing systems were based on tokens representing assets, money and writing are intimately connected. In this paper, we regard money-like systems as having existed in prehistory long before writing was developed. Both money and writing are symbolic systems that have "a much simpler structure than the form of utterance" (Nishibe, 2019). It would be better to talk of a 'histories of monies', as there are many stories about the origin of money. This paper considers the history of the dominant, and most successful in terms of cultural evolution, form of money found today (a money) in our single global industrial civilization (Holton and Nasson, 2009; Newell, 2012).*

[2] *The Hopi word Koyaanisqatsi captures this situation of being out of balance, and is the title of an ecocritical film produced by Godfrey Reggio in 1982. In this paper we refer to "balance with nature" and not the "balance of nature". The natural world is an evolving dynamic one, and in flux (not static equilibrium). More significantly, the idea that "nature can take care of itself", so can be ignored, is evidently not so (Kricher, 2009).*

[3] *The warning approach of the current Zeitgeist has antecedents in the Doomsday Clock of the Bulletin of Atomic Scientists (Drollette, 2024) and the Club of Rome's report, The Limits to Growth (Meadows et al., 1972).*

[4] *"BC100+ is the Blockchain for the UN Charter Values and the SDGs Action Plan 100+ (BC100+)" and a supportive manifesto can be signed at bc100plus.org/. "BC100+ is a global initiative … convening the blockchain ecosystem to the broader efforts of UN agencies and global initatives [sic] in support of the UN Charter values and the SDGs" (bc100plus.org/). "For organisations developing or implementing a blockchain-based solution to address the SDGs, we encourage projects to be registered in PositiveBlockchain.io, an open source database for blockchain-based projects making a positive impact. The current list of projects is available: positiveblockchain.io/database." (globaldigitalfinance.typeform.com/to/CShTHy6Q).*

[5] *While these electrum coins were the first coinage, much earlier, in the bronze age metal is believed to have circulated as "a multi-purpose money" in the form of "scrap metal and ingots, both graded according to weight or size" (Primas, 2013). Pieces of copper (0.4 – 20Kg in weight) were used as money (1719-1745) in Sweden called plate money in a similar way (Edvinsson, 2012). Other monies operated with these monies: in the bronze age, as rings (Snell, 1995) and thus money relations of some kind must have operated in those societies; and in Sweden's case as coins and ghost money (Edvinsson, 2012).*

[6] *Religious aspects seem irrelevant to modern secular societies (cf. Laum, 2023[1924]). However, this is the fallacy of presentism. The concept of Hera is believed, by current scholarship, to descend from a primeval mother goddess, which was more communal in outlook and closer to the concept of Gaia. Gaia's generative capacity carries over to Hera, who is a goddess of fertility, and faithful marriage. This is a transition from motherhood and fertility to create, ironically, a separation, which by elevating Zeus and the 12 Olympian Gods pantheon from the older Titans (e.g. Rhea, Hera's mother) and primeval deities (e.g. Gaia, who was Rhea's mother), changes the dynamic. The dynamic is no longer one of shared, communal motherhood; it becomes one of overprotective, exclusive, faithful marriage in which Zeus' infidelity is a threat. Protectiveness takes on a war-like characteristic of selfishness, where hoarding, inimical closed relations, competitiveness and an acquisitive mien dominates. The Etruscans made Iūnō more warlike by taking and conflating facets of Athena, which the Romans adopted (Latte, 1992[1960]). The result is a system based on private ownership of the means of production, the production of goods and services for profit, and the accumulation of these in the form of capital. In short, capitalism.*

[7] *Auel's Earth's Children sequence of books (1980-2011) deals with the Upper Paleolithic, which she claims is in "the realm of prehistorical speculation rather than simple historical fact" and thinks of "as closer to Science Fiction … it is fiction based on science and I am using science as my basis for my fiction" (Auel, 2002). This is probably the best we can do to write "realistically about early people" (Baker, 2015:29), as historical fiction is useful where we lack real historical records to imagine 30 000 years ago.*

[8] *Some successful alternatives have been banned, e.g. the Wörgl (Barinaga, 2024); others transformed, e.g. WIR Bank (Martignoni, 2016) and JAK Bank (Conaty and Lewis, 2012), or have grown successfully, but operate now with funding models that are not alternative, e.g. Sardex, that is effectively a brokered service and trading club (Barinaga, 2024). Others persist, but in a changed institutional landscape are less apposite than when they were created, e.g. fureai kippu (Hayashi, 2012), and the adat Banjar system of Bali (Petz, 2023), which both operate to some extent differently than from when they arose.*

[9] *The AgroforestryDAO history (2022-4) is available: agroforestdao.web.app/page1.html, though further developments can be seen in the AgroforestDAO Telegram group (with subgroups: General, Português, Economics, Share your agricultural context, Learn Web3, Proof-of-Syntropy, Calendar of harvests and experiences, Rooted Society Manifesto, and Español), and the Rooted Society manifesto (2.2.2024): https://mirror.xyz/diogoj.eth/Pqsja1w8l-6Gr4Uc0Fd5j5uH5ooFqYgovH7iH1t_Fwc*

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