



Bitcoin and stone money: Anglophone use of Yapese economic cultures, 1910-2020

Jo Lindsay Walton

University of Sussex, UK

Abstract

Recently parallels have been drawn between Bitcoin and Yapese stone money. This article focuses on Fitzpatrick and McKeon's (2019) exploration of similarities and differences. The analogy between Bitcoin and Yapese stone money is based on proposed commonalities that are inaccurate, ill-defined, and/or trivial. However, this does not signal a need to refine the comparison, but rather a need to reconsider the rationale for attempting it in the first place. Recent attempts to redefine Yapese stone money using terminology from the field of cryptocurrency reproduces a longer textual history in which writers from the Global North have misrepresented Yap for pedagogic or polemic convenience. Examples include works by William Furness III, John Maynard Keynes, Milton Friedman, and influential macroeconomics textbooks, such as N. Gregory Mankiw's *Macroeconomics*. This history features frequent colonialist tropes of Yap as well as the erasure of histories of colonial violence and power. More caution should be exercised in the study and pedagogic use of Yapese economic cultures, and greater effort should be made to center Yapese voices, acknowledge colonial contexts, and reflect positionality and uncertainty.

Keywords

Bitcoin, blockchain, macroeconomics, money, social currency, Yap

Introduction

Recently parallels have been drawn between Bitcoin and Yapese stone money. "Bitcoins are sometimes called virtual cash", write Yuri Takhteyev and Mariana Mota Prado. "But a better analogy is to Rai stones, a currency historically used in Yap" (Takhteyev and Prado, 2014). Saifedean Ammous (2018) claims: "Of all the historical forms of money I have come across,

Corresponding author:

Jo Lindsay Walton, Sussex Humanities Lab, University of Sussex, Falmer, East Sussex, BN1 9RG, UK.
Email: j.c.walton@sussex.ac.uk. <https://doi.org/10.2218/finsoc.7126>

the one that most resembles the operation of Bitcoin is the ancient system based on Rai stones on Yap Island". "[T]he Yapese use a very simple but effective form of what we would now call a distributed ledger", suggests Nick Furneaux. "Amazingly, blockchain-based cryptocurrencies work in almost exactly the same way" (Furneaux, 2018). This article demonstrates that these analogies ought to be rejected, and argues that the rationale for attempting them in the first place should be reconsidered.

Bitcoin is a proof-of-work, distributed ledger cryptocurrency, launched in 2009 by an anonymous person or collective under the moniker Satoshi Nakamoto. The Bitcoin blockchain is a complete list of transactions completed since the currency was created. Network members are anonymous by default, identified on the blockchain by their wallet IDs. This blockchain is stored in multiple copies spread across all members of the network (hence 'distributed ledger'). A subset of users, called 'miners', keep the blockchain updated. They do this by compiling transactions that have not yet been added to the blockchain, and broadcasting the new blocks throughout the network. They are incentivized with freshly minted Bitcoin, awarded to the first miners to correctly guess computationally intensive mathematical puzzles associated with new blocks (hence 'proof-of-work'). These puzzles are asymmetrical in that solutions are time-consuming and expensive to generate, but can be verified quickly and cheaply. The same process also generates Bitcoin supply growth. Because of its relative opacity to state scrutiny, Bitcoin is often described as a 'decentralized' cryptocurrency.

Crystalline limestone disks, called *rai* or *fei*,¹ are a form of money used on the South Pacific island of Yap (Waqab), today part of Micronesia. Rai stones vary in size from a few inches to about twelve feet. They were cut in quarries on other islands, principally Palau, over 450 kilometers Southwest, then transported to Yap via canoes and rafts, later using Western ships. Canoe voyages were lengthy and dangerous, and seafarers would sometimes lose their lives (cf. Hazell and Fitzpatrick, 2006). Radiocarbon dating and other methods suggest a very tentative date of around the year 1400 for the origin of the rai system (Glumac and Fitzpatrick, 2020: 67; cf. Fitzpatrick, 2003: 112). Contrary to what is implied by many economics textbooks, there is no evidence that rai stones were ever the sole money used on the island. Yapese economic history involves a number of other moneys and media, including shell money, cloth money, and the national currencies of colonial powers. Colonial powers ended the production of stones in the early twentieth century, and later destroyed a large part of the stone stock. Stones remain in use though their economic significance in the early 2020s has diminished considerably. Their precise role within Yapese economic cultures has also transformed over time, so caution should be used in ascribing continuities over this period.² There have also been differences in how stones of different sizes and origins have circulated.

To date, the most expansive and thoughtful comparison of Bitcoin and stone money is Scott M. Fitzpatrick and Stephen McKeon's (2019) 'Banking on stone money: Ancient antecedents to Bitcoin'.³ The authors present the manufacture and use of stone money as "an analog for cryptocurrencies and blockchains that ensure transparency, integrity, efficiency, and security", while also noting "key differences between Bitcoin and *rai*, some of which led to the downfall of the *rai* monetary system" (Fitzpatrick and McKeon, 2019: 10). They highlight circumstantial evidence that stone money may have inspired Bitcoin, and contend that comparative analysis may deepen our appreciation of blockchain's properties and potentials.

In the early sections of the article, I question the rationale for pursuing such an analogy in the first place. I do this by contextualizing it within a longer history of Anglophone political economy featuring Yap.⁴ This reveals how stone money has been repeatedly reconstructed to suit the purposes of individual authors. I briefly sketch how contemporary debates around cryptocurrency create affordances for the latest round of opportunistic reconstructions. In the

penultimate section, I examine Fitzpatrick and McKeon's comparison on its own merits. Although the analogy is intriguing, it nonetheless depends on opportunistic misrepresentations of Yapese economic cultures. None of the analogy's major specific points holds up to scrutiny. Each is either ill-defined, unconvincing, and/or trivial.

This leads me to urge greater caution in the study and pedagogic use of Yapese economic cultures. Until the pattern of opportunistic conjecture about stone money is much more widely recognized and redressed, I suggest, efforts at linking blockchain and stone money are likely to merely perpetuate it. Rather than attempting to rehabilitate such analogies, it would be better for the time being to avoid them altogether. Broadly in line with a diverse economies perspective (Gibson-Graham, 2007), I do also want to affirm the value of research involving traditional knowledge systems and more-than-capitalist economic forms, and their complex entanglements with capitalism past and present. In this spirit, the final section is more speculative. It mobilizes what I have learned so far about stone money to pose some questions about Yapese economic cultures and, more generally, about the role of storytelling in topologies of wealth.

The Island of Stone Money

In 1910, the American ethnographer William Henry Furness III published *The Island of Stone Money*, based largely on his two-month stay on Yap seven years prior. At this time there was already a significant body of writing about Yap in German and Japanese but little in English. Furness's book included chapters on religion, dance, and song, the construction of houses, and other topics. In the chapter "Money and Currency", Furness (1910: 102) described stone money, and mentioned the 'small change' of shell money and cloth money. He further suggested in passing that money was not strictly necessary on Yap, given the abundance of natural resources.

Furness (1910: 96-99) also spun a story that was to live vividly in the imagination of Western political economy for more than a century. It concerned the circulation of stone money:

After concluding a bargain which involves the price of a *fei* too large to be conveniently moved, its new owner is quite content to accept the bare acknowledgment of ownership and without so much as a mark to indicate the exchange, the coin remains undisturbed on the former owner's premises. [...]

Many years ago an ancestor of this family, on an expedition after *fei*, secured this remarkably large and exceedingly valuable stone, which was placed on a raft to be towed homeward. A violent storm arose and the party, to save their lives, were obliged to cut the raft adrift, and the stone sank out of sight. When they reached home, they all testified that the *fei* was of magnificent proportions and of extraordinary quality, and that it was lost through no fault of the owner. Thereupon it was universally conceded in their simple faith that the mere accident of its loss overboard was too trifling to mention, and that a few hundred feet of water off shore ought not to affect its marketable value, since it was all chipped out in proper form. The purchasing power of that stone remains, therefore, as valid as if it were leaning visibly against the side of the owner's house, and represents wealth as potentially as the hoarded inactive gold of a miser of the middle ages, or as our silver dollars stacked in the treasury at Washington, which we never see nor touch, but trade with on the strength of a printed certificate that they are there.

Furness supplemented this with another episode, relating how German colonial authorities collected fines by marking stones with black paint rather than physically moving them. The tone is cheerful although the subject is the coercion of an indigenous population to labor for the construction of surveillance and control infrastructure.

By and large, gift exchange now seems a striking omission in Furness's account of Yap. He does briefly refer to *rai* stones as funerary gifts and gifts related to "the seizure of a young girl to fill the office of *mispil*" (Furness, 1910: 49).⁵ Furness does not mention Yapese *mitmit* ceremonial exchange (Lingenfelter, 1972; Egan, 1998; Krause, 2019), nor the *sawei* system of exchange with islands to the east (Alkire, 1980; Hunter-Anderson and Zan, 1996; Descantes, 2005; Fitzpatrick, 2014).

A few years after Furness published *Island of Stone Money*, Bronisław Malinowski's *Argonauts of the South Pacific* (1922) and Marcel Mauss's *The Gift* (1925) would transform economic anthropology by placing gift-giving at its heart. Gifts were soon seen as politically and morally complex phenomena. Roughly speaking, Malinowski emphasized that even despite the fiction of 'no strings attached', gifts often give rise to strong obligations to reciprocate. Mauss concurred but insisted that gift relations are seldom between individuals as such, since "obligation is expressed in a mythical and imaginary way or, one might say, symbolic and collective" (Mauss, 2004: 42). Another key episode was the formalist-substantivist debate of the 1960s, when formalists sought to show, with limited success, the analytic priority of the utility maximizing individual, even in societies without markets or money. In short, the gift became a window into the wider, more-than-capitalist world, a world of locally distinctive property practices, and diverse ways for rights and obligations to circulate and transform – a world Furness failed to encounter, even whilst immersed within it. Instead, *rai* stones were forced into a concept that was already familiar to Furness: currency to pay for goods and services. It would not be the last time.

Anglophone ethnographies and histories of Yap

Over the twentieth century, texts rooted in economic anthropology and other fields, such as numismatics and archaeology, gradually began painting a richer picture of Yapese economic cultures.⁶ For example, W. Robert Moore (1952: 805-30) connected stone money with gift exchange and levelling mechanisms. Inez de Beauclair (1963: 158-59) mentioned the use of stone money in funerals, adoptions, ransom of an enemy killed in war, compensation for injury, the inauguration of communal houses, as a commitment to future land transfer, for expert canoe building, as well as for purchase of foodstuff. David Labby (1976: 35-44) described stone money as gendered wealth with circulation closely tied to distinctive Yapese institutions of kinship and land, embodying the principle: "our land belongs to someone else; someone else's land belongs to us".

So insofar as the stones were money, they were money with manifold functions, not reducible to a medium of exchange, unit of account, and store of value. The stones circulated not merely to coordinate production and consumption, but to cultivate and transform qualitative relationships within and between communities. David Graeber (2011: 130) suggests the term 'social currencies' for this broad category of moneys, used principally "to create, maintain, and otherwise reorganize relations between people", not principally for activities like buying goods and services or loaning at interest for profit. Graeber's approach draws on Philippe Rospabé's (1995) parallel between 'wergeld' and 'bridewealth', and Rospabé's observation that these valuables circulate not so much to clear debts as to symbolically affirm non-equivalence. Social currencies structure patterns of indebtedness that may become permanent, albeit plastic, parts of the participants' life stories.

I am, of course, not implying that the texts listed above are unproblematic, nor without their many contradictions and controversies. However, their problems pale in comparison with a second tradition of Anglophone writing on Yapese economic cultures. This second tradition is

found in brief remarks made by the economists John Maynard Keynes and Milton Friedman, in dozens of editions of introductory economics textbooks, and in the contemporary cryptocurrency discourse. This tradition seldom if ever includes Yapese voices, and is typically uninformed by any appreciation of gift exchange, reciprocity or social currencies. It has also adamantly ignored the plural, reflexive, and globally connected economic cultures to which Yapese stone money belongs.

Anglophone economics: John Maynard Keynes

In 1915, the Royal Economy Society's *Economic Journal* republished three pages from *The Island of Stone Money*. This included Furness's accounts of the stone lost overboard and the defiling of stones by German occupiers to extract labor for road works. It omitted the other moneys that Furness documented. John Maynard Keynes, as the journal's editor, is plausibly the one who selected the excerpt. Keynes, although he got the name wrong, was apparently once again thinking of Yap in this footnote to *A Treatise on Money*:

The earliest example of 'ear-marking' is in the case of the stone money of Rossel Island, which, being too heavy to move without difficulty, could be conveniently dealt with in no other way. One of the largest and most valuable of these stones lay at the bottom of the sea, the boat which was importing it having capsized. But there being no doubt that the stone was there, these civilized islands saw no objection to including it as part of their stock of currency – its lawful owner at any time being, in fact, thereby established as the richest man in the island – or to changing its ownership by 'ear-marking'. (Keynes, 1930: 292n)

The context is telling. Keynes was bringing up Yap in a rather playful preamble about social and psychological attitudes toward gold before getting down to the serious business of examining the case for an international gold standard. Keynes wanted to argue that gold has no special characteristics as a commodity to uniquely qualify it as a stable currency basis. Moreover, since the war, gold had remained concentrated in central bank reserves. Circulating neatly around central banks, rather than looping on wide rambling circuits through a variety of different social contexts and agencies, gold had grown more 'abstract'. In other words, the agency of gold had grown relatively subordinate to state bureaucratic control. Keynes even wondered if the gold standard might be ceremonially preserved by an emergent fiat system.

For Keynes, Furness' story thus contained two opportunities. First, he could invoke stone money to claim that there was nothing intrinsically special about gold as a standard of value. Second, the sunken stone could be claimed as a case of hybrid money between representative and pure fiat money. In both the case of gold, centralized during the war, and that of the stone, the 'backing' commodity of the monetary system was 'sunken' – on the sea bed or in the central bank vaults – and unavailable for general circulation.

Keynes' broader account has many merits, but his use of Yap established a dismaying pattern: limited and slapdash use of sources ("Rossel Island"), exoticizing or condescending admiration ("these civilized islands"), unexplained additions (the lawful owner of the sunken *rai* being "the richest man on the island"), alterations (the stone "changing its ownership by ear-marking", rather than remaining in the possession of one family as in Furness's account), and concepts that mystify more so than illuminate ("ear-marking" in contrast to Furness's "without so much as a mark to indicate the exchange"). Perhaps most tellingly, Keynes quietly filtered out the lesson Furness drew about labor being 'the true medium of exchange and true measure of value', along with his curious post-scarcity claim, but without registering the disagreement. Here, as in many later texts, the repurposing of Yap needed to be discreet, lest

it lose its allure as a pristine exemplar of universal laws. It would not have suited Keynes' rhetorical purposes for Yap to be encountered as an immanent presence within history, textually mediated, and subject to interpretation and dispute. Yap, it seems, was only worth arguing *with*, not *about*.

Anglophone economics: Textbooks

Similar patterns appear in multiple textbook editions from the 1940s till today, including: Dodd's *Introductory Economics*, Amacher's *Principles of Economics*, Mankiw's *Macroeconomics*, Baumol and Blinder's *Economics: Principles and Policies*, Ruffin and Gregory's *Principles of Macroeconomics*, Miles and Scott's *Macroeconomics: Understanding the Wealth of Nations*, and Williamson's *Macroeconomics*. Yap often is boxed off in a side-bar, implicitly framed as optional reading, there to embroider necessarily dry material. Its presentation varies in small ways, often easily missed. But these variations reflect at least two things.

First, willingness to filter and alter Yapese history for the sake of convenience. For example, whereas Keynes used stone money to show fiat money in a good light, Amacher's second edition of *Principles of Economics* mobilizes it in a diametrically opposite way, on behalf of commodity or metallic standard money. For Amacher's purposes, then, stone has useful connotations of stability and permanence. But these could be mitigated by the spectacularly perilous and unpredictable production process. So Amacher simply does not mention that stones were quarried on Palau, and even generalizes Furness' anecdote to extend to most, if not *all*, sunken stones: "even stones that are now under the sea maintain their value, and their ownership, though not location, can be changed" (Amacher, 1983: 63). Amacher simultaneously implies that stone money is no longer used.

Second, these variations reflect incoherence within the textbooks' own understandings of money. The textbook accounts of Yap are almost always located in the introduction to the function and origins of money as grounded in the commodity theory of money. Money is presented as a means of exchange, a unit of account, and a store of value (occasionally also a means of deferred payment). Its origin is located as a conveniently inevitable solution to the inconveniences of barter. The main inconvenience is the "double coincidence [of wants]" (Jevons, 1875: 5) where money is purported to emerge as a technical solution to the following problem: "if Farmer Jones grows corn and has a craving for peanuts, he has to find a peanut farmer, say, Farmer Smith, with a taste for corn" (Baumol, Blinder, and Solow, 2020: 237). Throughout the history of modern economics, this has been the dominant entry-level theory about money even though, as anthropologist Caroline Humphrey puts it: "Why should anthropologists be interested in logical deductions from an imagined state? No example of a barter economy, pure and simple, has ever been described, let alone the emergence from it of money; all available ethnography suggests that there never has been such a thing" (Humphrey, 1985: 49).⁷ Clearly, it is not only anthropologists who should be cautious about deductions from an imagined state but anyone who cares about the actual historical origins of money systems.

In fact, economic anthropology leaves little doubt that societies that are 'moneyless', in the textbook sense, tend to use complex localized systems of reciprocity, involving gift relations and social currencies, and that where barter does occur, it is nothing like what commodity theory imagines it (Humphrey, 1985; Ingham, 2004; Graeber, 2011). However, for mainstream economics, especially the broadly neoclassical tradition, the discredited commodity theory of money retains significant allure. Largely this is because it hides money's

dual role as an instrument of power and a reflection of non-monetary power. Positioning money as a commodity among others (distinguished only by its minimal intrinsic value) dovetails well with the notion that money is merely a neutral (or largely neutral) veil over the real economy. Money is seen not as a matter of power and politics but as a perfectly unobjectionable technical solution to a problem, and one that can emerge out of self-interested interactions between many independent individuals.

Clearly, Yapese stone money is a spectacularly poor fit for this theory. Nevertheless textbook authors appeal to it again and again, filtering and manipulating it in various ways in creative efforts to prolong the untenable theory. For example, William J. Baumol and Alan S. Blinder's third edition of *Economics: Principles and Policy* focuses on the idea that money works efficiently as long as it is uniform, divisible, durable, and storable. Using gold and silver as a starting point (based on the unlikely assumption that these have "high value in nonmonetary uses"), the authors present a highly stylized history, in which face value and bullion value are conflated, and their four chosen qualities increase inexorably (Baumol and Blinder, 1985: 224). The information they include about Yap is an abridgement of Art Pine's 1984 *Wall Street Journal* article, and their brief framing is indicative about how they want to use Yap: "Primitive forms of money still exist in some remote places, as this extract from a recent newspaper article shows" (Baumol and Blinder, 1985: 224). Yap is stuck in an especially bad version of their first phase, burdened with money so heterogenous, indivisible, and difficult to store that it ought to be obsolete. The abridgement itself is also telling. They omit Pine's reference to lower-value stones produced with the assistance of the man Pine calls "David Dean O'Keffe" [O'Keefe], which would cast doubt on Baumol and Blinder's presentation of the stones as a kind of substitute bullion. Similarly, they stress indivisibility, and even imply the stones may not be that durable – "the stones are worthless when broken" (Baumol and Blinder, 1985: 253) – yet leave out Pine's next point:

Rather than risk a broken stone – or back – Yapese tend to leave the larger stones where they are and make a mental accounting that the ownership has been transferred – much as gold bars used in international transactions change hands without leaving the vault of the New York Federal Reserve Bank. (Pine, 1984: 1)

David Miles and Andrew Scott, in *Macroeconomics: Understanding the Wealth of Nations* (2002), are even more inventive. As with other textbooks, they set out a version of the commodity theory of money, including the suggestion that "it is bizarre to quote prices in terms of a commodity when transactions do not actually involve the exchange of that commodity" (Miles and Scott, 2002: 298), thus bypassing many historical instances, attested at least since Homer's *Iliad*, where precisely this has been the case. But their most distinctive claim is that Yap employed a paper currency backed by *rai* stones:

As long as you had a piece of paper that proved you owned a stone (which may be stored miles away and never moved), you had something valuable. [...] So this is one (big!) step removed from pure commodity money. We are talking about a system in which paper claims circulate as money. (Miles and Scott, 2002: 299)

Some textbooks are less flagrantly inventive, while still finessing their presentation of stone money to reflect their authors' preoccupations and priorities. Stephen D. Williamson's second edition of *Macroeconomics* compares 'Yap stones' with playing card money in seventeenth-century New France. For Williamson (2005: 539) "the commodity backing of the playing card money was uncertain (due to the inability of public officials to keep their

promises)", whereas "the existence of the Yap stones was well-known to essentially everyone on the island". Williamson's emphasis on social and political institutions underpinning price stability versus inflationary pressure reflects his broadly new monetarist concerns.

The commodity theory of Ruffin and Gregory's sixth edition of *Principles of Macroeconomics* frames money as a productivity-improving information technology. In contrast to Baumol and Blinder's emphasis on indivisibility, Ruffin and Gregory impose a kind of shareholder system on stone money: "[a] particular large stone may be owned by many residents, each of whom has received some part of the stone in exchange for some product or service". This indicates, at best, a serious lack of curiosity about forms of collective ownership beyond the shareholder model. It leads to their verdict that "[t]he informational requirements of stone money are too great (each stone has a history) for a complicated world" (Ruffin and Gregory, 1997: 201), causing it to be eventually superseded by more impersonal, fit-for-purpose money technology (cf. Fitzpatrick, 2003: 66-67).

Mankiw's *Macroeconomics* (1992) again offers a version of the commodity theory of money where the inconvenience of an imaginary form of barter leads buyers and sellers to converge on a single commodity as a medium of exchange. Yapese history is reinvented to show a similar process in action, emphasizing unwieldiness rather than the double coincidence of wants. At first, Mankiw (1992: 144-45) imagines stones were conventionally moved around with each transaction:

The stones were heavy; it took substantial effort for a new owner to take his *fei* home after completing a bargain. Although the monetary system facilitated exchange, it did so at great cost.

As one might expect, it became common practice for the new owner of the *fei* not to bother to take physical possession of the stone. Instead, the new owner accepted a claim to the *fei* without moving it. In future bargains, he traded this claim for goods that he wanted. Having physical possession of the stone became less important than having legal claim to it.

This practice was put to a test when an extremely valuable stone was lost at sea during a storm.

The source Mankiw cites, Norman Angell's *The Story of Money* (1929), does not include any phase in which *rai* stones physically moved with each transaction. Mankiw seems to have invented it.

As this overview shows, when Yap has appeared in Western political economy, the lessons which authors draw often reflect their position in intellectual and political disputes which are not principally rooted in Yapese history or economics. Yap is served up as an oddity to distract from a story about the nature of money which is at best implausible, unsubstantiated, and prone to unacknowledged variations of detail. These tendencies also extend beyond the textbooks. Felix Martin's *Money: The Unauthorised Biography* (2014) provides a good illustration. Milton Friedman quotes Furness' *Island of Stone Money* at length in *Money Mischief* (Friedman, 1992). This impresses Martin (2014: 13), who describes Furness' book itself as "obscure," and calls the fact that Keynes and Friedman both read it "a strange coincidence," despite the ample representation of Yap in textbooks and the rather obvious fact that Friedman read Keynes.⁸ Furness (1910: 92) pondered the "simple-hearted" people who had "never heard of Adam Smith or Ricardo" yet who, in his eyes, vindicated the labor theory of value. Martin echoed this a century later by framing the Yapese economy as "simple" and "rudimentary", and by marveling about how two "giant[s] of economics" as different as Keynes and Friedman could come to the same conclusions about it (Martin, 2014: 13). But outside of Martin's selective framing, they did not come to the same conclusion.

Keynes focused on the first of Furness' anecdotes and Friedman on the second, in line with their own respective views about the role of policy intervention in the creation of material wealth. Keynes, the sea bed; Friedman, the black paint.⁹

The incoherence of textbook descriptions of stone money reflects a deeper problem surrounding the theory of money these textbooks are attempting to illustrate. This remarkable array of unsubstantiated speculation, misrepresented as fact, is compounded by an indifference about making appropriate corrections to subsequent editions. For example, Baumol and Blinder's fourteenth edition alters its account only as follows (my emphasis): "Primitive forms of money still exist in some remote places, as this extract from an *old* newspaper article shows" (Baumol, Blinder, and Solow, 2020: 213). Robert H. Frank and Ben Bernanke's first edition of *Principles of Economics* mentions Yap fleetingly, misleadingly describing the *rai*: "a wide variety of objects have been used as money, ranging from gold and silver coins to shells, beads, feathers, and, on the Island of Yap, large, immovable boulders" (Frank and Bernanke, 2001: 668). By the seventh edition, two more editors and some cacao beans have been added, but the "boulders" apparently really are immovable (Frank et al., 2019: 584). Likewise, Mankiw repeats his idea about the progressively dematerializing *rai* in his tenth edition; tweaks to the phrasing have only become misleading, with "[a]s one might expect" becoming "[e]ventually" (Mankiw, 2019). In this edition, however, Mankiw places Yap side-by-side with another intriguing specimen: Bitcoin.

Stone money and Bitcoin: Grounds for comparison?

I now want to focus on 'Banking on stone money: Ancient antecedents to Bitcoin' by Fitzpatrick and McKeon (2019). Fitzpatrick is an anthropologist and archaeologist, and his research on Yapese stone money includes extensive fieldwork and interdisciplinary collaboration; McKeon, on the other hand, contributes his expertise in blockchain finance. Because of the history of opportunistic use of Yapese economic cultures, there is good reason to be cautious about any attempted analogy between stone money and Bitcoin. The next section nonetheless examines Fitzpatrick and McKeon's analysis on its own merits. While their analysis is more measured than many considered so far, it nonetheless perpetuates several of the same tropes.

In this section, however, I want to examine what grounds Fitzpatrick and McKeon offer for conducting the comparison in the first place. After all, a comparison can be drawn between any two things and (with a little imagination) analogies and divergences revealed. In many economics textbooks, as we have seen, comparisons between stone money and capitalist money appear as clumsy distractions from implausible and inaccurate histories of the latter's origins. So what motivates this comparison between stone money and Bitcoin?

One rationale Fitzpatrick and McKeon (2019: 7) offer is that the *rai* "may have been a progenitor that inspired Bitcoin". They acknowledge that evidence for this is circumstantial. However, perhaps a better question might be whether such a connection is even really in doubt. As already sketched, stone money is a ubiquitous presence not only in the work of "numismatists and other scholars whose interests lie in the history of money" (Fitzpatrick and McKeon, 2019: 9) but also in introductory economic textbooks. On the whole, it appears unlikely that Nakamoto would not have come across stone money at some point. Yet this must be understood in context. Aspects of Bitcoin are prefigured in computer science projects, such as Hashcash, Bit Gold, DigiCash, Flooz e-currency, Hal Finney's Reusable Proof of Work, and Haber and Stornetta's Merkle tree blockchain. Wei Dai's b-money proposal integrated a distributed ledger based on cryptographic hashes and public key cryptography, proof of work to generate new currency, and currency incentives for mining.¹⁰ Culturally, there are partial

precedents in speculative fiction, such as the crypto-anarchist digital currency in Neal Stephenson's "Great Simolean Caper" (Stephenson, 1995). Stone money would of course have been a potential influence on many of these. It would be extremely odd if stone money were somehow *not* part of Bitcoin's rich formative matrix. But the ingredients for Bitcoin were ubiquitous. No evidence is given for the specific influence of stone money on Bitcoin to warrant an extended one-to-one comparison.

Given the contradictory accounts already sketched, we would also have to ask: which *version* of stone money is supposed to have inspired Bitcoin? The opportunistic fantasies of the textbooks, from Mankiw's entropic circulation to Miles and Scott's stone-backed paper currency? Perhaps the Smithsonian *rai* stone curatorial notes that imply pigs were the Yapese unit of account prior to the dollar (Smithsonian, 2015)? Or the Burt Lancaster film, in which a wise and remorseful Captain O'Keefe orders the *rai* stones he has quarried to be dynamited (Haskin, 1954)? As we will shortly see, the answer seems to be none of the above but rather yet another reconstruction, customized to Bitcoin's polemic specifications. Overall, this rationale for conducting a comparison is unpersuasive.

The second rationale for a comparison is that Bitcoin and stone money may have been created "to solve similar societal problems" (Fitzpatrick and McKeon, 2019: 19). Here, the broadly formalist approach contrasts sharply with the methodological pluralism of Fitzpatrick's earlier work (Fitzpatrick, 2003: 29-44). Instead, it resonates with colonialist fantasies found in economics textbooks that paint Yap as the idyllic and untainted setting for observing universal economic laws. Fitzpatrick and McKeon adopt an exploratory tone here. Beyond suggesting a connection with trust, they prefer not to specify exactly what these "similar societal problems" might be.¹¹ Although this light touch may help them to avoid imposing Western models of political economy onto Yapese contexts, it also leaves readers free to do exactly that. An illustration of how far this might go is provided by the consultancy firm RSM, who chronicle the origins of stone money as follows:

Two thousand years ago, the first Yapese (as they are known) needed to create a system of commerce [...] Because there was no gold or silver on the island, they needed to find some other material that would serve as currency [...] To solve this problem, the people of Yap came up with a creative solution. (Auch, 2020)¹²

In RSM's version, "the first Yapese" chose their "strongest" to sail to "the closest Island" to bring back "thousands of large granite boulders", which they then carved into disks and placed randomly around Yap. To begin with, ownership was memorized ("This is Sarah's ... right?" suggests RSM's accompanying video). Later on, everyone on Yap maintained their own personal written record of everyone else's finances: "[w]hen the Yapese wanted to spend their stones, they would announce the change in ownership to the entire community and everyone would update their ledgers". What is most telling is the ascription of techno-libertarian motives: "the Yapese knew that giving one or a few people record keeping power could end poorly. Those individuals could act unfairly toward others or change the record to benefit themselves" (Auch, 2020). Such willingness to speculatively reconstruct Yapese history may be read as part of what Olivier Jutel calls 'the Pacific Ideology' (an iteration of Barbrook and Cameron's 'Californian Ideology'):

Fantasies of open space and a fetishization of indigenous people are reconstituted in the Pacific as the western most frontier and 'American Oceanic Sublime' [...] The Pacific Ideology relies on [...] imperial mobility and utopian desires for a new world via blockchain tech-experiments. Islands are cast as open spaces where entrepreneurs and self-imagined 'digital artisans' [...] have the freedom to pursue techno-utopian desires. [...] This rhetoric of tech-transformation and experimentation sits alongside the imperial

class politics of tax shelters, tax-free economic development zones and the desire of possessing one's own private island. (Jutel, 2021)

The second rationale, I suggest, is even more problematic than the first. A further third rationale is expressed more cagily, and perhaps does not reflect both authors' considered views. Nonetheless, I think it provides a good sense of what the article's argument actually points to. Put crudely, Fitzpatrick and McKeon (2019) broadly undertake *advocacy* on behalf of Bitcoin and other blockchain finance. That is, if Bitcoin were made to seem similar to stone money – especially in the fantastical and contradictory form stone money is given in Western economics textbooks – then this might answer some common criticisms of Bitcoin.

What criticisms? In what is left of this section, I outline two: the criticism of Bitcoin as an evanescent bubble and of Bitcoin as a naively utopian extension of neoliberal hegemony. The aim here is not to take sides, but to show how a link with stone money could reasonably be perceived within these debates. By sketching some of these discursive affordances, I hope to suggest what is chiefly at stake in Fitzpatrick and McKeon (2019): neither a parallel so striking it cannot go unremarked, nor a hypothesis about intellectual influence, nor a robust case study in comparative political economy – but rather a test run of a tool that might defend blockchain finance against its detractors.

First, Bitcoin's critics often point to its *volatility*, arguing that it “can be neither a short nor long term store of value”, and it “does not constitute, not even remotely, a safe haven for one's investments” (Taleb, 2021). Because of this, there is some debate whether it should be considered a currency at all. “Bitcoin appears to behave more like a speculative investment than a currency” (Yermack, 2015). Given the ups and downs Bitcoin has undergone in just a few years, how likely is it to exist at all in 2030 or 2300? Fitzpatrick and McKeon's analogy seeks to annex the obduracy of stone on behalf of the notoriously flighty Bitcoin. Yapese stone money is ancient. As Paul Einzig (1948: 39) writes:

First Spanish money came when Yap was a Spanish colony; then it was displaced by German money after the transfer of the island to the Second Reich, and Spanish money was no longer of any use. Then Japanese money came after the First World War, and German money was no longer acceptable. [...] Japanese money has also ceased to be valid. On the other hand, they firmly believed that Yap's stone money would always remain good.

Of course, the decline of stone money could reflect badly on Bitcoin's longevity. However, Fitzpatrick and McKeon argue that “Bitcoin has mitigated [...] two important factors associated with the decline of *rai*” (Fitzpatrick and McKeon, 2019). One of these is *seizure*. Bitcoin is widely described as “resistant to seizure by third parties” (Fitzpatrick and McKeon, 2019: 12). Even so, Bitcoin is far from invulnerable. In the USA, in 2020/2021, the IRS seized at least \$1.2 billion in cryptocurrency (Sigalos, 2021). In China, an estimated 90% of Bitcoin mining capacity was shut down in 2021 after a regulatory ban (Global Times, 2021). Nonetheless, Bitcoin's defenders can point to its greater virtuality to argue for its resilience to the kinds of factors which drove the *rai*'s decline – O'Keefe's activities, German ‘fines’ and prohibitions on quarrying, the Japanese destruction of a vast number of stones, and the concerted efforts of colonial powers to impose their own currencies (Yanaihara, 1940). More subtly, comparisons between stone money and Bitcoin seizures could be supposed to open up questions about precisely how distributed ledgers can become available to different modes of regulatory and other power. As noted, however, Bitcoin histories of Yap seldom dwell on colonialism. The *rai*'s decline is more often associated with a second factor, *inflation*. “Bitcoin is characterized by limited inflation by design” (Fitzpatrick and McKeon, 2019: 11). When this point is repeated by

journalists¹³ or on cryptocurrency forums,¹⁴ the cautious tone is foreseeably abandoned. Instead, Bitcoin is celebrated as an inflation hedge that is all but impervious to collapse. The storied quality of the *rai* and the complications this introduces into the very notion of ‘inflation’ are seldom addressed. Bitcoin’s many rapid depreciations (November 19, 2013, for example) are treated either as non-inflationary or as temporary fluctuations that are immaterial to how it functions as a long-term store of value. There is seldom nuance about either what drives inflation (inflation is conflated with printing/quarrying too much currency) or its impact (inflation is conflated with hyperinflation). Instead, Bitcoin is supposed to have solved the problem of a *permanently* scarce money supply. Indeed, given the – at time of writing – 70+ Bitcoin forks and 8,000+ other altcoin currencies in existence, and the boom in NFT collections, we now enjoy an abundance of scarcity, the likes of which the world has never seen.

The *rai* system also offers resources to deal with a second set of critics. That is, it may reinforce Bitcoin’s beleaguered countercultural or counterhegemonic credentials. While some critics regard Bitcoin as a temporary anomaly, other critics allow that it may be adopted into mainstream economic life, but only by surrendering any last vestiges of techno-utopian promise. Bitcoin has never been quite so de-centralized as its fiercest anti-authoritarian champions contended: “breakdowns reveal centers of power in the ostensibly decentralized machinery of the cryptocurrency” (Vidan and Lehdonvirta, 2019). Now, over a decade after its inception, Bitcoin is seen as having found “a role that perfectly exemplifies the present moment: a wildly volatile vehicle for baseless speculation, a roller coaster of ups and downs driven by a mix of hype, price-fixing, bursts of frenzied panic, and the dream of getting rich without doing much of anything” (Brunton, 2019: 205). Support from well-established billionaires, such as Elon Musk, Peter Thiel, and the Winklevoss brothers, along with interest from investment banks and central banks, has been interpreted as a sign that cryptocurrency may be ‘growing up’, but also perhaps selling out.

Some critics extend this line of thinking to most or all blockchain finance, not just Bitcoin. Others propose alternative blockchain futures based on Ethereum or on various other smaller blockchain experiments. These include tokens that aspire, ostensibly at least, to measure and/or incentivize sustainable behaviors (e.g., BioCoin, Earth Token, EcoCoin, the ixo Protocol, and SolarCoin), bolster indigenous peoples’ fiscal autonomy (e.g., MazaCoin), improve financial inclusion (e.g., BolivarCoin and Humaniq), further transparency in charitable giving (e.g., AidCoin), fund carbon removal (e.g., CarbonCoin and Klima), address data privacy issues in health care (e.g., Docademic and MediBloc) or data privacy more generally (e.g., DECODE), shake up chronic underinvestment in climate transition (e.g., CleanTek Market), strengthen mutual aid and economic democracy (e.g., Breadchain), or prototype new radical modes of governance, value, and labor.¹⁵

In this regard, Yapese stone money might be seen as a useful resource in the ideological rebranding of blockchain finance. David Golumbia (2016) has influentially documented linkages existing between Bitcoin and right-wing extremist ideas, “ideas that travel the gamut from the sometimes-extreme Chicago School economics of Milton Friedman to the explicit extremism of Federal Reserve conspiracy theorists”. Stone money can be co-opted to “community-wash” Bitcoin (Muldoon, 2022) through associations with anti-imperialism, egalitarianism, and small-scale communitarian society. One Reddit user comments that, Yap is “a small community” so “word of mouth is blockchain”.¹⁶ Jens Weidmann, President of the Deutsche Bundesbank, remarks that, “oral ledgers can quickly become overwhelmed if economic transactions are conducted outside a Pacific atoll or become highly frequent” (Weidmann, 2020). “Stand in the middle of the town and proclaim to everyone that

an exchange has been made”, suggests another Reddit user on a thread about Fitzpatrick and McKeon’s study. “Exact same thing as a blockchain”.¹⁷ There is a deep irony to these cozy narratives that mistake stone money, whose production and circulation rests on complex relations between estates and kinship groups, between Yap and Palau, and between Pacific islands and colonial powers (Morgan, 1996; Fitzpatrick, 2003: 85-106), for a tiny, isolated, monolithic, and insular sphere of exchange.

With these two brief sketches, I have tried to trace how stone money is being instrumentalized to legitimate blockchain finance. Commendably, however, Fitzpatrick and McKeon’s version appears to be underpinned by one or two additional motives. For example, they go against the grain by reiterating Fitzpatrick’s earlier view that “Yapese stone money is not really money at all” (Fitzpatrick, 2003: 67). Even more significantly, they include Yapese oral tradition into a discourse that has thus far erased it. But they miss the opportunity to highlight tensions between the traditional stories they relate and the analogy they propose. For instance, stone money and Bitcoin are characterized as “unequivocal source[s] of truth” (Fitzpatrick, 2003: 67). Yet their brief glimpse into this oral tradition already reveals equivocation and multiple possibilities with the first stone money either brought back by a crew of fishermen from Tomil (guided by an enchanted butterfly) or by the rivals Fatha’an (from Rull) and Anguman (from Tomil).¹⁸ Bitcoin and stone money are also touted as technologies that make interpersonal trust obsolete; trust emerges conspicuously as a theme across the histories of Fatha’an and Anguman. At first, the pair work side-by-side to quarry and shape the first *rai* stone until Fatha’an anticipates and evades Anguman’s treachery and catches him in a magic typhoon.

I will return to storytelling in the final section. But first, having explored where Fitzpatrick and McKeon’s analogy may have come from, what purposes (deliberately or not) it might serve, and why we have good reason to be cautious of it, we can finally examine the analogy itself.

Analogies between Bitcoin and stone money reconsidered

Textbook authors, eager to illustrate evolution from commodity money to fiat money, have downplayed the role of *place* in articulating *rai* ownership. Fitzpatrick and McKeon (2019: 13) also follow into the footsteps of this tradition:

[...] what is extraordinary is that once a *rai* was brought to Yap and ownership established, it would then be placed in a specific location, such as the front of a house or domicile or along dancing grounds, and remain there in perpetuity [...]

This is at best misleading, as the broader literature is filled with examples of some *rai* stones being moved. For instance, this extract from Gilliland (1975: 11):

Though the stones might have been placed outside the men’s house, they did not necessarily remain there as a “decorative bank”. [...] *Rai* left the *failu* as payment for fishing equipment, canoes, for pigs or for a feast. Even festivals and dances, which constituted a great part of the Yapese life, called for the exchange of *rai*. [...]

Overstating the uniformity and immobility of the stones, Fitzpatrick and McKeon (2019: 8) can then marvel that “a shared ledger was used to track ownership of *rai* centuries before computers were invented”. This raises the question of whether Yapese oral tradition can be

justly described as a ‘ledger’. Even given a generous definition that does not imply technological cognitive prosthesis (such as a book or a spreadsheet), but rather data storage practices principally neurologically instantiated, the oral traditions of Yap remain a rather awkward match. To the extent that the lineage of every stone can be traced back through every date-stamped transaction to its original quarrying, this aspect of the comparison would be sound. But to the extent that such lineages are subject to narrative salience, prioritizing important stones, current location and ownership, recent or highly significant transactions, original provenance, and broad patterns of circulation, the comparison becomes less sound. The tremendous mnemonic capabilities of oral cultures should not be underestimated, and often far exceed what observers from writing-using cultures suppose is possible. However, lacking further evidence, it is not credible that any oral culture preserves transactional histories at the scale and level of detail implied by the authors’ blockchain analogy.

Redundancy is a second key aspect of this analogy. The word *shared*, as in *shared ledger*, may imply – and must imply, if it is to parallel Bitcoin – essentially the same data set, repeated again and again, with only minor and evanescent variations, for instance because of an unsynced local copy, or because of corrupt data that can be corrected against the blockchain. In this respect, oral tradition is once more a spectacularly poor match for Bitcoin. While Yap may possess a relatively “narrow geographic community” (Gilliland, 1975: 9), it is nevertheless about 100 square kilometers in extent, with five official languages, and a population in the early 19th century of around 28,000 to 34,000 across almost two hundred villages, driven to below 3,000 people mid-20th century, and at the 2020 census over 11,500. There are currently around 6,000 stones, and Japanese occupiers counted over 13,000 (Gilliland, 1975: 11). It is not clear what period Fitzpatrick and McKeon are referring to but even assuming whatever configuration is least challenging, it is not credible that every Yapese ‘node’ knows the full and unique history behind every individual stone.¹⁹ Nor is it credible that new transactions spread so rapidly through the network that discrepancies due to latency are negligible.

On any such scale, what is more reasonable to expect is a manifold of overlapping data sets, perhaps mostly reinforcing one another but with some potential for lacunae and contradictions. My suspicion is that Fitzpatrick and McKeon might be tempted to concede such a point as a clarification, except that it is a clarification that causes the analogy to collapse. In particular, any *consensus* regarding *rai* becomes a strikingly different affair. Ownership is not ‘indisputable’ (Fitzpatrick and McKeon, 2019: 1). Far from being automated, consensus may involve negotiation, deliberation, rivalry, and even legal arbitration. The circulation of information is bound to respond to communities of place and communities of interest: all else being equal, those who know about a given stone are likely to be those who have some stake in its status.

Not only are these data sets *shared* in two very different senses, the sharing *mechanisms* are strikingly different. This is perhaps why block mining and synchronization are assigned such vague Yapese correlates: “An ancient corollary [sic] to nodes in the Bitcoin network are the villagers of Yap. They confirmed and repeated information about the transaction of *rai* stones through an oral ledger, preventing double-spending” (Fitzpatrick and McKeon, 2019: 15). The question Fitzpatrick and McKeon do not answer is how, specifically, this information is supposed to be confirmed and repeated. The authors do not specify, but plausibly they allude to *mitmit* and other occasions of festivity, dance, poetry, ritual dialogue, and gift exchange. If so, it must be emphasized that such occasions have worked both to *transform* as well as to *reaffirm* relationships. Moreover, the relationships in question involve collective relational identities at the level of estates and villages, rooted in historical incidents and hierarchical

divisions of obligation and labor, as well as marriages, births, deaths, adoptions, alliances, transgressions, feuds, and so on. While this encoding of information may be rich and detailed, it does not map well onto any blockchain-like notion: a long list of current and historic *rai* ownership being verified and updated. Writing about traditional dance, for example, Elizabeth Midil Rutun describes the sitting dance as “analogous to the reference section of the library in the way that it chronicles stories in different subject matters” (Rutun, 2022: 109). Meanwhile, Krause (2015) quotes Yap State Senator, Ted Rutun, giving a good sense of the style of historical detail encoded within dance:

The information that you need to preserve, you put into the dance. That information may have to do with the relationship between your village and another village. Information that goes into the dancing chant may have to do with a time when disaster struck so that people would know, future generations would know that in such a time a war was waged on the village – the village was attacked. Or a storm hit the village and killed so many people. Or something that is more celebrated like the arrival of something good – is it the stone money from Palau, or when they got a necklace [highly valued traditional money] from somewhere? The way they went through obtaining those things would be detailed in the dance. [...] So instead of reading a book, it's an oral history that was about the creation of this nation. (Krause, 2015: 52)

“Transparency is a key feature in both systems” (Fitzpatrick and McKeon, 2019: 15). If this observation is to be anything but trivial, it must be acknowledged that *different aspects* of the two systems are available to public scrutiny. With respect to Bitcoin, what is made public is a complete history of transactions between anonymized entities.²⁰ Bitcoin is conspicuously opaque in other respects, and its capacity to elude state scrutiny is often declared one of its advantages. To anonymously conduct a ransomware attack and accept payment in *rai* would be difficult.²¹

The authors go even further suggesting that: “Both oral and digital blockchains represent an ‘unequivocal source of truth’ where anyone within the system (island society or electronic realm) can know and observe the entire transaction history, enabling auditability” (Fitzpatrick and McKeon, 2019: 15). Of course, in the case of Bitcoin, only certain types of truths are verifiable as described, excluding many that might be highly relevant for auditability. The capacity for blockchains to fork also casts doubt on as zealous a phrase as “unequivocal source of truth”.

In the case of what the authors refer to as an “oral [...] blockchain”, it would be absurd to characterize community memory as *unequivocal*. Moreover, as Egan (1998: 75-76) writes:

Yapese believed that knowledge had to be fragmented and kept secret to provide bases of power while at the same time curtailing its centralization. Yapese jealously guarded detailed knowledge of histories, of formal political relations and protocols, and of magic and important technical skills. [...] Keeping knowledge secret and segmented prevented the possibility of anyone learning too much and using their accumulated information to press new claims to authority.

Fitzpatrick and McKeon also suggest *scarcity* per se as grounds for the analogy, which can be rejected as trivial since there are no non-scarce moneys. The conditions that sustain the scarcity of the Euro, for instance, may be somewhat complex but the fact of its scarcity is never in doubt. The claim about scarcity, however, sets up a more interesting statement, about *work*: “Within fiat monetary systems, central banks manage expansion and contraction of the money supply. In contrast, expansion of the money supply in both *rai* and Bitcoin is generated solely through contribution of work” (Fitzpatrick and McKeon, 2019: 220).

No reason is provided for limiting the scope of this comparison to Bitcoin, stone money, and fiat money. It is worth noting that the inclusion of coinage or gold standard money might

well make Bitcoin and stone money feel relatively *dissimilar*: mining limestone and mining gold must bear some resemblance. Beyond that, the word *work* has a special sense in the context of Bitcoin, especially in terms of *proof-of-work*: work refers to computational resources purchased by miners in order to guess a number (called the *golden nonce*) that will permit them to append the next block of transactions to the blockchain and claim a bitcoin reward. Work, in this sense, can only be carried out by owning or leasing technological capital.²² As Fitzpatrick and McKeon note, it also has significant energy requirements, currently met through a mix of renewable sources and unsustainable fossil fuels. As Micronesia is among the Pacific Small Island Developing States with high exposure and vulnerability to climate impacts (Perkins and Krause, 2018; Howson, 2020), there is a missed opportunity here to comment on the urgent climactic entanglements of Bitcoin and Yap. More broadly, the strikingly different materialities of *work* in the case of Bitcoin versus *rai* should not be glossed over any more than the strikingly different materialities of *mining*.

Finally, the notion that “central banks manage expansion and contraction of the money supply”, while not strictly untrue, is misleading in this context. Most national money supplies are enlarged *ex nihilo* by banks issuing loans (Keynes, 1930; Pettifor, 2018). The degree to which this is managed by central banks is both a matter of controversy and variable across time and space (Ingham, 2004). Fitzpatrick and McKeon’s tacit distinction between the ‘non-work’ of adding a new loan to an account spreadsheet versus ‘real work’ – such as cutting and transporting *rai* stones or guessing golden nonces – ought to be rejected. At the very least, loans must be applied for and approved; a banking system that enables the existence of fiat money is unmistakably sustained by *work* in a broad sense.

Narrative currencies

I want to conclude on a speculative note by considering the role of storytelling. Some individual *rai* stones are implicated in stories. But what about individual bitcoins? It depends what you mean by ‘storytelling’. ‘Storytelling’ may refer to the bare scraps of ‘plot’ constitutive of ledger transactions; to historical episodes of the recent past artfully brought to life; to a longer tradition of folk tales and legends filled with tricksters, heroes, victims, villains, and the like; or to the stories we believe about ourselves, that is, something akin to ‘ideology’ or our ‘social imaginary’. The distinctions as well as the continuities between these storytelling forms are significant.

Though both Bitcoin and *rai* stones involve storytelling, they do so in ways that set them apart rather than drawing them together. At the heart of the Bitcoin blockchain is a vast tale of numbers churning into other numbers. The iteration and expansion of this principally numeric narrative is a relatively automated process and not a particularly suitable arena for the staging and adaptation of cultural values and norms.²³ In stark contrast, the reproduction of *rai* knowledge over time – “with ritual gatherings and social events serving as the verification of ownership” (Fitzpatrick and McKeon, 2019: 15) – entails the rehearsal and potential revision of values, histories, norms, personalities, affects, and so on. One of Yap’s more storied stones has been, curiously, the focus of non-Yapese storytellers who have poured it full of values, myths, lessons, and structures of feeling, often negotiating with or contesting previous storytellers. Why has the stone on the sea bed proved so enduring? Perhaps because the stories it carries are about the origins and legitimacy of capitalist money. That is, they are supranational myths, justifying the hegemony to which these storytellers loosely belong. In this limited sense, the capitalist world system can be said to have been absorbed into the traditional Yapese economy, as well as the reverse. Consider, for example, another story about

a lost stone, recorded by the German anthropologist Wilhelm Müller not long after Furness's visit:

Gafinemalal and Tamatson were two people from the village of Lamar. They went in a canoe to Palau to fetch a rai as a charm for mosquitoes, which did not exist in Yap before. They planned to send these mosquitoes into enemy villages as aids to war, so that the people, bitten at night, would drowse in the day and might be attacked. On the homeward leg, before they reached Yap, a great storm blew over and swamped the stone. This happened near the village of Malai. Then many mosquitoes descended from the sky and bit the two stone-bringers. They fled, abandoning the bamboo raft which carried the stone to drift. Tamatson hid himself in a pool, sticking only his face out of the water. Gafinemalal wrapped himself in netting, but was still stabbed to death. The stone itself was taken by the currents to Nel, where it can still be found today. Another piece drifted to Ronu.²⁴

Why isn't the punch line of *this* story: 'despite never arriving at its destination, the stone circulates to this day'? What kind of story is this, and how does it differ from that related by Furness? One obvious difference is that this story names individuals and places: "This happened near the village of Malai". For such a brief tale, this detail may feel unnecessary. Yet were a storyteller to omit it, they would lose the connection to other stories about Malai. Names create the opportunity to conduct dialogue via interconnected narratives. Stories tell stories about stories, and in their palimpsestuous interplay, good and bad, right and wrong, true and false, beautiful and ugly, can be drawn and redrawn.²⁵ One therefore wonders if there were named individuals and places in whatever Fatumak told Furness.

Non-Yapese storytellers have consistently rejected such affordances. Storytellers, such as Furness, Keynes, Mankiw, and Friedman, have chosen to treat their source material as history, a history emptied of its didactic, mythic, ironic, spiritual, and agonistic contents. They begin from the assumption that an event has *happened*, and it falls to them to extract its *lesson*. In Furness' retelling, the story teaches a labor theory of value. In Keynes's retelling, the story teaches us something about the passing of the gold standard, and so on. Neither of them considers that the episode may *already* have been formulated as a lesson.

What lessons might it have taught, just prior to Furness's retelling? What might Fatumak have tried to say with this story? I can only tentatively guess. Overall, it seems unlikely to be saying that every stone that sinks can still circulate perfectly well, or that the physical stones can be dispensed with altogether in favor of a ledger of virtual stones. Later Western storytellers would gradually push the tale in that direction. It feels more likely to me that this is a story about an *exception*, although the nature of that exception has been erased in Furness's recollection.

Indeed, probing into the conditions of possibility for a lost *rai* to circulate might have been precisely the point of the original story. One intriguing possibility is that, in this story, it is simply the size and beauty of the *rai* that makes its characters behave so unusually. It would then be a story that imagines something so valuable that you cannot help but tell the truth about it, and people cannot help but believe you. Another difference is that Gafinemalal and Tamatson feature in an origin myth. Their story apparently explains where mosquitoes came from. It also seems to be a story about hubris. It reminds me of one story of the first stones, the story of Anguman, who hoped to catch Fatha'an in a storm, and instead was caught in Fatha'an's storm (Fitzpatrick, 2003: 74). It reminds me of proverbs I am familiar with from my own cultures: *a taste of your own medicine*. Or: *Hoisted on your own petard*. Furness's (1910: 97) story includes the intriguing phrase, "lost through no fault of the owner". Are we invited to suspect that Gafinemalal and Tamatson were at fault for the violent storm that broke out and for the loss of the stone?

It is also worth considering the timing of the story Furness ascribes to Fatumak. Apparently largely through David Dean O'Keefe's interventions during the last decades of the nineteenth century, the total size and distribution of the stone money stock had altered dramatically, heralding instability and fluidity as villages vied for power and prestige. Meanwhile, the population of Yap was continuing its long decline (Morgan, 1996: 40-41). *Rai* production was in flux, with a colonial order in 1899 to end quarrying on Palau, apparently both as a move against O'Keefe and an attempt to secure more Yapese labor for roadworks and other projects (Gilliland, 1975: 11).²⁶ The question of whether and how to resist this colonial prohibition may well have been pressing. Could the story about the half-lost *rai* stone also represent a political allegory? One skeptical of further *rai* importation as an insurrectionary priority, given its recent sowing of contention among Yapese, enriching upstarts and foreigners? Traditionally, danger, injury and loss of life would increase the value of the *rai*.²⁷ But, in this story, might the moment of cutting the *rai* raft loose to ensure survival carry a symbolic significance for Yapese society as a whole?

This is of course all violently conjectural. But if it were roughly this kind of story, it need not have recently sprung into existence. It might rather be a case of an older story revived by its affordances for engaging with contemporary social anxieties and opportunities. Maybe the sea bed *rai* could be considered part of a proto-origin myth. Perhaps for now it was merely a story about a single ghostly *rai* leaning outside a single house, despite also lying on the sea floor. Yet in time, through slow increments of implicit narrative deliberation, perhaps the story could accrue much greater solidity. Perhaps it could grow to legitimate some aspect of some version of a partly or fully dematerialized *rai* currency, comparable to – yet also deeply different to – the representative or fiat currency the Western economists later imagined operated on Yap. Or perhaps into something else entirely.

Conclusion

Existing comparisons between stone money and Bitcoin appear untenable, misleading, and contribute to a history of colonial misrepresentation of Yapese economic cultures. The grounds for making such comparisons in the first place are weak, and the current discursive conditions around blockchain finance suggest that an extremely scrupulous comparison risks reinforcing inaccurate and injurious myths. More generally, much more caution should be adopted in the study and pedagogic invocation of Yapese economic cultures, including greater care to center Yapese voices past and present, to reflect positionality and uncertainty, as well as to bear witness to colonial histories. However, I suggest that Yapese economic cultures should continue to feature in economics textbooks as a way to start to transform the debts incurred by previous misrepresentations. This could be an opportunity to correct striking factual errors, introduce economics students around the world to Yapese history and culture, present salient concepts in economic anthropology, and offer food for thought about the intersection of colonial power and the history and future of money.

Notes

1. This article conform to the most common English transliteration (*rai*), although *raay* is also used.
2. See Gilliland, 1975: 10-11; Hezel, 1995: 179; and Egan, 1998: 80-84. One important intervention was that of Captain David Dean O'Keefe, a settler colonist and merchant who involved himself heavily in Yapese commerce and politics in the latter part of the nineteenth century, and

- catalyzed major transformations in stone money production and circulation.
3. First published online in June 2019, although the January 2020 print edition is also often cited.
 4. In carrying this out, I don't lay claim to any authoritative knowledge of Yapese economic cultures; the methodology is broadly literary-critical, reflecting my primary background and training. By examining a selection of significant texts, it is possible to identify lacunae, interpolations, and contradictions both within individual texts and across the corpus as a whole.
 5. I have not been able to find any very convincing sources about this. Compare Senfft, 2000: 11; Born, 2000b: 5, 9; Müller, 1917: 391; Hunt et al., 2000: 85; Schneider, 2000: 218n; De Beauclair, 1963: 159; Lingenfelter, 1972: 114, 156.
 6. See Yanaihara, 1940; Price, 1944; Einzig, 1948; Lessa, 1950; Moore, 1952; De Beauclair, 1963; Lingenfelter, 1972; Gilliland, 1975; Labby, 1976; Hunter-Anderson and Zan, 1996; Egan, 1998; Fitzpatrick, 2003; Descantes, 2005; Hage and Harary, 2010.
 7. Humphrey goes on to explore the conditions under which societies may become dominated by barter, including intriguing uses of money that may be better classed as 'bartering' than 'paying.' Dismissing the 'double coincidence of wants' framing, Humphrey persuasively argues that barter implies "open-ended, potentially innovative, negotiable, transaction, in which need not only answers need but can also create a new demand: 'If you don't want these potatoes, perhaps you would like this pair of scissors?'" (Humphrey, 1985: 50).
 8. Friedman might for example have come across the 1915 *Economic Journal*, or seen Keynes's 1930 account, or accounts by Dodd, Amacher, or Baumol and Blinder. Yap appeared in more popular press too, for example, *National Geographic* in 1921, 1942, 1946, and relatively extensively in 1952. Yap was featured with some frequency in numismatic publications such as *The Numismatist*, *Coin World*, and *Numismatic News*, and *The Centinel*. Rai stones existed outside Micronesia in museums; the Smithsonian collected a smaller stone in 1897 and a larger one in 1962. Willard Price's travelogue *Japan's Islands of Mystery* (1944) devoted several chapters to Yap. There was a novel about O'Keefe's time in Yap (Klingman and Green, 1950), adapted into a movie starring Burt Lancaster (Haskin, 1954). It is worth noting that Friedman's excerpt begins and ends exactly where the *Economic Journal* excerpt does, and the *Economic Journal* introduces a minor modification to the punctuation which also appears in Friedman's excerpt. Friedman does quote the page numbers of Furness's *Island of Stone Money*, rather than of the *Economic Journal*.
 9. That is, if – and it is a big *if* – one were determined to read Yapese stone money as a parable about commodity money and representative or fiat money, Furness's two stories actually offers two sharply different angles. The sunken rai features in a story about successfully transitioning from commodity money to representative money, in at least one instance. Through a policy decision, aggregate demand is increased compared to what it would otherwise be. By contrast, the black crosses (as Furness describes them) feature in a narrative about being violently prevented from making such a transition. This narrative is about an obdurate materiality that places hard limits on the generation of value through policy alone. Yapese communities are unable to deem the marking of rai by the occupying colonial power to be "too trifling to mention" (Furness, 1910: 92). Were the occupiers to return and destroy a stone, it is implied, it would be unlikely simply to circulate, "as valid as if it were leaning visibly against the side of the owner's house". The evolutions and relations of Keynes's and Friedman's macroeconomic theories are of course complicated. Nevertheless, roughly speaking, given their broad instincts around how monetary and fiscal policy impact the economy, one might well expect Friedman the monetarist to emphasize the story about the limitations of policy decisions, and Keynes, already on his way to developing his influential account of government deficit spending to boost employment, to emphasize the story about the power of such decisions.
 10. There is some evidence to suggest that Wei Dai's work, despite its very close parallels, may not

have been a direct influence (Brunton, 2019: 117).

11. As Fitzpatrick and McKeon acknowledge, it is not only decentralized ledgers that solve the problem of tracking ownership as such, so this cannot be one of the “similar societal problems” mentioned. Two problems that Bitcoin is presented as solving, seizure by authorities and inflation-resistant scarcity, are presented as instances where Bitcoin and stone money *differ*, so these also cannot be the “similar societal problems” being talked about. There is an account given of some other advantages of blockchain (Fitzpatrick and McKeon, 2019: 4), but this seems to have been drawn up without stone money in mind (insofar as it mentions things like viruses, servers, real time syncing of ledgers versus delayed reconciliation, etc., which are difficult to apply to the stone money context without further explanation). Perhaps the most promising candidate is “problems associated with trust”. The authors write: “Why did two very disparate types of ‘money’ – Yapese *rai* and Bitcoin – emerge using a similar means for tracking ownership? Distributed ledgers are often used to solve problems associated with trust [...] Given that the actual possession of *rai* was often infeasible, an owner would deem it to be valuable only if they could trust that all participants in the economic system agreed on the record of ownership. Effectively, it was not a bearer asset; ownership was established solely through the ledger” (Fitzpatrick and McKeon, 2019: 5). However, beyond the broad theme of trust, this is not an intelligible statement of “similar societal problems”. First, it is simply untrue that the “only” way an owner will deem something valuable is either if they can physically hold it or if their ownership is established “solely” through a distributed ledger shared by “all participants in the economic system”: many things are deemed valuable when neither circumstance obtains. A sleight of hand has excluded a vast variety of institutions that might have authority to resolve and to disincentivize ownership disputes. Second, the “problem” of trust as described here arises *from* the *rai* system (the practical difficulty of ‘bearing’ large stones); it is not a preexisting problem in answer to which the *rai* system was developed. Third, it is unclear *whom* the Yapese are supposed to have wanted to avoid trusting. If the *rai* system is held to enable participants to withhold trust from one another, or from the discursive dispute resolution mechanisms embedded in Yapese offices of authority and the Yapese *tha'* system (Lingenfelter, 1972; 1991; Iwao, 1987; Huang, 2021), then the extraordinary claim that a Yap-wide consensus in fact circumvented such decision-making practises would need to be evidenced. Fourth, if the suggestion is that the *rai* system permitted participants in the *rai* economy to conduct transactions knowing little or nothing about one another, then it is scarcely cohesive with stone money’s broad status as a social currency, creating and transforming social bonds rather than making them unnecessary. In principle, of course, substantially different societies can be confronted by similar societal problems, and may even address them in interestingly similar ways. Yet from what I can tell, the closest this article comes to spelling out what “similar societal problems” it has in mind depends on a fantasy version of Yapese economic cultures reverse-engineered from the feted advantages of Bitcoin, not anything at all like the economic cultures described in (among other places) Fitzpatrick’s own earlier work.
12. Is Fitzpatrick and McKeon (2019) a potential progenitor for this short article? It does not cite Fitzpatrick and McKeon (2019), but it does cite an abstract for a 2004 article by Fitzpatrick with a similar title. That particular endnote comes after the claim that the closest island to Yap is 250 miles away; Fitzpatrick and McKeon (2019)’s opening sentence describes the distance between Yap and Palauan archipelago as 250 miles, whereas the 2004 abstract only mentions the figure of 300 miles. I contacted the author of the RSM article to confirm that the 2019 article was the correct source, however, he believes that the given citation is probably correct. This led to an interesting discovery: the author confessed that he was already aware that the description of Yapese history was inaccurate. The article’s purpose, he explained, was to engage and attract his readers to the crypto space, not to educate them about Yap. Initially when describing the *rai* stone

system, his audience had not found it believable that a blockchain could be operated through oral tradition, so he deliberately invented written ledgers. (Personal correspondence, Jan-Feb 2022). The discrepancy is not necessarily an inconsistency: depending exactly where you measure from and to, rounding down to 250 or up to 300 is possible. Neither of the Fitzpatrick articles suggest that Palau is Yap's closest neighbor.

13. An article on the University of Oregon's press office hub comments: "it is known that some of the principles behind Bitcoin have been validated by history and that might offer a clue about the longevity and uses of blockchain based cryptocurrency as an asset class" (Maiello, 2021). The FT emphasizes memory: "since blockchain ledgers are based on (seemingly) immutable computer code, they appear more durable than communal memory" (Tett, 2021). *ZME Science* remarks: "Since Bitcoin is immune to both inflation and seizure by third parties due to the way it was set up, perhaps the cryptocurrency will have a much longer life than the Rai" (Puiu, 2021).
14. In the Reddit forum r/cryptocurrency in 2021, u/wiiniee remarks, "the thing is, they weren't actually scarce, just ostensibly. [...] Bitcoin actually IS scarce". Similarly, u/ChewieDefense comments, "BTC is sound money, but it doesn't have the drawbacks of rai stones. The supply is fixed".
15. See Howson, 2020; Tomlinson et al., 2021; Guerrilla Media Collective, TNI, and DisCO.coop, 2019; Muldoon, 2022.
16. u/Malphos101 on r/todayilearned, 2018.
17. u/CornMonkey-original on r/CryptoCurrency, 2021.
18. See Gilliland, 1975: 75, and Price, 1944: 77-8, for other origin stories.
19. The authors do more-or-less acknowledge these impossibilities, but don't consider them pertinent for a population in the thousands or tens of thousands. "Essentially, there exists a cognitive constraint on the number of *rai* stone transactions that could be processed through word of mouth, limiting its ability to scale" (Fitzpatrick and McKeon, 2019: 16).
20. An entity might voluntarily de-anonymize by using their private key to generate a signature proving ownership of an address.
21. Moreover, contextualizing stone money within the wider flows of wealth might paint a different picture: "Yapese hid their wealth, be it shell valuables, cash, or planted food in order to give themselves control over its disposal. Friends, relatives, and fellow villagers could not make claims to what they did not know existed. Claims were not only a matter of seeking needed support from those able to give it" (Egan, 1998: 77-78).
22. There are of course other types of work relevant to the maintenance of Bitcoin. For instance, Vidan and Lehdonvirta point out that "[i]n looking at infrastructural breakdowns, we are able to make visible the work that is inevitably part and parcel of the operations of a network such as Bitcoin, as well as the discursive work needed to make the infrastructure invisible in the first place" (Vidan and Lehdonvirta, 2019). Jaya Klara Brekke (2021) approaches other work which enables or enacts Bitcoin through the figure of the hacker-engineer, "primarily concerned with achieving decentralised networks, privacy, censorship-resistance and network autonomy".
23. Blockchain finance with a prominent role for rich representations of human histories would be perfectly feasible, of course. For further exploration, NFTs and DeFi would be a more promising place to start than Bitcoin. Furthermore, the fact that the Bitcoin blockchain does not tell particularly interesting stories by itself does not mean, of course, that Bitcoin is not discursively embedded (Dodd, 2018).
24. My translation from Müller's 1918 German translation.
25. Another piece drifted to Ronu": does this perhaps have the feel of a later interpolation, very characteristic of oral transmission? A stage also seems to be missing; we never hear of the stone breaking apart. Or perhaps it is a second rai that drifts to Ronu?

26. Historical sources suggest that no quarrying of stone money took place after 1914" (Fitzpatrick, 2003: 112).
27. Compare Perly, 1979: 71, Fitzpatrick, 2003: 83, and Throop, 2010: 21. The longer version of the story of Anguman and Fatha'an, reproduced in Fitzpatrick, 2003, although not Fitzpatrick and McKeon, 2019.

References

- Alkire, W.H. (1980) Technical knowledge and the evolution of political systems in the central and Western Caroline Islands of Micronesia. *Canadian Journal of Anthropology*, 1(2): 229-37.
- Amacher, R.C. (1983) *Principles of Economics*. 2nd edition. Cincinnati, OH: South-Western Pub. Co.
- Ammous, S. (2018) *The Bitcoin Standard: The Decentralized Alternative to Central Banking*. Hoboken, NJ: Wiley.
- Angell, N. (1929) *The Story of Money*. Garden City, NJ: Garden City Pub. Co.
- Baumol, W.J. and Blinder, A.S. (1985) *Economics: Principles and Policy*. 3rd edition. San Diego, CA: Harcourt Brace Jovanovich.
- Baumol, W.J., Blinder, A.S. and Solow, J.L. (2020) *Macroeconomics: Principles and Policy*. 14th edition. Boston, MA: Cengage Learning.
- Berentsen, A. and Schar, F. (2018) A short introduction to the world of cryptocurrencies. *Review*, 100(1): 1-16.
- Born, L. (2000a) *Funeral Obsequies on Yap (Western Carolines)*. New Haven, CT: Human Relations Area Files.
- Born, L. (2000b) *Some Remarks on the Music, Poetry and Dance of the People of Yap*. New Haven, CT: Human Relations Area Files.
- Brekke, J.K. (2021) Hacker-engineers and their economies: The political economy of decentralised networks and 'cryptoeconomics'. *New Political Economy*, 26(4): 646-59.
- Brunton, F. (2019) *Digital Cash: The Unknown History of the Anarchists, Utopians, and Technologists Who Built Cryptocurrency*. Princeton, NJ: Princeton University Press.
- De Beauclair, I. (1963) The stone money of Yap. *Bulletin of the Institute of Ethnology*, 16: 147-60.
- Descantes, C. (2005) *Integrating Archaeology and Ethnohistory: The Development of Exchange between Yap and Ulithi, Western Caroline Islands*. Oxford: Archaeopress.
- Dodd, N. (2018) The social life of Bitcoin. *Theory, Culture & Society*, 35(3): 35-56.
- Egan, J. (1998) *Taro, Fish, and Funerals: Transformations in the Yapese Culture*. PhD thesis. University of California, Irvine.
- Einzig, P. (1948) *Primitive Money in its Ethnological, Historical and Economic Aspects*. London: Eyre and Spottiswoode.
- Fitzpatrick, S.M. (2003) *Stones of the Butterfly: An Archaeological Investigation of Yapese Stone Money Quarries in Palau, Western Micronesia*. PhD thesis, University of Oregon.
- Fitzpatrick, S.M. (2004) Banking on stone money. *Archaeology*, 57(2).
- Fitzpatrick, S.M. (2014) The archaeology of Western Micronesia. In: Cochrane, E.E. and Hunt, T.L. (eds.) *The Oxford Handbook of Prehistoric Oceania*. Oxford: Oxford University Press, 252-70.
- Fitzpatrick, S.M. and McKeon, S. (2019) Banking on stone money: Ancient antecedents to Bitcoin. *Economic Anthropology*, 7(1): 7-21.
- Frank, R.H. and Bernanke, B. (2001) *Principles of Economics*. Boston, MA: McGraw-Hill/Irwin.
- Frank, R.H., Bernanke, B., Antonovics, K.L. and Heffetz, O. (2019) *Principles of Economics*. 7th edition. New York: McGraw Hill Education.
- Furneaux, N. (2018) *Investigating Cryptocurrencies: Understanding, Extracting, and Analyzing Blockchain Evidence*. Indianapolis, IN: Wiley.

- Furness, W.H. (1910) *Island of Stone Money: Yap of the Carolines*. London: J.B. Lippincott Company.
- Gibson-Graham, J.K. (2007) *A Postcapitalist Politics*. Minneapolis: University of Minnesota Press.
- Gilliland, C.L.C. (1975) *The Stone Money of Yap: A Numismatic Survey*. City of Washington: Smithsonian Institution Press.
- Global Times (2021) China to shut down over 90% of its Bitcoin mining capacity after local bans. *Global Times*, 20 June.
- Glumac, B. and Fitzpatrick, S.M. (2020) Yapese stone money: Local marble as a potential inspiration for producing limestone exchange valuables in Palau, Micronesia. In: Cooney, G., Gilhooly, B., Kelly, N. and Mallía-Guest, S. (eds.) *Cultures of Stone: An Interdisciplinary Approach to the Materiality of Stone*. Leiden: Sidestone Press, 65-78.
- Golumbia, D. (2016) *The Politics of Bitcoin: Software as Right-Wing Extremism*. Minneapolis: University of Minnesota Press.
- Graeber, D. (2011) *Debt: The First 5,000 Years*. Brooklyn, NY: Melville House.
- Guerrilla Media Collective, TNI, and DisCO.coop (2019) *If I Only Had a Heart: A DisCO Manifesto*. Available at: <https://disco.coop/wp-content/uploads/2019/11/DisCO_Manifesto-v.1.pdf>. Accessed October 2021.
- Hage, P. and Harary, F. (2010) *Island Networks Communication, Kinship, and Classification Structures in Oceania*. Cambridge: Cambridge University Press.
- Haskin, B. (1954) *His Majesty O'Keefe*. Norma Productions. Available at: <play.google.com/store/movies/details/His_Majesty_O_Keefe>. Accessed October 2021.
- Hazell, L.C., and Fitzpatrick, S.M. (2006) The maritime transport of prehistoric megaliths in Micronesia. *Archaeology in Oceania*, 41(1): 12-24.
- Howson, P. (2020) Climate crises and crypto-colonialism: Conjuring value on the Blockchain frontiers of the Global South. *Frontiers in Blockchain*, 3(22): 1-6.
- Huang, Y. (2021) Walking on the village paths: Kanaawoq in Yap and Rarahan in Yami. In: Fox, J.J. (ed) *Austronesian Paths and Journeys*. Canberra: ANU Press, 303-36.
- Humphrey, C. (1985) Barter and economic disintegration. *Man*, 20(1): 48-72.
- Hunt et al. (2000) *The Micronesians of Yap and their Depopulation: Report of the Peabody Museum Expedition to Yap Island, Micronesia, 1947-1948*. New Haven, CT: Human Relations Area Files.
- Hunter-Anderson, R. and Zan, Y.G. (1996) Demystifying the Sawei, A traditional interisland exchange system. *Isla: A Journal of Micronesian Studies*, 4(1): 1-45.
- Ingham, G.K. (2004) *The Nature of Money*. Cambridge: Polity.
- Iwao, U. (1987) Political structure and formation of communication channels on Yap Island: A case study of the Fanif District. *Senri Ethnological Studies*, 21: 177-203.
- Jevons, W.S. (1875) *Money and the Mechanism of Exchange*. New York: D. Appleton and Company.
- Jutel, O. (2021) Blockchain imperialism in the Pacific. *Big Data & Society*, 8(1): 1-14.
- Keynes, J.M. (1930) *A Treatise on Money*. New York: Harcourt, Brace and Company.
- Klingman, L. and Green, G. (1950) *His Majesty O'Keefe*. New York: Scribner.
- Krause, S. (2019) The 2014 Ngolog Mitmit: A case study examining public and private heritage in Yap State, FSM. *Present Pasts*, 9(1): 2-11.
- Krause, S.M. (2015) The art of communication in Yap, FSM: Traditional forms of respectful interactions. In: Lee, S., Nabobo-Baba, U., Kinikini-Kauvaka, L.L. and Rehuher-Marugg, F.K. (eds) *Traditional Knowledge and Wisdom: Themes from the Pacific Islands*. ICHCAP, 46-59.
- Labby, D. (1976) *The Demystification of Yap: Dialectics of Culture on a Micronesian Island*. Chicago, IL: University of Chicago Press.
- Lessa, W.A. (1950) The place of Ulithi in the Yap empire. *Human Organization*, 9(3): 1618.
- Lingenfelter, S.G. (1972) *Political Leadership and Culture Change in Yap*. PhD thesis, University of Pittsburgh.

- Lingenfelter, S.G. (1991) In the court or in the village? Settling disputes in Yap: 1950-1979. *The Journal of Pacific History*, 26(1): 74-93.
- Maiello, M. (2021) Researchers turn to stones to find the ancient origin of Bitcoin. Around the O, 28 January. Available at: <<https://around.uoregon.edu/content/researchers-turn-stones-find-ancient-origin-bitcoin>>. Accessed October 2021.
- Mankiw, N.G. (2019) *Macroeconomics*. 10th edition. New York: Macmillan Learning.
- Martin, F. (2014) *Money: The Unauthorised Biography*. New York: Alfred A. Knopf.
- Mauss, M. (2004) *The Gift: Form and Reason for Exchange in Archaic Societies*. London: Routledge.
- Miles, D.D. and Scott, A. (2002) *Macroeconomics: Understanding the Wealth of Nations*. 1st edition. Hoboken, NJ: Wiley.
- Moore, W.R. (1952) Grass-skirted Yap. *National Geographic*, 102(6): 805-30.
- Morgan, A. (1996) Mystery in the eye of the beholder: Cross-cultural encounters on 19th-century Yap. *The Journal of Pacific History*, 31(1): 27-41.
- Muldoon, J. (2022). *Platform Socialism*. London: Pluto.
- Müller, W. (1918) Yap. Vol. 2. [2 vols. *Ergebnisse Der Südsee-Expedition 1908-1910*]. Hamburg: L. Friederichsen & Co.
- Perkins, R.M. and Krause, S.M. (2018) Adapting to climate change impacts in Yap State, Federated States of Micronesia: The importance of environmental conditions and intangible cultural heritage. *Island Studies Journal*, 13(1): 65-78.
- Pettifor, A. (2018) *The Production of Money: How to Break the Power of Bankers*. London: Verso.
- Pine, A. (1984) Fixed assets, or: Why a loan in Yap is hard to roll over – tiny Micronesian island uses giant stones as currency; don't forget your change. *Wall Street Journal*, 29 March.
- Price, W. (1944) *Japan's Islands of Mystery*. New York: John Day Co.
- Puiu, T. (2021) The surprising similarity between Bitcoin and ancient stone money from a pacific island. *ZME Science*, 11 October. Available at: <<https://www.zmescience.com/science/news-science/bitcoin-stone-money-04234/>> Accessed October 2021.
- Rospabé, P. (1995) *La Dette de Vie: Aux Origines de La Monnaie Sauvage*. Paris: Découverte.
- Ruffin, R. and Gregory, P.R. (1997) *Principles of Macroeconomics*. 6th edition. Reading, MA: Addison-Wesley.
- Schneider, D.M. (2000) *Yap Kinship Terminology and Kin Groups*. New Haven, CT: HR Area Files.
- Senfft, A. (2000) *Ethnographic Contributions Concerning the Caroline Islands of Yap*. New Haven, CT: Human Relations Area Files.
- Sigalos, M. (2021) The IRS has seized \$1.2 billion worth of cryptocurrency this fiscal year – here's what happens to it. *CNBC*, 4 August 2021. Available at: <<https://www.cnbc.com/2021/08/04/irs-has-seized-1point2-billion-worth-of-cryptocurrency-this-year.html>>. Accessed October 2021.
- Smithsonian (2015) Yap Island's stone-cold cash. Available at: <<https://smithsonianapa.org/recollections/rai/>>. Accessed February 2022.
- Rutun, E.M. (2022) Misconceptions and mistranslations: The language of traditional Yapese dances. In: Pangelinan, P.J.C. and McVey, T. (eds.) *Advances in Higher Education and Professional Development*. IGI Global, 103-17.
- Stephenson, N. (1995) The Great Simoleon Caper. *TIME*, 1 March.
- Takhteyev, Y. and Prado, M.M. (2014) Bitcoin goes boom. *Foreign Affairs*, 31 January. Available at: <<https://www.foreignaffairs.com/articles/2014-01-30/bitcoin-goes-boom>>. Accessed October 2021.
- Taleb, N.N. (2021) Bitcoin, currencies, and fragility. *Quantitative Finance*, 21(8): 1249-55.
- Tett, G. (2021) Bitcoin 1.0: The ancient stone money of Yap. *Financial Times*, 3 March. Available at: <<https://www.ft.com/content/aa156703-49d8-4cc4-a740-b35d525a5417>>. Accessed October 2021.

- Tomlinson, B., Boberg, J., Cranefield, J. et al. (2021) Analyzing the sustainability of 28 'Blockchain for Good' projects via affordances and constraints. *Information Technology for Development*, 27(3): 439-69.
- Weidmann, J. (2020) On the future of money and payments. Available at: <<https://www.bundesbank.de/en/press/speeches/on-the-future-of-money-and-payments-843720>>. Accessed October 2021.
- Williamson, S.D. (2005) *Macroeconomics*. Second edition. Boston, MA: Addison-Wesley.
- Vidan, G., and Lehdonvirta, V. (2019) Mine the Gap: Bitcoin and the maintenance of trustlessness. *New Media & Society*, 21(1): 42-59.
- Yanaihara, T. (1940) *Pacific Islands under Japanese Mandate*. Oxford: Oxford University Press.
- Yermack, D. (2015) Is Bitcoin a real currency? An economic appraisal. In: Chuen, D.L.K. (ed.) *Handbook of Digital Currency*. San Diego, CA: Academic Press, 31-43..