
From Seashells To Satoshi

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Chapter 1

Shelling Out

“The root problem with conventional currency is all the trust that’s required to make it work. The central bank must be trusted not to debase the currency, but the history of fiat currencies is full of breaches of that trust.”

SATOSHI NAKAMOTO
February 11, 2009

Copernicus reimagined the cosmos and died unheard. Galileo defended him and was silenced. Nakamoto reimagined money — then vanished. Now it is our turn to study Bitcoin. Perhaps it will be wise to approach the subject cautiously.

Figure 1.1: *Wu-Tang Clan C.R.E.A.M. (Cash Rules Everything Around Me) Loud Records Vinyl, 7", 45 RPM, Shape, Record Store Day, Single, Limited Edition, Picture Disc, Die Cut Wu-Tang Logo, 28 Nov 2014, Hip Hop*

Let's be honest: money is awkward. It's the tedious maths of a split bill, the discomfort of asking to be paid back. It's a subject we're taught to avoid, yet it governs nearly every aspect of our lives.

My own reluctance to engage with it forced a realisation: for something so fundamental, most of us understand surprisingly little about it. This discomfort sparked a journey into what money is, what it has been, and what it is becoming. And it's not going anywhere. Its permanence is etched into our culture by the great wordsmiths of the English language.

From Shakespeare (c. 1599):

He that wants money, means, and content, is without three good friends.

to Liza Minnelli (1972):

Money makes the world go around.

to Wu-Tang Clan (1993):

Cash rules everything around me
C.R.E.A.M., get the money
Dollar dollar bill, y'all.

Clearly, money is a persistent human obsession. But does the word mean the same thing to a rapper from Staten Island as it did to the Bard of Avon? What about a thousand years ago? Or a hundred thousand?

The answer is a definitive no. This book argues that for all its history, the true nature of money was only fully revealed to us in 2009.

In his seminal essay, "Shelling Out," Nick Szabo traces the abstract

concept of money back to our earliest ancestors. Szabo (2002)¹ suggests that collectibles like jewelry were the first assets used for trade, functioning as a “formal token of delayed reciprocal altruism.”

This innovation solved a fundamental problem of trade: the *coincidence of wants*. Imagine person *A* expertly harvests a valuable good, *a*, but only in the summer. They wish to trade with person *B*, who harvests good *b* only in the winter. Without a medium of exchange, a direct trade is impossible.

c. 98,000 BCE

To solve this, our ancestors imbued certain objects with stored value. These objects were difficult to obtain or create, requiring significant time and energy. This expenditure—which we will call *proof-of-work*—made them scarce and hard to replicate. Roughly 100,000 years ago, these assets were often beautiful necklaces, used successfully to bridge the seasonal gap between work and consumption.

c. 500 CE onwards

Over millennia, this concept of using provably costly assets for trade spread. The forms varied, from the giant, immovable Rai stones of Yap Island² (see Figure 1.2) to intricately crafted seashell ornaments.

However, these early forms of money all shared a fatal flaw. Their security—their proof-of-work—was physical, and human ingenuity is relentless at finding shortcuts. The value of these assets was naturally exploited.

Debasement Event: Late 19th Century CE

The Rai stones, for example, held value because they were monstrously difficult to carve and transport. When outsiders arrived with

¹The brilliance of Shelling Out makes Nick Szabo a prime candidate for Satoshi Nakamoto, yet the creator’s anonymity is one of Bitcoin’s most vital features. Unlike the ‘false prophets’ who seek fame by claiming the identity, the real Satoshi prioritized the mission over the man. We owe it to the legacy of Bitcoin to respect that boundary.

²giant circular stones that rarely moved



Figure 1.2



Figure 1.3

iron tools that made their creation trivial, the existing stones were devalued. The supply was flooded with cheap replicas for little-to-no proof-of-work, and soon, too many stones were chasing too few goods.

Ancient Use: from c. 1600 BCE | Debasement Event: 16th – 19th Centuries CE

A similar, but inevitable, fate awaited currencies backed by seashells. When modern dredging techniques allowed for harvesting seashells by the million, their scarcity was destroyed. Those in possession of seashell wealth were forced to swap them for other assets that better represented true proof-of-work. This desperate act of exchanging a debased currency for something of real value gives us a common term: “shelling out.”

This history is not just a series of sad events where people lost their life savings. It reveals a principle as consistent as evolution: humanity will always gravitate towards the asset that best maintains and maximizes its proof-of-work. Inferior assets, whose integrity can be compromised and supply easily inflated, will inevitably be extinguished.

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This constant displacement of assets, where the old, inferior medium is abandoned for a superior one, gives us the modern term: *shelling out*. But the need for money didn’t vanish; as societies grew more complex following the Agricultural Revolution, a more robust form was demanded to facilitate specialized trade and organized wealth. One early, widely exchanged commodity was salt, a vital preservative and seasoning so valuable that Roman soldiers were paid in it, giving us the root of the word *salary*, from the Latin *salarium* (salt money).

The search for a superior, more durable form of *proof-of-work* eventually led humanity to *precious metals*, with *gold* reigning supreme. Unlike shells, gold possesses qualities—rarity, chemical inertness, and an astronomically long formation story—that made it costly to pro-

cure and hard to counterfeit. Historically, this difficulty maintains a steady *stock-to-flow* ratio; as rising demand incentivizes more complex extraction, the resulting supply increase tends toward a modest 2% annual inflation, stabilizing the market balance.

Across history, roughly *two hundred-and-some thousand tonnes*³ of gold have been mined (World Gold Council, 2025), each ounce a condensed ledger of labor and energy. A typical one-ounce gold coin contains roughly 10^{23} atoms, a tidy reminder that even a single coin is a dense packet of work and raw material with seemingly infinite divisibility.

Gold, however, had practical flaws. It was heavy and awkward to move in bulk; transporting significant wealth required immense expenditures of energy and the protection of armed guards, creating a high barrier to entry for global commerce. Furthermore, the integrity of metallic money was perpetually undermined. On one end was private fraud: from ancient *coin-clipping* to modern *tungsten-filled bars*, the cost of verifying the purity of every atom in a gold hoard is prohibitively high. People once bit coins as a crude test of softness, but in an age of sophisticated counterfeits, one cannot easily *prove* the internal composition of a vault without melting it down. On the other end was official debasement.

To facilitate trade, society introduced standardized monetary units like the gold *florin*, but even these were not immune to the frailty of trust. Early units—think of the *pound sterling* or the Spanish *peso*—originally referenced specific weights of silver, yet both private clippers and sovereign minters found ways to shave or alter metal content. This historical friction mirrors the modern cryptographic necessity: because physical metal is so costly to audit, the system eventually defaulted to *trust*—and that trust invariably frayed.

Portability and speed solved the immediate practical problem. *Goldsmiths* and custodians offered safekeeping for bullion; in exchange, they issued paper receipts—lightweight, tradable claims on metal locked in vaults. Those receipts began to circulate in place of coinage, accelerating the *velocity of money*. However, this convenience birthed a new abstraction: *fractional-reserve* practices. Bankers realized that since not everyone would verify or withdraw their metal simultane-

³Only about three or four Olympic swimming pools worth.

ously, they could issue more claims than they held physical reserves.

This transition shifted the system from a direct mapping of work-hardened metal to value toward a layered architecture of claims and credit. The consequence was the birth of "magicked" money; given an initial deposit D and a reserve requirement r , the amount of new money created is defined by the expansion of the money supply:

$$\Delta M = D \left(\frac{1 - r}{r} \right) \quad (1.1)$$

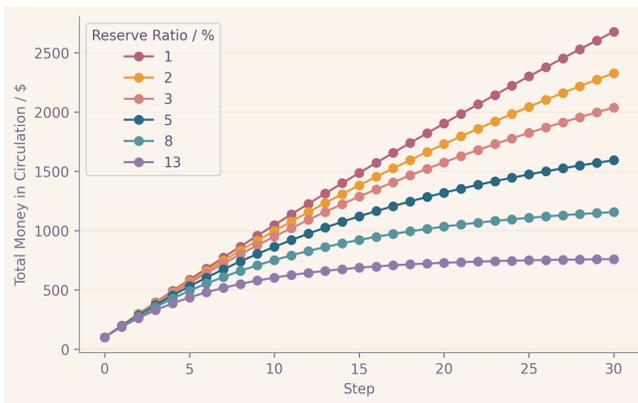


Figure 1.4: The geometric expansion of the money supply via fractional-reserve lending. This plot illustrates the cumulative money in circulation over 15 cycles of re-depositing and re-lending at a 1% reserve ratio. **Note:** On March 26, 2020, the U.S. Federal Reserve effectively removed this physical constraint by reducing the reserve requirement to 0%. This shift to an "ample-reserves" framework allows for theoretically infinite credit expansion, prioritizing market liquidity over the traditional mandate of physical reserve backing.

By moving from the physical to the ledger-based, humanity gained speed but lost the ability to *verify* the underlying proof-of-work, replacing a hard physical reality with a mathematical promise. With this scale came increased centralization. Governments and elites centralized note issuance and reserve management in institutions now called *central banks*—bodies that standardized and stabilized pay-

ment systems while concentrating the power to manage money and its seigniorage. In the United States that process culminated in 1913 with the creation of the *Federal Reserve*⁴; a secretive 1910 meeting of financiers at Jekyll Island is part of the Fed's colorful origin story and is treated at length in popular accounts (Griffin, 2010). Centralization brought stability to some problems and new avenues for concentrated influence to others.

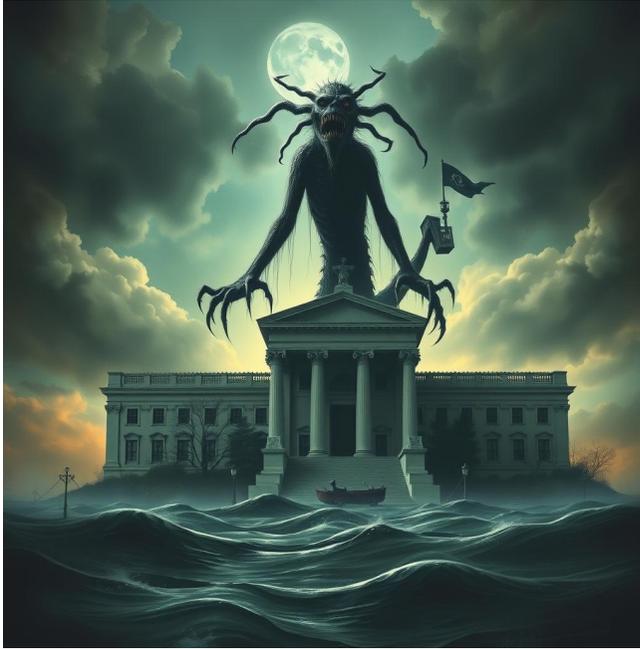


Figure 1.5

Over the centuries the link between paper claims and bullion weakened. Fractional banking created multiple circulating claims on the same underlying metal; in modern markets, separate practices such as *rehypothecation*— the re-use of collateral in securities and margin markets— perform a different technical role but similarly multiply

⁴Ironically, the Federal Reserve is neither federal nor has any reserves.

claims on underlying assets. The net effect: paper and credit gradually replaced direct ownership of metal as money's operational center.

Those changes played out dramatically in the twentieth century. Governments sometimes suspended convertibility in wartime, complicating the neat story that a gold link always restrained fiscal excess. The interwar years and the aftermath of World War I exposed the limits and strains of metallic systems; Germany's Weimar hyperinflation is a stark example of war, reparations, and monetary strain producing devastating currency collapse. The post-war international order at Bretton Woods (1944) pegged other currencies to the U.S. dollar and the dollar to gold, but the final unilateral U.S. decision to end dollar-gold convertibility—the “closing of the gold window” in August 1971⁵—finished the transition to a largely *fiat* monetary world. (Earlier, in 1933, Executive Order 6102 forbade most private hoarding of gold in the United States — an important step in the era's monetary policy shifts.)

Fiat money— *fiat*, “let it be done”—relies on law, institutions, and collective acceptance rather than on an intrinsic commodity anchor. Some rules that now govern this trust-based regime can feel arbitrary; the contemporary 2% inflation target, for example, traces parts of its modern pedigree to the wave of inflation-targeting experiments pioneered by New Zealand and others in the late twentieth century, a lineage often condensed into vivid anecdotes about casual remarks during news interviews that later took on policy weight, whilst minicing the inflation rate of gold supply.

$$T_{1/2} = \frac{\ln(2)}{i} \quad (1.2)$$

If you want a tidy emblem of the shift from metal to promise, consider the humble charge card. In 1950 Frank McNamara's Diners Club card — born of an episode at Major's Cabin Grill in New York — made it easy to transact on the basis of a paper promise rather than an on-the-spot transfer of metal. That device didn't *instantly* convert the world to debt, but it accelerated a long march toward payments increasingly mediated by lines of credit, networks, and contractual claim.

⁵what the fuck happened in 1971

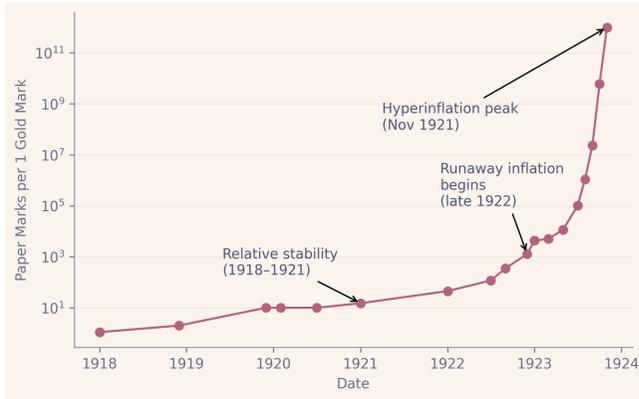


Figure 1.6



Figure 1.7

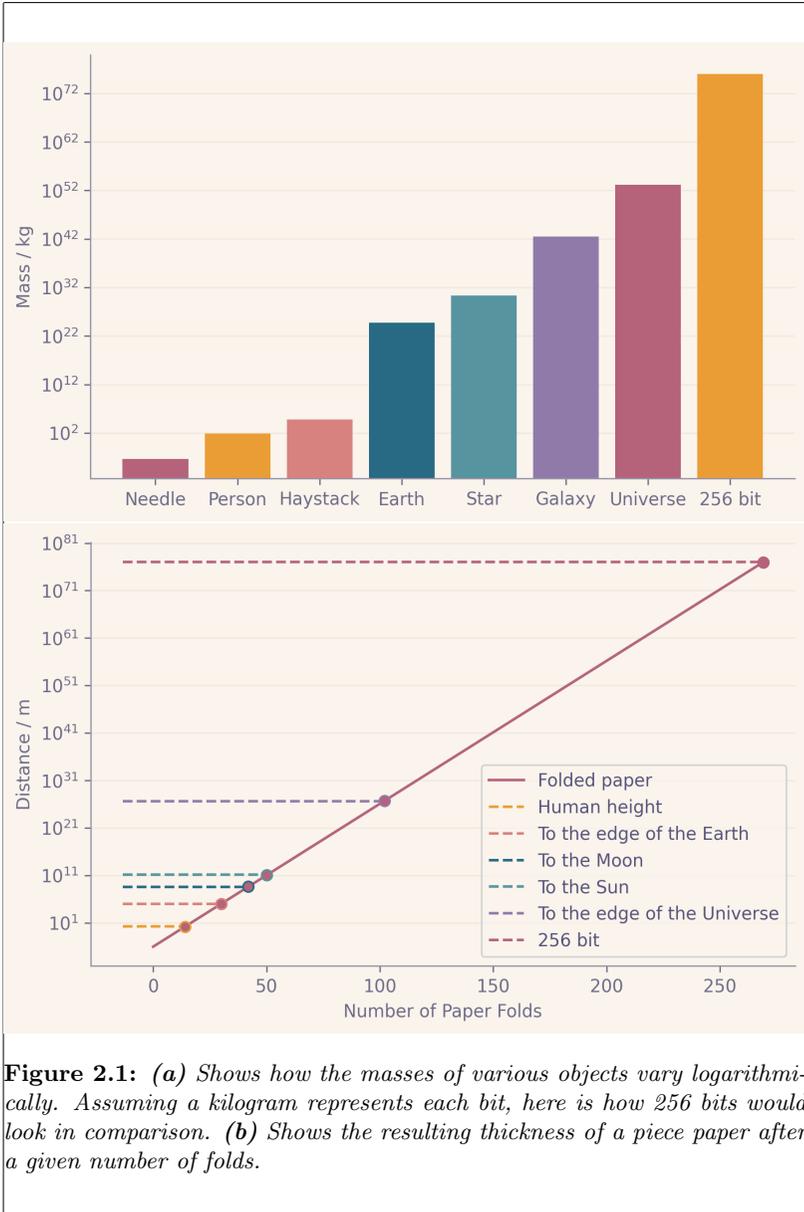
Chapter 2

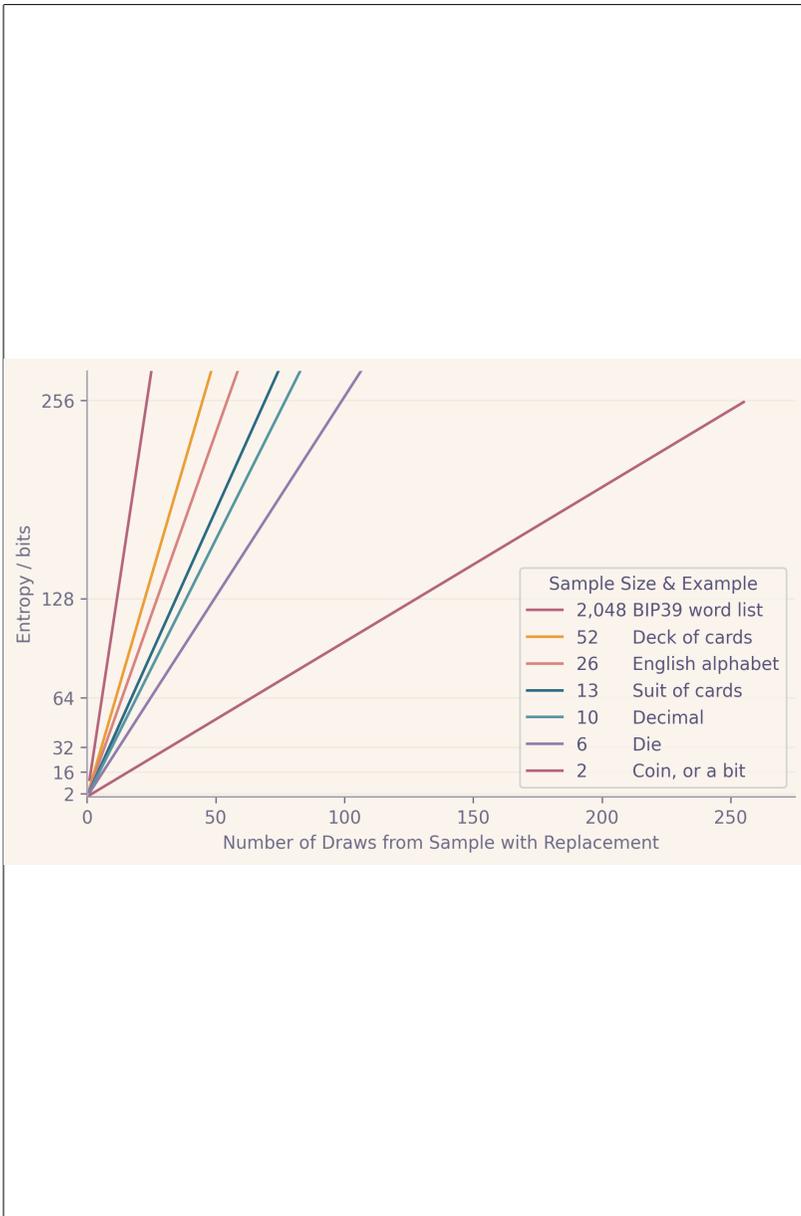
Maths

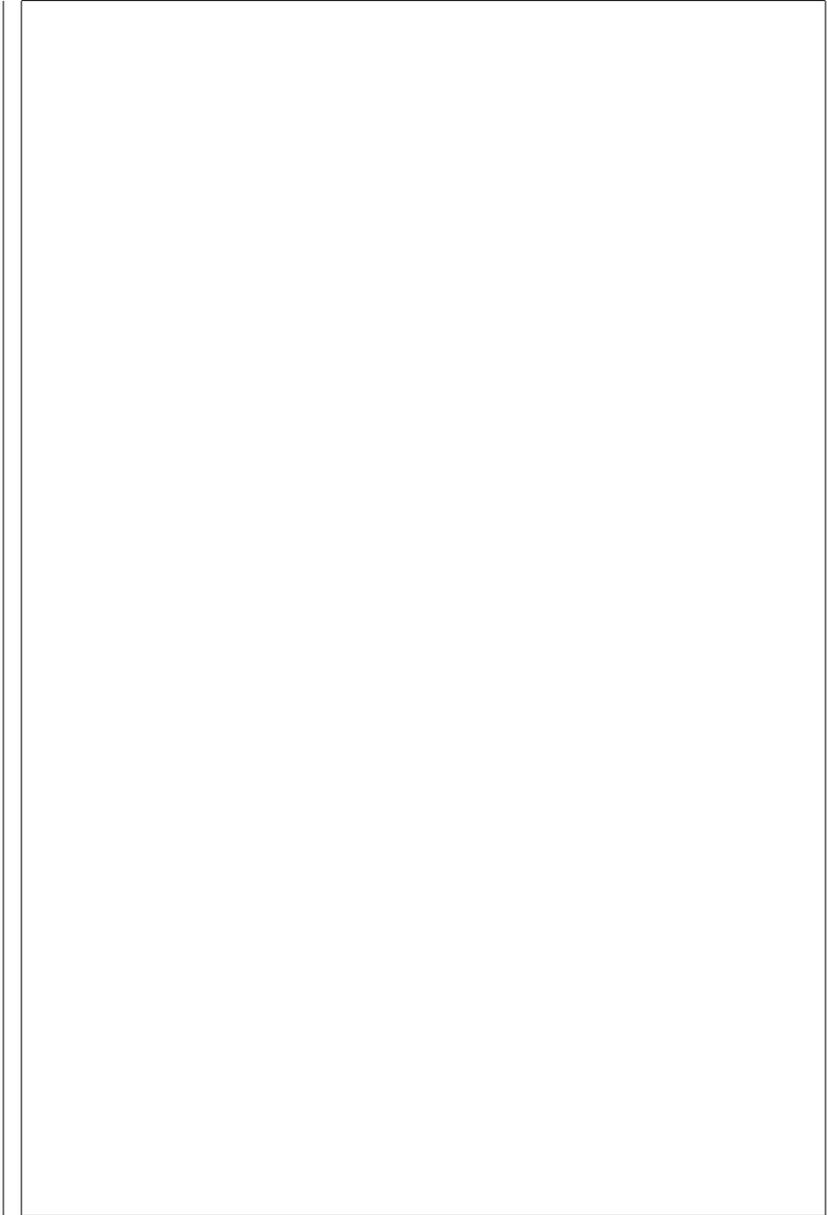
In terms of storage, 265 bits can represent a large amount of information. For comparison, 1 byte is equal to 8 bits, so 265 bits would be equivalent to 33.125 bytes. This could be used to store various types of data, such as a small text document, a few high-resolution images, or a short audio recording.

In summary, the significance of 265 bits depends on the specific application or use case, as it determines the range of values, precision, or amount of information that can be represented or stored.

2.1 Entropy



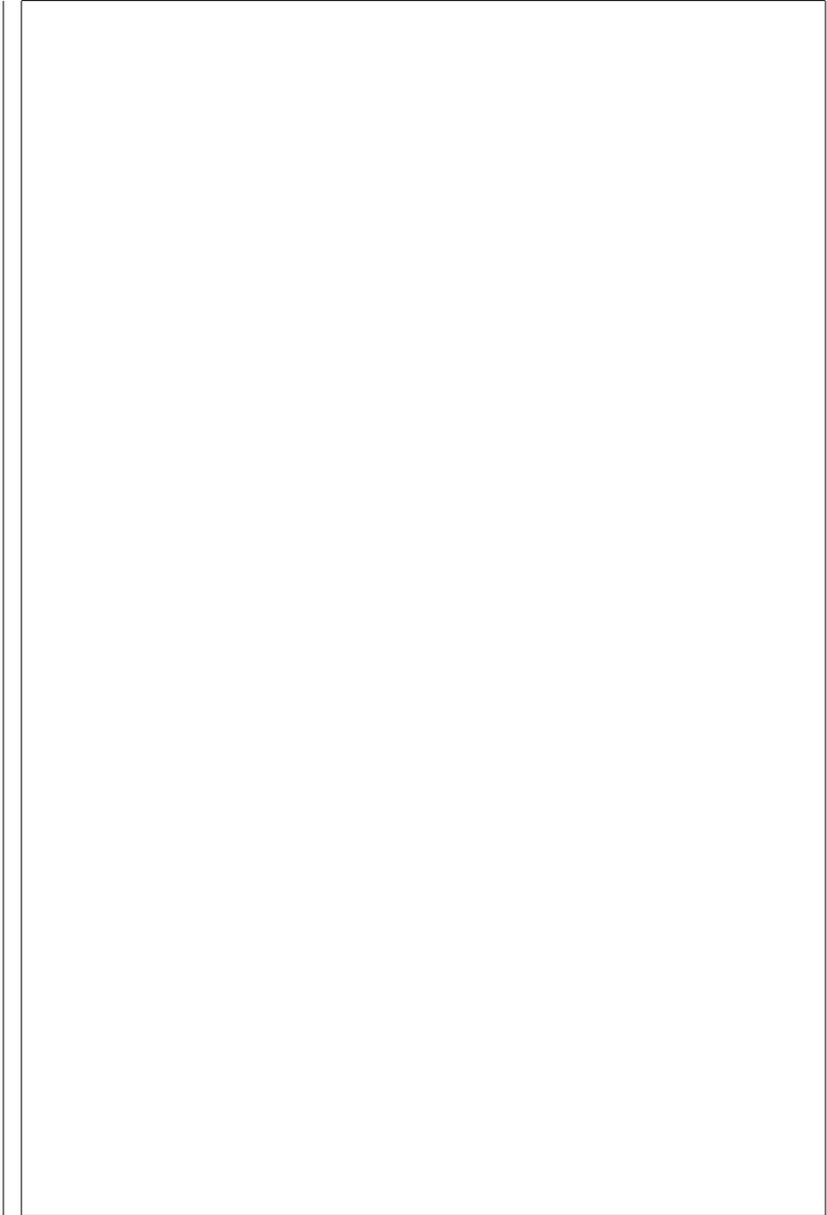




Chapter 3

Usage

- beginner - bitcoiny - wallet of satoshi / muun
- technical - seedsigner/coldcard - checks on die rolls - bluewallet
+ sparrow / umbrel - phoenix



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