



# Cryptobanknotes: Hybrid Banknote Technology for Today

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## Hybrid Banknotes Bring Together Cash and Crypto

As Central Bank Digital Currencies (CBDCs) become reality and the use of cryptocurrencies for payments becomes ever more mainstream, concerns have arisen about the widespread adoption of these new digital monies. Particularly worrisome are how to make them available to everyone, everywhere, at all times. To date, the only payment technology that can do this is cash.

However, the pure physicality of banknotes presents problems in the digital age. Foreign remittances are slow, holding banknotes can be costly and problematic, and cash can impede central bank monetary policy.



Proposed design for a private issue cryptobanknote.

It seems only logical, therefore, that an ideal payment instrument would combine the advantages of banknotes and digital currencies. A hybrid banknote would use a universally accepted and robust payment technology, cash, to deliver the cutting-edge benefits of digital money. A hybrid banknote could routinely function as a banknote does currently but have the ability to access an electronic network to transfer value.

## Hybrid Banknotes Solve Urgent Problems

Banknotes have proved so enduring because they serve some essential functions. However, the continued widespread use of traditional banknotes can hinder the adoption of digital currency and the exploitation of its advantages.

A hybrid banknote will allow for the best of both worlds, fulfilling the role of cash while allowing for digital usages. It will also act as a transitional device between traditional payment systems and electronic and digitally based payment systems, especially CBDCs. Hybrid banknotes would gradually replace current banknotes and exist alongside current smart-phone technology until no longer needed. Here's how a hybrid banknote would aid in the transition to digital currencies:

**Financial Inclusion:** There are many people who do not have the bank accounts that would be needed to access an electronic network and use digital money on a regular basis. They depend on cash for their daily transactions but could periodically use a hybrid banknote's electronic capabilities perhaps at a retailer or public kiosk.

**No Internet Access:** There are places and times when there is no internet access (or even electricity), rendering electronic money and payment methods useless. Designed to work totally offline, a hybrid banknote would fill the gap.

**Disaster Usage:** During natural or man-made disasters, pandemics, hostilities, and hacking attacks on electronic networks, hybrid banknotes will continue to function. Even if a cryptocurrency's or central bank's CBDC servers stop working, hybrid banknotes will still be available for use in hand-to-hand transactions.

**The Cash Industry:** There are many industries and people employed in the manufacture, transportation, safekeeping, and cycling of cash. Making this sector obsolete would have a great economic impact and cause significant pushback against CBDCs and cryptocurrencies. Hybrid banknote production and issuance would maintain this industry as it adapts to cashless payments.

**Popular Payment Practices:** People are used to cash, and many people prefer using cash over existing electronic payment methods. This may be a generational phenomenon. Hybrid banknotes allow the public to continue dealing in cash but gives them the option to make electronic transactions.

**Increased Cash Usage:** Despite the predictions of the imminent death of cash, its usage is actually increasing. The possession of physical banknotes is seen as a measure of security during times of economic uncertainty. Hybrid banknotes allow people to continue to hold a physical object as a store of value.

**Digital Money Adoption:** A banknote that allows for electronic transactions will foster the adoption of digital money. Hybrid banknotes conflate the concepts of physical and electronic money, which will lead to greater familiarity and comfort with digital payments on the part of the general public. This will promote the adoption of CBDCs and cryptocurrencies.

**Central Bank Policy Implementation:** Hybrid banknotes will facilitate the application of new central bank policies such as breaking the zero lower bound in interest rates or other innovative policy initiatives that would require smart contracts. Currently, the existence of cash prevents a complete movement below a zero interest rate. However, a banknote that interacts with an electronic network and represents a digital currency will lift this restriction and open new possibilities.

**Enhanced Security:** Hybrid banknotes, because of their ability to interact with electronic networks, will allow for the development of new security features. These features will not only produce a more secure note but will also allow for the cancellation or invalidation of notes known to be involved in criminal enterprises.

**Transactional Anonymity:** Acting as traditional banknotes, hybrid banknotes provide for anonymous transactions as in any cash transaction. However, whenever a hybrid banknote is used on an electronic network that anonymity can be lost. The degree of anonymity of a hybrid banknote when used online ultimately depends on the design of the ledger and protocols with which it operates. Indeed, there are ways currently being developed to maintain anonymity in transactions involving blind signatures, timed erase, and Zcash.

**Carbon Reduction:** Hybrid banknotes reduce the carbon footprint of cryptocurrencies, especially those that involve proof of work. When passing hand to hand, the notes use no electricity as there are no

interactions with a blockchain, no need to verify transactions. Verification only happens when the note makes an electronic transaction. This may only occur once in the lifetime of a note, which can run for years. During all that time, the CBDC or other cryptocurrency will be in circulation with no energy usage.



Proposed design for a private issue cryptobanknote.

### **Cryptobanknotes: Hybrid Banknotes Ready Today**

There are two basic types of hybrid banknotes: smart banknotes and cryptobanknotes. And, there are two types of cryptobanknotes: CryptoNotes and CryptoBills.

A smart banknote is a traditional banknote that talks to an electronic network via one or more RFID chips. Using a smart phone, its value can be moved back and forth on an electronic network. The status of the smart banknote, whether it contains its face value or not is indicated by an icon formed by electronic ink on the note. Smart banknotes can be recharged and can continue circulating until worn out. However, such notes are still on the technological horizon. They will require advancements in substrate, chip, and ink technologies to be fully realized. (And, Noll Historical Consulting is actively pursuing their development.)

On the other hand, the technology needed for the production of cryptobanknotes already exists. These notes can be produced today.

Cryptobanknotes are hybrid banknotes that can convey the value of a digital money but cannot interact directly with an electronic network. They are modeled on a paper wallet as used with cryptocurrency, sometimes bearing the private and public keys needed to access a cryptocurrency address. There are two types of cryptobanknotes: CryptoNotes and CryptoBills. Each type of note has its own special functions and can circulate together with perhaps CryptoNotes representing high denominations and CryptoBills representing low denominations.

### CryptoNotes Provide Direct User Access to Crypto

A CryptoNote is a hybrid banknote that bears the public and private keys necessary to access a cryptocurrency account. CryptoNotes can pass hand-to-hand until a user wants to transfer the value of the note electronically.



Proposed design for €100 CryptoNote with foil patch, covering private key QR code.

When CryptoNote users need to complete an electronic transaction, they remove the foil patch on the note that protects the private key against unauthorized reading. Then, using their phone, the user scans the QR codes for the public and private keys, accessing the corresponding e-wallet. The value of the note can then be transferred. Now, with the foil patch removed from the note, the CryptoNote can no longer be used in circulation. And, because of the physical damage

to the note, it cannot be reissued. The lost foil patch also makes it evident to everyone that the note may no longer have value. However, the CryptoNote can now function as a cold wallet if the note's value has not been transferred.



Proposed design for €100 CryptoNote with foil patch removed to reveal private key QR code.

### CryptoBills Are Low Cost, Long Life Hybrid Banknotes

A CryptoBill is a hybrid banknote that bears only the public key of the cryptocurrency holdings of the issuer. The private keys to individual accounts are held by the note issuer. Cryptobills can pass hand-to-hand until a user wants to transfer the value of the note to an electronic account. The note must then be taken to the issuer or its representative to have the value represented by the note transferred. This action does not involve the actual note but only the cryptocurrency accounts holding the backing value for all cryptobills. As a result, the note can be reissued repeatedly and circulate until worn out.

A CryptoBill would look very similar to existing banknotes. However, the note would require a QR code, bearing a public key, but no chips or removable foil patches are needed.

Like a current banknote, the CryptoBill would repeatedly pass hand-

to-hand and be used in transactions or vending machines. No access to an electronic network is necessary. As with current banknotes, there is no need to determine whether the note actually holds value, because it is irrelevant. A CryptoBill is simply a token for its underlying cryptocurrency. As a result, users are only concerned with the authenticity of the note as they are with current banknotes.



Proposed design for \$100 CryptoBill, showing public key QR code.

Further, because both CryptoNotes and CryptoBills use existing printing techniques and materials, their functionality can be added to preexisting banknote designs or designs created with existing design software. Thus, any company, foundation, government, or central bank can have their cryptocurrency (CBDC, stablecoin, Bitcoin, Ethereum, El Petro, etc.) printed in cryptobanknote form either in-house or by a security printer.

### The Technology Behind Cryptobanknotes

Just as fiat banknotes were originally backed by gold and silver, so cryptobanknotes are fully backed by cryptocurrency, be it a CBDC, stablecoin, Bitcoin, or some other cryptocurrency. While CryptoNotes and CryptoBills have slightly different designs and production requirements, they both share the same underlying cryptobanknote technology.

In producing a cryptobanknote, an e-wallet is created for each cryptobanknote, with the amount of cryptocurrency equal to the face

value of the cryptobanknote. Together, these e-wallet addresses create a certain digital storage, equal in amount to the cash circulation of cryptobanknotes.

During production of a series of cryptobanknotes, the necessary amount of cryptocurrency is allocated for "freezing" in the e-wallets of each cryptobanknote. This frozen cryptocurrency will not be used until an electronic payment is made with a specific cryptobanknote. Only at that moment will the transaction be displayed in the general blockchain registry.

The public and private key of each cryptobanknote e-wallet is automatically generated and automatically filled with the required amount of cryptocurrency at the time of cryptobanknote production. As soon as a cryptobanknote is produced, its e-wallet is deleted from the software memory and the next e-wallet is generated and filled for the next cryptobanknote. After that, all private keys are securely recorded to prevent unauthorized reading.

In the event of a defect in a printed cryptobanknote, the value of the defective cryptobanknote is returned to the general e-wallet. At no time does anyone have access to the private key of any cryptobanknote e-wallet.

Finished cryptobanknotes can then be issued to the public just like traditional banknotes.



Proposed design for a private issue CryptoBill.

## CryptoNotes and CryptoBills Have Many Advantages

Transcending the division between the world of banknotes and electronic money through CryptoNotes and CryptoBills will bring many advantages to central banks and cryptocurrency advocates. Such banknotes will use a universally accepted and robust payment technology, cash, to deliver the cutting-edge benefits of digital money, passing hand to hand until used to access an electronic network to transfer value.

Hybrid banknotes like CryptoNotes and CryptoBills can provide anonymous, offline transactions, using a familiar technology. At the same time, they can promote the adoption of digital money and facilitate central bank monetary policies possible only with CBDCs. All this can be done while meeting the popular demand for cash.

Also, the use of one form of hybrid banknote does not preclude the use of another. CryptoNotes and CryptoBills can all be used together, serving specific purposes within the same currency. Some issuers may want to use full-feature notes like CryptoNotes for high denominations and use simpler CryptoBills for low denominations. And, there may be times, such as during disaster relief, when a single-use CryptoNote may be preferable. Hybrid banknotes provide many options.

CryptoNotes and CryptoBills bring together the world of cash and traditional banknotes and the world of cryptocurrencies and electronic networks. These devices were designed to solve a myriad of payment problems that are with us today and will be into the future.

### Your Future, Your Success

Seize the future now with today's hybrid banknote technology: CryptoNotes and CryptoBills. While chipped smart banknotes are years away from final development, cryptobanknotes are ready for production now. So, while your competitors are busy in research, you can be busy running the presses.

Here, we have provided only basic information about cryptobanknotes. Let us help you ensure your success.

Noll Historical Consulting, LLC, through our Innovative Technologies Division, will:

Adapt cryptobanknote technology to your specific needs and equipment,

Provide a roadmap for the software required for the production, circulation, and recovery of cryptobanknotes,

Formulate the main technical specifications for the creation of any additional equipment necessary for the use of cryptobanknotes and their innovative functions,

Conduct a thorough analysis and development of individual technical conditions for the creation of CBDC cryptobanknotes, as well as the necessary sequence of emission of cryptobanknotes, in relation to a specific country or central bank, depending on the national characteristics and financial situation in the country,

Analyze and develop customized technical conditions for creating cryptobanknotes for cryptocurrencies, stablecoins, and etc. for any cryptocurrency issuer.



Proposed design for a private issue cryptobanknote with alphanumeric code.

## We're Ready, Contact Us!

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### About Andrei Lipkin, Director of Innovative Technologies

Andrei Lipkin is a graduate of the Belarusian State University of Informatics and Radioelectronics and former banknote and security document designer at the State Special Printing House of Belarus. While rising to lead the Marketing Division, Lipkin introduced numerous innovations into the documents issued by the various Ministries of the Republic of Belarus and developed innovative, state-of-the-art security features and designs. He also oversaw their production from prepress linework to final press runs while working to ensure customer satisfaction. After over 20 years in government employment, Lipkin left to work as a consultant to central banks, cryptocurrency companies, and security printers. He developed technological processes for printing hybrid documents that combine innovative financial blockchain technologies with definitive financial instruments. He invented the cryptobanknote in 2017.

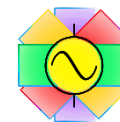


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### About Noll Historical Consulting, LLC

Located just outside Washington, DC, Noll Historical Consulting was established in 1999 by Franklin Noll, PhD. Our clientele includes the US Government, international agencies, and private companies. While focused on the history of the technology of money, our functionality has grown over the past 20-plus years to include banknote design, heritage management, and public relations support. Today, Noll Historical Consulting is deep in the world of crypto and digital money and finance, using history to anticipate and solve the problems facing the worlds of cryptocurrency, decentralized finance, blockchain, and more. We are extending the story of the technology of money into the future.

Visit us at [www.franklinnoll.com](http://www.franklinnoll.com)



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