

Crystals and Mud on the Blockchain

James Grimmelmann
Cornell Tech and Cornell Law School

August 11, 2020

Institute for Cryptocurrencies and Contracts (IC3)

In this talk

- A story from the history of land law
- Crystals and mud
- The blockchain as a crystal
- Living in a muddy world

The double-spend
problem for land

The double-spend problem for land

- Alice owns Blackacre
- Alice conveys to Bob
- Alice conveys to Carol

- Rule of law: “first in time, first in right”

Who owns Blackacre?

In 1250

- P1 conveys to P2 by going onto Blackacre and handing him a clod of dirt
- If Carol sues, a jury will be asked whether Alice gave Bob a clod of dirt
- This is a distributed system with terrible records

Failure case

- Alice might have conveyed to Bob in 1263 by handing him a clod of dirt, or maybe not
- Alice's son Dave conveys to Carol in 1313 by handing her a clod of dirt
- No one who was there in 1263 is around fifty years later in 1313 to testify in the Bob-Carol suit. No one on the jury remembers what happened.

In 1650

- P1 conveys to P2 by signing and sealing a piece of paper (a “deed”)
- If Carol sues, a jury will be asked whether Alice gave Bob a signed and sealed deed
- This is a distributed system with somewhat better records

Anatomy of a land scam (version 1)

- Alice conveys to Bob with a secret deed
- Alice conveys to Carol for £££
- Bob shows up with his deed, sues Carol, and wins

What went wrong here?

- In 1250, the records were too ambiguous
 - The rule wasn't clear in practice
- In 1650, the records are more definite — but they're not public enough to rely on
 - The rule is clearer ...
 - ... but also sometimes clearly unfair

In 1850

- P1 conveys to P2 by signing and sealing a deed
- P2 then *records* the deed at the land records office: it's bound and indexed
- If Carol sues, a jury will be asked whether Bob's or Carol's deed was recorded first
- This is a centralized system with better records

Title search for land using paper records

- Land records are bound in volumes by date
- Search backwards to find the transaction the current record owner claims under
 - Repeat for each previous owner
 - Stop at the (legal) beginning of time
- Search forward for conflicting transfers

Sound familiar?

- Land record = blockchain
- Volume = block
- Chain of title = transaction history
- Beginning of time = Bitcoin first mined
- Searches = blockchain verification

Crystals and Mud

This is a general pattern in the history of property law

- Desire for *crystals*: clear, hard-edged, bright-line rules like “first in time, first in right”
 - Inexpensive litigation
 - Predictable outcomes
 - Clear asset ownership
 - Easier transactions

Carol M. Rose, *Crystals and Mud in Property Law*, 40 STAN. L. REV. 577 (1988)



Crystals and Mud in Property Law

Carol M. Rose*

Property law, and especially the common law of property, has always been heavily laden with hard-edged doctrines that tell everyone exactly where they stand. Default on paying your loan installments? Too bad, you lose the thing you bought and your past payments as well. Forget to record your deed? Sorry, the next buyer can purchase free of your claim, and you are out on the street. Sell that house with the leak in the basement? Lucky you, you can unload the place without having to tell the buyer about such things at all.

In a sense, hard-edged rules like these—rules that I call “crystals”—are what property is all about. If, as Jeremy Bentham said long ago, property is “nothing but a basis of expectation,”¹ then crystal rules are the very stuff of property: their great advantage, or so it is commonly thought, is that they signal to all of us, in a clear and distinct language, precisely what our obligations are and how we may take care of our interests.² Thus, I should inspect the property, record my deed, and make my payments if I don’t want to lose my home to unexpected physical, legal, or financial impairments. I know where I stand and so does everyone else, and we can all strike bargains with each other if we want to stand somewhere else.

Economic thinkers have been telling us for at least two centuries that the more important a given kind of thing becomes for us, the more likely we are to have these hard-edged rules to manage it.³ We draw

* This article was originally prepared as a paper for the Conference on Property and Rhetoric, sponsored in June 1986 by Northwestern University and funded by the American Bar Foundation. The Siragusa Foundation provided additional research support. As the paper evolved, I received many helpful comments from patient audiences, initially at that wonderful institution, the Yale Law School Half-Baked Lunch, and later at faculty seminars at the Northwestern University Law School, New York University Law School, and Tulane Law School. I particularly thank Allan Axelrod, Randy Barnett, Victor Goldberg, Ian Macneil, Thomas Merrill, Geoffry Miller, Stewart Sterk, Cass Sunstein, John Stick, and David Van Zandt for their critiques and insights. All errors, of course, are my own.

1. J. BENTHAM, *THEORY OF LEGISLATION, PRINCIPLES OF THE CIVIL CODE* pt. 1, ch. 8, at 68 (Baxi ed., Hildreth trans., 1975).

2. See, e.g., Holderness, *A Legal Foundation for Exchange*, 14 J. LEGAL STUD. 321, 322-26 (1985) (favors property doctrines that have narrow, specific definition of entitlements-holders, because they lower information costs and transaction costs).

3. 2 W. BLACKSTONE, *COMMENTARIES ON THE LAWS OF ENGLAND* 4 (1766 & photo. reprint 1979) (necessary to create individual property in things as these things became “conveniences” in increasing “refine[ment]” of human life); *id.* at 7 (property in land occurred with development of agriculture); see also Demsetz, *Toward a Theory of Property Rights*, 79 AM. ECON. REV. PROC. 347 (1967) (property rights develop with increase in value of resources); R. Pos-

“In a sense, hard-edged rules like these—rules that I call ‘crystals’—are what property is all about. If, as Jeremy Bentham said long ago, property is ‘nothing but a basis of expectation,’ then crystal rules are the very stuff of property: their great advantage, or so it is commonly thought, is that they signal to all of us, in a clear and distinct language, precisely what our obligations are and how we may take care of our interests. . . . I know where I stand and so does everyone else, and we can all strike bargains with each other if we want to stand somewhere else.”

Rose, *Crystals and Mud*, at 577

Anatomy of a land scam (version 2)

- Alice conveys to Bob
- Bob forgets to record
- Alice conveys to Carol
- Carol records her deed
- Carol sues Bob and wins

Who should win?

- Bob was a ninny; he forgot to record
- But Carol is just opportunistically taking advantage of Bob's foolishness, not adding any value
- Courts and legislatures have been sympathetic to the Bobs of the world

More scams

- Dave searches for unrecorded grants, then swoops in and buys second but records first
- Alice conveys to Eve first, but Eve waits to record until after Bob searches

Result: recording first only helps the innocent

- Pure *race* statutes are the law in 3 states
- In the other 47, a subsequent purchaser with *notice* of the prior sale takes nothing
- This foils Carol and Dave and maybe Eve
- But the records are no longer definitive
- What counts as “notice” is a new source of litigation, uncertainty, and expense

“[T]he official records become an unimpeachable source of information about the status of land ownership; the law counts the record owner, and only the record owner, as the true owner. . . . This system was too crystalline to last. The characters to muck up this crystalline system by now should be sounding familiar: ninnies, hard-luck cases, and the occasional scoundrels who take advantage of them.”

Rose, *Crystals and Mud*, at 587

Property law in the real world

- Pure mud doesn't work
 - Too much uncertainty
- Pure crystals don't work
 - Too much potential for fraud and mistake
- Property law oscillates between the two
- Both are necessary for a functional system

Blockchains

What do blockchains add?

- Filing and searching are cheaper
 - Digital FTW
- Verification is computationally tractable
 - Mathematics FTW
- No need to trust the recording office
 - Peer-to-peer FTW

Perfect records?

- Suppose we put asset titles on a blockchain
- Some problems (deeds behind the radiator at the recording office) go away
- But other problems don't ...

The myth of perfect title documents

- Example (Arvind Narayanan): car titles simplify car sales, but can't be conclusive
- Protecting against stolen cars creates a risk of stolen documents
- The title documents and the physical thing can get out of sync

Other off-record risks

- Transfer of asset without recordation
 - E.g., sale, gift, by will, or bankruptcy
- Theft of private keys
- Fraud in the factum (“Sign this ‘petition’”)
- Fraud in the inducement (“I’ll ‘pay’ \$1M”)
- Adverse possession

Blockchains are crystals

- Armor-plated against errors *in the blockchain*
- No help against errors *off the blockchain*

What to Do?

Solution #1

legal imperialism

- Blockchain assets are intangible property; smart contracts are legal contracts; etc.
- Courts can order property transferred and contracts rewritten
- Therefore ...

This isn't realistic

- Blockchain *users* may not cooperate
 - No transfers without their private keys
 - They might be defiant
 - Or out of the jurisdiction
- Blockchain *miners* may not cooperate
 - No chain rewriting without their consensus
 - They're distributed worldwide

Solution #2

blockchain purism

- Whatever the chain says goes
 - Any law to the contrary is ineffectual
- *Caveat user*
 - Keep your private keys secure, read your smart contracts carefully, don't pay in Bitcoin for off-chain goods, etc.

This isn't realistic either

- Ninnies, hard-luck cases, and scoundrels aren't going away any time soon
- Where the legal system *can* set things right, it's hard to say that it shouldn't
- E.g., fraud is still a crime even if your victims pay you in Bitcoin
- And there's a deeper problem ...

Example: payment systems

- Checks and credit cards have extensive protections for the careless and the luckless
 - That's why they're in wide consumer use
- Wire transfers have very few protections
 - They're used almost entirely by businesses
 - Which are exceedingly careful with them

Example: secured lending

- Businesses give their creditors *liens* on their inventory, accounts, etc.
- In case of default, secured creditors are paid quickly and reliably out of the collateral, rather than waiting in line
- Liens trace into *proceeds*, e.g., money received for the sale of a boat
- Creditors would be ... unhappy ... to be told that their liens don't reach blockchain-based payments

In praise of mud

- Banking and payment users *like* much of the mud of the existing legal system
 - It protects them from scary failure cases
 - And it facilitates valuable transactions
- A system that doesn't have enough of this mud is dangerous to use, and people and businesses will avoid it

Solution #3

intermediaries

- The chain is the chain in its crystalline purity
- But people use it through exchanges, escrows, payment processors, and wallets
- These intermediaries aren't just convenient
 - They protect users against mistakes
 - They are subject to legal process
 - Etc.

Intermediaries as mud

- Blockchain intermediaries muck up the purity of the blockchain
 - They introduce new opportunities for fraud, mismanagement, waste, etc.
 - They complicate asset ownership with new risks and failure modes
- But some mud is necessary to let human hands grasp blockchain's crystals

Know-it-all contracts

- Smart contracts securely transfer digital assets to parties under specified conditions
- The blockchain can't verify that a concrete foundation has been properly poured
- Most contractual complexity is an attempt to deal with the complexity of real life
- Oracles are another kind of crystal-to-mud interface for blockchains

Bottom Line

Bitcoin is a near-flawless crystal in a muddy world

- There is little harm in having a new banking and payment alternative, *but ...*
- The problems blockchains solves are mostly not the ones that property and commercial law have spent centuries worrying about
- People will never be as perfect as the blockchain

Not all doom and gloom

- Cryptocurrencies may *improve* our property and contracting systems in places
- They won't *replace* them unless we make some much bigger changes to society
- Be skeptical of sweeping claims; think carefully about use cases
- Talk to lawyers! Most of us don't bite.

Discussion