Covenants

Harsha Goli, sometimes known as arshbot
Lightning Labs

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What is a “Covenant”?

- main antagonist in the “Halo” series?
- a witches coven?
- a bible thing?

Covenants are agreements 🤝

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Covenants are agreements on how to spend the bitcoin

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The recipient agrees by accepting the bitcoin with special spending rules

An amusingly bad idea

— Greg Maxwell

Some good ideas

Some good ideas

Hodl Chicken

Bitcoin Will

🐔 Hodl chicken

	Alice withdraws first	Bob withdraws first	Neither withdraw
Alice	😩	😊	😩
Bob	😊	😩	😩

📝 Bitcoin Will

	I die	+spouse cheats	refund
Me	💀	💀	😊
Spouse	😊	😩	-
Kids	😊	😊	-
Attorney	😊	😊	-

A tidal wave of approaches

OP_TAPLEAF_UPDATE_VERIFY

OP_CHECKTEMPLATEVERIFY

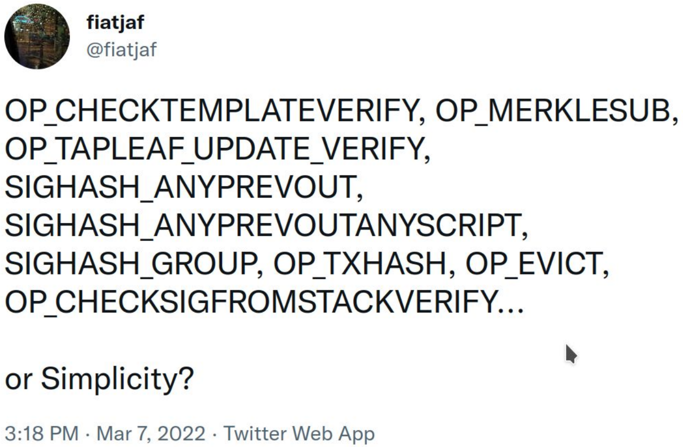
OP_CHECKSIGFROMSTACKVERIFY

OP_MERKLESUB

SIGHASH_ANYPREVOUT

OP_CAT

SIGHASH_GROUP



fiatjaf
@fiatjaf

OP_CHECKTEMPLATEVERIFY, OP_MERKLESUB,
OP_TAPLEAF_UPDATE_VERIFY,
SIGHASH_ANYPREVOUT,
SIGHASH_ANYPREVOUTANYSCRIPT,
SIGHASH_GROUP, OP_TXHASH, OP_EVICT,
OP_CHECKSIGFROMSTACKVERIFY...

or Simplicity?

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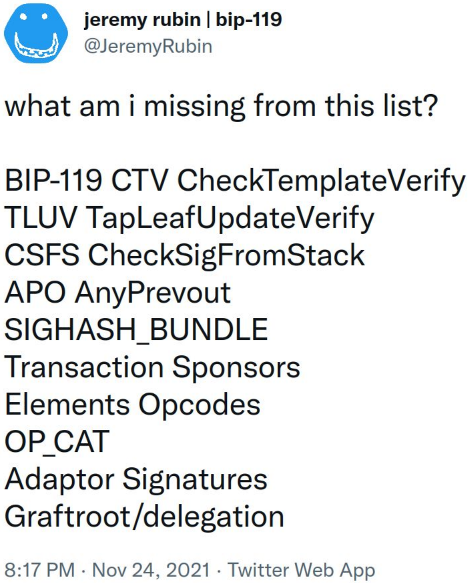
OP_EVICT

OP_TXHASH



jeremy rubin | bip-119
@JeremyRubin

what am i missing from this list?

BIP-119 CTV CheckTemplateVerify
TLUV TapLeafUpdateVerify
CSFS CheckSigFromStack
APO AnyPrevout
SIGHASH_BUNDLE
Transaction Sponsors
Elements Opcodes
OP_CAT
Adaptor Signatures
Graftroot/delegation

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🪣 Two main buckets

🪣 Two main buckets

OPCode Based

OP_CTV

OP_COV

OP_PUSHTXDATA

OP_CD

🪣 Two main buckets

OPCode Based

OP_CTV OP_PUSHTXDATA

OP_COV OP_CD

Signature Based

OP_CSFS + OP_CAT + OP_TX

SIGHASH_ANYPREVOUT + NO_INPUT

OPCode based bois

OP_CHECKTEMPLATEVERIFY (OP_CTV)

Conceptually simple - checks if the spending transaction fits the specified template

OP_CHECKTEMPLATEVERIFY (OP_CTV)

Conceptually simple - checks if the spending transaction fits the specified template

The spending transaction/template transaction comparison is performed by hashing all of transaction’s relevant bits (defined by the template)

OP_CHECKTEMPLATEVERIFY (OP_CTV)

Important Bits!

LocktimeVersion

Sequence Hash

ScriptSig Hash

Number of Inputs

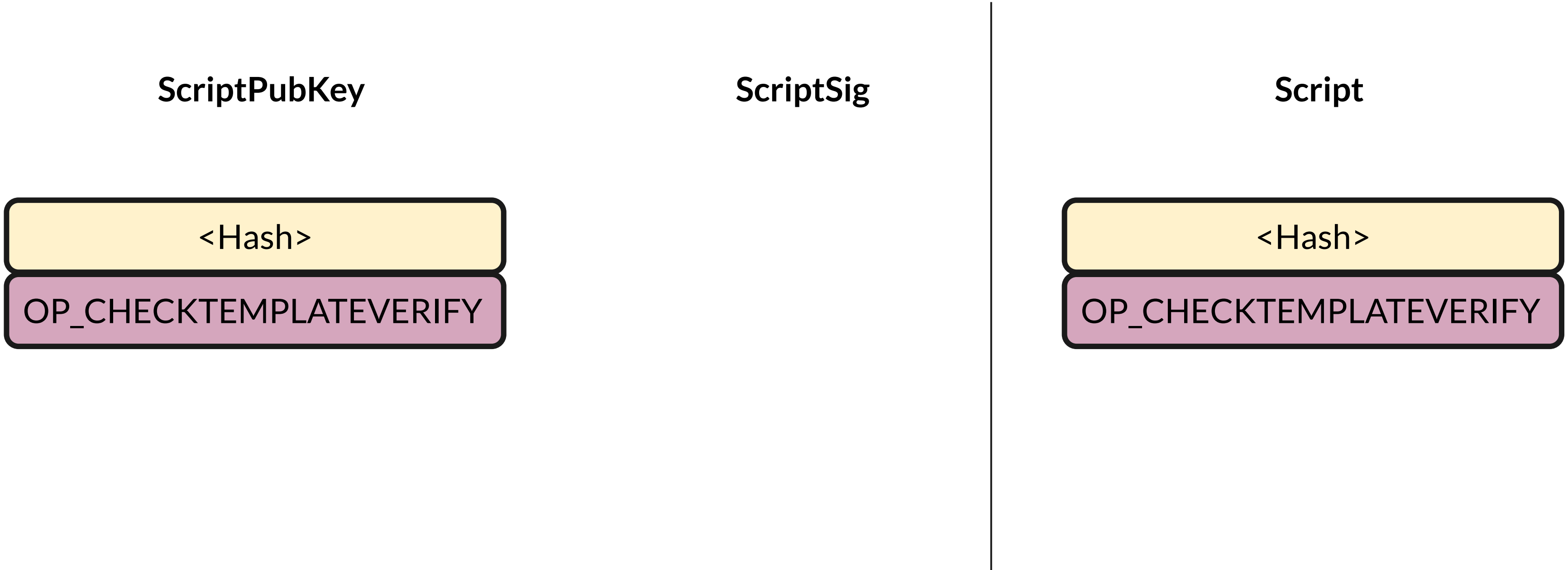
Number of Outputs

Outputs hash

Current input index

Values by Hash

Example



ScriptPubKey

<Hash>

OP_CHECKTEMPLATEVERIFY

ScriptSig

Script

<Hash>

OP_CHECKTEMPLATEVERIFY

OP_CHECKOUTPUTVERIFY

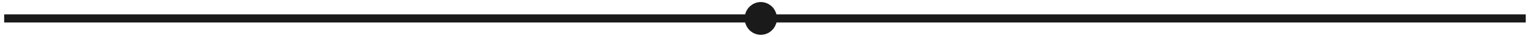
- OP_COV allows a user to specify a pattern and output index of the spending transaction
- Suffers from half spend problem (doesn’t restrict inputs to one)
- Allows recursive covenants (bad)

OP_CONSTRAINDESTINATION

Collection of 4 op_codes

- OP_CD — X amount to Address
- OP_BBV — expires spend path after block
- OP_POS — pops data only if specific address is output
- OP_LFC — constrains fee

Flexibility Scale



less flexi

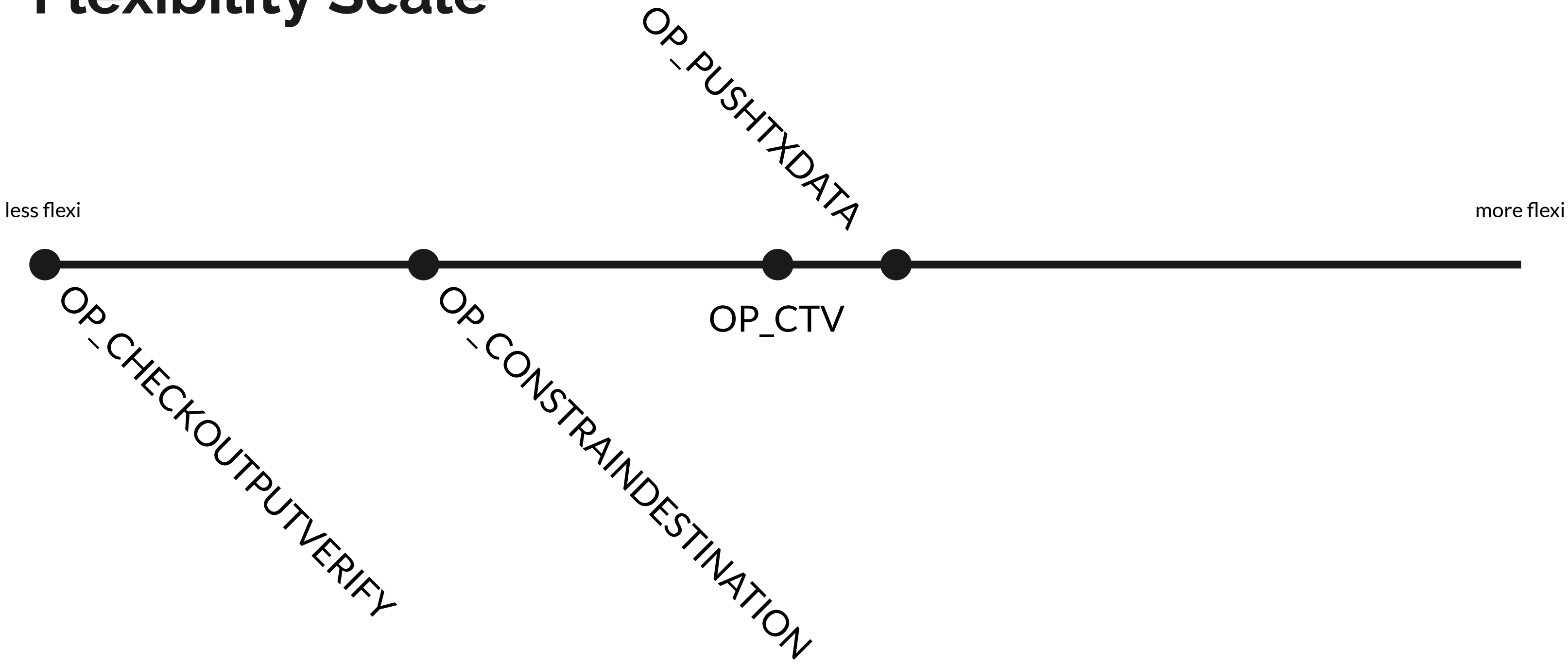
more flexi

OP_CTV

OP_PUSHTXDATA

- outputs must follow a pre-specified pattern (like op_ctv)
- Allows for fined tuned control of the spending transaction (unlike op_ctv)
- Allows control over:
  - Fees
  - transaction size with and without witness serialization
  - transaction weight

Flexibility Scale



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OP_CHECKOUTPUTVERIFY

OP_CONSTRAINDESTINATION

OP_CTV

OP_PUSHTXDATA

Signature based bois

OP_CHECKSIGFROMSTACK + OP_CAT + OP_TXHASH

OP_CSFS

- Checks if a signature signs an arbitrary message
- arbitrary message can be a transaction
- Could be used as a more flexible OP_CTV

OP_CAT

- Removed once because of a bug that created 184 Billion bitcoin in a transaction due to an overflow bug
- Concats two elements, useful for constructing messages
- Often included to proposals OP_CHECKSIGFROMSTACK proposals

OP_TXHASH

- Simple functionality that is kind of like OP_CTV
- Computes tagged txhash and pushes onto stack

or

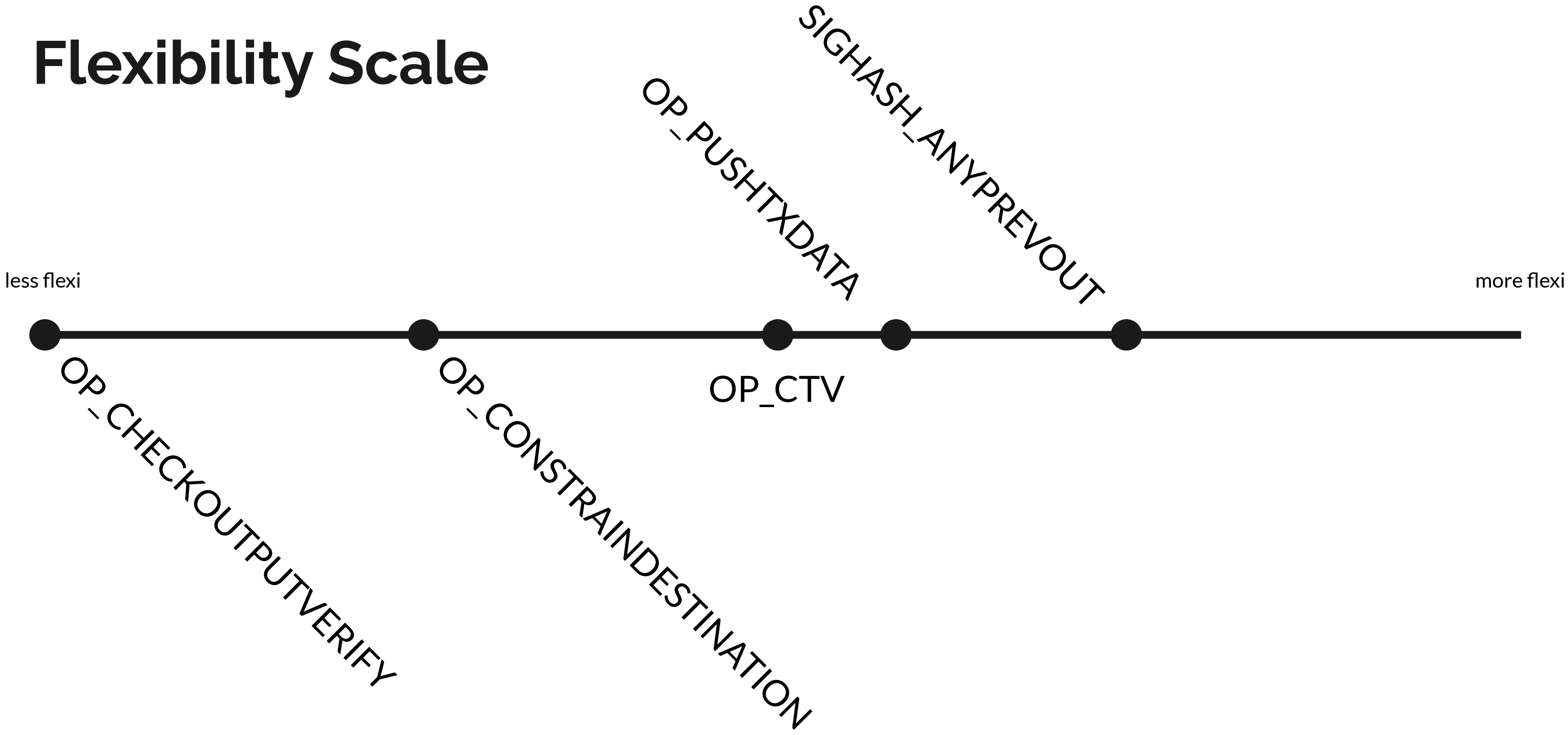
OP_TX

- Simplified alternative to OP_TXHASH
- breakdown of the steps in OP_TXHASH since something similar can be accomplished with OP_SHA256 and OP_TX

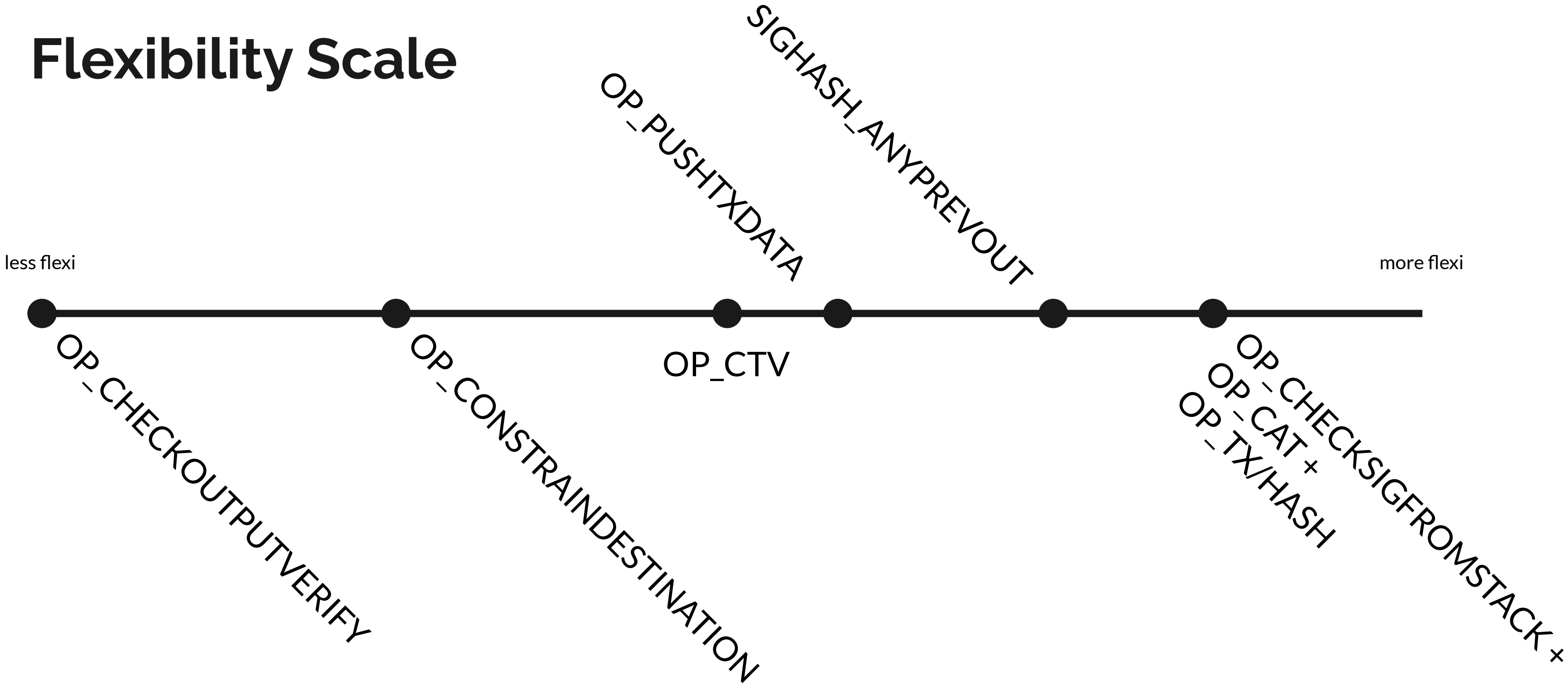
SIGHASH_ANYPREVOUT

- New kind of public key for tapscript transactions
- Allows you to create a signature for which only a specific spending transaction can fulfill
- sighash where the identifier for the UTXO being spent is not signed, allowing the signature to be used with any UTXO that's protected by a similar script
- Necessary for eltoo
- with OP_CAT main proposal can be compatible with schnorr

Flexibility Scale



Flexibility Scale



Wrapping up

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What we've learned

- Covenants are *just* agreements
- Future is rife with possibilities
- Loads of proposals, 2 main groups
- OP_CTV has the most support
- Signature based is more flexible but at a cost

Thank you!

Cheers,
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tw _arshbot