

Less is more: Signatures, cities and hash codes

Description

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In 1997, the Hubble Space Telescopeâ??s Imaging Spectrograph (STIS) picked up the signature of a black hole. Instead of a vertical straight scan line, the STIS showed an S shape. Signatures point to the presence of something (a referent). But you see the thing only indirectly, i.e. you get to know that the referent exists, even though you canâ??t see it simply by looking for it, or at it â?¦ even if you could.

From what I have read, the COVID-19 virus also produces a *genomic signature*, or perhaps several, depending on the means of detection and measurement. According to the OED, a signature is: â??Any typical physical or behavioural characteristic, pattern, or response by which an object, substance, etc., may be identified.â?• As is the case with the S-shaped blip on the black hole spectrograph, a signature doesnâ??t bear a resemblance to the thing it signifies. Hereâ??s a picture of the earth-bound Jodrell Bank radio telescope for picking up extra terrestrial signatures.



Social signatures

A signature takes up less space than its referent, and can be used as a stand in during various calculations or logical operations, like moving name tags (signatures) around while organising the seating at a reception. Thatâ??s substantially easier than moving the people (referents) around.

Iâ??ve been searching for examples of the use of â??signatureâ?• in descriptions of large scale social entities, like cities, societies or political movements. I came close with an article on â??emotional signatures.â?•

> â??Political ideology thus has a discrete emotional signature, one favoring anxiety among conservatives and anger among liberalsâ?• (98).

In the context of that particular study, anxiety was a means of identifying the presence of a conservative mindset. The emotion of anger indicated a liberal mindset. An emotion, or at least an emotion *word*, served as a signature of a group.

Urban signatures

There are plenty of businesses, buildings and cities claiming to be signatures, landmarks, showcases and flagships. Digital tech contributes to the concept of an urban signature. For example, some scholars have investigated the flow of people moving around a city derived from traces left across the city by images uploaded to photo sharing websites.

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Researchers used that as an index of the cityâ??s cultural and social structure. Itâ??s a bit like detecting the rapid flow of material around a black hole to determine its presence and size, even though you canâ??t see the black hole. Terms such as *footprint*, *fingerprint* and *profile* also come to mind as substitutes for *signature* in an urban context.

Data signatures

Iâ??m examining cryptography as an urban phenomenon. That foregrounds the concept of *hash coding* , important in search, indexing, data access, authentication, security, encryption and cryptocurrencies. Some scholars write about the *hash code* of a file or document as its signature. Itâ??s an algorithmically generated much abbreviated form of the document that serves as its unique identifier â?? its signature.

Here I want to show how a hash code belongs to a family of data translation operations relevant to the way graphical, 2D and 3D objects and elements are represented in databases. That might be relevant to signatures of the city, or at least of a cityâ??s inert visual elements.

Hash code

A hash code is a compressed version of a file. The hash is a string of characters of uniform length, depending on the hashing algorithm used. It is derived from the original (referent) data, whatever the original size and format of that data. It bears no resemblance to the original data for either a human reader or machine. See posts about hash coding.

Assuming a robust hashing algorithm, the hash string cannot be reverse engineered to recover the original data, even if you or your computer has access to the algorithm that produced the hash. The hash string is a unique identifier (signature) of its referent, and is therefore extremely useful in database management, search, listing, ordering and processing data. Most importantly, if you run the same referent data through the same hash algorithm it will produce exactly the same hash string. So hash

coding is used for verifying that a file is not corrupted or tampered with in transit.

Iâ??ve yet to discover a direct spatial analogue to hash coding, at least in a way thatâ??s relevant to the spatial arrangement of cities. That said, the family of translation operations to which hashing belongs is relevant, at least in the way spatial urban data is represented graphically, e.g. aerial imagery, street patterns, property boundaries.

Data compression

A hash code is a form of data compression. Thatâ??s the condensation of something large or complicated down to something small and more portable, and that holds the ability to identify its referent. Image compression, also known as *downsampling*, provides such a function. In that case a full colour, high definition image gets downsampled to something smaller. The usual use of compression is to create a small version of an image file, but to make it as visually close to the original as possible.

Lossless data compression

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Lossless data compression produces a smaller file, but no information is lost. In the case of an image file, if the sky is a uniform blue colour then the lossless compression algorithm counts the number of pixels of the same colour along a scan line in the image and stores information about the range of pixels with that colour. Thatâ??s the run-length encoding method. Itâ??s more efficient than storing colour information about every single pixel.

â??Lossyâ?• compression

â??Lossyâ?• compression, such as JPEG image compression, adopts more cunning methods, such as reducing the palette of pixel colour values where there are a lot of adjacent pixels with high contrast. The eye is less sensitive to colour variation across a busy part of the picture compared with large areas of subtle colour variation. What is important here is that the method strips away a substantial part of the image information, thereby reducing the file size. However, once it is lost, thereâ??s no way to bring that information back from the compressed file.

Scaling down the size of an image involves a simpler method than JPEG compression. It simply averages the colour value of every square group of pixels (e.g. 8Ã?8) to a single pixel. Information gets lost in the averaging process. Itâ??s not possible to reconstitute the original information from a set of averages.

I think of such compression as meeting some of the functionality of a hash code, thereby serving as a rudimentary signature of the uncompressed image.

Encryption

This is the translation of data into an unreadable format. An encrypted file is about the same size as the original, its referent. Itâ??s no more portable than the original, and is only of use to someone with the decryption key, by which it can be restored. Encryption and hash coding are related, but an encrypted file doesnâ??t deliver the functionality of a signature. See posts on encryption.

Data translation

Thatâ??s simply the translation of data from one format to another, such as converting DWG to OBJ for 3D files, or PNG to GIF for image files. These formats are legible to a wide range of software applications and editors.

Hereâ??s a table summarising these different aspects of data conversion methods.

	Reduced size	Needs a key	Unique to referent (potentially)	Referent is recoverable	Used for security
Data translation	sometimes	no	yes	mostly	no
Encryption	no	yes	yes	yes	yes
Compression (lossless)	yes	no	yes	yes	no
Compression (lossy)	yes	no	yes (except for extreme downsampling)	no	no
Hash code	yes	n/a	yes	no	yes

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Iâ??m part way to showing how signatures and hash coding permeate the city (for a later post).

Semiotics of signatures

As I have been studying semiotics and the philosophy of C.S. Peirce, I am bound to note that a signature (and a hash code) is a *rhematic-indexical-legisign*. People donâ??t look like their hand written signatures. Anything can be said to resemble any other thing in some way (shape, colour, sound, smell, size, orientation, function, place, etc). Thatâ??s in the nature of metaphor and figurative speech. But the use of a signature doesnâ??t depend on establishing a resemblance. That would be an *icon*, e.g. a small picture or thumbnail of yourself in a blog post or tweet.

A signature is an *index* in that it exhibits some kind of causal connection with its referent. The person to whom the signature refers makes the signature. By a complicated chain of causes a black hole makes a signature on a spectrograph. The recognition and use of a signature depends on a set of conventions (*legisign*). To be useful it has to refer to something else (a referent), a bit like a pronoun in a sentence. It is functionally incomplete without its referent (itâ??s a *rheme*). See post: Sign here.

Extreme compression

If graphical image compression continues it produces something with about as much information as a thumb nail image. That would be an icon, not an index. Even more compression produces just a blurry blob of colours, perhaps just a few pixels. That could provide just enough information to retain unique identification with the original, its referent. In that case the compressed image looks more like a signature and can function as a hash code, though not as secure.

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1. Architecture

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Tags

1. hash
2. Peirce
3. semiotics
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