The First Information Technology: Writing Systems

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IS 103
History of Information
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The journey begins...
The Dawn of Information
The Emergence of Representation
The Variety of Signs
Origins and Development of Writing Systems
Types of Writing Systems
Independent Inventions of Writing Systems
What kind of "information" has a history?

... it's always there when we look for it, available wherever we bother to direct our attention. We can glean it from the pages of a book or the morning newspaper and from the glowing phosphors of a video screen. Scientists find it stored in our genes and in the lush complexity of the rain forest. The Vatican Library has a bunch of it, and so does Madonna's latest CD. And it's always in the air where people come together, whether to work, play, or just gab.

What is it that can be so pervasive and yet so mysterious? Information, of course.

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The Scope of "Information"

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Information (that has a history) always involves the creation, storage, transmission, or manipulation of representations of states of affairs.
What we mean when we talk about "information"

Peter Lyman and Hal Varian, *How Much Information?* 2003
Quantifying "information"

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How Much Information? 2009 Report on American Consumers
The Beginnings of Material Representation

- The Beginnings of Information
- The Emergence of Representation
- The Variety of Signs
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- Types of Writing Systems
- Independent Inventions of Writing Systems
The Egyptians…believed themselves to be the most ancient of mankind….This king…contrived the following method of discovery: He took two children of the common sort, and gave them over to a herdsman to bring up at his folds, strictly charging him to let no one utter a word in their presence, but to keep them in a sequestered cottage, and from time to time introduce goats to their apartment, see that they got their fill of milk…. His object herein was to know… what word they would first articulate. … The herdsman obeyed his orders for two years, and on one day opening the door of their room, the children both ran up to him with outstretched arms, and distinctly said "Becos." …He informed his lord, [who then] learnt that "becos" was the Phrygian name for bread. In consideration of this circumstance the Egyptians yielded their claims, and admitted the greater antiquity of the Phrygians.

Herodotus, *Histories*, 2.2
The First "Information System": Language

Early theories: "bow-wow," "uh-oh," "pooh-pooh," etc.

1886: Linguistic Society of Paris forbids "toute communication concernante l'origine du langage" [All papers dealing with the origin of language]

No direct evidence about origins of language

No existing "primitive" languages
The Beginnings of Representational Artifacts

"... whereas notations of whatever sort were apparently means of recording the passage of time in terms of culturally significant events."
The First "Information System": Language

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No direct evidence about origins of language; No existing "primitive" languages. Inference from social behavior, etc.
The First "Information System": Language

Was development of language gradual or sudden? Does language presuppose neural modification?

“language” might have emerged w. *Homo erectus* (1.5 m years) or with mod. *Homo sapiens* (ca 100-150k years) But surely by 60k BP

“The momentum we see in cultural revolution after [the dispersion] was no longer genetically based... Darwinian evolution in the genetic sense continued, and underlies the rather superficial differences that are observed between different racial groups today… but the newly emerging behavioral differences between the groups were not genetically determined. They were learned, and they depended on the transmission of culture.” Colin Renfrew

Evidence from mod. genetics, archaeology, comparative anatomy, etc.
The Beginnings of Representational Artifacts

Cave paintings, Lascaux, France: ca 15,000 BC (others perhaps to 30,000 BC)

"Man's first affirmation of himself"
Maurice Blanchot

"Venus of Tan-Tan," Morocco, possibly 250k years old, but may be a naturally occurring object.
"Images and symbols… were markers of periodic and continuous cultural processes, of rites, and of repetitive myths and stories…" Alexander Marshack
The Varieties of Signs

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The Varieties of Signs

3 Types of signs (after Charles Peirce): **icon, index, symbol**

- **Icon**: relation of resemblance (more-or-less) to signified. E.g.,

- **Index**: stands in causal/spatial relation to the signified (blaze on tree to act of marking, thermometer to temperature)

- **Symbol**: arbitrary relation between sign and signified. E.g., written word *cat*, spoken word /kæt/. 
The Varieties of Signs

**Icon**: sign stands in relation of resemblance or similarity to signified (though often only roughly).
The Varieties of Signs: Indexical

**Index**: stands in causal/spatial relation to the signified (pawprint to bear, blaze on tree to act of marking, thermometer to temperature)
The Varieties of Signs: Symbols

Arbitrary (or effectively arbitrary) relation between sign and thing signified
Early Indexical Signs

Earliest signs are mnemonics for record-keeping, geneology, etc. (Tallying systems)

Knotted rope, notched stick or bone, etc.
Become frequent in upper paleolithic

Notched Bone, England, upper paleolithic, 12,000 years old

Notched Bone, Turkey, ca 3000 BC

Notched bone, Congo, ca. 25,000 BC -- may represent lunar calendar
Elaborated Indexical System: The Inca *qipu*

Knots of varying colors in llama or alpaca hair

Sequences recorded population, taxes, genealogy, astronomy (and possibly names) in base-10 positional system. System maintained by knot-keepers (*quipucamayoq*).

Limits: can record only quantity and category; requires extensive convention for interpretation
Early Iconicity

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Petroglyphs, Bhimbetka, India, ca 9000 BC

Petroglyphs, Scandinavia, Bronze Age

Rock carving, Hong Kong (Kau Sai), 3000 BC
Pictographic (Iconic) Communication Systems

Fig. 4.—Geometrical forms. (From a photograph of rocks).

Fig. 4.—Geometrical forms. (From a photograph of rocks).
"Letter of credence" presented by Chippewa delegation to Washington, 1849

"The chief salutes the president, and his warriors belonging to the eagle and catfish totems are in harmony with him and are willing to accept the white man's ways."
Pictographic Systems

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Yukaghir (Siberia) “love letter,” late 19th c.
"I know you're fighting with that Russian girl you broke up with me over. I'm unhappy in my house as I think of you, but you should know there's another guy hitting on me, so get your act together before I get married and have children."
Abstraction in pictographic systems

Extending pictographic systems to deal with abstract or relational notions. E.g., "brother," "go," etc.

A step toward the development of "true" writing:

Form signs for abstract entities by extending or combining signs for concrete things (ca. 3300 BC)

- foot = "go, come, walk, etc."
- person + mountain = "foreigner"
- eye + water = "weep," "sad," etc.

Cf modern use of "metonymic" icons
Ideographic (Semasiographic) Systems: the importance of context
Ideographic (Semasiographic) Systems: the importance of context

"Turn the key. If the car is cold, don't step on the gas pedal; if it's warm, depress the gas pedal halfway as you turn the key."
Semasiographic system: symbols stand directly for ideas, not for words of a language.

Cf mathematical notation:

\[ 10^9 = 1,000,000,000 \]

"Ten to the ninth equals a billion."/ "Zehn hoch neun gleicht eine Milliarde," "Dieci alla nona potenza equivale ad un miliardo," etc.

\[ \forall x \ (Fx \rightarrow Gx) \]

"For all x, if F of x then G of x" ("pout tout x si x est F alors x est G") "Everything that is F is G," "If something is an X it's a G,"/ "being F always entails being G," etc.

But language-independent systems appear inadequate to express the full range of thoughts & information (as opposed, e.g., to artificial languages.)
Explaining the symbol

The generic character \_ doth signify the genus of space. the acute angle on the left side doth denote the first difference, which is Time. The other affix signifies the ninth species under the differences, which is Everness. The Loop at the end of this affix denotes the word is to be used adverbially; so that the sense of it must be the same which we express by the phrase, For Ever and Ever.

John Wilkins “An Essay Towards a Real Character and a Philosophical Language” 1668
The origins of true writing

Writing – what a concept!
The origins of true writing

Writing – what a concept!

I don’t know what we’re going to do
The origins of true writing

Writing: symbols represent elements of language rather than directly representing things in the world.
The origins of true writing

Writing: symbols represent elements of language rather than directly representing things in the world.
Glottographic writing: rather than referring directly to reference/ideas, signs are associated with elements of the language (words, morphemes, syllables, phonemes).

Cf "5" vs five, "cinque, wǔ, etc.
"$" vs "dollars," etc.
Origins of Writing in Sumer

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Origins of Writing in Sumer

8-5000 BC -- earliest use of clay tokens.
4,000 BC -- earliest clay bullae
3500-3300 BC -- earliest clay tablets from Uruk.

Bullae and tokens

Early cuneiform
Tokens as origins of Sumerian writing?

### Evolution from Token to Cuneiform Writing

<table>
<thead>
<tr>
<th>Token</th>
<th>Pictograph</th>
<th>Neo-Sumerian</th>
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The Origins of "complete" writing

"Complete" glottographic system: signs denote words/signs of the language

But how to signify "abstract" words? Creation, after, but, believe, faithful, if, etc.
Metaphoric extension (cf extended meanings of head, hand, foot, etc.)
Rebus: Icons of things that stand in for their (phonetic) names
The Rebus Principle

Eye saw ewe duck deer

"I saw you duck, dear."
Rebus principle leads to logography

Rebus principle allows signs to be reutilized to signal abstract words, functional elements, etc.

“water” /a/ → “in” /a/

“oracle” /me/ → plural suffix /-me/

Accompanied by increasing conventionalization of signs...

Creates need for “determinative” signs to indicate how other signs are being used.

Eg. “marsh plant” (/te/) sign also used for name of goddess assoc. w. marshes /eresh/ -- /u/ “plant” used to indicate “marsh plant” use of sign.
Logography to Syllabic System

Logographs ultimately perceived as having purely phonetic value.

Cf English logographs – @, &, £, ¢

imagine the word  h@b&

Where does this happen in everyday life?

.
Logographs ultimately perceived as having purely phonetic value.

Cf English logographs -- imagine the word $h@b&$

Where does this happen in modern life?

Texting: CU@*$, 2G2B4GOT10, ne14?$

Signs come to stand in for syllables

Logographs ultimately perceived as having purely phonetic value.
Origins of Alphabetic Writing

Alphabetic system derived from application of syllabic system to different phonological structures.

Logographic: mod. Chinese, Japanese (mixed)

Syllabic: Linear B, Cherokee, Korean Hangul (featural)

Alphabetic: Roman, Cyrillic, Gk, Hebrew, etc,
Origins of Alphabetic Writing

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Logographic: mod. Chinese, Japanese (mixed)

Syllabic: Linear B, Cherokee, Korean Hangul (featural)

Alphabetic: Roman, Cyrillic, Gk, Hebrew, etc,

Problem with completely phonetic alphabetic systems: ambiguity.

Cf French *au, aux, ô, os, haut, hauts, eau, eaux, os, etc.*
Development of Written Symbols

Iconic
Development of Written Symbols

Simplification of sign

Iconic → Semasiographic/ideographic → Proto-writing
Development of Written Symbols

Simplification of sign

Iconic

Semasiographic/ideographic

Proto-writing

Rebus extension
Development of Written Symbols

Simplification of sign

[εlvIs]

Proto-writing

"True" (glottographic) Writing
Development of Written Symbols

Simplification of sign

Iconic

Semasiographic/ideographic

Rebus extension

Proto-writing

[εlvIs] /ɛl/

logographic syllabic

"True" (glottographic) Writing
Development of Written Symbols

Simplification of sign

Iconic → Semasiographic/ideographic → Rebus extension → [εlvIs] → /ɛl/ → /ɛ/

logographic syllabic alphabetic

"True" (glottographic) Writing
But evidence is slight for derivation of Chinese from proto-Sumerian
Later Developments

Subsequent development of further orthographic elements: word-spacing, punctuation, paragraphing, etc.

Not fixed till early age of print. Reduce ambiguity, make writing increasingly accessible to wider community or in absence of immediate context,
Later Developments

boustrophedon

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Gruss und Gruß
[Image of cows and a farm scene]
Independent Invention of Writing Systems

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Types of Writing Systems
Independent Inventions of Writing Systems
Independent writing systems: The Cherokee Syllabary

Sequoyah [George Gist] and the "talking leaves": 1819

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Independently invented writing systems: The Cherokee Syllabary

Cherokee Phoenix: First American Indian newspaper (1828)
Independently invented writing systems: Korean Hangul

Writing system invented in mid-15th c. to replace hanja (Chinese-based writing system). Invention credited to King Sejong ("the Great"), who introduced it to increase mass literacy. Possibly influenced by central Asian scripts.

Only "featural" system: symbols representing sounds as features (i.e., "labial," etc.) are clustered into a single "block" representing a syllable.
Havelock writes:

The introduction of the Greek letters into inscription somewhere around 700 B.C. was to alter the character of human culture, placing a gulf between all alphabetic societies and their precursors. The Greeks did not just invent an alphabet, they invented literacy and the literate basis of modern thought [55]….It is no accident that the pre-alphabetic cultures of the world were also in a large sense the pre-scientific cultures, pre-philosophical and pre-literary. [58]

Consider just one aspect or element of this broad claim. On the basis of the specific evidence presented by Havelock and Gough, would you say it is largely true, largely false, or true in some respects?
Assignment for 2/5


**Additional Materials**