

# Writing Systems: The First "|" "T" 

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IS 103
History of Information
Jan. 29, 2015

## i

## The journey begins...



## Itinerary, 1/29

"Information" and "Technology"
The Dawn of Information
The Emergence of Representation
The Variety of Signs
Origins and Development of Writing Systems
Types of Writing Systems
Independent Invention of Writing Systems

## The dawn of "technology"



## technology (OED) a. The branch of knowledge

 dealing with the mechanical arts and applied sciences; the study of this.

Frequency of "machinery" and "technology" in Google Books, 1900-2000

## $i$ <br> The dawn of "technology"


"Science explores,

Technology executes,
Man conforms"
—Chicago World's Fair, 1933


AGE OF OPPORTUNIT


## The dawn of "technology"

Whereas the term mechanic (or industrial, or practical) arts calls to mind men with soiled hands tinkering at workbenches, technology conjures clean, well-educated, white male technicians in control booths watching dials, instrument panels, or computer monitors. Whereas the mechanic arts belong to the mundane world of work, physicality, and practicality, technology belongs on the higher social and intellectual plane of book learning, scientific research, and the university.

Leo Marx


## What kind of "information" has a history?

The Beginnings of Information

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... 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.

John Verity in Business Week, special number on the "Information Revolution," I994

## What kind of "information" has a history?

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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.

## How much "information"?

| Storage Medium | Type of Content | Terabytes/Yr <br> Upper <br> Estimate | Terabytes/Yr Lower Estimate |
| :---: | :---: | :---: | :---: |
| Magnetic | Videotape | 1,340,000 | 1,340,000 |
|  | Audiotape | 128,800 | 128,800 |
|  | Digital tape | 250,000 | 250,000 |
|  | MiniDV | 1,265,000 | 1,265,000 |
|  | Floppy disc | 80 | pn |
|  | Zip | 350 | $3!$ |
|  | Audio MD | 17,000 | 17,00 |
|  | Flash | 12,000 | 12,00 |
|  | Hard Disk | 1,986,000 | 403,06 |
|  | TOTAL | 4,999,230 | 3,416,2 |

Source: How much information 2003

Table 1.3: Worldwide production of printed original content, if stored digitally in terabytes circa 2002. Upper estimate is scanned; lower estimate is compressed.

| Storage Medium | Type of Content | Terabytes/ Yr <br> Upper Estimate | Terabytes/Yr Lower Estimate | 1999 Upper Estimate | 1999 <br> Lower Estimate | \% Change <br> Upper <br> Estimates |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Paper | Books | 39 | 8 | 39 | 8 | 0 |
|  | Newspapers | 138.4 | 27.7 | 124 | 25 | 12\% |
|  | Office Documents | 1,397.5 | 279.5 | 975 | 195 | 43\% |
|  | Mass market periodicals | 52 | 10 | 52 | 10 | 0 |
|  | Journals | 6 | 1.3 | 9 | 2 | -33\% |
|  | Newsletters | 0.9 | 02 | 0.8 | 0.2 | 0 |

> Table 1.2: Worldwide production of original information, if stored digitally, in terabytes circa 2002. Upper estimates assume information is digitally scanned, lower estimates assume digital content has been compressed.

| Storage Medium | 2002 <br> Terabytes <br> Upper <br> Estimate | Terabytes <br> Lower <br> Estimate | 1999-2000 <br> Upper <br> Estimate | 1999-2000 <br> Lower <br> Estimate | \% Change <br> Upper <br> Estimates |
| :--- | ---: | ---: | ---: | ---: | ---: |
| Paper | 1,634 | 327 | 1,200 | 240 | $36 \%$ |
| Film | 420,254 | 76,69 | 431,690 | 58,209 | $-3 \%$ |
| Magnetic | 5187130 | $3,416,230$ | $2,779,760$ | $2,073,760$ | $87 \%$ |
| Optical | 103 | 51 | 81 | 29 | $28 \%$ |
|  | TOTAL: | $\mathbf{5 , 6 0 9 , 1 2 1}$ | $\mathbf{3 , 4 1 6 , 2 8 1}$ | $\mathbf{3 , 2 1 2 , 7 3 1}$ | $\mathbf{2 , 1 3 2 , 2 3 8}$ |


Peter Lyman and Hal Varian, How Much Information? 2003

## Quantifying "information"

The Beginnings of
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The Emergence of
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The Variety of Signs
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How Much Information? 2009 Report on American Consumers

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An information explosion?
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## The Emergence of Representation

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## The First "Information System": Language



Psamtik I, 654-610 BCE


James $V$ of Scotland

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



Psamtik I


James $V$ of Scotland

Early theories: "bow-wow," "uh-oh," "pooh-pooh," etc. I886: 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 First "Information System": Language



FOXP2 gene


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 $100-150 \mathrm{k}$ years) But surely by 60 k 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 

"... whereas notations of whatever sort were apparently means of recording the passage of time in terms of culturally significant events."


# The Beginnings of Representational Artifacts 



Cave paintings, Lascaux, France: ca $15-13,000$ BC (others perhaps to 30,000 BC)
"Man's first affirmation of himself" Maurice Blanchot

Robot \& Jacques Marsal


## 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: Indexical

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


## i



## The Varieties of Signs

Icon: sign stands in relation of resemblance or similarity to signified (though often only roughly).

## The Varieties of Signs: Symbols

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

tree


## Early Indexical Signs

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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 Limits: can record only quantity and category; requires extensive convention for intepretation


## Early Iconicity

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Petroglyphs, Bhimbetka,
India, ca 9000 BC


Rock carving, Hong Kong (Kau Sai), 3000 BC


Petroglyphs, Scandinavia, Bronze Age

# Pictographic (Iconic) Communication Systems 



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

## Pictographic (Iconic) Communication Systems


"Letter of credence" presented by Chippewa delegation
to Washington, I849
"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."

## Abstraction in pictographic systems

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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 )

$$
\begin{aligned}
& \text { foot = "go, come, walk, etc." } \\
& \text { person + mountain = "foreigner" } \\
& \text { eye + water = "weep," "sad," etc. }
\end{aligned}
$$

Cf modern use of "metonymic" icons


## Picłographic Systems

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Yukaghir (Siberia) "love letter," late 19th c.

## "Pictographic" Systems

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"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."

## Ideographic (Semasiographic) Systems: the importance of


"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."

## The limits of ideographic/ semasiographic systems

Semasiographic/ideographic 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.

$$
\forall x(F x \rightarrow G x)
$$

"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
$i$

## The origins of true writing

## The origins of true writing

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## Writing - what a concept!


a:r甲nэw૭Pwirgフ̃nэduw ${ }^{w}$

## The origins of true writing

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## Writing - what a concept!


a:r甲now૭Pwirgonn9duw I don't know what we're going to do

## The origins of true writing

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True Writing: symbols represent elements of language rather than directly representing things in the world.

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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, fünf, wŭ, etc.
"\$" vs "dollars," etc.

## Origins of Writing in Sumer

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## Origins of Writing in Sumer

$8-5000 \mathrm{BC}$-- earliest use of clay tokens.

4,000 BC -- earliest clay bullae 3500-3300 BC -- earliest clay tablets from Uruk.



Bullae and tokens


Early cunieform


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## The Origins of "complete" writing

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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.)

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## The Rebus Principle



Rebus: Icons of things that stand in for their (phonetic) names

I would like to meet you

## Rebus principle leads to logography

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

$$
\text { "water" /a/ } \rightarrow \text { "in" /a/ }
$$

T"oracle" /me/ $\rightarrow$ plural suffix /-me/

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## Logography to Syllabic System

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Logographs ultimately perceived as having purely phonetic value.
Cf English logographs - @, \&, £, 申
imagine the word h@b\&
Where does this happen in everyday life?

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## Logography to Syllabic System

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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@*\$, 2G2B4GO10, ne14Xs?


Signs come to stand in for syllables


Iconic

## Development of Written Symbols

Simplification of sign


Proto-writing

## Development of Written Symbols

## Simplification of sign



## Development of Written Symbols

## Simplification of sign

$\qquad$


## Development of Written Symbols

## Simplification of sign



## Development of Written Symbols

## Simplification of sign

$\qquad$


## Types of Writing Systems



Logographic: mod. Chinese (logosyllabic), Japanese kanji

Syllabic: Phonecian, Linear B, Cherokee, Korean Hangul (featural), Japanese (hiragana \& katakana), Bengali, Gujurati...

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

## Genealogy of Writing Systems



But evidence is slight for derivation of Chinese from proto-Sumerian

## Later Developments

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ヨ入Yร：Иヨ入』ム苂 $\overrightarrow{\text { EYEIN }}$

## boustrophedon

 away your freedom to share and change it．By contrast．
 your freedom to share and change free software－－to make
 Public License applies to most of the Free Software



Does direction of writing influence cognition？

## Lafer Developments



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


#### Abstract

     -        แ    BTMTR み\&  GhaUTRN:





## Independent Invention of Writing Systems

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## Independent writing systems: The Cherokee Syllabary

Sequoyah [George Gist] and the "talking leaves": I819

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## Independently invented writing systems: The Cherokee Syllabary



## Independently invented writing systems:

# Writing system invented in mid-I $5^{\text {th }} \mathrm{c}$. to replace hanja (Chinese-based writing system). Invention credited to King Sejong ("the Great"), who introduced it to increase mass literacy 



The word 'hangeul' in hangul

## Assignment for 2/3

## 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
Consider just one aspect or element of this broad claim. Taking into consideration both Havelock and Gough's articles, evaluate the claim from the point of view of either McLuhan or Williams. cultures, pre-philosophical and pre-literary.

## Assignment for 2/3

Havelock, Eric, "The Greek Legacy," in David Crowley,
ed. Communication in History: Technology, Culture, Society. Allyn \& Bacon. Pp. 55-62.
Gough, Kathleen. I968. Implications of literacy in traditional China and India. In Goody, Jack (ed.). Literacy in Traditional Societies.Cambridge: Cambridge University Press, 44-56.

## Additional Materials

Scribner, Silvia and Michael Cole. I988. "Unpackaging Literacy." Social Science Information, I7, I

