



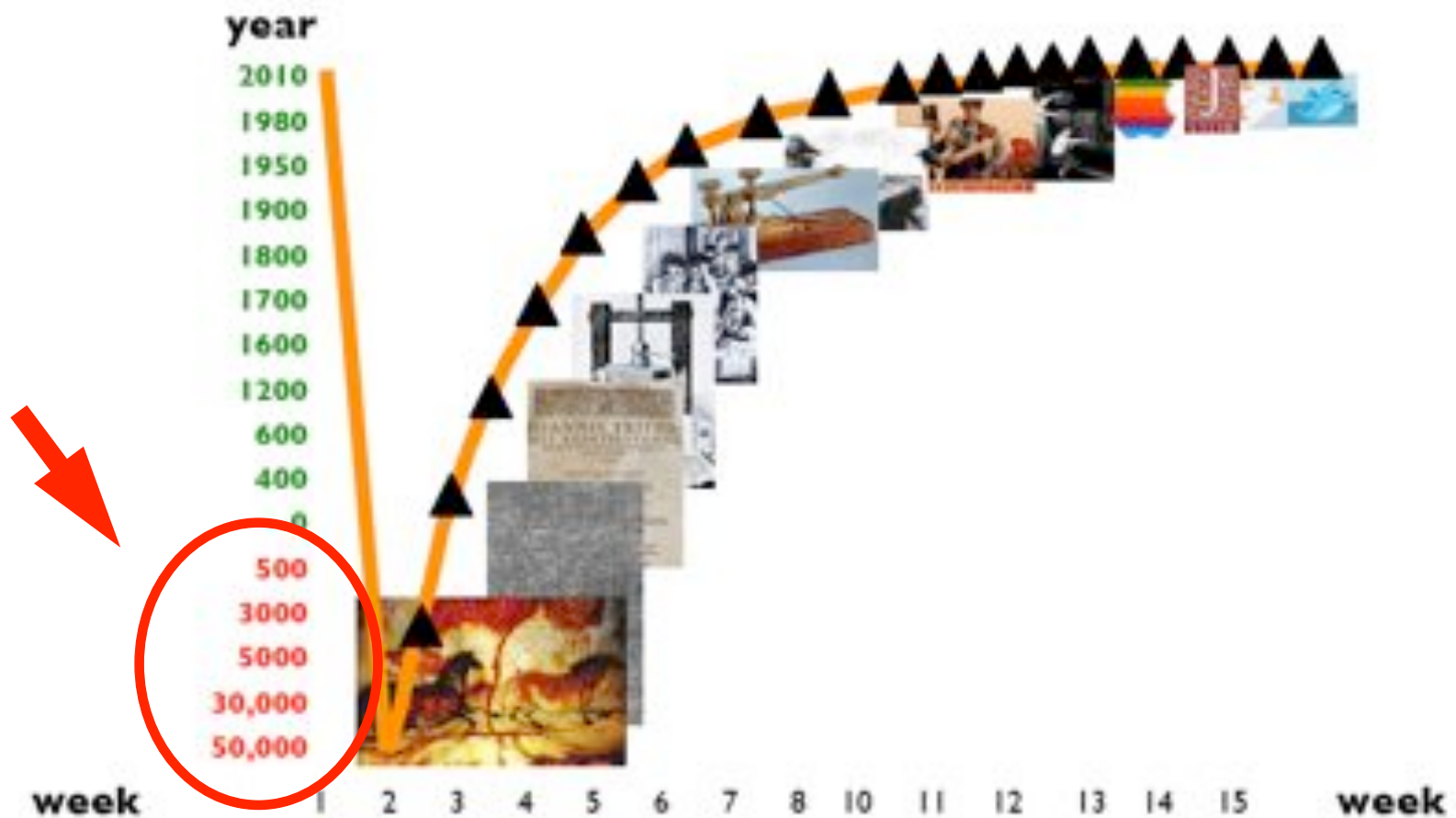
The First Information Technology: Writing Systems

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IS 218
History of Information
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The First 50,000 Years...





Itinerary, 1/28

The Origins of Language

The Origins of Representational (Symbolic)
Artifacts

The Variety of Signs

Proto-writing

The Origins and Development of Writing
Systems

Types of Writing Systems

Independent Inventions of Writing Systems



The First "Information System": Language



James V of
Scotland



FOXP2 gene

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: all modern human populations speak languages of comparable complexity.

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)

Or with Upper paleolithic tool-making (ca. 40-45 k years)



The Beginnings of Representational Artifacts



"Venus of Tan-Tan,"
Morocco, possibly
250k years old, but
may be a naturally
occurring object.



Cave paintings, Lascaux, France: ca 15-13,000 BC (others perhaps to 30,000 BC)

Man's first affirmation of himself, and expression of his own newness--when, by the ways and means of art, he entered into contact with the power, brilliance, and joyful mastery of a force that is essentially the force of a beginning. . . ."

Maurice Blanchot



The Beginnings of Representational Artifacts

"Images and symbols... were markers of periodic and continuous cultural processes, of rites, and of repetitive myths and stories..." Alexander Marshack





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 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)



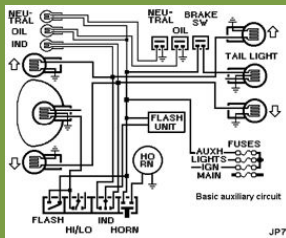
Symbol: arbitrary relation between sign and signified.

E.g., written word *cat*, spoken word /kæt/.





The Varieties of Signs

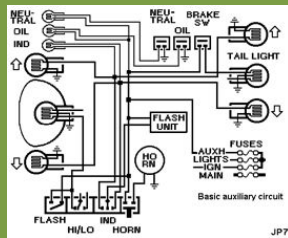


Icon: sign stands in relation of resemblance or similarity to signified (often only roughly).





The Varieties of Signs



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





The Varieties of Signs





The Varieties of Signs





Early Iconicity



Petroglyphs, Bhimbetka,
India, ca 9000 BC



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



Petroglyphs, Scandinavia, Bronze Age



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)





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



The Varieties of Signs: Symbols

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



tree



The Varieties of Signs: Symbols



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

Were there paleolithic symbols?



Elaborated Indexical System: The Inca *quipu*



Knots of varying colors in llama or alpaca hair;

Sequences recorded population, taxes, genealogy, astronomy (and possibly names) in decimal system. System maintained by knot-keepers.

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



Pictographic (Iconic) Communication Systems

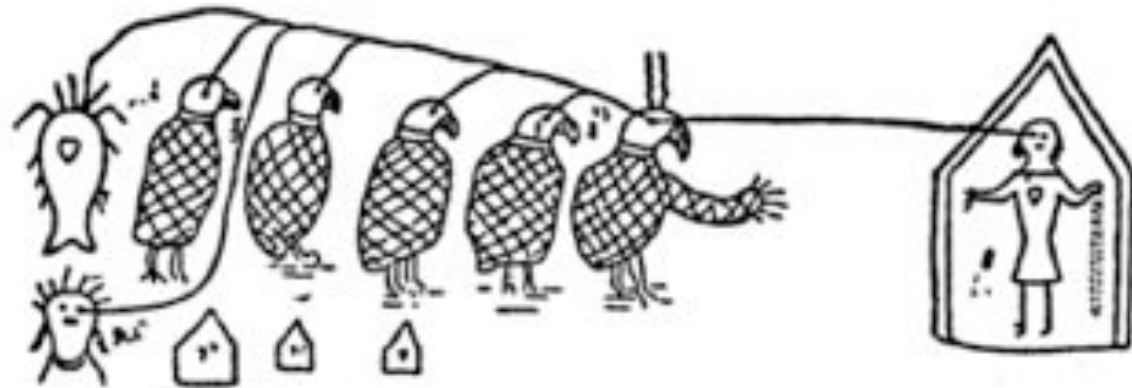


Fig. 4.—Geometrical forms. (From a photograph of rocks).





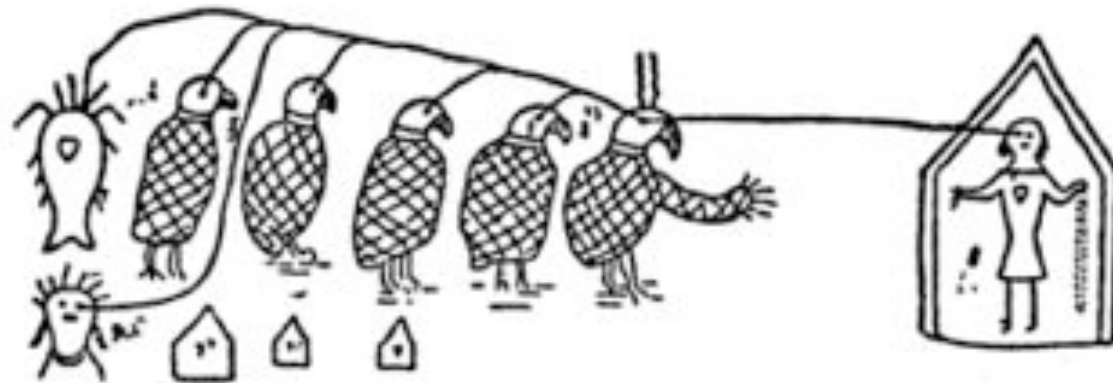
Pictographic (Iconic) Communication Systems



Kiowa message to the US President



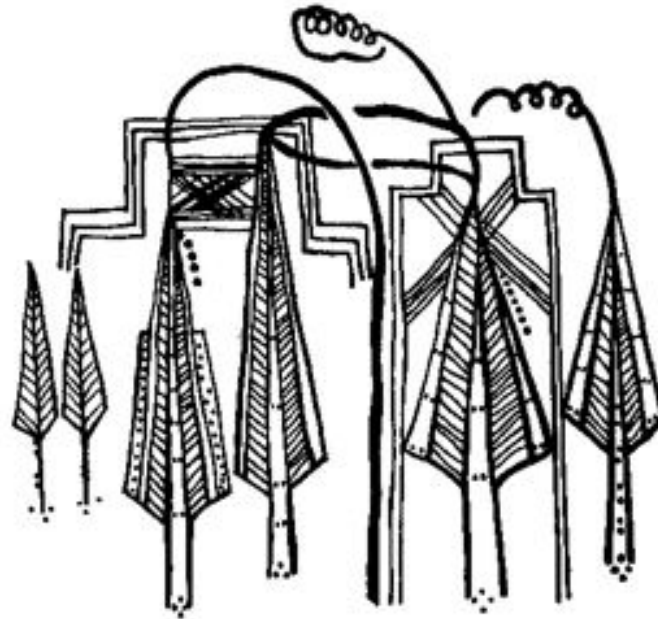
Pictographic (Iconic) Communication Systems



"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."



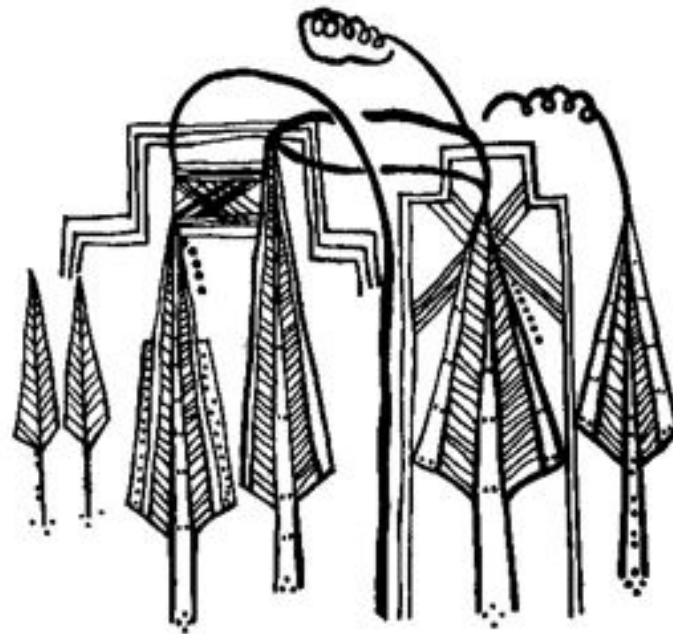
Pictographic Systems



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



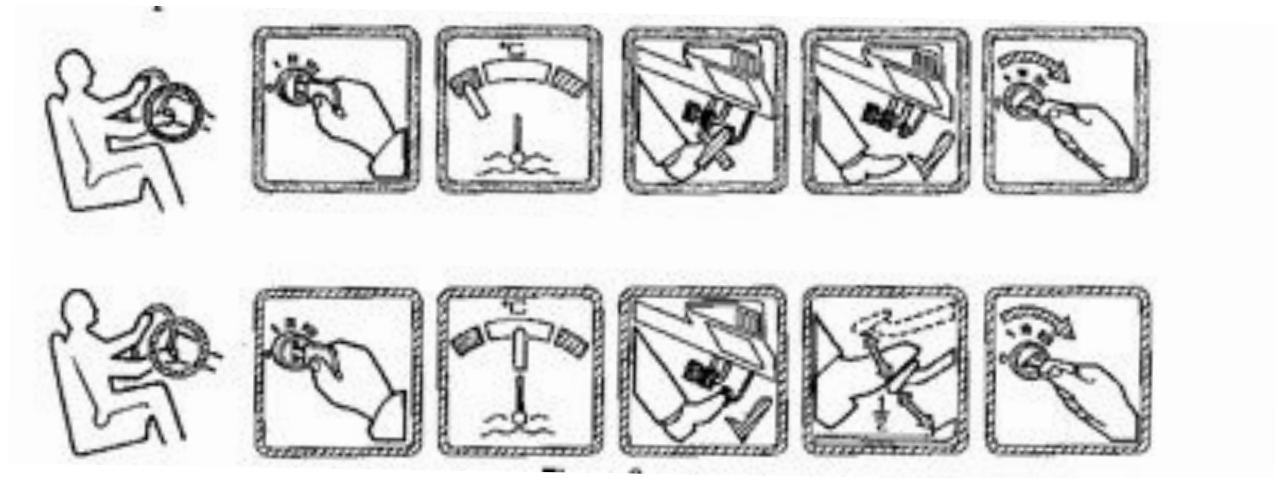
"Pictographic" Systems



"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 on the stick before I get married and have children."



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."



An Aside: The 10,000-year warning

Sandia Labs: warning signs to last 10,000 years for radioactive waste dumps.



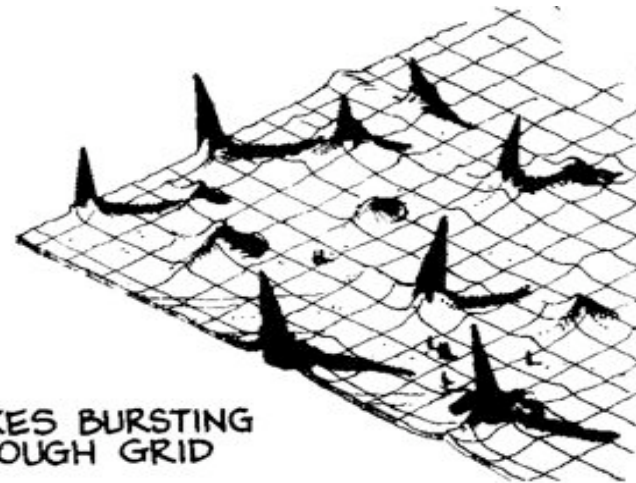
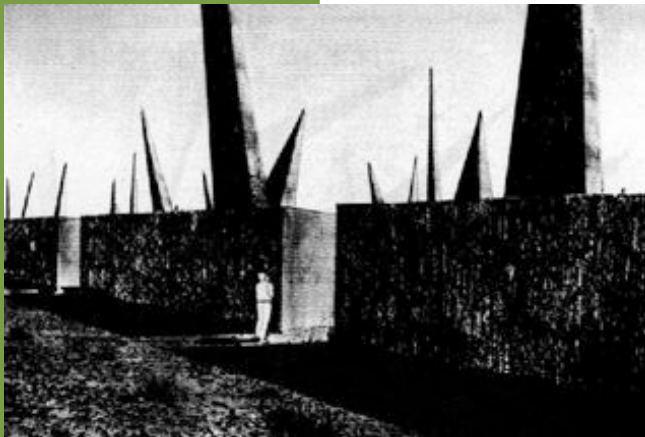
DANGER

POISONOUS RADIOACTIVE  WASTE BURIED HERE
DO NOT DIG OR DRILL HERE BEFORE A.D. 12,000





The 10,000-year warning





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" etc.

Cf modern use of "metonymic" icons





The limits of ideographic/ semasiographic systems

Semasiographic system: symbols stand directly for ideas, not for words of a language,

In theory, semasiographic systems could communicate a full range of information without reference to spoken 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 a un miliardo,"etc.

$$\forall x (Fx \rightarrow Gx)$$

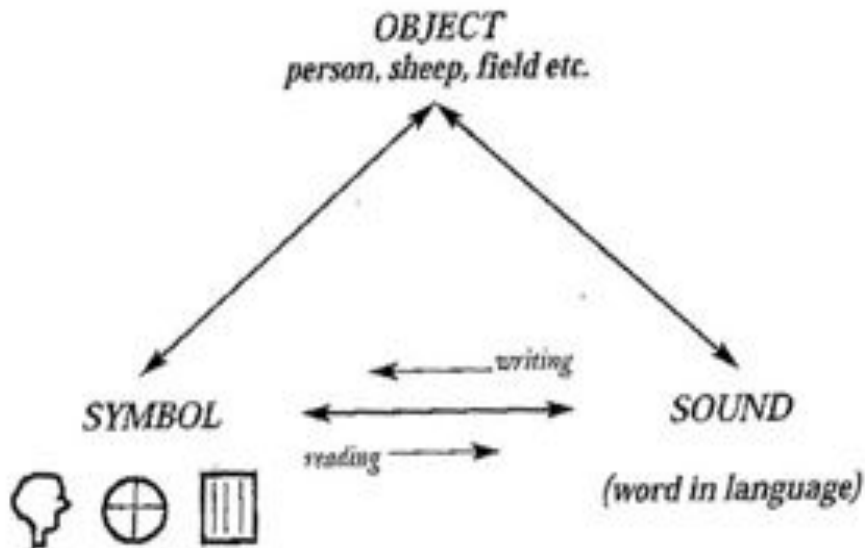
"For all x, if F of x then G of x"/"Everything that is F is G," etc.

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



The origins of true writing

1.



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, wŭ, etc.

"\$" vs "dollars," etc.



Origins of Writing in Sumer



Bullae and tokens

Early cunieform



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 cunieform



Tokens as origins of Sumerian writing?



Figure 7 Pictographic tablet from Uruk, Iraq, late fourth millennium B.C. The account in the upper central case, for example, shows the sign for sheep and five wedges standing for the abstract numeral 5. Courtesy Vorderasiatisches Museum, Staatliche Museen zu Berlin, East Germany.

Evolution from Token to Cuneiform Writing					
Token	Pictograph	Neo-Sumerian/ Old Babylonian	Neo-Assyrian	Neo-Babylonian	English
					Sheep
					Cattle
					Dog
					Metal
					Oil
					Garment
					Bracelet
					Perfume



Origins of Writing in Sumer

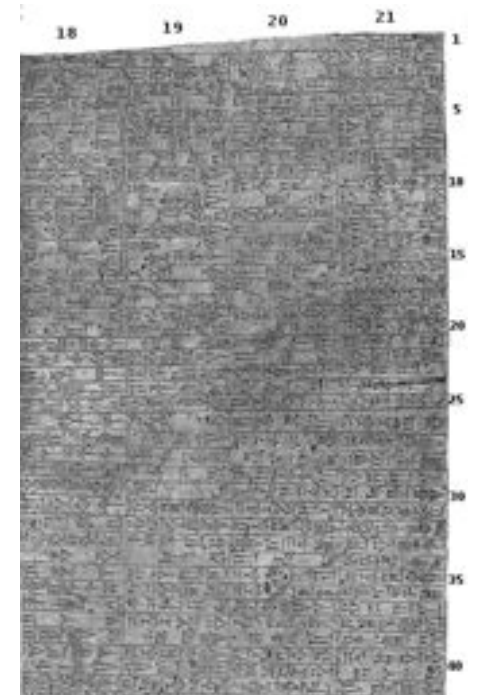


2500 BC -- cuneiform “true” writing

2400 BC script used for Akkadian

2000 BC script used for Babylonian & Assyrian..

1750 BC Code of Hammurabi





Functions of Early Writing

Writing develops as memorial aid -- things that are hard to remember...

- Commercial records

- Calendars & dates

Or that have to be said just so:

- Titles

- Laws/proclamations

- Liturgical texts

- Poetry



Origins of Writing in Sumer

Epic of Gilgamesh (7th c. BC)

He who saw everything in the
broad-boned earth, and knew what
was to be known

Who had experienced what there
was, and had become familiar with
all things

He, to whom wisdom clung like
cloak, and who dwelt together with
Existence in Harmony

He knew the secret of things and
laid them bare. And told of those
times before the Flood

In his city, Uruk, he made the walls,
which formed a rampart stretching
on...



Epic from ca.
1500-1750 BC,
existing tablets from
600 BC in
Akkadian...



Increasing Abstraction of Written Form

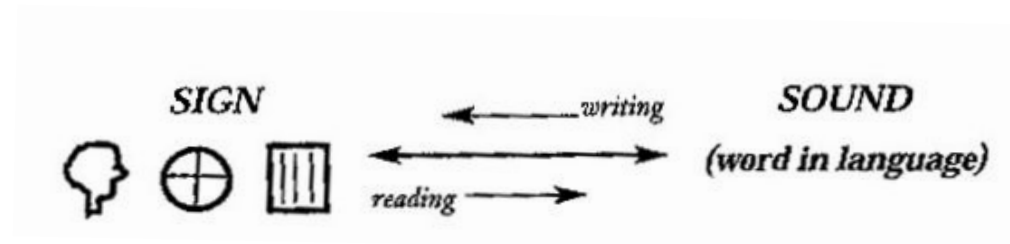
Proto-cuneiform c.3000 bc	Early cuneiform c.2400 bc	Late (Neo-Assyrian) cuneiform c.700 bc	Transcription and meaning
			ag "head"
			ka "mouth"
			du/ga/gab "go/walk/stand"
			gad "ox"
			uda "sheep"
			ku "fish"
			dag "pot"
			gi "reed, to render"

Figure 2.2 The development from proto-cuneiform, through early Sumerian cuneiform, to later Akkadian cuneiform. Proto-cuneiform signs are often pictographic, though not always, as the sign for 'sheep' shows.



The Origins of "complete" writing

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





The Rebus Principle



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/

T “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 modern life?

.



Logography to Syllabic System

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

Where does this happen in modern life?



Signs come to stand in for syllables

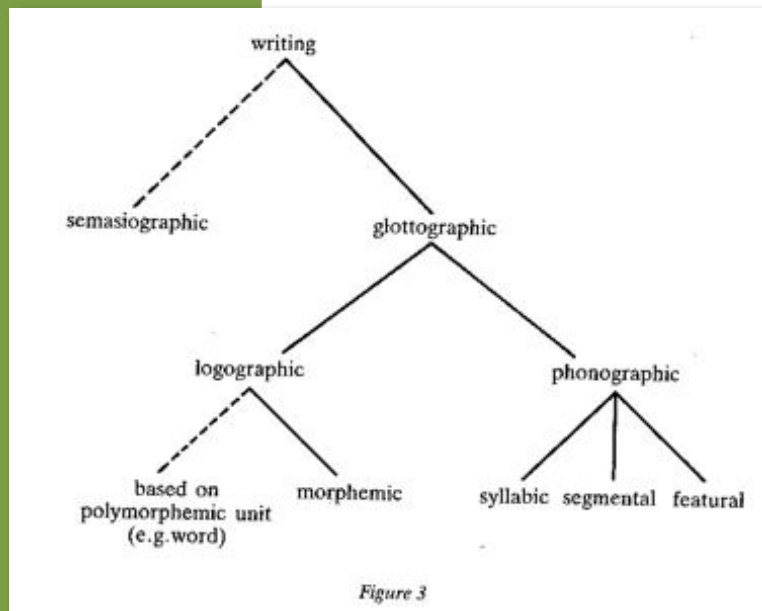
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Origins of Alphabetic Writing

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



Logographic: mod. Chinese, Japanese (mixed)

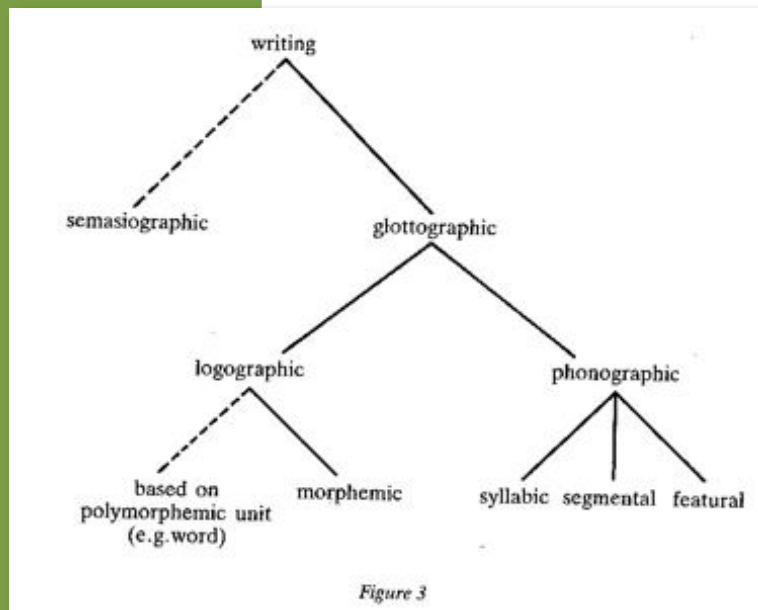
Syllabic: Linear B, Cherokee, Korean Hangul (featural)

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



Origins of Alphabetic Writing

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,

Problem with completely phonetic alphabetic systems: ambiguity.

Cf French *au, aux, ô, os, haut, hauts, eau, eaux, os*, etc.



Development of Written Symbols



Icon



Development of Written Symbols

Simplification of sign →



Iconic



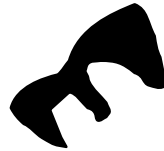
Semasiographic/
ideographic

Proto-writing



Development of Written Symbols

Simplification of sign →



Iconic

Semasiographic/
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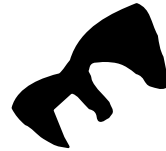
Rebus
extension

Proto-writing



Development of Written Symbols

Simplification of sign →



Iconic



Semasiographic/
ideographic



Rebus
extension



[ɛlvls]

logographic

"True" (glottographic) Writing

Proto-writing

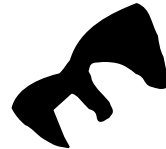


Development of Written Symbols



Iconic

Simplification of sign →



[ɛlvls]

/ɛl/

Semasiographic/
ideographic

Rebus
extension

logographic

syllabic

"True" (glottographic) Writing

Proto-writing



Development of Written Symbols

Simplification of sign →



Iconic



Semasiographic/
ideographic



Rebus
extension



[ɛlvls]

logographic



/ɛl/

syllabic



/ɛ/

alphabetic

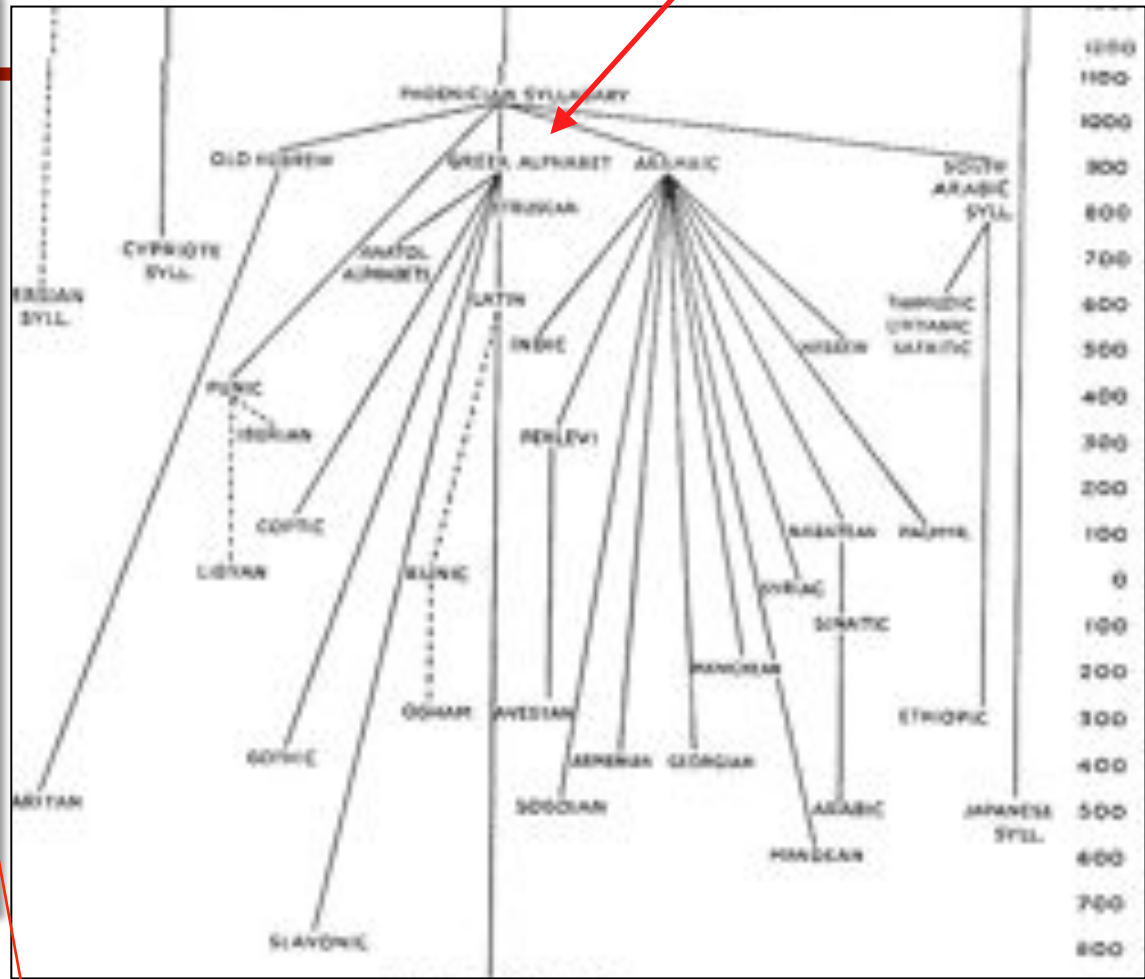
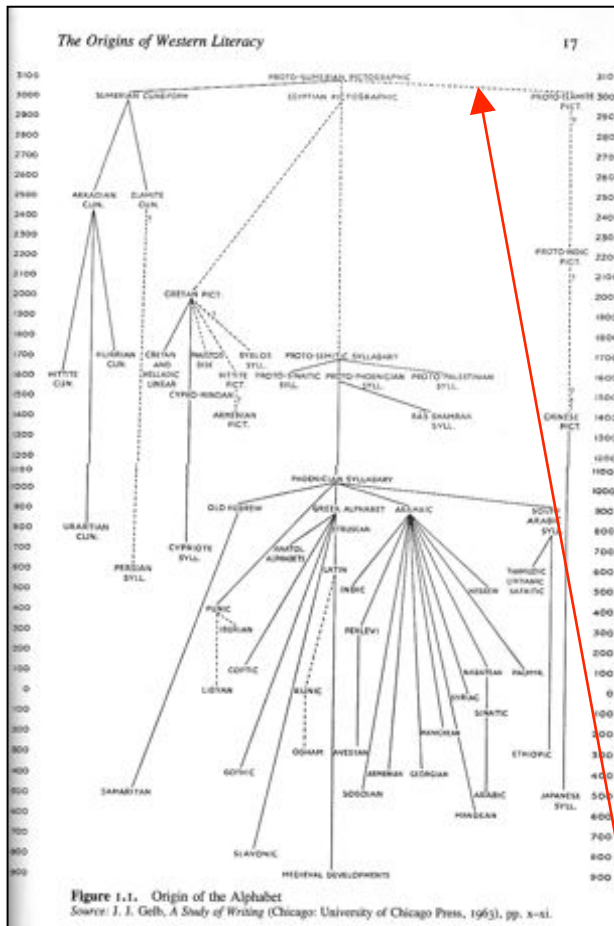
"True" (glottographic) Writing

Proto-writing



Geneology of Writing Systems

Invention of the alphabet



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



Independent Invention of Writing Systems



Independent writing systems: The Cherokee Syllabary



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

a	e	i	o	u	v[ʷ]
D a	R e	T i	Ꭰ o	Ꭱ u	Ꭲ v
S ga Ꭳ ka	F go	Y gi	A go	J gu	E gv
Ꭴ ha	P ho	Ꭶ hi	F ho	Ꭷ hu	Ꭸ hv
W la	Ꭺ le	P li	G lo	M lu	Ꭾ lv
Ꭽ ma	Ꭿ me	H mi	Ꮀ mo	Ꮁ mu	
Ꮃ na Ꮄ hna Ꮅ nah	A ne	h ni	Z no	Ꮇ nu	Ꮊ nv
Ꮎ qua	Ꮏ que	Ꮐ qui	Ꮑ quo	Ꮒ quu	Ꮓ quv
Ꮔ s Ꭵ sa	Ꮕ se	Ꮖ si	Ꮗ so	Ꮘ su	R sv
Ꮚ da W ta	S de Ꭰ te	J di Ꭱ to	V do	S du	Ꮟ dv
Ꮢ dia Ꭲ tia	L tie	C ti	Ꮥ tio	Ꮦ tu	P tiv
G tsa	T tse	Ꭶ tsi	K tso	Ꭷ tsu	Ꭸ tsv
G wa	Ꭺ we	Ꭲ wi	Ꭳ wo	Ꭴ wu	Ꭵ wv
Ꭶ ya	B ye	Ꭷ yi	Ꭸ yo	G yu	B yv



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 writing system). Invention credited to King Sejong ("the Great"), who introduced it to increase mass literacy. Possibly influenced by central Asian scripts.

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





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

ΦΑΝΟΔΙΚΟ
 ΧΟΜΨΟΤΙΜΕ
 ΡΑΤΕΟΣΤΟ
 ΗΝΙΟΧΟΡΠ
 ΣΙΟΚΡΗΤΗΡ
 ΧΟΠΥΙΑΚ:ΕΔΑ
 ΡΗΤΗΡΙΟΝ:Κ
 ΠΞ:ΙΟΜΘΗΑ
 ΡΥΤΑΝΗΙΟΝ
 ΕΥΚΕΝ:ΣΥΚΕ
 ΕΥΣΙΝ

boustrophedon

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

it is so far as me hence forth free that I am to write the history her civil administ
 ration and the conduct of her war her annually elected magistrates the aut
 hority of her lawssupreme over all her citizensthe tyranny of the last king m
 a de this liberty all the more welcome for such had been the rule of the forme
 r kingsthat they might not undeservedly
 be counted as founders of parts at all events of the city



Later Developments

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

It is of a Rome henceforth free that I am to write the history-- her civil administration and the conduct of her wars, her annually elected magistrates, the authority of her laws supreme over all her citizens. The tyranny of the last king made this liberty all the more welcome, for such had been the rule of the former kings that they might not undeservedly be counted as founders of parts, at all events, of the city...



The Role of Punctuation

I spoke to the boys Sam and Tom.
The press secretary gave them the rules
they were not allowed to speak to the
committee directly.
To my parents Ayn Rand and God.



The Role of Punctuation

Comrade Stalin. You are right and I was wrong. You are the true heir to Lenin. I should apologize. Trotsky





The Role of Punctuation

Comrade Stalin. You are right and I was wrong? *You* are the true heir to Lenin? *I* should apologize?? Trotsky

