The Organization of Knowledge

History of Information i103
Geoff Nunberg

Feb. 21, 2013
Getting modern
Defining "knowledge"
The shifting frame of knowledge; from Renaissance to Enlightenment
Early reactions to "information overload"
New conceptualizations of knowledge
The material representations of knowledge: encyclopedias, libraries, museums, dictionaries
The Emergence of the Modern "Informational System"

Many, if not most, of the cultural phenomena of the modern world derive from [the 18th century] -- the periodical, the newspaper, the novel, the journalist, the critic, the public library, the concert, the public museum [not to mention advertising, intellectual property, propaganda, the scientific society (and science itself), the modern dictionary and encyclopedia, etc.– GN]. Perhaps most important of all, it was then that 'public opinion' came to be recognized as the ultimate arbiter in matters of taste and politics."--Tim Blanning, The Culture of Power

The political & social significance of "information"
Defining "knowledge"
Defining "knowledge"

Individual senses

*Oxford English Dictionary:*

Acquaintance with a branch of learning, a language, or the like; *His knowledge of French is excellent.*

Collective sense

The sum of what is known. *All knowledge may becommodiously distributed into science and erudition.*
Collective knowledge: the missing roles

Collective sense: knowledge as a three-place relation

The sum of what is known [about X] [by Y]

"Medical knowledge" vs "medical information"

The difference between "knowledge" and "what is known."
What makes for "knowledge"?

What qualifies something as (collective) knowledge?

P is collectively significant

- Nunberg's out of paper towels
- Kimberly-Clark closed at $59.41 yesterday.
- Paper towel consumption is 50% higher in America than in Europe.
- Arthur Scott introduced the first paper towel in 1931.
Shifting Conceptions of Knowledge, 1500-1800
The archaeology of knowledge

How do we characterize conceptions of "knowledge" historically?

- Explicit descriptions & theories
- Models/images of knowledge in
  - Forms of institutions & practices (curriculum)
  - Material embodiments (library, museum, form of book)
  - Textual embodiments – encyclopedia, dictionary, compendium, bibliography
  - Metaphors & visualizations: field, tree, discipline, trésor, etc.
Shifting Conceptions of Knowledge, 1500-1800

Varieties of Renaissance knowledge:

*scientiae/artes*: "Ars sine scientia nihil est."

Higher vs lower

General/specialized

The "universal man" (*polymathia, pansophia*) "A man is able to learn many things and make himself universal in many excellent arts." Matteo Palmieri, 1528

Book-learning vs knowledge of things
The 15th-Century Curriculum

The *enkyklios paideia* ("circle of 'learning'"):

- **Trivium**: grammar, logic, rhetoric
- **Quadrivium**: arithmetic, astronomy, geometry, music
- The three philosophies: ethics, metaphysics, "natural philosophy"
- Higher faculties: theology, medicine, law
The 15th-Century Curriculum

Curriculum roughly uniform throughout Europe, enabled *peregrinatio academica*

"town and gown"

System of knowledge is "closed"

Organization of knowledge fixed and "natural"
Changing Frames of Knowledge

Within 200 years, something like the mod, system emerges.

Responses to influences that are:
- Pragmatic/material
- Philosophical/academic
- Symbolic/political

(Not independent…)

But how can we tell that the system of knowledge has changed?
Breaking with the past

It would disgrace us, now that the wide spaces of the material globe, the lands and seas, have been broached and explored, if the limits of the intellectual globe should be set by the narrow discoveries of the ancients. Francis Bacon, *The Advancement of Learning*, 1605
Opening the World of Knowledge: Botany

*Herbarum vivae eicones* ("Living Pictures of Herbs") by Otto Brunfels, 1532. Matched Swiss & German plants to those known to Pliny and Dioscorides, ignoring differences, with residual *herbae nudae* ("naked plants")
Opening the world of knowledge

Valerius Cordus, *Historia plantarum* 1561 (1544), published posthumously by Conrad Gesner.

Records numerous plants not described by the ancients; emphasizes differences among similar plants.

By 1600, thousands of species are described, though in disorganized fashion.

Systems of description (not taxonomies) emerge. Plants bear four names (common, pharmacists' Latin, trad. Latin, Greek)

Drawing annotated by Gestner
Opening the world of knowledge

John Ray, *Historia generalis plantarum*, 1686-

Classified 6100 plant species by seeds, seeds, fruit and leaves. Produced first modern definition of the species.

"... no surer criterion for determining species has occurred to me than the distinguishing features that perpetuate themselves in propagation from seed. Thus, no matter what variations occur in the individuals or the species, if they spring from the seed of one and the same plant, they are accidental variations and not such as to distinguish a species...

“I reckon all Dogs to be of one Species, they mingling together in Generation, and the Breed of such Mixtures being prolific”
The birth of "modern" classification

"I know no greater man on earth." Jean-Jacques Rousseau
The birth of "modern" classification

Plants classified into 24 classes according to length and number of stamens; further classified into orders etc. Established binary system of naming.

Frontispiece to Linnaeus, *Hortus Cliffortianus* 1737
Organizing Knowledge
Responses to Early Modern "Information Overload"

Linneaus, index card, ca 1760
Pragmatic Forces: Perceptions of "Information Overload"

Antonfrancesco Doni, 1550: there are “so many books that we do not have time to read even the titles.”

“That horrible mass of books… keeps on growing, [until] the disorder will become nearly insurmountable." Gottfried Leibniz, 1680
### Increasing number of books

<table>
<thead>
<tr>
<th>Period</th>
<th>Number of Titles Printed in England</th>
</tr>
</thead>
<tbody>
<tr>
<td>1630s</td>
<td>600</td>
</tr>
<tr>
<td>1640s</td>
<td>1,600</td>
</tr>
<tr>
<td>1650s</td>
<td>1,200</td>
</tr>
<tr>
<td>1660s</td>
<td>800</td>
</tr>
<tr>
<td>1670s</td>
<td>1,000</td>
</tr>
<tr>
<td>1680s</td>
<td>1,500</td>
</tr>
<tr>
<td>1690s</td>
<td>1,400</td>
</tr>
<tr>
<td>1700-50</td>
<td>500</td>
</tr>
<tr>
<td>1750-89</td>
<td>600</td>
</tr>
<tr>
<td>1790-1800</td>
<td>800</td>
</tr>
<tr>
<td>1800-1810</td>
<td>800</td>
</tr>
<tr>
<td>By 1827</td>
<td>1,000</td>
</tr>
</tbody>
</table>

### Size of personal libraries
- Personal library of typical French magistrate, 15<sup>th</sup> c. 60 books
- Montaigne, late 16<sup>th</sup> c. 1000 books
- Montesquieu, early 18<sup>th</sup> 3000 books

By 1827 ("rising fast")
The endless anxiety...

It will soon be the employment of a lifetime merely to learn [books'] names. Many a man of passable information at the present day reads scarcely anything but reviews, and before long, a man of erudition will be little better than a mere walking catalogue. Washington Irving, 1822

Books are not only printed, but in a great measure written and sold by machinery.... Every little sect among us, Unitarians, Utilitarians, Anabaptists, Phrenologists, must have its periodical, its monthly or quarterly magazine, hanging out like its windmill ...to grind meal for society. Thomas Carlyle, 1840
The endless anxiety...

Something has happened in the last hundred years to change the relation of the written word to daily life. Whether it is the records we have to keep in every business and profession or the ceaseless communicating at a distance which modern transport and industry require, the world's work is now unmanagenable, unthinkable, without literature. ...[There is a] huge number of activities which (it would seem) exist only to bombard us with paper... Jacques Barzun, 1954

And while Mr. Reagan prospered in schools without libraries, I believe that the "information explosion" of more recent years has made school libraries necessary. This is the information age! There is an information explosion. Some students will need a longer period of time to master mathematics, science, economics, world history. 1983
The endless anxiety...

Relative to your current position, an exponential curve looks just as scary wherever you get on board. G Nunberg, *floreat* 2012
The Reorganization of Libraries

Gabriel Naudé proposes library organization scheme to “find books without labor, without trouble, and without confusion.” (1627)
Creation of "reference" works

Compendia and reference books (répertoires or trésors)

Répertoires divided into:

- Dictionaries (& onomasticons); Florilegia (collections of sayings, etc.); commonplace books; miscellanies…

"I esteem these Collections extreamly profitable and necessary, considering, the brevity of our life, and the multitude of things which we are now obliged to know, e’re one can be reckoned amongst the number of learned men, do not permit us to do all of ourselves."  Gabriel Naudé, 1661

The Cyclopaedia will "answer all the Purposes of a Library, except Parade and Incumbrance.”  Ephraim Chambers, 1728
Men of good will have extracted the substance of a thousand volumes and passed it in its entirety into a single small duodecimo, a bit like skillful chemists who press out the essence of flowers to concentrate it in a phial while throwing the dregs away."

Louis-Sebastian Mercier, *L'An 2440*, 1771
Strategies for dealing with information overload

The most accomplished way of using books at present is twofold. Either, first, to serve them as men do Lords, learn their titles exactly and then brag of their acquaintance:—or, secondly, which is indeed the choicer method, to get a thorough insight into the Index, by which the whole book is governed and turned, like fishes, by the tail... Thus men catch knowledge by throwing their wit on the posteriors of a book, as boys do sparrows by flinging salt upon the tail.

Jonathan Swift, "Tale of a Tub," 1704

...How Index-learning turns no student pale, Yet holds the eel of Science by the tail.

Pope, "The Dunciad," 1728
Strategies for dealing with information overload

Compendia and reference books (*répertoires* or *trésors*)

As long as the centuries continue to unfold, the number of books will grow continually, and one can predict that a time will come when it will be almost as difficult to learn anything from books as from the direct study of the whole universe. It will be almost as convenient to search for some bit of truth concealed in nature as it will be to find it hidden away in an immense multitude of bound volumes.

—Denis Diderot, *Encyclopédie*, 1755
Strategies for Dealing with Information Overload

Note-taking system described by Vincent Placcius, from De arte excerpendi, 1689
Reconceptualizations of Knowledge
Vincent de Beauvais, Speculum triplex, 1244, in 3 divisions:

Speculum naturale: God, angels & devils, man, the creation, and natural history

Speculum doctrinale: Grammar, logic, ethics, medicine, crafts…

Speculum historiale: History of the world…
New Schemes of Organization: Philosophical Influences

Francis Bacon's scheme puts man at the center:
Nature (astronomy, meteorology, etc.).
Man (anatomy, powers, actions),
Man acting on nature (medicine, visual arts, arithmetic),
The Tree of Bacon

The Two Trees of Bacon

[Diagram showing the two trees of Bacon]
The Tree of Bacon

- **Reason**
  - Divine or Natural Theology
    - Pure Mathematics
    - Geometry
    - Astronomy
  - Natural Science
    - Physics
    - Metaphysics
  - Experimental Philosophy
    - Mixed Mathematics
    - Cosmography
    - Architecture
    - Engineering

- **Philosophy**
  - Human
    - Individual
      - Nature of the soul
        - Devotion
        - Fascination
        - Invention
        - Judgment
      - Mind
        - Rational
        - Memory
        - Tradition or Delivery
        - Speech
        - Writing
        - Grammar
        - Logic
        - Rhetoric
      - Moral
        - Nature of the good Culture of the mind
        - Conversation
        - Negotiation
        - Government
  - Civil
    - Nature of God
      - Knowledge of God
      - Works of God
    - Law of Nature
      - Law of People
      - Law of Governments
    - Language of the Church
Chamber's Cyclopædia, 1728

The Tree of Chambers

<table>
<thead>
<tr>
<th>KNOWLEDGE, is either</th>
<th>OR.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaic and Aristotelian, containing the application of general notions to broader purposes, which is a</td>
<td>KNOWLEDGE.</td>
</tr>
<tr>
<td>Real employment of the power of reason and intelligence, which is to</td>
<td>KNOWLEDGE.</td>
</tr>
<tr>
<td>Knowledge, scientific</td>
<td>KNOWLEDGE.</td>
</tr>
<tr>
<td>Knowledge, mechanical</td>
<td>KNOWLEDGE.</td>
</tr>
<tr>
<td>Knowledge, theoretical</td>
<td>KNOWLEDGE.</td>
</tr>
<tr>
<td>Knowledge, practical</td>
<td>KNOWLEDGE.</td>
</tr>
<tr>
<td>Knowledge, moral</td>
<td>KNOWLEDGE.</td>
</tr>
<tr>
<td>Knowledge, religious</td>
<td>KNOWLEDGE.</td>
</tr>
<tr>
<td>Knowledge, mystical</td>
<td>KNOWLEDGE.</td>
</tr>
<tr>
<td>Knowledge, speculative</td>
<td>KNOWLEDGE.</td>
</tr>
</tbody>
</table>

The Tree of Chambers is a representation of the hierarchy and relationships of knowledge and science as presented in Chamber's Cyclopædia.
The Encyclopédie

First vol. appears in 1751; last in 1772

Denis Diderot
The tree of human knowledge could be formed in several ways, either by relating different knowledge to the diverse faculties of our mind or by relating it to the things that it has as its object. … But how could there not be arbitrariness? Nature presents us only with particular things, infinite in number and without firmly established divisions. Everything shades off into everything else by imperceptible nuances.

D’Alembert, Preliminary Discourse to the *Encyclopédie*
The "objectivity" of knowledge

[T]he encyclopedic arrangement of our knowledge … consists of collecting knowledge into the smallest area possible and of placing the philosopher at a vantage point, so to speak, high above this vast labyrinth, whence he can perceive the principle sciences and the arts simultaneously. From there he can … discern the general branches of human knowledge, ... and sometimes he can even glimpse the secrets that relate them to one another. It is a kind of world map which is to show the principle countries, their position and their mutual dependence, the road that leads directly from one to the other.
A “true scheme” of knowledge?

… a certain Chinese encyclopaedia entitled 'Celestial Empire of benevolent Knowledge'. In its remote pages it is written that the animals are divided into: (a) belonging to the emperor, (b) embalmed, (c) tame, (d) sucking pigs, (e) sirens, (f) fabulous, (g) stray dogs, (h) included in the present classification, (i) frenzied, (j) innumerable, (k) drawn with a very fine camelhair brush, (l) et cetera, (m) having just broken the water pitcher, (n) that from a long way off look like flies.

…there is no classification of the Universe not being arbitrary and full of conjectures

Jorge Luis Borges
The Tree of Diderot & D'Alembert
The Tree of Diderot & D'Alembert
The Tree of Diderot & D'Alembert

ESSAI D'UNE DISTRIBUTION GÉNÉALOGIQUE DES SCIENCES ET DES ARTS PRINCIPAUX.

Selon l'Explication détaillée du Système des Connaissances Humaines dans le Discours préliminaire des Editeurs de l'Encyclopédie publiée par M. Diderot et M. d'Alembert, Weimar, 1769

Art of Remembering.
  Natural.
  Artificial.
  Prenotion.
  Emblem.
Supplement to Memory.
  Writing.
  Printing.
  Alphabet.
  Cipher.

Arts of Writing, Printing, Reading (process) | Reading, Deciphering.
  Orthography.
  Art of printing
  Art of deciphering
  Art of writing
  Art of reading
The Tree of Diderot & D'Alembert

"Système Figuré Des Connaissances Humaines"
http://goo.gl/xiBcR
"Sciences, Arts Libéraux, Arts Méchaniques"

Formier

Economie Rustique (silk-making)
"Sciences, Arts Libéraux, Arts Méchaniques"

…the advantage that the *liberal* arts have over the *mechanical* arts, because of their demands upon the intellect and because of the difficulty of excelling in them, is sufficiently counter-balanced by the quite *superior* usefulness which the latter for the most part have for us….while justly respecting great geniuses for their enlightenment, society ought not to degrade the hands by which it is served”

d'Alembert, Preliminary Discourse to the Encyclopédie
Organizing the Trésor
If thou be desirous (gentle Reader) rightly and readily to understand, and to profit by this Table, and such like, then thou must learn the Alphabet, to wit, the order of the Letters as they stand, perfecty without booke, and where every Letter standeth: as (b) neere the beginning, (n) about the middest, and (t) toward the end. Nowe if the word, which thou art desirous to finde, begin with (a) then looke in the beginning of this Table, but if with (v) looke towards the end. Againe, if thy word beginne with (ca) looke in the beginning of the letter (c) but if with (cu) then looke toward the end of that letter. And so of all the rest. &c.

Rob't Cawdrey, A table alphabeticall conteyning and teaching the true writing, and understanding of hard usuall English wordes, borrowed from the Hebrew, Greeke, Latine, or French, &c 1604

What is this???
Practical advantages of alphabetical order:

Facilitates access to particular entries (assuming a certain mode of reading)

Philosophically modest

"It might be more for the general interest of learning, to have the partitions thrown down, and the whole laid in common again, under one undistinguished name."

Ephraim Chambers
The Grand Larousse was everything to me; I would take down a volume at random, behind the desk, on the next-to-last shelf. A-bello, belloc-Ch, or Ci-D. . . (these associations of syllables had become proper names that denoted the sectors of universal knowledge: there was the Ci-D region, the Pr-Z region, with their flora and fauna, their cities, their great men and their battles). ... Men and beasts were there in person -- the engravings were their bodies, the text was their souls, their unique essences. Jean-Paul Sartre, Les Mots
Ilma Julieta Urrutia Chang was Guatemala's national representative for the major beauty pageants in 1984.

The N battery is a type of battery. It has a battery. It has a diameter of 12 mm and a height of 30.2 mm. For a typical alkaline battery, the N size weighs 9 grams.

A System Requirements Specification (SRS) is a document where the requirements of a system that is planned to be developed are listed.

Protestants in Eritrea are about 91,232, which are 2% of the population.
Material Representations of Knowledge
Material Representations of Knowledge

Leiden University Library, 1610
Material Representations of Knowledge

Curriculum mirrored in form of library (bibliographies)

Leiden University Library, 1610
Knowledge and the "Virtuosi"

"He Trafficks to all places, and has his Correspondents in every part of the World; yet his Merchandizes serve not to promote our Luxury, nor encrease our Trade, and neither enrich the Nation, nor himself. A Box or two of Pebbles or Shells, and a dozen of Wasps, Spiders and Caterpillers are his Cargoe. He values a Camelion, or Salamander’s Egg, above all the Sugars and Spices of the West and East-Indies… He visits Mines, Cole-pits, and Quarries frequently, but not for that sordid end that other Men usually do, viz, gain; but for the sake of the fossile Shells and Teeth that are sometimes found there." (Mary Astell, "Character of a Virtuoso," 1696)
Representations of Knowledge: The Kunstkammer

Organization of knowledge mirrored in form of Kunstkammer, cabinets of curiosities, Wunderkammer, etc.

Museum Wormiamum, 1655
Representations of Knowledge: The Kunstkammer

Natural History Kabinet, Naples, 1599
Representations of Knowledge: The Studiolo

Studiolo of Francesco I
Florence (1570)

Kunstkammer, 1636
Representations of Knowledge: The Studiolo

Studiolo of Federico da Montefeltro Urbino (ca. 1460) with wood intarsia (inlay)
Representations of Knowledge: The Kunstschränk

The Kunstschränk (art cabinet or art shrine)
From Cabinets to Museums

Kunstkammers first made available for public viewing in mid-17th. C (Kunstmuseum Basel, 1661)

Public museums in 18th c:

- British Museum, 1759, containing cabinet of curiosities assembled by Hans Sloan, ms collections, Royal Library. Later: collections of antiquities, etc.

- Uffizi Gallery, Florence, 1765

- Belvedere Palace, Vienna, 1781

- Louvre Palace opened to public in 1793 with royal collections; augmented by Napoleon
17th c. Galleries

23. The Imperial Gallery in Prague, by Johann Bretschneider, 1714. The paintings are arranged according to the visual and decorative effect.
18th c. Galleries

Painting Galleries, Schloss Belvedere, Vienna, 1781

Rationalizing the organization of the trésor
Readings for Feb. 26


Johnson, Samuel. 1755. “Preface” to the *Dictionary*.

Johnson, Samuel. 1785 (1755). *A Dictionary of the English Language*. Slide hand icon at the bottom and page forward/back until you come to the definition of dictionary.)
Homework for Feb. 26

Read the descriptions of the procedures Johnson followed in compiling his dictionary in Macarthur and in Johnson's Preface. How might the procedures have been different if he had had modern technologies at his disposal—a networked computer, substantial corpora of online literature and texts, and so forth. Can the entire procedure of lexicography be crowd-sourced, à la the Urban Dictionary? Do you think we still require professional lexicographers?

Answer some of these questions in no more than 500 wds