Illustrating the Enlightenment

Illuminating the Evolution of Scientific Illustration during the 18th century

DIGITAL HUMANITIES HACKATHON HELSINKI

Early modern naturalists used illustrations as evidence of the observations and visualizations of knowledge. The emergence of new scholarship had a significant impact on the illustrations produced for British audiences. The Enlightenment brought about profound changes in society, leading to an increased demand for popular scientific publications. By tracing patterns in the illustrations and their reuse, it becomes evident that they served different purposes, which is reflected in the formats and contents of these publications.

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1704 J. Ray, *Historia plantarum*

1705 Halley's comet discovered based on Newton's earlier findings

1715 Four-field crop rotation

1719 First volume of *The Compleat Herbal*

1735 C. Linnaeus, *Systema Naturae*

1750 C. Linnaeus, *Philosophia Botanica; Species Plantarum;* ~Industrial Revolution starts in Britain

1757 British rule in India

1761 Transit of Venus observed from many stations around the world: international scientific cooperation

1768 First scientific voyage of the British Royal Navy (J. Cook); J. Banks recorded loads of species

1771 *Encyclopædia Britannica;* C. Messier's catalogue of astronomical objects

~1795 Evolution and common descent (E. Darwin); extinctions (G. Cuvier)

1859 C. Darwin: *On the Origin of Species*

Research Questions

How were the intellectual, economic, and societal changes of the Enlightenment era reflected in the use of scientific illustrations?

- How did the content of the publications reflect the advancements in natural history?
- How is the book format linked to the characteristics of the publications?
- How do illustrations and their reuse demonstrate the change or diffusion of knowledge?
- Did the quality of illustrations improve and what does it indicate?

Data

- The dataset comprises over 100K page images from 4745 publications.
- Scientific collection from Eighteenth Century Collections Online (ECCO).

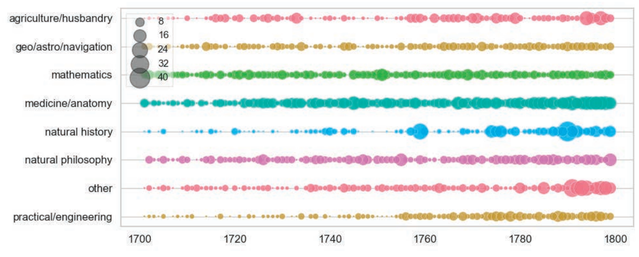
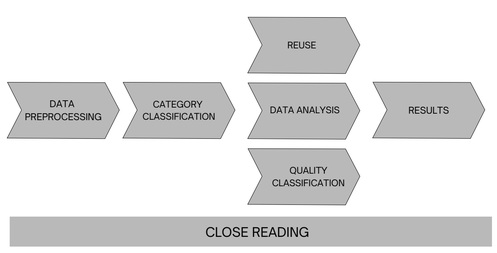
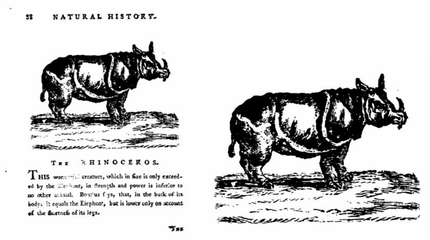


Fig. 1 The concentration of the used publications throughout the decade divided by subject.

Methods & Pipeline





✗ Anatomy
✗ Architecture
✗ Botanical
✗ Mathematical / Astronomical
✓ Zoological
...

- **Data preprocessing**: Image segmentation and object detection using Deep Learning and Convolutional Neural Networks.
- **Category classification:** Comparing a custom model trained on human annotations with the CLIP model.
  - For the resulting predictions, the certainty threshold was set to 50% to filter out possible misclassifications.
- **Reuse analysis**: Identifying similar pictures from the dataset.
  - Based on embeddings and cosine similarity.
- **Image quality classification**: Classifying illustrations into high- and low-quality categories.
  - A classifier trained on 700 and evaluated on 400 images, achieving 84.5% accuracy.
- **Data analysis:** Combining quantitative and qualitative perspectives.

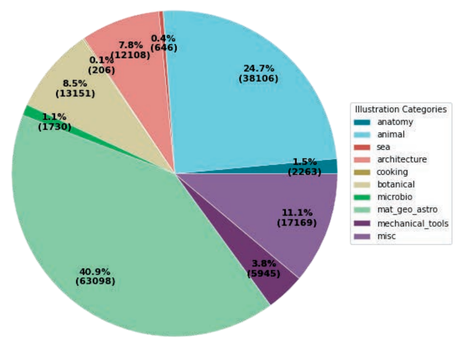


Fig. 2 Classification of illustrations using the CLIP model.

Analysis & Results

Our analyses suggest that the use of scientific illustrations was related to the economic, social and technical developments of the Enlightenment era, and that illustrations with different purposes were published in different formats.

- Overall, the number of publications increased towards the end of the century.
- However, contrary to our expectations, the relative proportion of the illustrated publications did not significantly increase.

Increasing publication numbers and quality

- Our findings support the fact that high-quality printing became more affordable and technically feasible. The increase in quality is more prevalent in the smaller octavo format (Fig 3), compared to the larger and more prestigious folio format.
- Together with the general increase in the number of octavo publications, this indicates that the book market became more diverse.

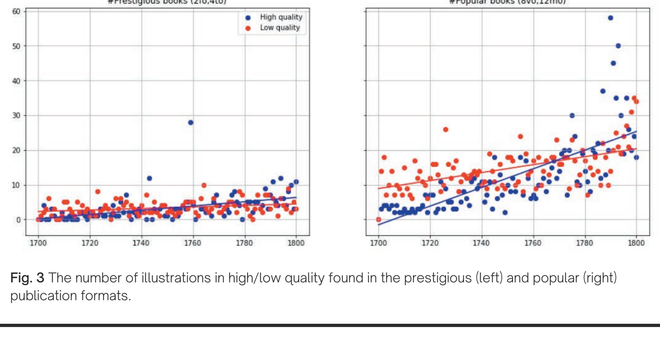


Fig. 3 The number of illustrations in high/low quality found in the prestigious (left) and popular (right) publication formats.

Different formats, different purposes

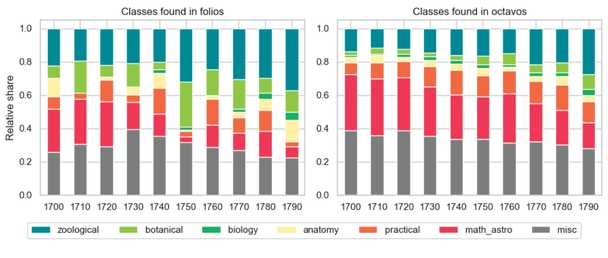


Fig. 4 The relative appearance of the illustration classes in folios (left) and octavos (right).

- Octavos contain more illustrations related to applicable knowledge and mathematics.
  - This indicates a pedagogical purpose.
- Botanical illustrations were more prominent in folios (Fig 4), most likely due to the necessity for detail.
- The higher co-occurrence of categories in folios (Fig 5) is partly explained by the use of the format for dictionaries and encyclopedias, including many categories. In contrast, octavos tend to be less pluralistic in their contents.

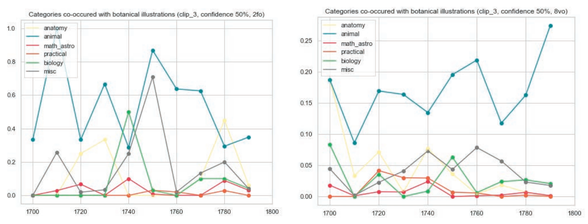
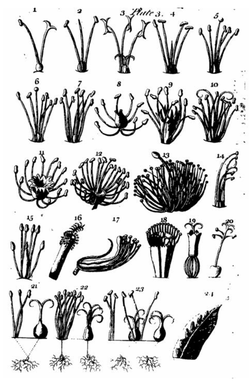


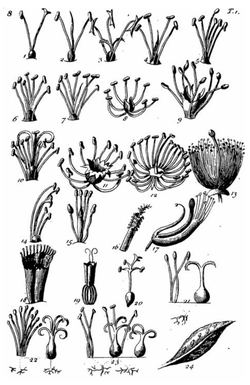
Fig. 5 The co-occurrence of categories with botanical illustrations in the prestigious (left) and popular (right) publication formats.

Reuse and close-reading Linnean influence

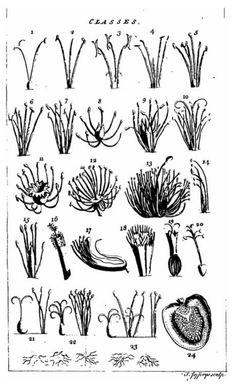
- Linnaean influence is evident in late 18th century publications, especially in the octavo editions of Linné's own works.
- Going against our original assumption, thro close reading we did not find a connection between the co-occurrence of animals and plants as part of the same knowledge system and the emergence of the Linnaean system. The sole exceptions were found in folios.
- Some new books reused the earlier images; others replaced details with new observation results and combined data. This shows how the knowledge changed gradually.



James Lee, *An introduction to botany* (1760, 1776, 1788, 1794, 1796, 1799)



Johanne Hill, *Flora Britanica* (1760)



A New and complete Dictionary of arts and science (1763)

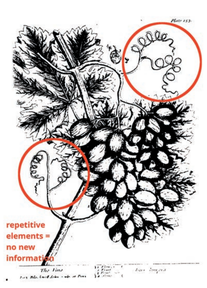
Discussion

The progress of the Enlightenment is reflected in our results. The 18th century witnessed an increase in quantity and quality of illustrated publications. Octavo editions focused on practical knowledge, folio contained more detailed illustrations related to the natural sciences. Growth in booktrade and higher affordability of books contributed to the availability of quality illustrations and lead to a rise in popular science publications.

Further analysis and refinement of classifiers would improve data quality. Training a model to detect specific elements would measure the scientific degree of botanical illustrations. An in-depth study of reused or modified illustrations and texts would deepen our understanding of the knowledge development process.

Future Research

C.J. Trew, *Herbarium Blackwellianum*, illustr. by N. F. Eisenberger (1750-73)



E. Blackwell, *A Curious Herbal* (1782, first published 1737)

Recognise specific elements within an image to measure how scientific it is:

- inclusion of fruit and seed in the illustration
- one plant per page
- details
- repetitive elements

GitHub repository

- **code**
- **bibliography**
- **extra visuals**

... and much more