

Analogueal reasoning in 17th and 18th century science

Research Focus

The object of this research is to look at the extent and nature of the uses of analogy during the first century following the so-called scientific revolution. Using the research tool provided by JSTOR we systematically analyze the uses of “analog” and its cognates (analogies, analogous, etc) in the *Philosophical Transactions of the Royal Society of London (PT)* for the period 1665-1780. In addition to giving the possibility of evaluating quantitatively the proportion of papers explicitly using analogies, this approach makes it possible to go beyond the maybe idiosyncratic cases of Descartes, Kepler or Galileo and other much studied giants of the so-called Scientific Revolution. As a result a classification of types of uses is proposed. Relations between types of analogies and research fields are also established. In this research we are less interested in discussing the “real nature” or “essence” or even the cognitive limitations of analogueal thinking than in describing its various uses and different meanings as they changed over the course of a century.

Types of uses

Reflexive uses of analogy: explicit comments on the uses of analogy itself in science. For example:

“The Method of Reasoning by Analogy is but too apt to lead us into Mistakes, and therefore we ought to be very diffident of consequences deduced this Way. Every new Appearance that has no known Cause, immediately fixes, and but to often at last puts the Thoughts of the Observer upon the Rack. When the Mind arrives at this Intensity of Action, how natural is it to free ourselves from a painful Uncertainty at any rate, and that with as little Expense of Reflection as may be? The most obvious and easy Method is to class, if it admits it, and to reduce it to some other known *Phenomena*.” Tubervill Needham 1748

Analogy as a general scientific principle: the word analogy refers to a general principle of uniformity of nature. For ex.:

“And therefore a few experiments clearly explained, and supported by the analogy of nature (which in all its operations is constantly similar to itself) are sufficient for the purpose of a demonstration a posteriori, or from the effect to the cause.” Alexander Stuart 1738

Analogy as concrete models: the model is said to be analogous to the phenomenon under study. For example:

Benjamin Gooch (1775) proposes to make experiments on animals to obtain knowledge to treat aneurysms in the thigh of humans: “I communicated my thoughts upon this subject to some of my brethren, wishing to have experiments made upon brutes, that might ascertain as far as possible, by analogy, a matter which appeared to us of great importance.”

Analogy as illustrations: such analogies are mainly used to clarify or explain a particular point in an argument. For example:

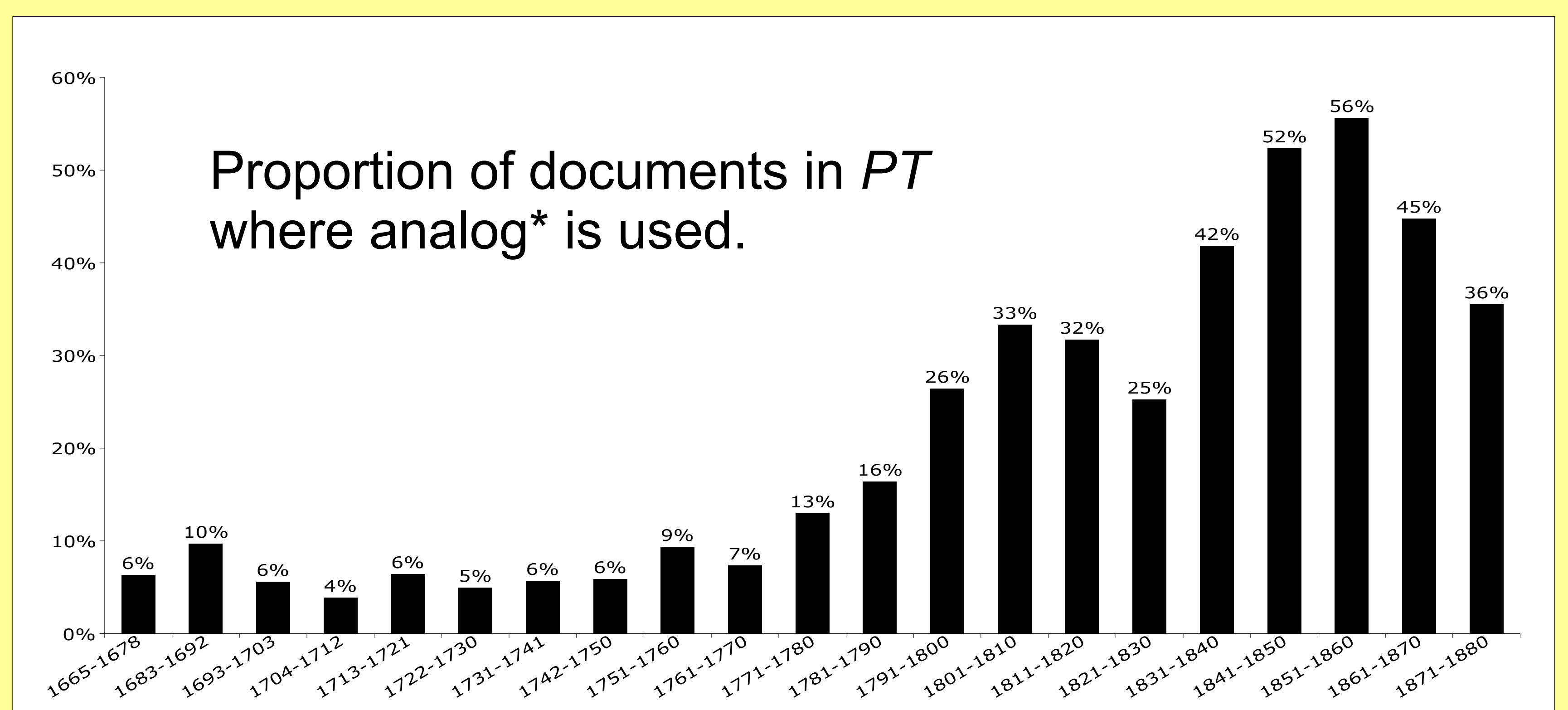
“If another Comparison was necessary, we might instance the Flower of any corymbiferous Plant, where the *Flosculi* and *Stamina* represent the little Bundles of cartilaginous Fibres; and the *Calyx*, upon which they are planted, bears Analogy to the Bone.” William Hunter 1743

Analogy as proportion: A is to B as C is to D, where A,B, C & D are quantifiable magnitudes. For example:

“[A]ny one may make a probable conjecture at least in this matter, if he but compute according to the dimensions of such Bones, what must be the true size or bulk of the Man, whose Body, as is pretended, when intire, was composed of parts and Limbs, analogous or answering in a due proportion of these Remains.” Thomas Molyneux 1700

From 1665-1780 in the PT

Terms analog* appear 615 times in 335 papers, most of time once (66%). Among the papers, we found 430 cases of analogueal uses.



Normalized relative frequencies of uses of each type analogy by research field.

Types of Analogy (# of papers)	Astronomy (24)	Biology (143)	Chemistry (17)	Geology (15)	Mathematics (41)	Medecine (24)	Physics (51)	Others (20)
Reflexive (14)	0	1,3	1,4	0	0,6	2	0,9	0
Principle (11)	1,3	1,5	0	0	0	1,3	1,2	0
Model (13)	1,1	0,7	0	3,4	0	1,1	2	1,3
Illustration (78)	0,2	1,3	2,3	0,3	0,3	1,4	0,8	0,6
Proportion (76)	2,6	0	0	0	4,2	0	1,5	1,1
Classificati. (141)	0,3	1,4	1	1,7	0,1	0,8	0,9	0,6
Prediction (97)	1,3	1,2	1	1,4	0,2	1,3	0,5	1,4

Types of uses

Analogy as a tool of classification: using analogies as a way to distribute objects into classes. For example:

“That the Spirit of Wine does not take fire, seems to proceed from the same Impediment which hinders light Oyls from coming up to an Accension, because they are so suddenly thrown off; and there seems to be a great Analogy betwixt Aetherial Oyls and the Spirit of Wine, both as to Specific Gravity, and as to other Properties, Spirit of Wine seems to be a more thin and diluted Essential Oyl, that contains some Water and more Air in its Pores, they seem to own the same matreal Cause [...]” Frederick Slare 1694

Prediction from analogy: the analogy is used to support a conclusion, where some properties of a target object are inferred on the basis of analogous properties present in the source object. For example:

“But, as for the Secondary Planets, as well those about *Jupiter*, as that about *Saturn*; it is most likely that they have no such Rotation upon their Axis. Not so much, because; by reason of their smallness, no such thing hath been yet observed, (or, indeed, could be, though it were true;) But because they being Analogical to our Moon, it is most likely that they are moved in like manner.” Anonymous 1666