Millennium of art paintings through the lens of physics

Matjaž Perc

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Growth and structure of Slovenia's scientific collaboration network

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ABSTRACT

We study the evolution of Slovenia's scientific collaboration network from 1960 till present with a yearly resolution. For each year the network was constructed from publication records of Slovene scientists, whereby two were connected if, up to the given year inclusive, they have coauthored at least one paper together. Starting with no more than 30 scientists with an average of 1.5 collaborators in the year 1960, the network to date consists of 7380 individuals that, on average, have 10.7 collaborators. We show that, in spite of the broad myriad of research fields covered, the networks form "small worlds" and that indeed the average path between any pair of scientists scales logarithmically with size after the largest component becomes large enough. Moreover, we show that the network growth is governed by near-liner preferential attachment, giving rise to a log-normal distribution of collaborators per author, and that the average starting year is roughly inversely proportional to the number of collaborators eventually acquired. Understandably, not all that became active early have till now gathered many collaborators. We also give results for the clustering coefficient and the diameter of the network over time, and compare our conclusions with those reported previously.

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Zipf's law and log-normal distributions in measures of scientific output across fields and institutions: 40 years of Slovenia's research as an example☆

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ABSTRACT

Slovenia's Current Research Information System (SICRIS) currently hosts 86,443 publications with citation data from 8359 researchers working on the whole plethora of social and natural sciences from 1970 till present. Using these data, we show that the citation distributions derived from individual publications have Zipfian properties in that they can be fitted by a power law $P(x)\sim x^{-\alpha}$, with α between 2.4 and 3.1 depending on the institution and field of research. Distributions of indexes that quantify the success of researchers rather than individual publications, on the other hand, cannot be associated with a power law. We find that for Egghe's g-index and Hirsch's h-index the log-normal form $P(x)\sim \exp[-a\ln x - b(\ln x)^2]$ applies best, with a and b depending moderately on the underlying set of researchers. In special cases, particularly for institutions with a strongly hierarchical constitution and research fields with high self-citation rates, exponential distributions can be observed as well. Both indexes yield distributions with equivalent statistical properties, which is a strong indicator for their consistency and logical connectedness. At the same time, differences in the assessment of citation histories of individual researchers strengthen their importance for properly evaluating the quality and impact of scientific output.

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PLOS ONE

Community Structure and the Evolution of Interdisciplinarity in Slovenia's Scientific Collaboration Network

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Abstract

Interaction among the scientific disciplines is of vital importance in modern science. Focusing on the case of Slovenia, we study the dynamics of interdisciplinary sciences from 1960 to 2010. Our approach relies on quantifying the interdisciplinarity of research communities detected in the coauthorship network of Slovenian scientists over time. Examining the evolution of the community structure, we find that the frequency of interdisciplinary research is only proportional with the overall growth of the network. Although marginal improvements in favor of interdisciplinarity are inferable during the 70s and 80s, the overall trends during the past 20 years are constant and indicative of stalemate. We conclude that the flow of knowledge between different fields of research in Slovenia is in need of further stimulation.

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Millennium of art paintings through the lens of physics

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ARTISTS

Art movements

Schools and groups

Genres

Fields

Nationalities

Centuries

Art institutions

ARTWORKS

Styles

Genres

Media

ARTWORK OF THE DAY

Landscape with Green Trees or Beech Trees in Kerduel

Maurice Denis · 1893

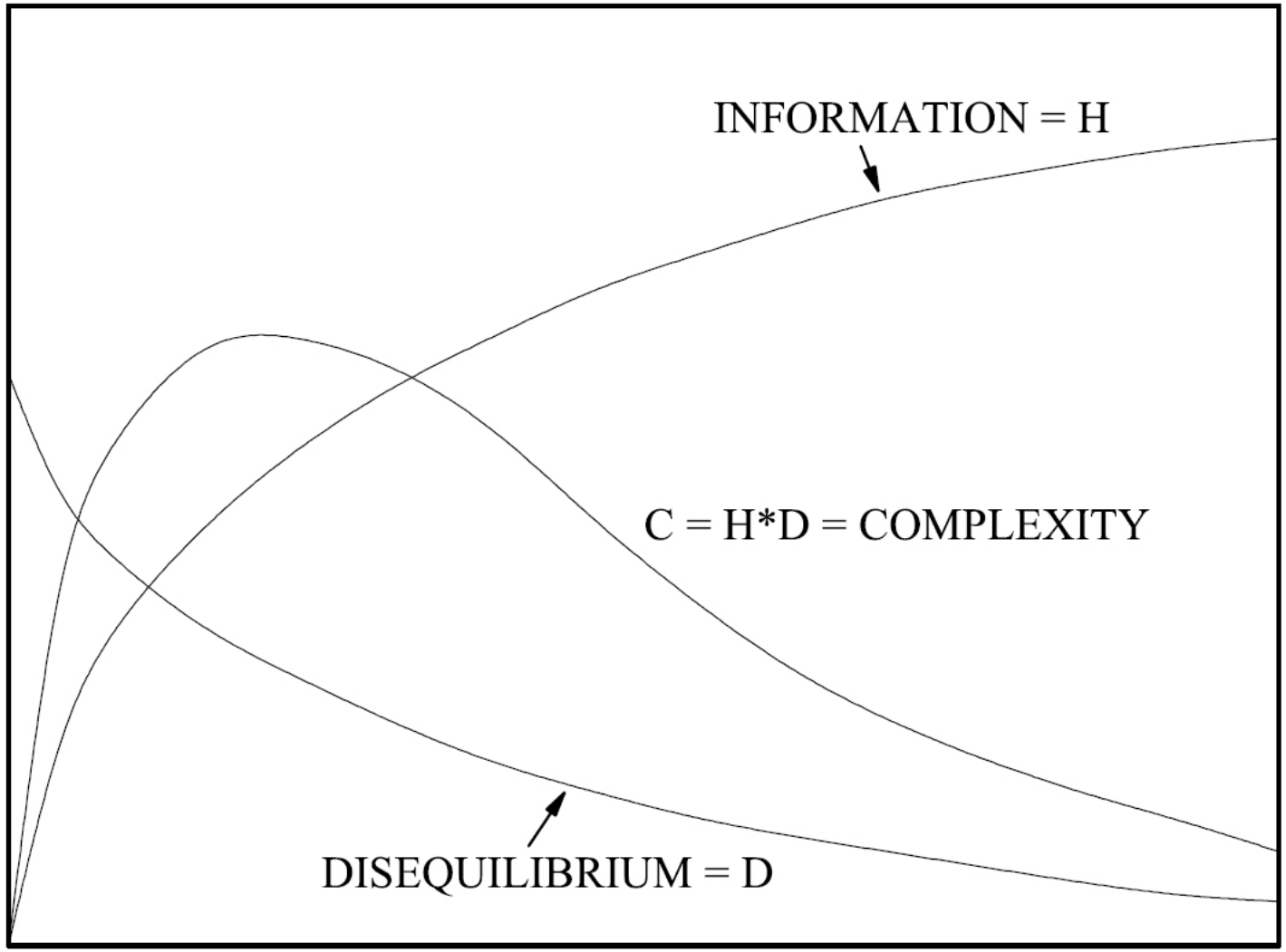
In The Green Trees, the landscape in Loctudy (that is also to be found in a contemporary painting, Young Girls Picking Flowers by the Sea, formerly in the collection of the symbolist poet Georges Rodenbach) is used as the setting for a dreamlike ceremony in which a young girl steps out of a procession to meet an angel from which she is separated by a short wall; this is a dramatised allegory of the Calling or of the Election in a magic forest, that of Kerduel where one must not forget the famous King Arthur would have lived. Maurice

ARTWORK DETAILS

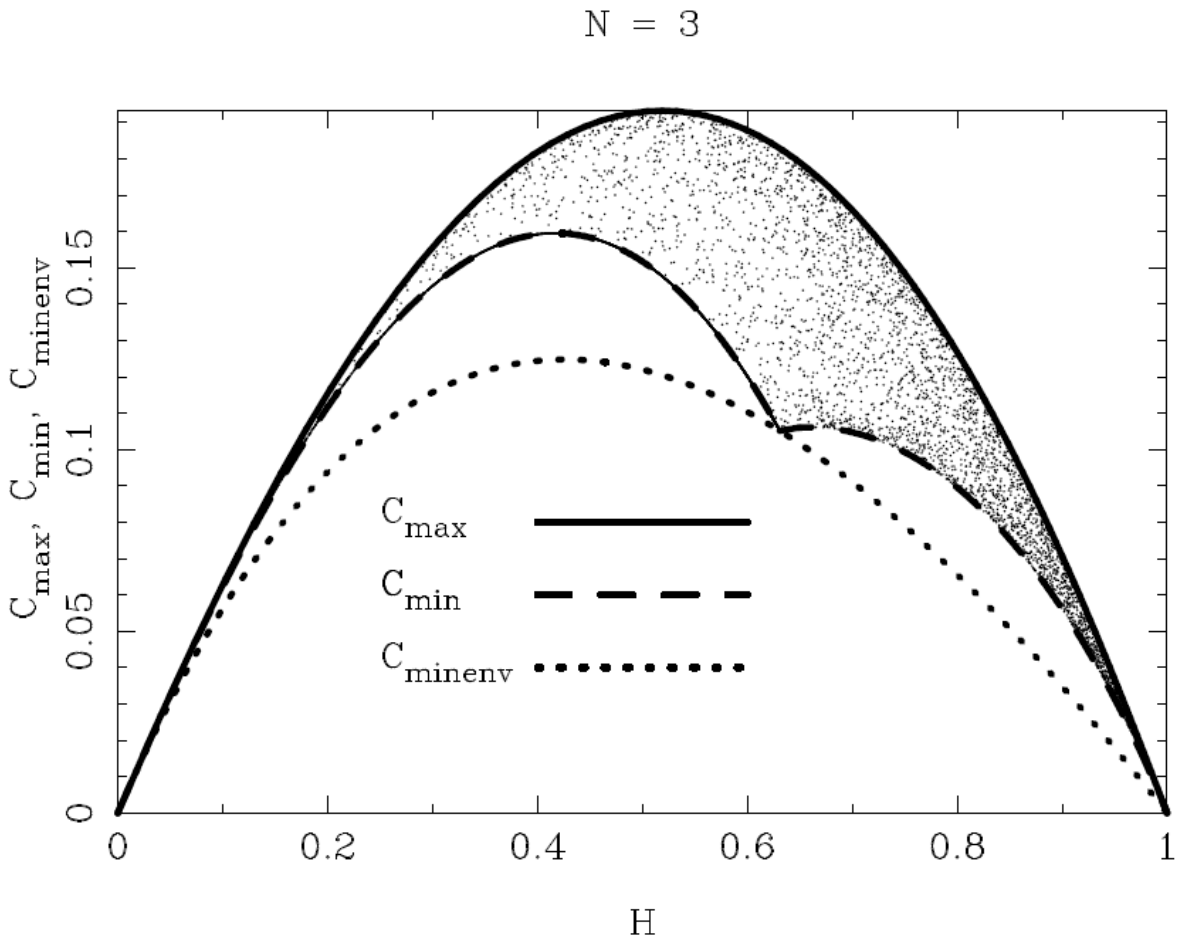
ORDER OIL PAINTING REPRODUCTION

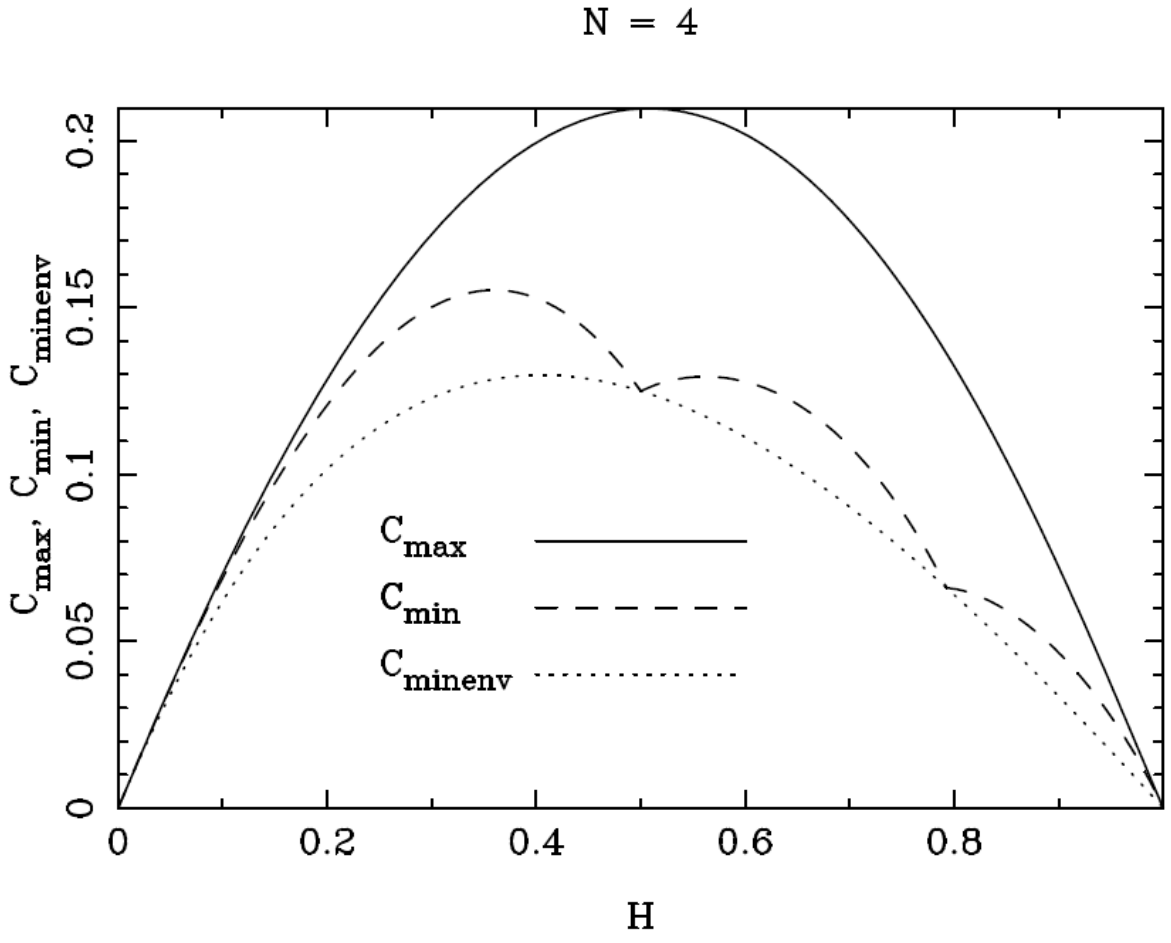
Millennium of art paintings through the lens of physics

Entropy and complexity



Entropy and complexity



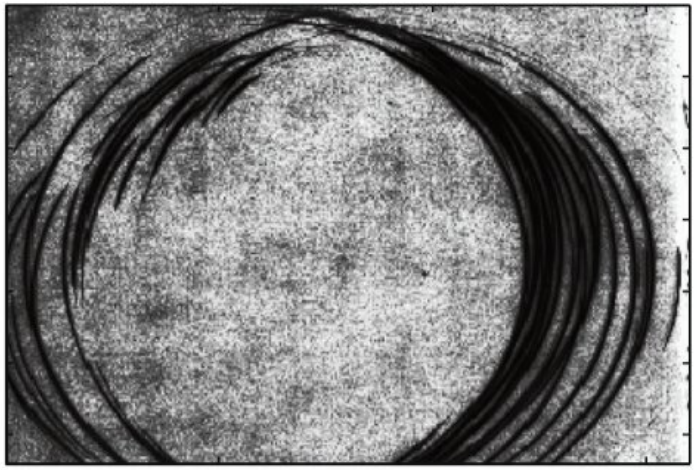


$$C = H \cdot D = -\left(K \sum_{i=1}^{N} p_i \log p_i \right) \cdot \left(\sum_{i=1}^{N} \left(p_i - \frac{1}{N} \right)^2 \right)$$

Art paintings through the lens of entropy and complexity

D15

D44



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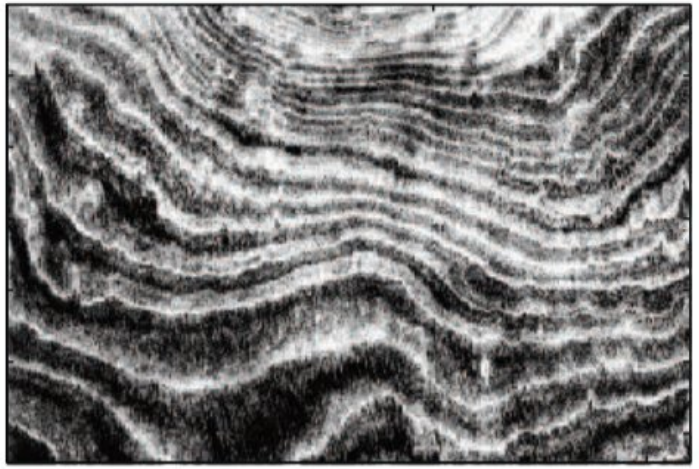
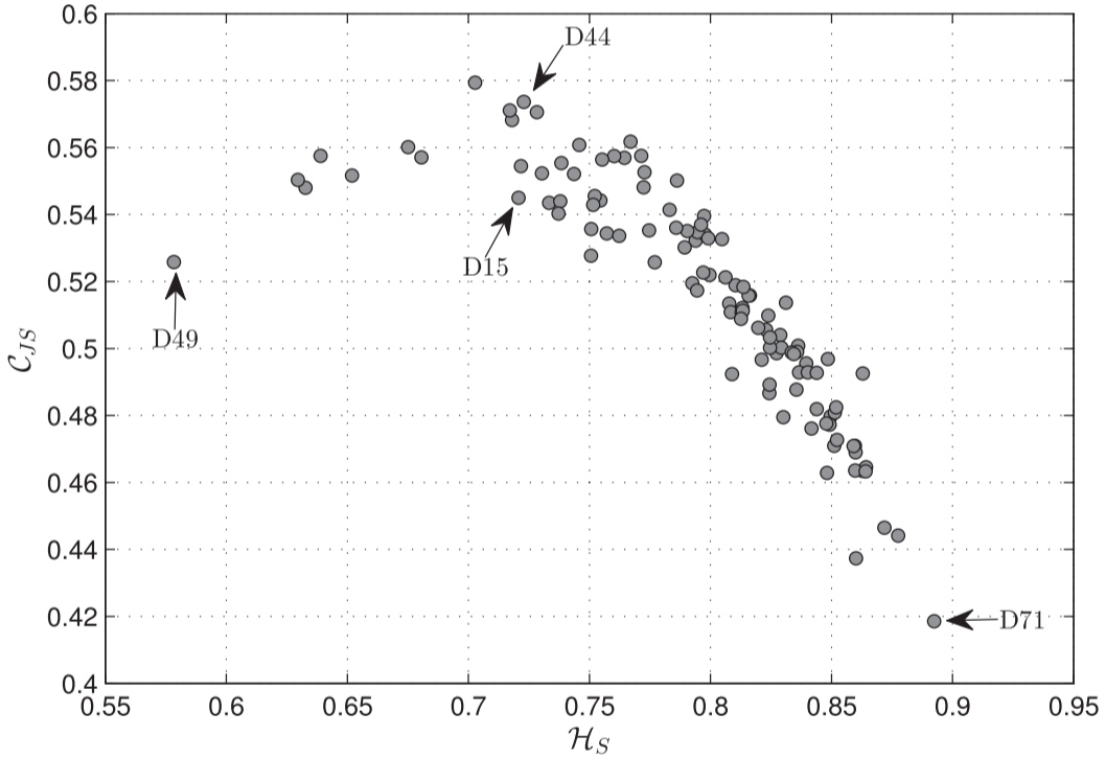




Art history in brief

Alois Riegl (1858 -1905) was an Austrian art historian. He pioneered art history as a self-sufficient academic discipline, and he argued that art evolves continuously from haptic to optic.

Heinrich Wölfflin (1864 -1945) was a Swiss art historian, whose objective classifying principles, in particular "linear" vs. "painterly" aided the development of formal analysis in art history in the early 20th century.

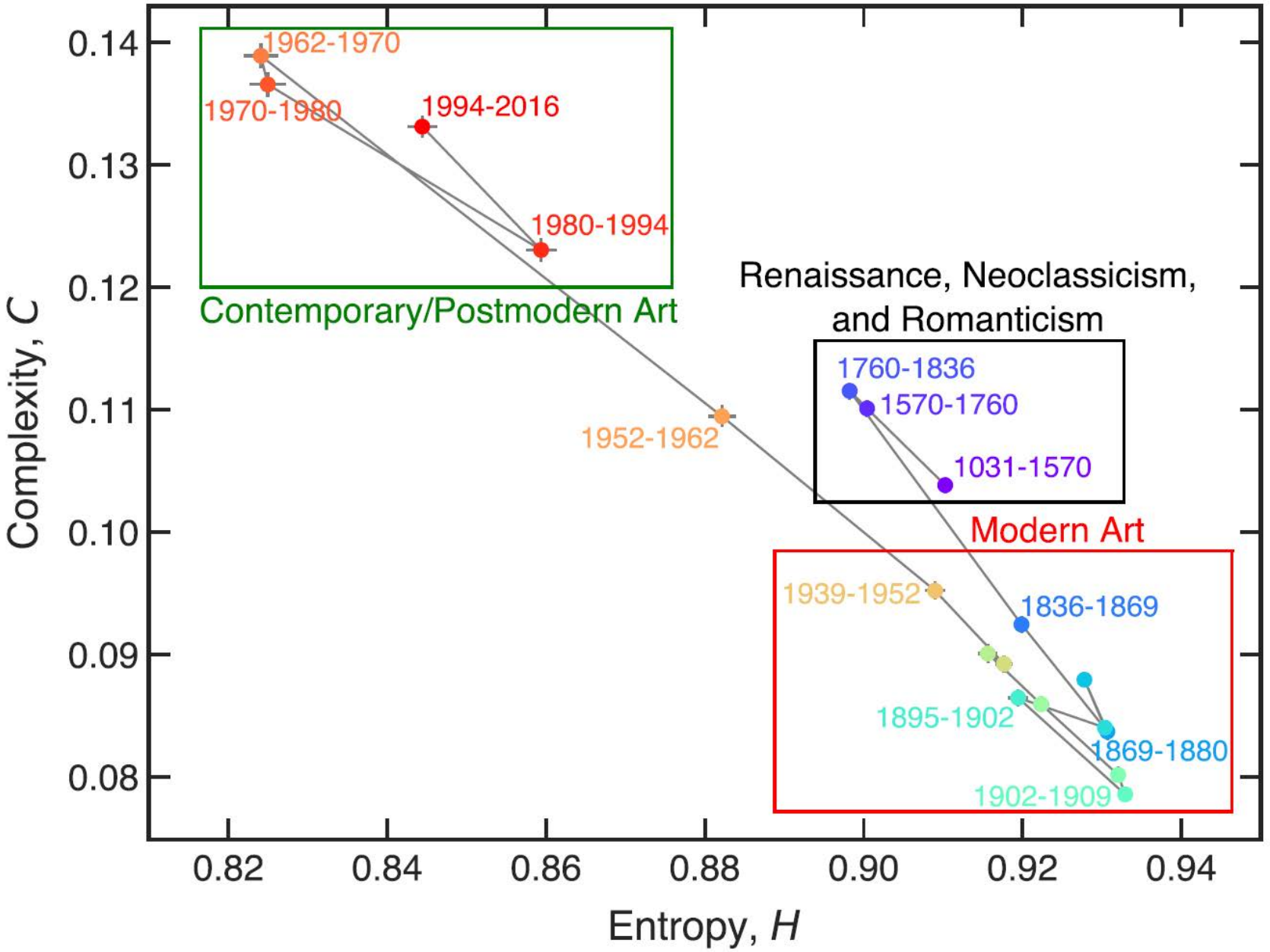
Haptic perception
(Greek: haptós "palpable",
haptikós "suitable for touch")
means literally the ability
"to grasp something".

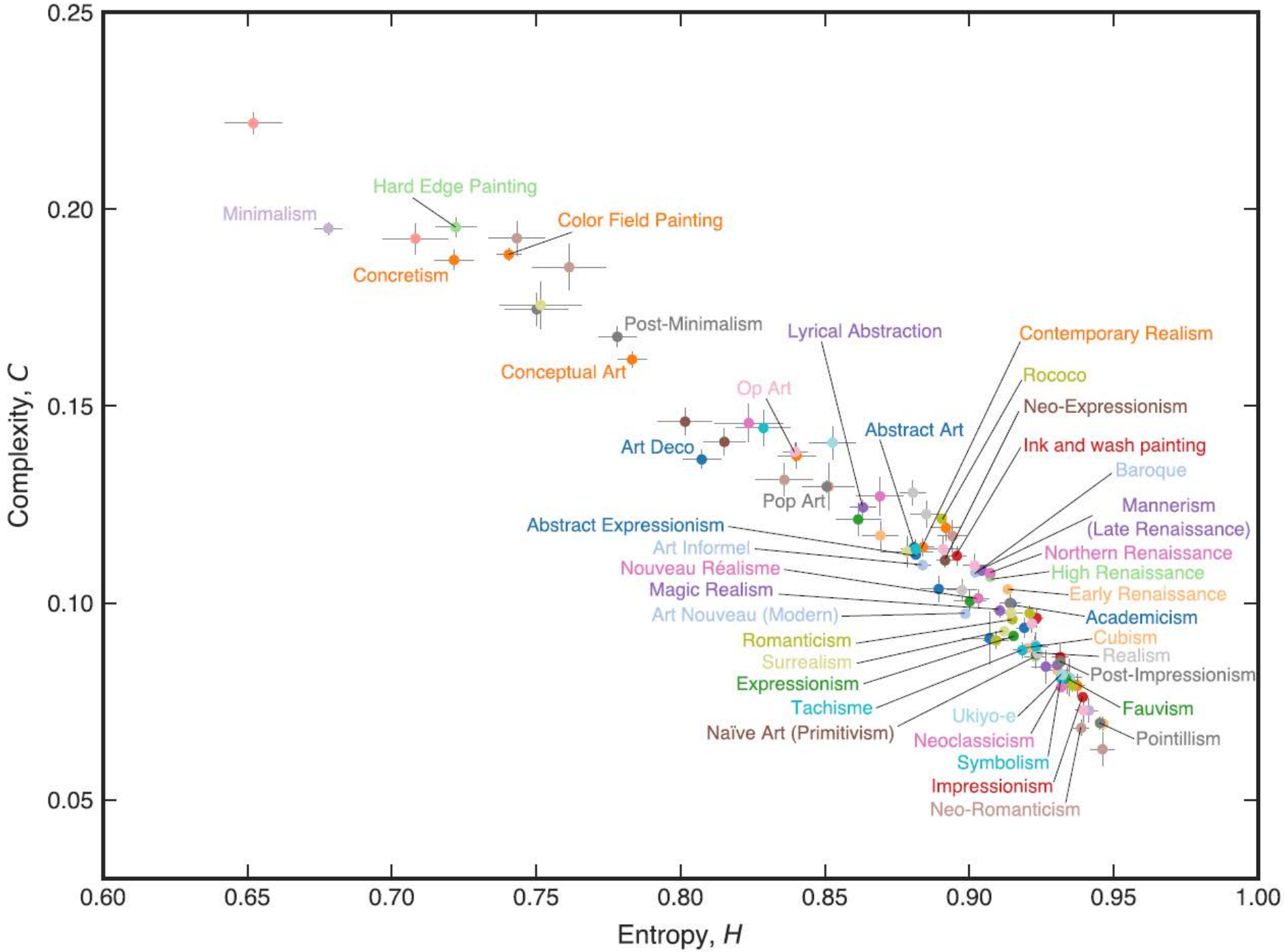
The conceptual link between art and physics

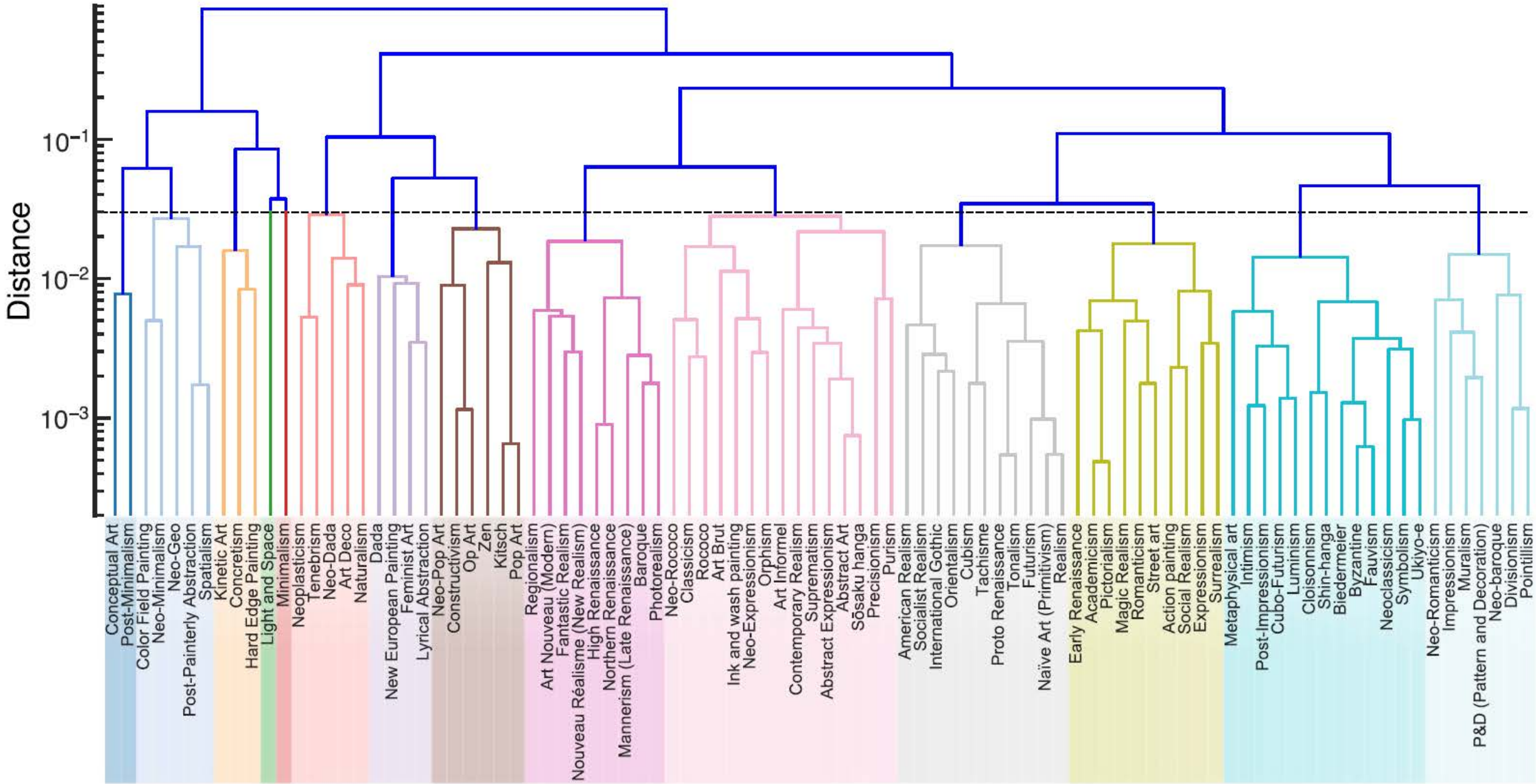
Haptic/Linear
vs.
Optic/Painterly

Order/Simplicity
vs.
Disorder/Complexity

Tales about a millennium of art




0.25
0.20
0.15
0.10
0.05
Complexity, C
0.60
0.65
0.70
0.75
0.80
0.85
0.90
0.95
1.00
Entropy, H
Minimalism
Hard Edge Painting
Color Field Painting
Concretism
Post-Minimalism
Conceptual Art
Lyrical Abstraction
Contemporary Realism
Rococo
Op Art
Neo-Expressionism
Abstract Art
Art Deco
Ink and wash painting
Baroque
Pop Art
Mannerism
(Late Renaissance)
Abstract Expressionism
Art Informel
Northern Renaissance
Nouveau Réalisme
High Renaissance
Magic Realism
Early Renaissance
Art Nouveau (Modern)
Academicism
Romanticism
Cubism
Surrealism
Realism
Expressionism
Post-Impressionism
Tachisme
Fauvism
Ukiyo-e
Naïve Art (Primitivism)
Pointillism
Neoclassicism
Symbolism
Impressionism
Neo-Romanticism


Distance
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Conceptual Art
Post-Minimalism
Color Field Painting
Neo-Minimalism
Neo-Geo
Post-Painterly Abstraction
Spatialism
Kinetic Art
Concretism
Hard Edge Painting
Light and Space
Minimalism
Neoplasticism
Tenebrism
Neo-Dada
Art Deco
Naturalism
Dada
New European Painting
Feminist Art
Lyrical Abstraction
Neo-Pop Art
Constructivism
Op Art
Zen
Kitsch
Pop Art
Regionalism
Art Nouveau (Modern)
Fantastic Realism
Nouveau Réalisme (New Realism)
High Renaissance
Northern Renaissance
Mannerism (Late Renaissance)
Baroque
Photorealism
Neo-Rococo
Classicism
Rococo
Art Brut
Ink and wash painting
Neo-Expressionism
Orphism
Art Informel
Contemporary Realism
Suprematism
Abstract Expressionism
Abstract Art
Sōsaku hanga
Precisionism
Purism
American Realism
Socialist Realism
International Gothic
Orientalism
Cubism
Tachisme
Proto Renaissance
Tonalism
Futurism
Naïve Art (Primitivism)
Realism
Early Renaissance
Academicism
Pictorialism
Magic Realism
Romanticism
Street art
Action painting
Social Realism
Expressionism
Surrealism
Metaphysical art
Intimism
Post-Impressionism
Cubo-Futurism
Luminism
Cloisonnism
Shin-hanga
Biedermeier
Byzantine
Fauvism
Neoclassicism
Symbolism
Ukiyo-e
Neo-Romanticism
Impressionism
Muralism
P&D (Pattern and Decoration)
Neo-baroque
Divisionism
Pointillism

Tales about a millennium of art

Main reference:

History of art paintings through the lens of entropy and complexity,
Higor Y. D. Sigaki, Matjaž Perc, and Haroldo V. Ribeiro,
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