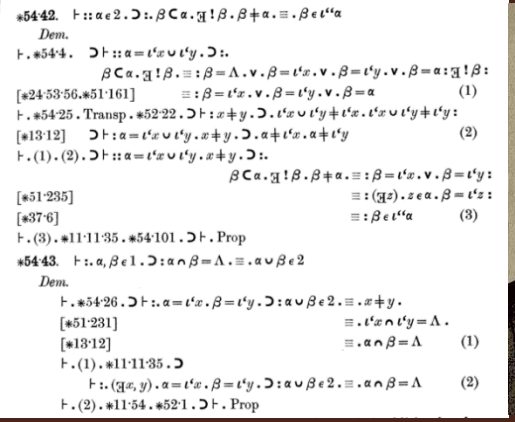
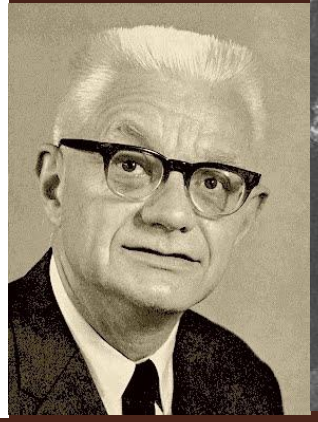
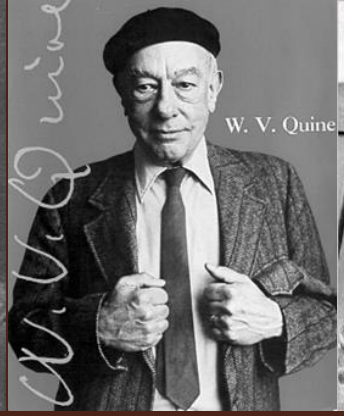
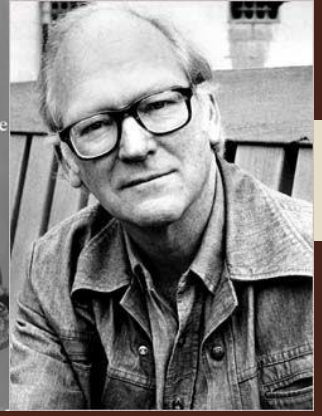


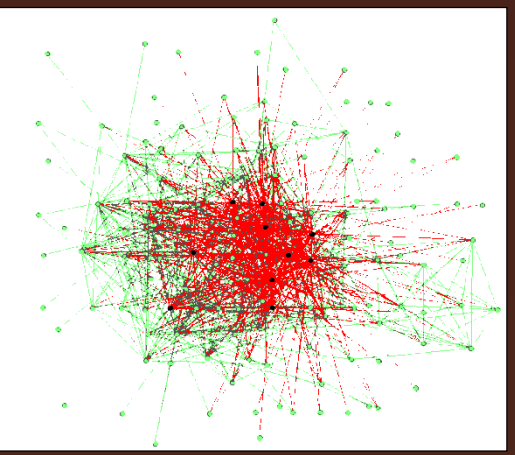
*54·42. ⊢ :: α ∈ 2 . ⊃ :. β ⊂ α . ∃ ! β . β ≠ α . ≡ . β ∈ ι‘‘α
Dem.
⊢ . *54·4 . ⊃ ⊢ :: α = ι‘x ∪ ι‘y . ⊃ :.
β ⊂ α . ∃ ! β . ≡ : β = α . ∨ . β = ι‘x . ∨ . β = ι‘y . ∨ . β = α : ∃ ! β :
[*24·53·56 . *51·161] ≡ : β = ι‘x . ∨ . β = ι‘y . ∨ . β = α (1)
⊢ . *54·25 . Transp . *52·22 . ⊃ ⊢ : x ≠ y . ⊃ . ι‘x ∪ ι‘y ≠ ι‘x . ι‘x ∪ ι‘y ≠ ι‘y :
[*13·12] ⊃ ⊢ : α = ι‘x ∪ ι‘y . x ≠ y . ⊃ . α ≠ ι‘x . α ≠ ι‘y (2)
⊢ . (1) . (2) . ⊃ ⊢ :: α = ι‘x ∪ ι‘y . x ≠ y . ⊃ :.
β ⊂ α . ∃ ! β . β ≠ α . ≡ : β = ι‘x . ∨ . β = ι‘y :
[*51·235] ≡ : (∃ z) . z ∈ α . β = ι‘z :
[*37·6] ≡ : β ∈ ι‘‘α (3)
⊢ . (3) . *11·11·35 . *54·101 . ⊃ ⊢ . Prop

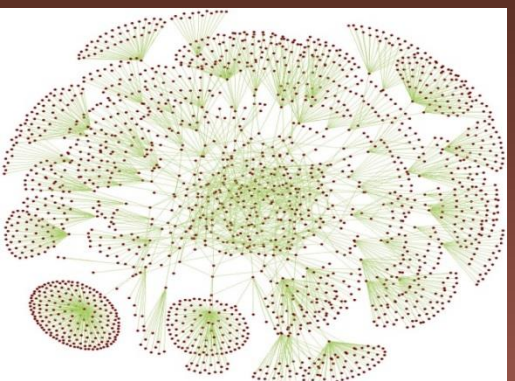
*54·43. ⊢ :. α, β ∈ 1 . ⊃ : α ∩ β = Λ . ≡ . α ∪ β ∈ 2
Dem.
⊢ . *54·26 . ⊃ ⊢ :. α = ι‘x . β = ι‘y . ⊃ : α ∪ β ∈ 2 . ≡ . x ≠ y .
[*51·231] ≡ . ι‘x ∩ ι‘y = Λ .
[*13·12] ≡ . α ∩ β = Λ (1)
⊢ . (1) . *11·11·35 . ⊃
⊢ :. (∃ x, y) . α = ι‘x . β = ι‘y . ⊃ : α ∪ β ∈ 2 . ≡ . α ∩ β = Λ (2)
⊢ . (2) . *11·54 . *52·1 . ⊃ ⊢ . Prop











Teoria do Conhecimento e Filosofia da Ciência IV

Metamorfoses do empirismo

ou: A quadratura do Círculo (de Viena)

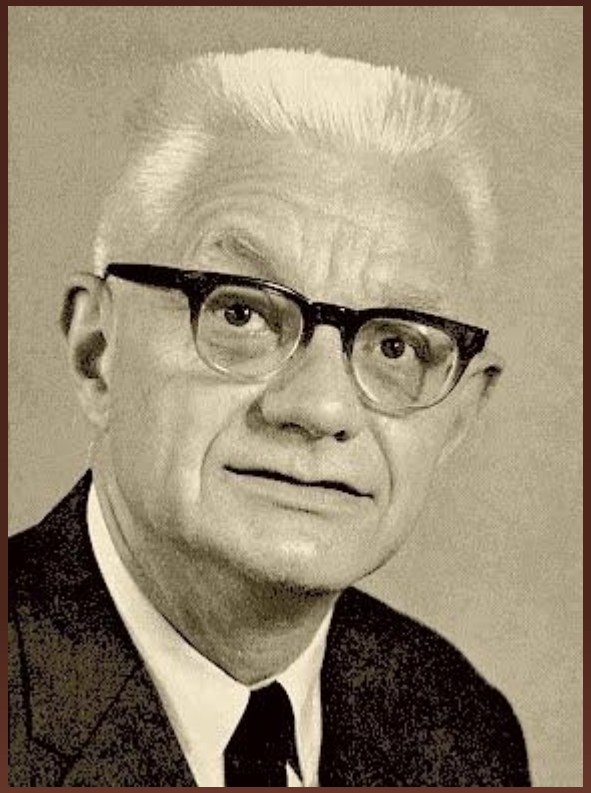
Unidade 1, Parte 2 – Hempel e Neurath

Prof. Dr. Valter Alnis Bezerra
Departamento de Filosofia | FFLCH
Universidade de São Paulo
FLF0469 | 2017

Carl G. Hempel

Um empirista crítico

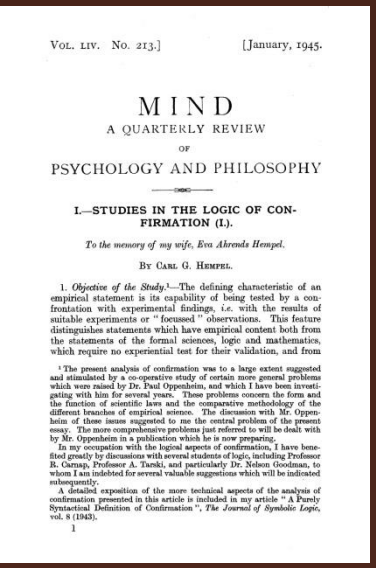
De um dos artífices da concepção padrão...



... A um crítico das imagens dedutivas de ciência

Hempel

Modelo D-N de explicação científica e teoria da confirmação



VOL. LIV. NO. 213.] [January, 1945.

MIND
A QUARTERLY REVIEW
OF
PSYCHOLOGY AND PHILOSOPHY

I.—STUDIES IN THE LOGIC OF CONFIRMATION (I.).

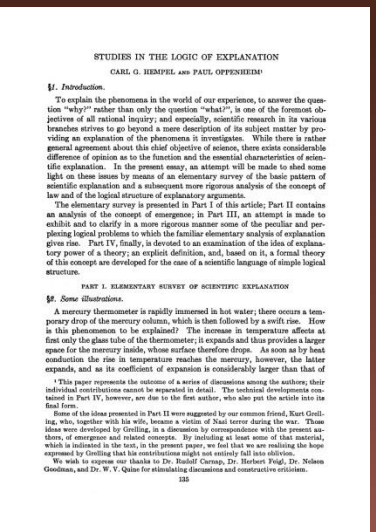
To the memory of my wife, Eva Ahrends Hempel.

BY CARL G. HEMPEL.

1. *Objective of the Study.*[1]—The defining characteristic of an empirical statement is its capability of being tested by a confrontation with experimental findings, i.e. with the results of suitable experiments or "focussed" observations. This feature distinguishes statements which have empirical content both from the statements of the formal sciences, logic and mathematics, which require no experiential test for their validation, and from

[1] The present analysis of confirmation was to a large extent suggested and stimulated by a co-operative study of certain more general problems which were raised by Dr. Paul Oppenheim, and which I have been investigating with him for several years. These problems concern the form and the function of scientific laws and the comparative methodology of the different branches of empirical science. The discussion with Mr. Oppenheim of these issues suggested to me the central problem of the present essay. The more comprehensive problems just referred to will be dealt with by Mr. Oppenheim in a publication which he is now preparing.
In my occupation with the logical aspects of confirmation, I have benefited greatly by discussions with several students of logic, including Professor R. Carnap, Professor A. Tarski, and particularly Dr. Nelson Goodman, to whom I am indebted for several valuable suggestions which will be indicated subsequently.
A detailed exposition of the more technical aspects of the analysis of confirmation presented in this article is included in my article "A Purely Syntactical Definition of Confirmation", *The Journal of Symbolic Logic*, vol. 8 (1943).

1



STUDIES IN THE LOGIC OF EXPLANATION

CARL G. HEMPEL AND PAUL OPPENHEIM[1]

§1. *Introduction.*

To explain the phenomena in the world of our experience, to answer the question "why?" rather than only the question "what?", is one of the foremost objectives of all rational inquiry; and especially, scientific research in its various branches strives to go beyond a mere description of its subject matter by providing an explanation of the phenomena it investigates. While there is rather general agreement about this chief objective of science, there exists considerable difference of opinion as to the function and the essential characteristics of scientific explanation. In the present essay, an attempt will be made to shed some light on these issues by means of an elementary survey of the basic pattern of scientific explanation and a subsequent more rigorous analysis of the concept of law and of the logical structure of explanatory arguments.

The elementary survey is presented in Part I of this article; Part II contains an analysis of the concept of emergence; in Part III, an attempt is made to exhibit and to clarify in a more rigorous manner some of the peculiar and perplexing logical problems to which the familiar elementary analysis of explanation gives rise. Part IV, finally, is devoted to an examination of the idea of explanatory power of a theory; an explicit definition, and, based on it, a formal theory of this concept are developed for the case of a scientific language of simple logical structure.

PART I. ELEMENTARY SURVEY OF SCIENTIFIC EXPLANATION

§2. *Some illustrations.*

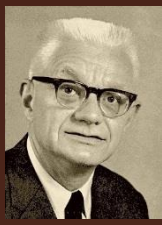
A mercury thermometer is rapidly immersed in hot water; there occurs a temporary drop of the mercury column, which is then followed by a swift rise. How is this phenomenon to be explained? The increase in temperature affects at first only the glass tube of the thermometer; it expands and thus provides a larger space for the mercury inside, whose surface therefore drops. As soon as by heat conduction the rise in temperature reaches the mercury, however, the latter expands, and as its coefficient of expansion is considerably larger than that of

[1] This paper represents the outcome of a series of discussions among the authors; their individual contributions cannot be separated in detail. The technical developments contained in Part IV, however, are due to the first author, who also put the article into its final form.
Some of the ideas presented in Part II were suggested by our common friend, Kurt Grelling, who, together with his wife, became a victim of Nazi terror during the war. Those ideas were developed by Grelling, in a discussion by correspondence with the present authors, of emergence and related concepts. By including at least some of that material, which is indicated in the text, in the present paper, we feel that we are realizing the hope expressed by Grelling that his contributions might not entirely fall into oblivion.
We wish to express our thanks to Dr. Rudolf Carnap, Dr. Herbert Feigl, Dr. Nelson Goodman, and Dr. W. V. Quine for stimulating discussions and constructive criticism.

135

Textos célebres:

Hempel – "Studies in the logic of confirmation, I & II" (1945);

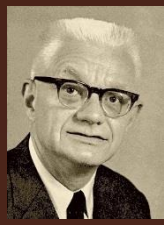


Hempel & Oppenheim – "Studies in the logic of explanation" (1948); E. Nagel – *The structure of science*

Hempel
Os problemas do critério de significado

Textos célebres:

Hempel – “Problemas e transformações no critério empirista de significado” (1950)

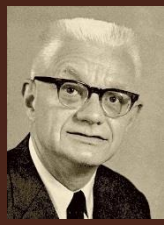


“Critérios empiristas de significado cognitivo: problemas e transformações” (1965)

Rumo ao holismo de significado e ao holismo teórico

Hempel
Um empirista crítico

- "The irrelevance of the concept of truth for the critical appraisal of scientific theories". In: HEMPEL, C. G. - *Selected philosophical essays*, pp. 75-84. [Ed. por Richard Jeffrey.] Cambridge: Cambridge University Press, 2000.

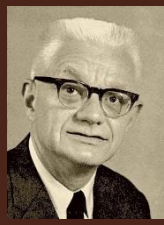


- "Valuation and objectivity in science". In: COHEN, R. S. & LAUDAN, L. (eds) - *Physics, philosophy and psychoanalysis*, pp. 73-100. Dordrecht: D. Reidel, 1983. **Outra edição**: HEMPEL, C. G. [2001], pp. 372-395.

- "On the cognitive status and rationale of scientific methodology". Parte I – "Methodology of science: descriptive and prescriptive facets". Parte II – "On evidence and truth in science". In: HEMPEL, C. G. - *Selected philosophical essays*, pp. 199-228. [Ed. por Richard Jeffrey.] Cambridge: Cambridge University Press, 2000.

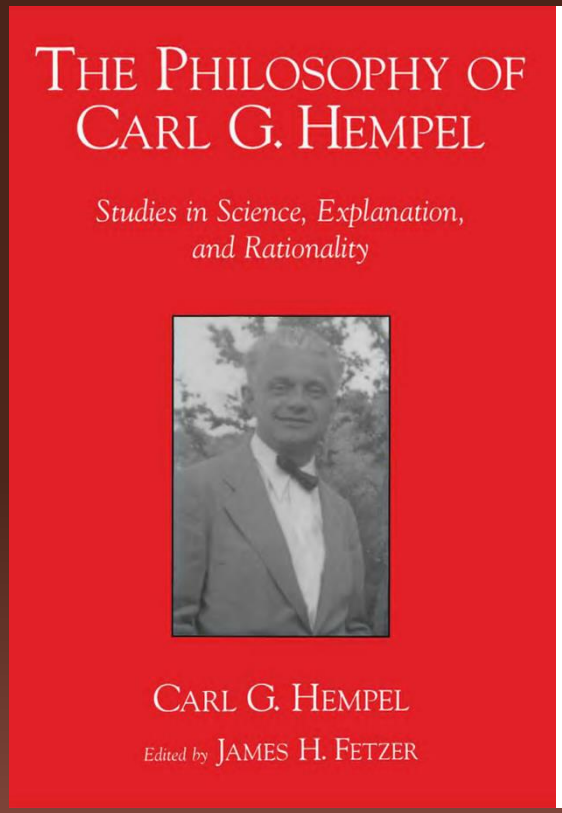
Hempel
Um empirista crítico

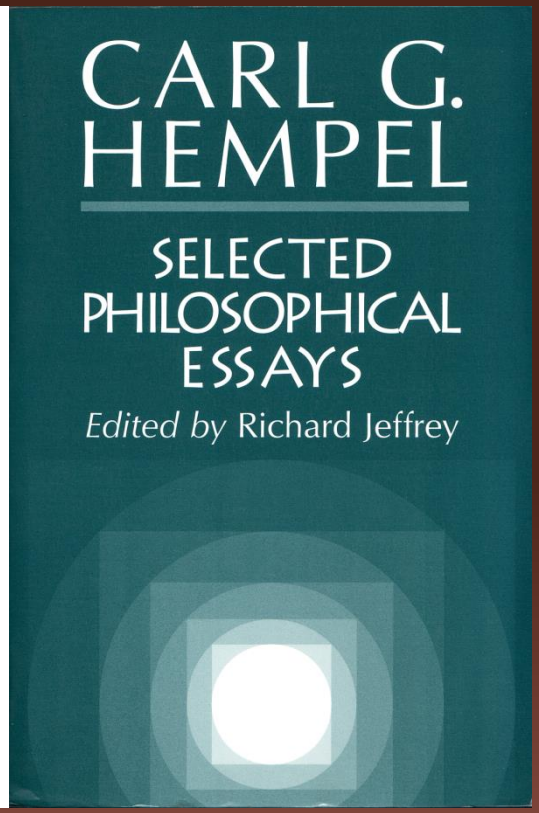
O pensamento de Hempel evolui no sentido de vir a defender teses como:

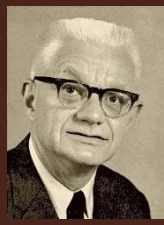


- Holismo de significado
- Holismo de testabilidade / hipóteses auxiliares / provisos
- Anti-realismo no sentido metodológico
- Pluralismo metodológico
- Crítica à visão dedutivista de ciência
- Papel dos valores (“*desiderata*”) na ciência
- Naturalismo epistemológico / equilíbrio reflexivo

Hempel
Fortuna crítica recente

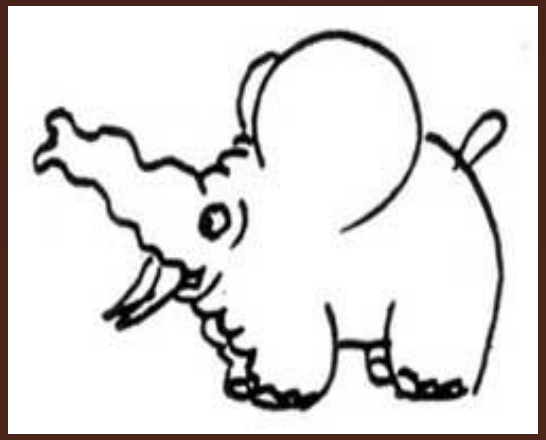






Otto Neurath

Um positivista iconoclasta



(1882-1945)

- Filósofo da ciência
- Sociólogo
- Economista
- Designer gráfico (foi o idealizador e propagandista do sistema de linguagem visual artificial ISOTYPE).

Otto Neurath
Um positivista iconoclasta

Neurath foi um positivista lógico entusiasta desde o primeiro momento:

- Integrante do Círculo de Viena
- Signatário do manifesto “A concepção científica do mundo” (Hahn, Neurath & Carnap, 1929)
- Co-editor da *International Encyclopedia of Unified Science*
- Ferrenho adversário da metafísica (que sempre considerou como desprovida de significado)
- Protagonista do debate com Schlick em 1934-35 sobre a constituição da base empírica
- Defensor da noção de “ciência unificada”

Otto Neurath
Um positivista iconoclasta

Este mesmo Neurath defendeu algumas teses epistemológicas das mais surpreendentes:

- Defensor de uma teoria coerencial da justificação
- Defendeu a noção de que mesmo a base empírica da ciência é totalmente revisável
- Admitia o lugar inalienável de um processo de *negociação* por parte da comunidade científica nas decisões *epistêmicas e metodológicas*
- Criticou a noção de um método científico universal e imutável

Otto Neurath
Um positivista iconoclasta

- Criticou também a noção de teste conclusivo, e formulou a noção de “quebra de confiança” [*Erschütterung*] em vez de “refutação”
- Convidou a atentar para a história da ciência e para a práxis científica, de forma coordenada com a epistemologia
- Defendeu que a ciência não se esgota nas teorias, enquanto sistemas axiomáticos bem definidos, mas se estrutura em sistemas mais ricos e complexos — as “enciclopédias-modelo” ou os “aglomerados”
- Naturalismo e coerentismo – A “metáfora do navio”

Otto Neurath
Um positivista iconoclasta

A imagem de ciência de Neurath é, a um só tempo:

- Empirista
- falibilista
- fisicalista
- naturalista
- coerentista
- holista
- interdisciplinar
- historicista

Cartaz de exposição em Haia, 2007
http://www.stroom.nl/

Neurath

Sentenças protocolares e o debate sobre a base empírica

Textos representativos:

Moritz Schlick – “O fundamento do conhecimento” (1934)

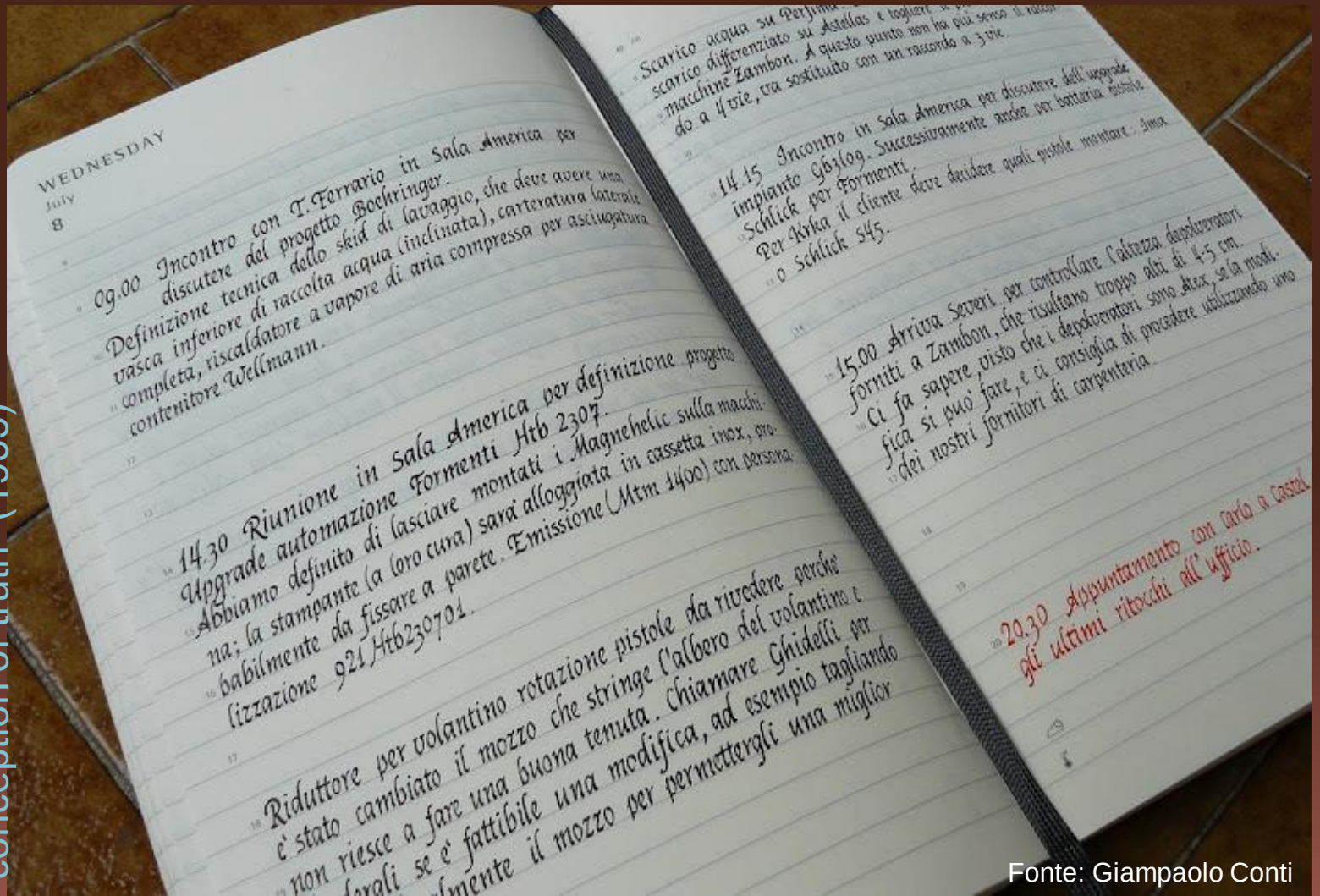
Otto Neurath – “Sentenças protocolares” (1932)

Rudfolf Carnap – “Sobre as sentenças protocolares” (1932)

Neurath

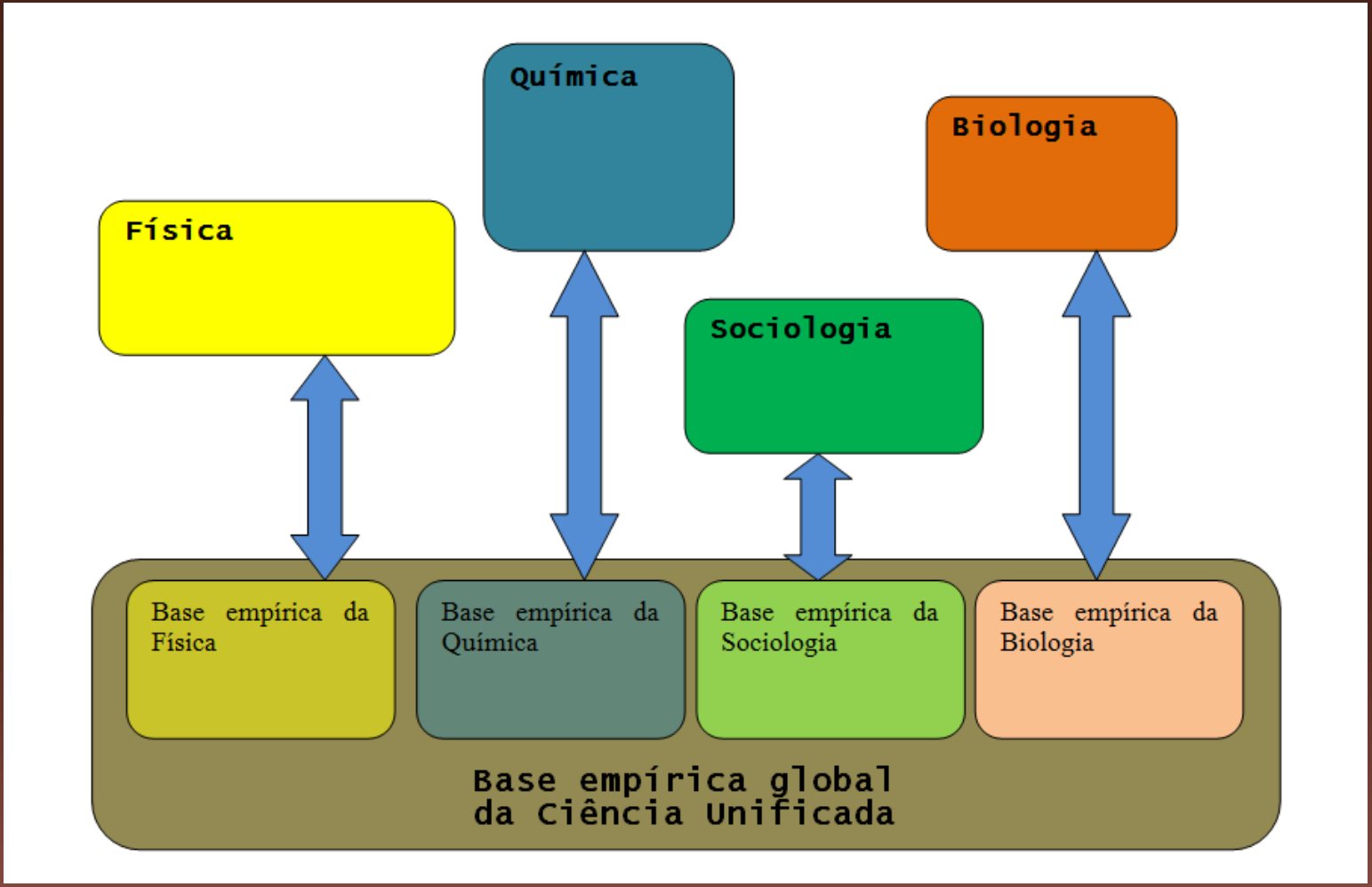
Sentenças protocolares e o debate sobre a base empírica

Textos representativos: Schlick – “Fatos e proposições” (1935); Neurath - “O fisicalismo radical e o ‘mundo real’” (1934); Hempel – “On the logical positivists’ conception of truth” (1935)



Fonte: Giampaolo Conti

Neurath
O projeto da ciência unificada

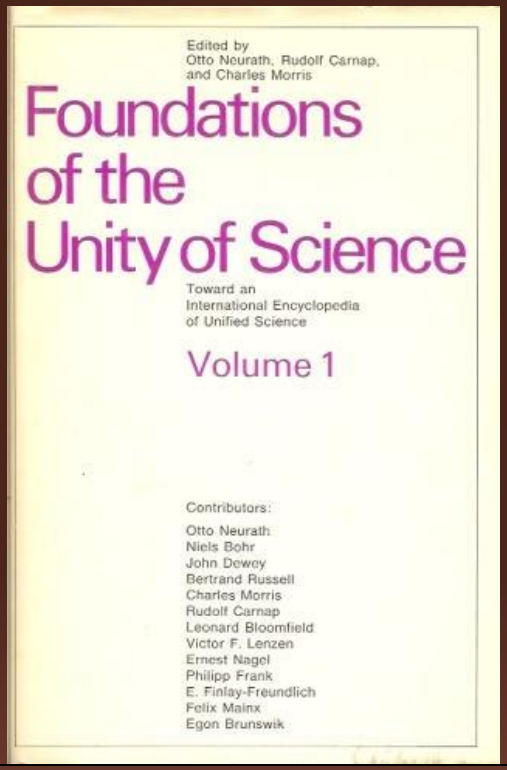


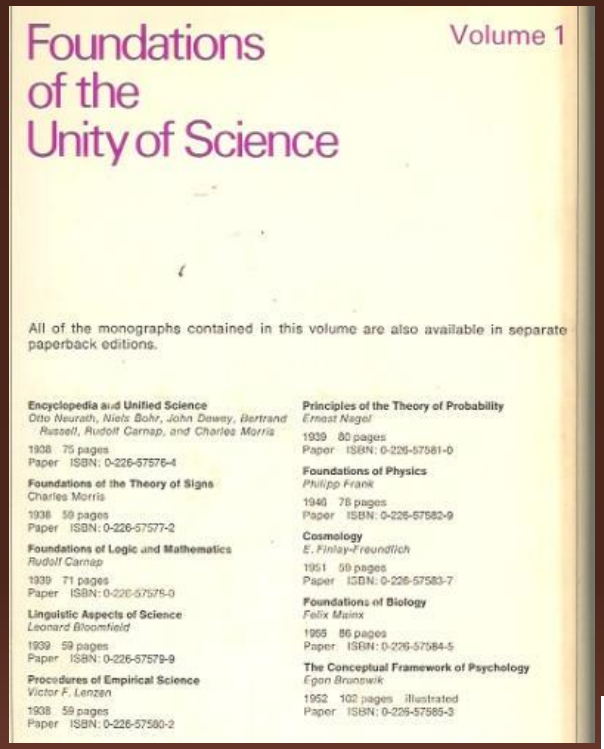
A interdisciplinaridade científica pela perspectiva da ciência unificada

Neurath
O projeto da ciência unificada

Foundations of the Unity of Science (ed. Neurath, Carnap & Morris) - Volume 1

- Encyclopedia and Unified Science / Otto Neurath et al
- Foundations of the Theory of Signs / Charles Morris
- Foundations of Logic and Mathematics / Rudolph Carnap
- Linguistic Aspects of Science / Leonard Bloomfield
- Procedures of Empirical Science / Victor Lenzen
- Principles of the Theory of Probability / Ernest Nagel
- Foundations of Physics / Phillipp Frank
- Cosmology / E. Finlay-Freundlich
- Foundations of Biology / Felix Mainx
- The Conceptual Framework of Psychology / Egon Brunswik

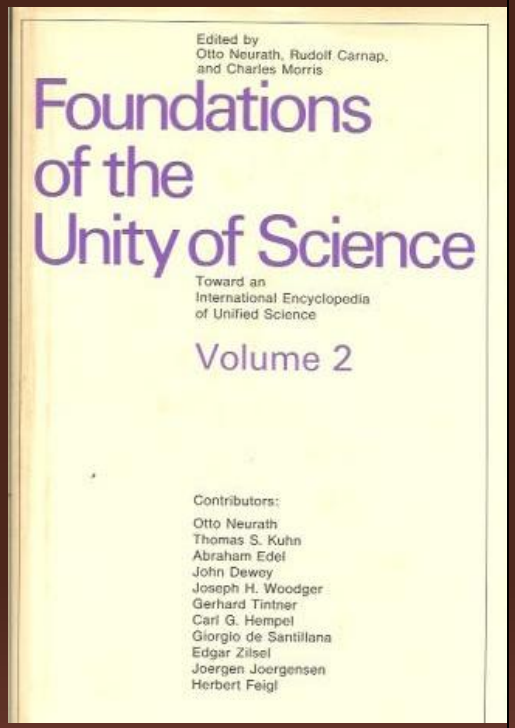


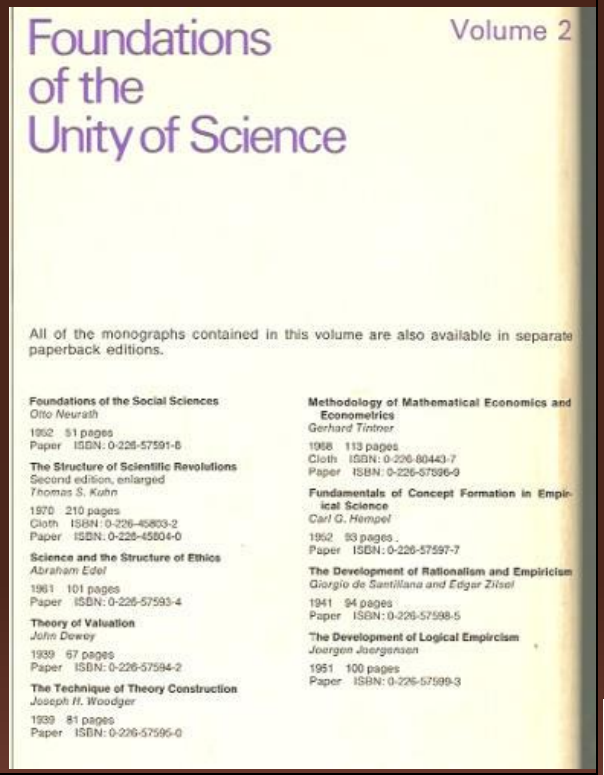


Neurath
O projeto da ciência unificada

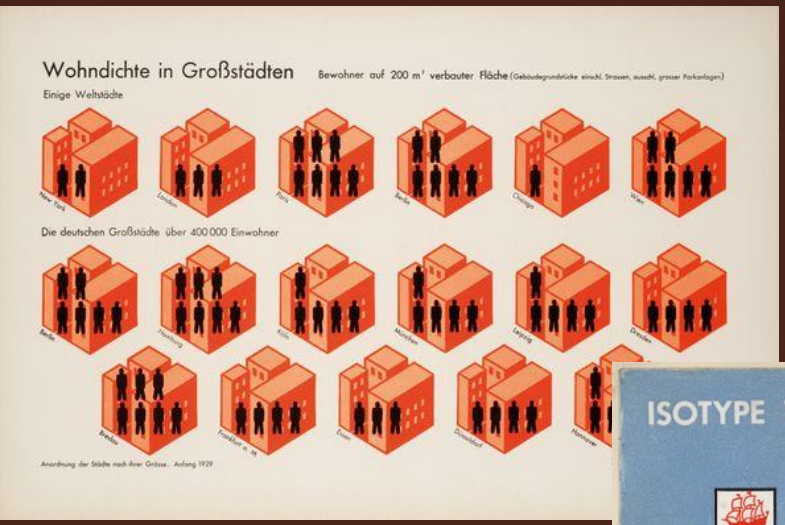
Foundations of the Unity of Science (ed. Neurath, Carnap & Morris) - Volume 2

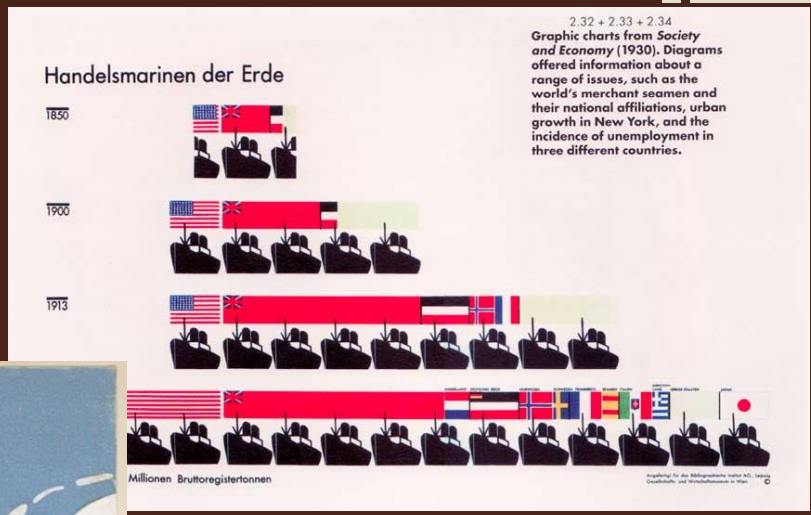
- Foundations of the social sciences / Otto Neurath
- Structure of scientific revolutions / Thomas Kuhn
- Science and the structure of ethics / Abraham Edel
- Theory of valuation / John Dewey
- Technique of theory construction / J. H. Woodger
- Methodology of mathematical economics / Gerhard Tintner
- Fundamentals of concept formation in empirical science / Carl Hempel
- Development of rationalism and empiricism / Giorgio De Santillana and Edgar Zilsel
- Development of logical empiricism / Jorgen Jorgensen
- Bibliography and index / Herbert Feigl and Charles Morris

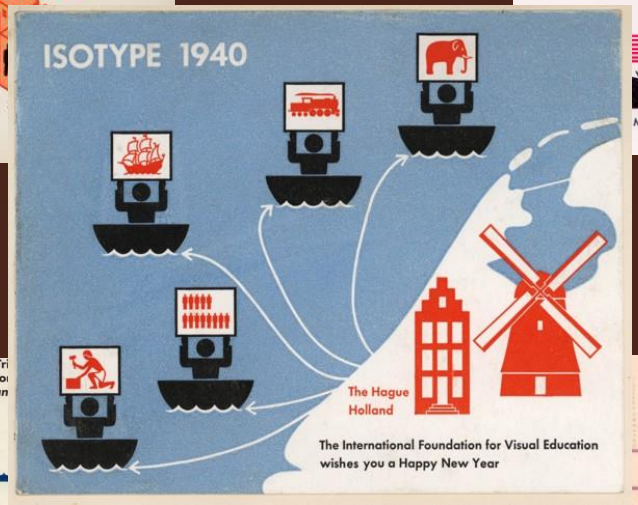


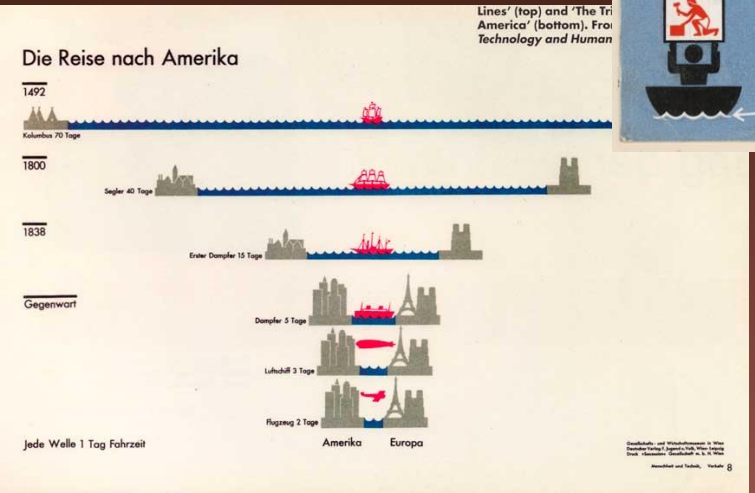


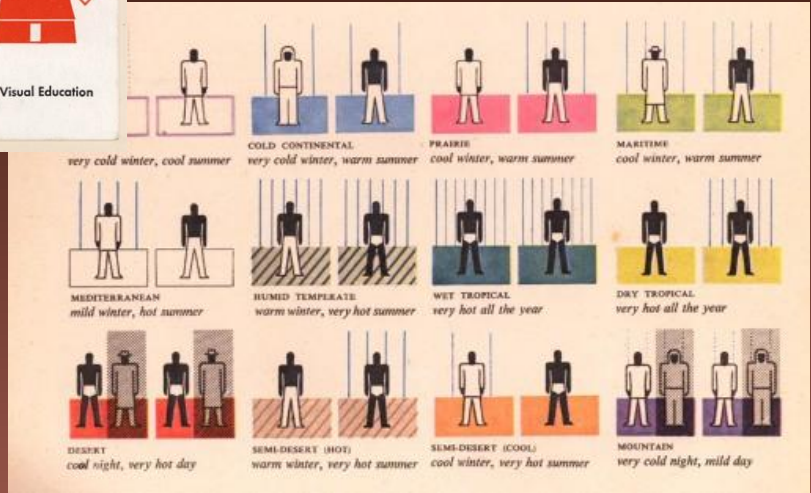
Outro lado de Neurath – Designer gráfico
O ISOTYPE de Neurath e Gerd Arntz





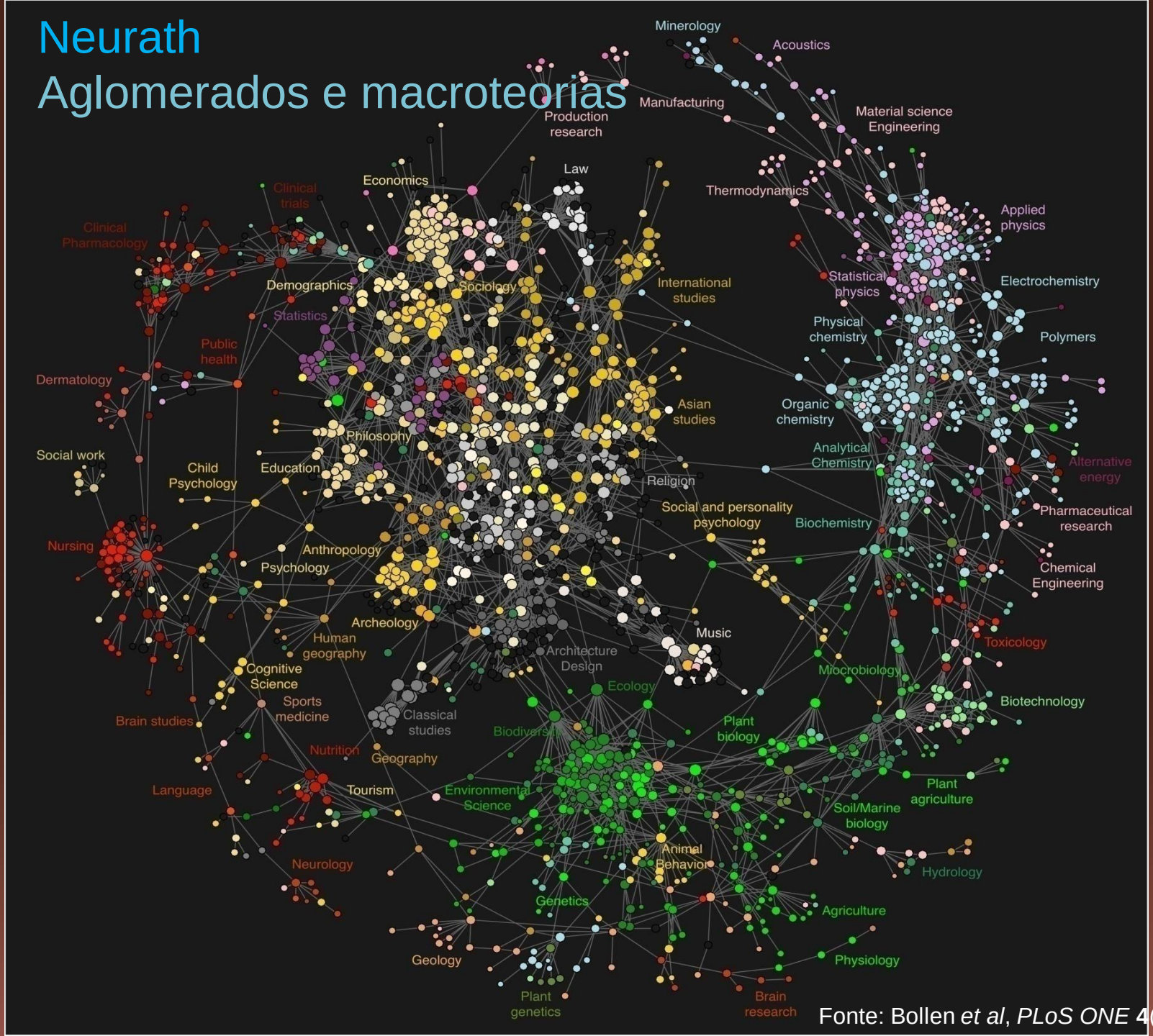






Texto: Neurath – “Pseudorracionalismo do falseamento” (1935)

Neurath
Aglomerados e macroteorias



Fonte: Bollen *et al*, *PLoS ONE* **4**(3)(2009).

Neurath
Aglomerados e macroteorias

«De nossa parte, procuramos utilizar modelos que não requerem que pensemos, desde o início, em um ideal desse tipo [i.e. de sistematização dedutiva]. Partimos de massas de enunciados que só parcialmente estão conectados de forma sistemática, e que, ao mesmo tempo, nós somente abarcamos [*überschauen*] de maneira parcial. As teorias se colocam junto aos relatos singulares. Ao mesmo tempo que o pesquisador trabalha com o auxílio de uma parte dessa massa de enunciados, outros introduzem acréscimos [*Ergänzungen*] que o primeiro está disposto a aceitar em princípio, pio, sem avaliar completamente as consequências lógicas de tal decisão. Os enunciados da massa de enunciados com que efetivamente se trabalha empregam muitos termos imprecisos, de modo que somente se pode destacar os "sistemas" enquanto abstrações. [...]

Neurath
Aglomerados e macroteorias

[...]
Os enunciados se conectam entre si, por vezes, de maneira mais estreita e, por vezes, de maneira mais tênue. A conexão total não é transparente, ainda que, em determinados lugares, se tente fazer deduções sistemáticas. Tal situação não origina, de modo algum, a idéia de um "regresso ao infinito", ao passo que Popper deveria rejeitá-la especialmente em conexão com isso (p. 19). Se se deseja dizer que Popper parte de *sistemas-modelo,* pode-se dizer que nós, por nossa parte, partimos de *enciclopédias-modelo;* com isso se deseja expressar, desde o princípio, que não colocamos na base de nossas considerações os *sistemas de enunciados nítidos.»*

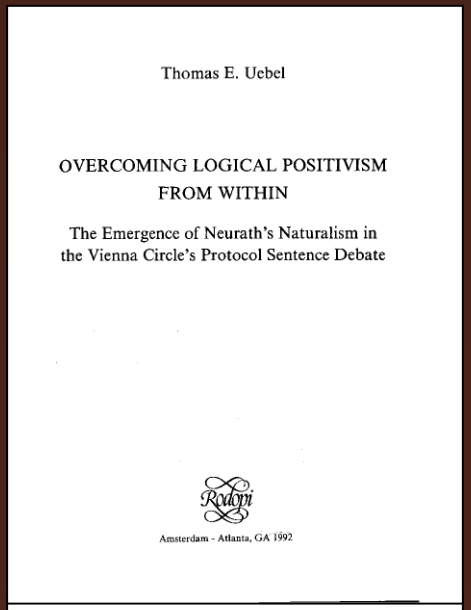
Neurath, "Pseudorracionalismo de la falsación" (1935), Seção 2, trad. por Andoni Ibarra, in: *Redes*, **10**(19)(2002).

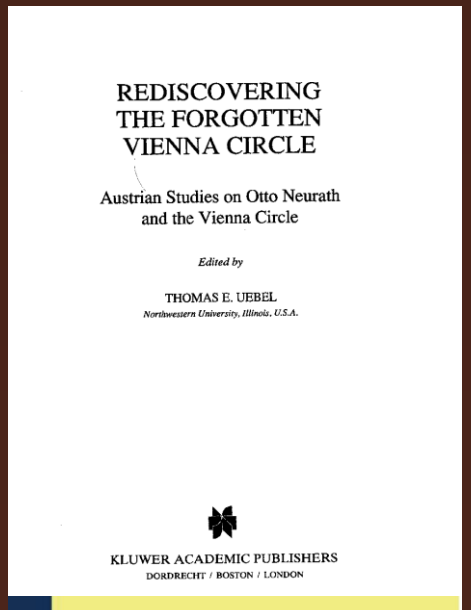
Neurath
Aglomerados e macroteorias

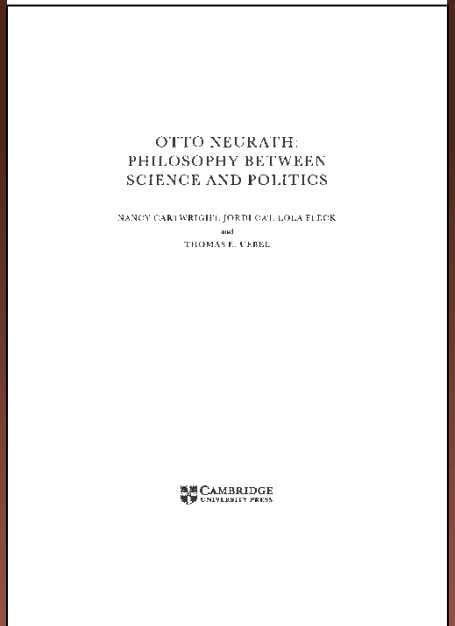
«[...] É claro que se procura axiomatizar a ciência sempre que possível. Entretanto, se [Thilo] Vogel [em “Bemerkungen zur Aussagentheorie des radikalen Physikalismus”, 1934] é de opinião que é preciso ter o sistema axiomatizado para que a contradição seja revelada, ele ignora o fato de que, na prática, se avança de forma muito mais desajeitada e fica-se bem feliz em ter uma contradição apontada *ou* um número maior de concordâncias. É precisamente a história da física que mostra que os nossos procedimentos são, com frequência, conscientemente defeituosos. Ocasionalmente acontece de duas hipóteses contraditórias acerca do mesmo assunto serem usadas em dois lugares com algum grau de sucesso. E, contudo, sabe-se que, em um sistema mais completo, somente *uma* hipótese deveria ser utilizada o tempo todo. Nós simplesmente nos resignamos a ter um esclarecimento moderado para, mais tarde, eliminar ou aceitar os enunciados.»

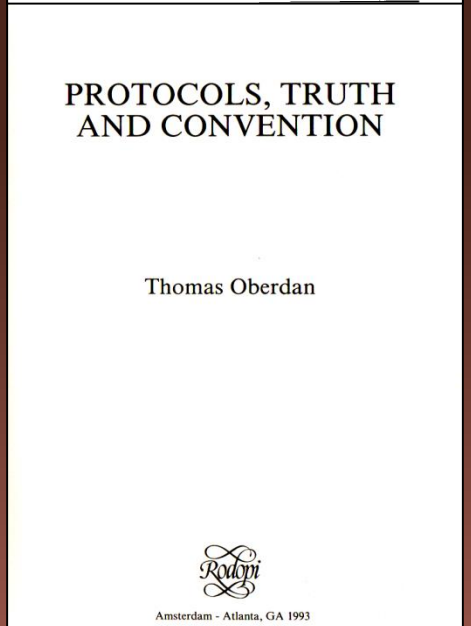
Neurath, “Radical physicalism and the ‘real world’”, in *Philosophical Papers*, p. 109, o primeiro itálico é meu.

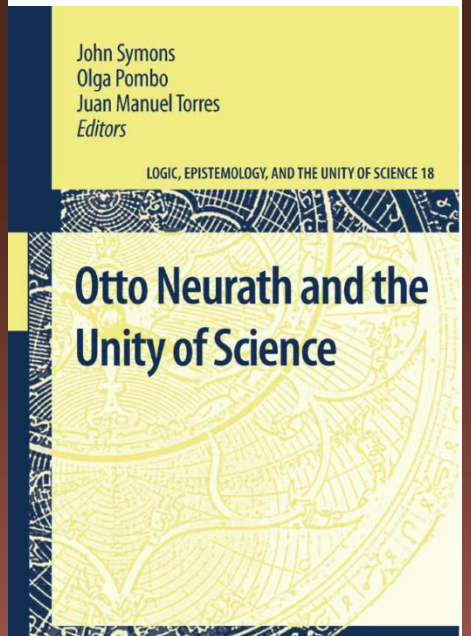
Neurath
Fortuna crítica recente

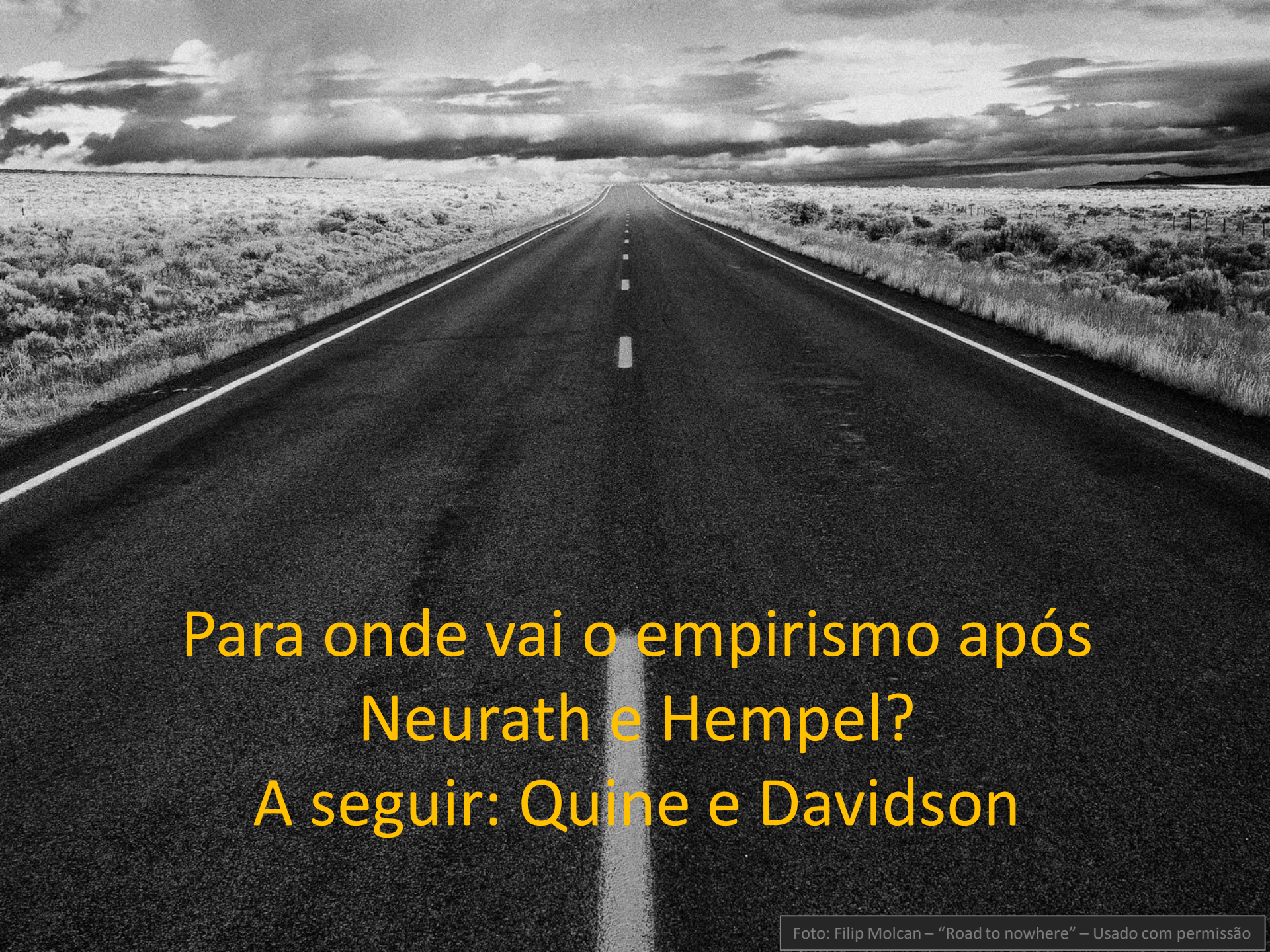












Para onde vai o empirismo após Neurath e Hempel?
A seguir: Quine e Davidson

Foto: Filip Molcan – “Road to nowhere” – Usado com permissão

Endereços

http://sites.google.com/site/filosofiadacienciausp/

http://filosofiadacienciausp.wordpress.com/