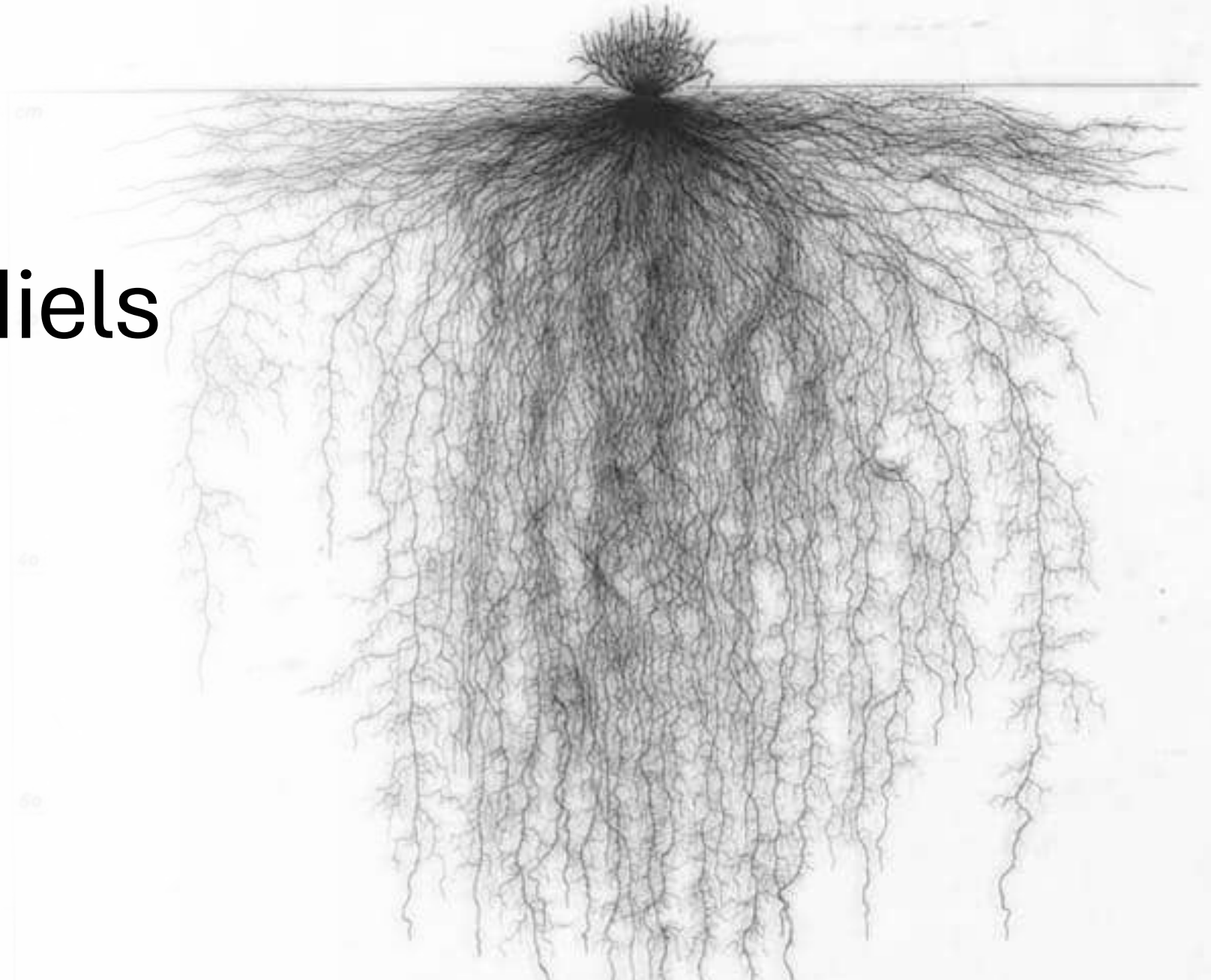
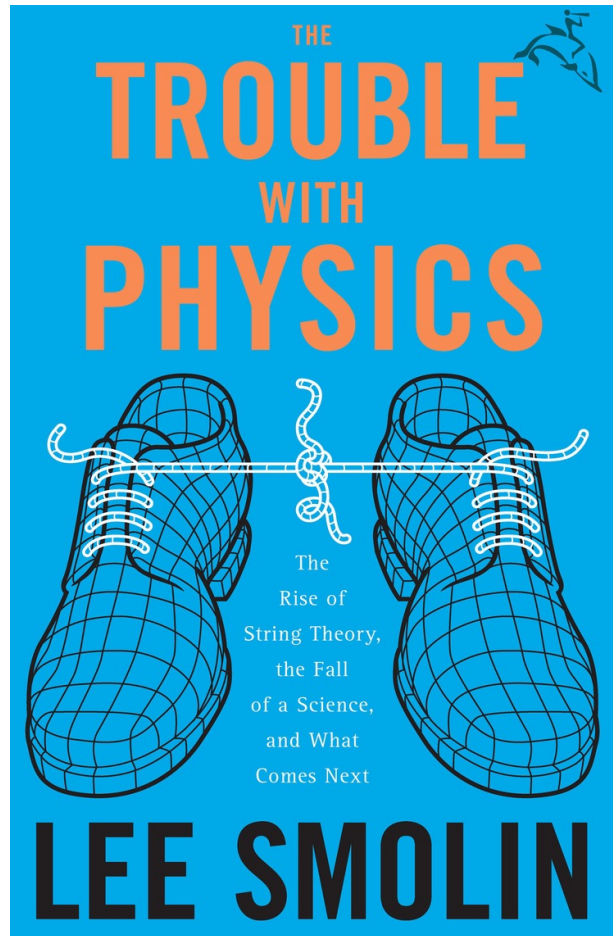


# Roots of Niels Bohr's Thought

Hans Halvorson



# Not so secret: Trouble with physics



The development of quantum mechanics in the first decades of the twentieth century came as a shock to many physicists. Today, despite the great successes of quantum mechanics, arguments continue about its meaning, and its future.

1.

The first shock came as a challenge to the clear categories to which physicists by 1900 had become accustomed. There were particles—

# Pointing the finger: Bohr was a positivist

“Without doubt, Bohr’s philosophical views have shaped the way generations of physicists think about quantum mechanics, but they have also, in the eyes of an increasing number, discouraged and stifled progress.” (Jim Al-Khalili, 2020, p 122)

# Pointing the finger: Bohr was unclear

“While imagining that I understand the position of Einstein, ... I have very little understanding of the position of his principal opponent, Bohr.

... Indeed, I have very little idea what this means. I do not understand in what sense the word ‘mechanical’ is used .... I do not know what the italicized passage means.” (John Bell, Bertlmann’s Socks)



# Pointing the finger: Science has forgotten its humanist roots



# Catherine Chevalley

“Bohr’s ideas were not located in their proper background, either scientific or philosophical, until quite recently.”

# Filosofisk smagsprøve

“Every unambiguous communication about the state and activity of our mind implies of course a separation between the content of our consciousness and the background loosely referred to as ‘ourselves’ but any attempt at exhaustive description of the richness of conscious life demands in various situations a different placing of the section between subject and object.”

“In order to illustrate this important point, I shall quote a Danish poet and philosopher, Poul Martin Møller, who lived about a hundred years ago and left behind an unfinished novel called “The Adventures of a Danish Student”, in which the author gives a remarkably vivid and suggestive account of the interplay between the various aspects of our position . . .” (Bohr 1960, p 65)

Bell, Al Khalili, and their ilk are hamstrung.

They cannot see the root system.

# Bohr as Kantian?

“Bohr’s interpretation was rooted into every detail of the long genesis of atomic physics, and it was formulated within the philosophical language that developed in the German culture starting with Kant.”  
(Catherine Chevalley)



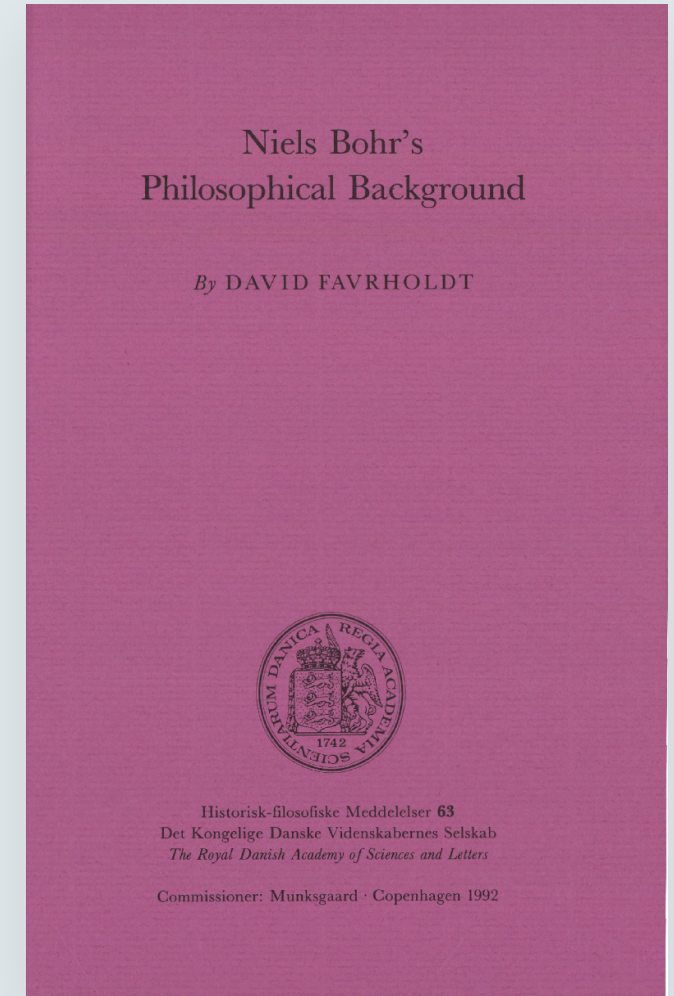
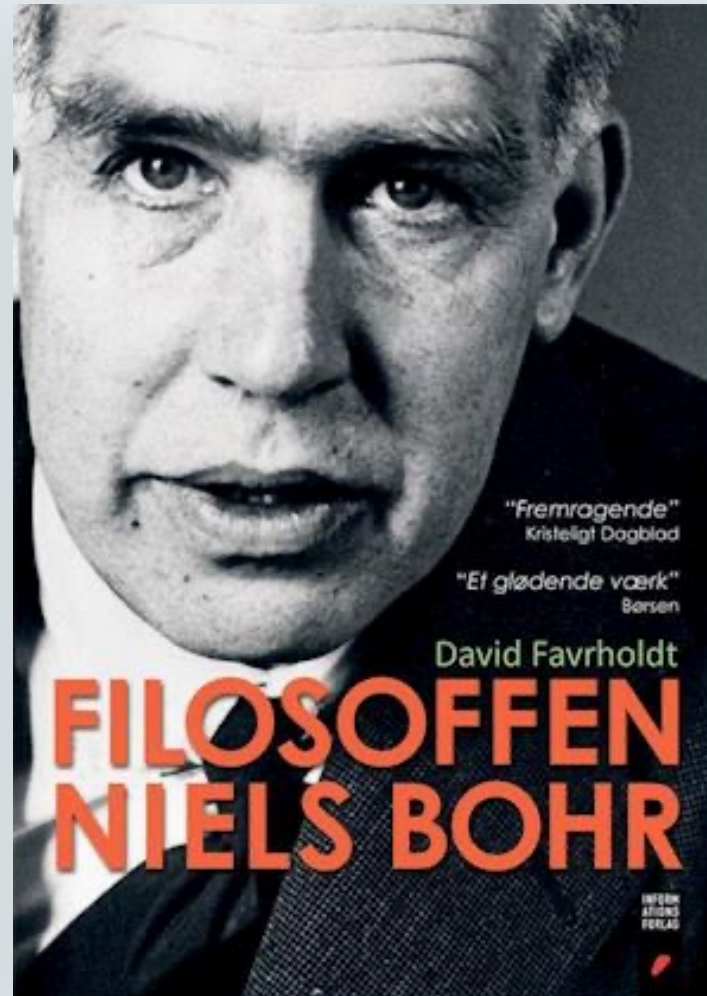
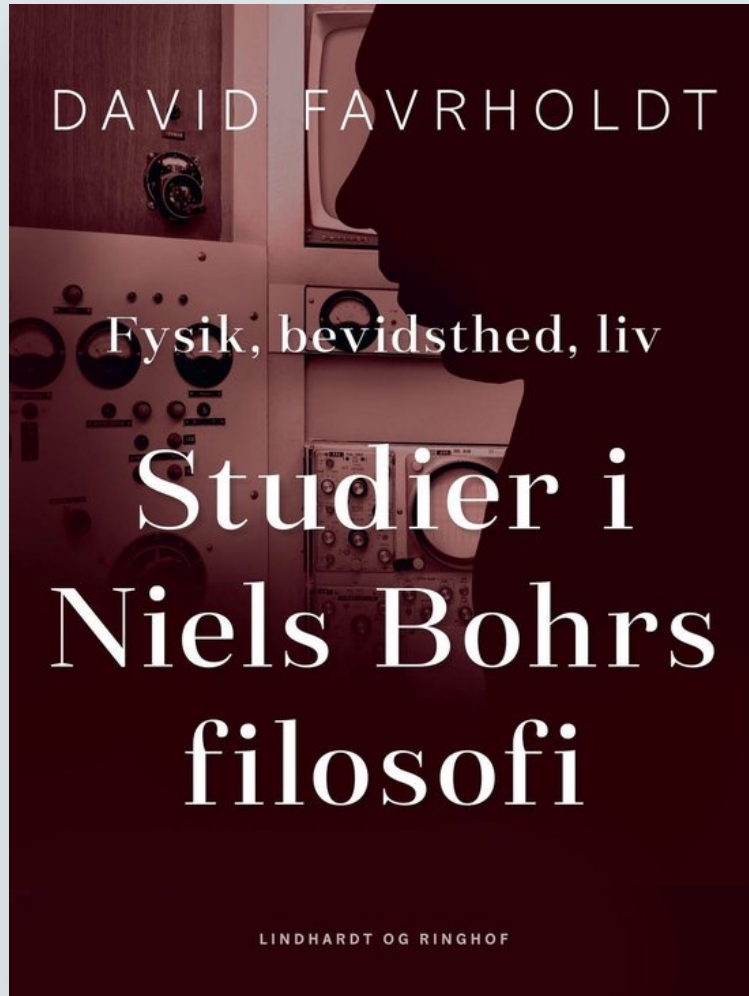
# Bohr as Kierkegaardian?

“There can be no doubt that the Danish precursor of modern existentialism and neo-orthodox theology, Søren Kierkegaard, through his influence on Bohr, affected also the course of modern physics to some extent.”

(Jammer 1966, p 173)



# Bohr's Defender





# Bohr as great philosopher

“Of course, a lot has already been written about Bohr's philosophy, but unfortunately not many people have been able to see the depth of it and its new vision when it comes to traditional philosophical issues.” (Favrholdt, FNB)

“I consider Niels Bohr to be one of the greatest thinkers in human history.” (Favrholdt, FNB)

# Ideas ex Nihilo

“Do we have any reason at all to believe that Bohr was influenced by Kierkegaard’s philosophy? The answer is in the negative.” (NBFB, p 62)

“If we wish to speak of an influence in this case, the influence is actually an antithetical one. And if in his first reading of Kierkegaard Bohr reacted against his ideas, then the roots of his own view must be sought elsewhere.” (NBFB, p 54)

# Ideas ex Nihilo

“Neither Kierkegaard nor Høffding mentions an arbitrary dividing line between subject and object. Only in Poul Martin Møller’s writings do we find this idea.” (NBPB, p 57)

“It seems that [Harald] Høffding played little or no part as regards the formulation of Bohr's specific contribution to philosophy.”

- Contra Favrholt, the proper way to understand “influence” on Niels Bohr’s thought is via ***transformation***.
- Not direct transmission from texts, but more like absorption from the cultural soil.
- Kierkegaard’s ideas are in the mix – as are the ideas of many other 18<sup>th</sup> and 19<sup>th</sup> century thinkers.

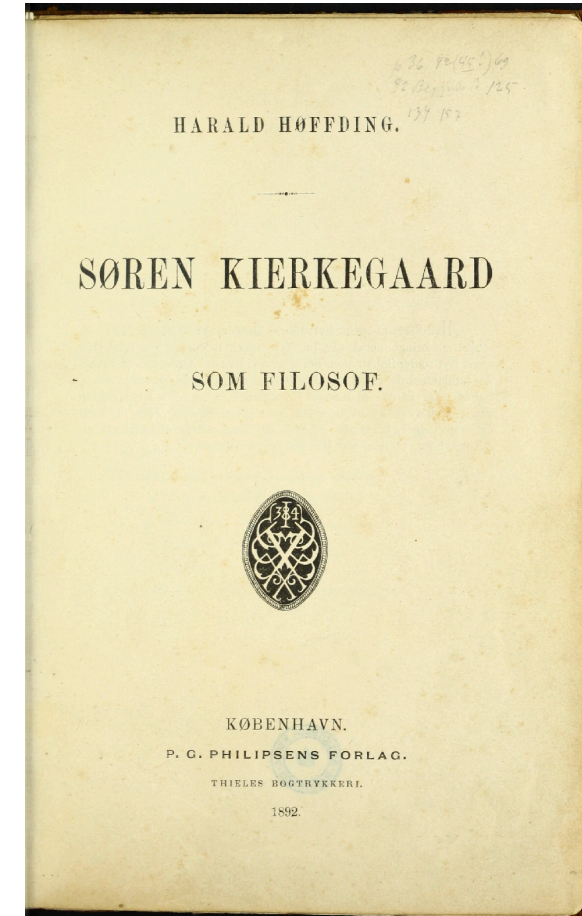
# Working Backwards

- Bohr
  - The moveable line between subject and object
  - “Unambiguous”
  - Complementarity is an objective description
  - Classical concepts
  - Analysis and synthesis
  - Mechanism versus vitalism
  - Free will
  - No “God’s eye view”

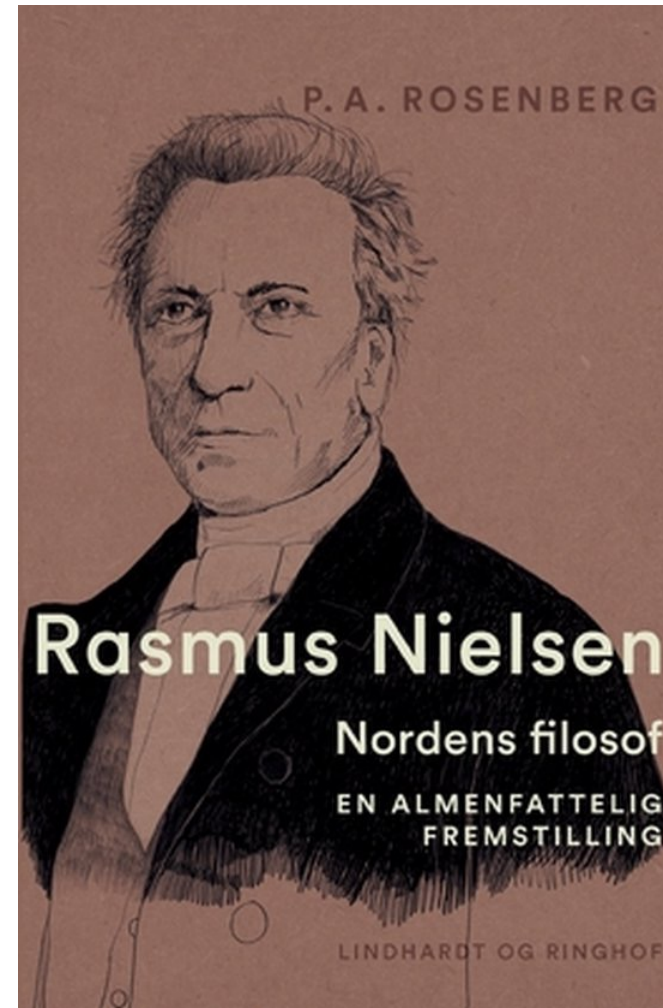
# Bohr's proximal philosophical influences

1. Bohr read *Stadier paa Livets Vei*
2. Bohr's father was friends with Harald Høffding
3. Bohr took a year of Filosofikum (teacher was Høffding)
4. Bohr's father took a year of Filosofikum (teacher Rasmus Nielsen's)

# Harald Høffding (1843-1931)



# Rasmus Nielsen (1809-1884)





# A single data point in English

SK and RN were contemporaries and friends for a couple of years. Then SK accused RN of stealing his ideas.

See Jon Stewart, “Rasmus Nielsen: From the Object of ‘Prodigious Concern’ to a ‘Windbag’.”

# The once-famous Rasmus Nielsen

“No one who studies the life of the mind in nineteenth-century Denmark, will be able to skip over [Nielsen’s] great philosophical writings, and everyone who got to hear his lectures at the university will remember him as a great awakener and a rare personality.” (Brandes 1899)

# The once-famous Rasmus Nielsen

- Nielsen taught several generations of the most distinguished scientists, philosophers, and humanists in Denmark
  - Taught Filosofikum from 1841 to 1882
- Published thousands of pages of philosophy
- Nothing of Nielsen's has been translated into a “world language”

# Nielsen's students



J. Lange 1859



G. Brandes 1859



H. Høffding 1861

“At first it was Rasmus Nielsen, whose enthusiastic references to Kierkegaard and whose rousing eloquence had the greatest influence on me.” (Høffding 1909)

# Høffding, *Danske Filosofer*

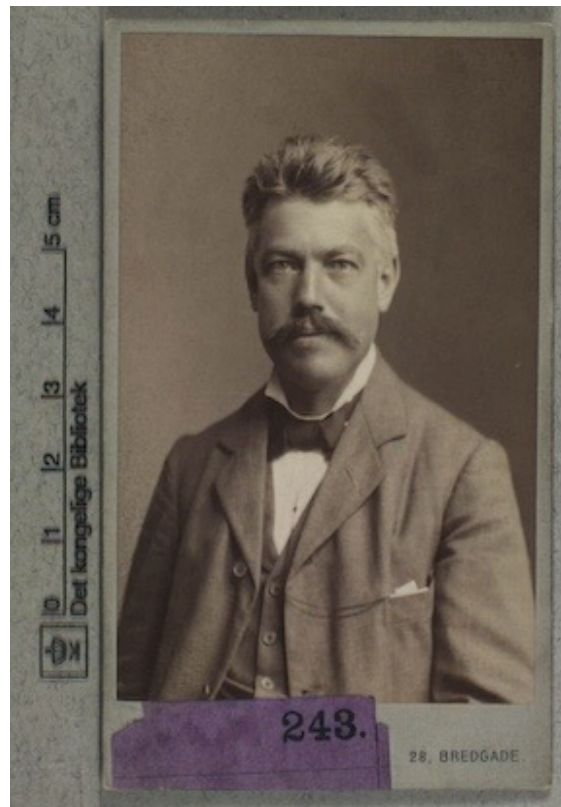
Da jeg i Aaret 1861 kom til Universitetet, stod Nielsen i sin fulde Kraft, fuld af Iver og Virkelyst, og det Kursus, jeg hørte hos ham i mit første Studenteraar, fik stor Betydning for mig. Han læste væsentligt over Kierkegaard, idet han gennemgik „Stadierne“ efter et lille Udvalg af Hovedsteder i Kierkegaards Skrifter. Vel var atter her Anlægget saa stort, at det ikke blev udført, men med stor Veltalenhed førte han dog sine unge Tilhørere paa Vej til Forstaaelse af den store Skikkelse, der nyligt havde forladt Kamppladsen, og hvis Optræden endnu mærkedes i sine Eftervirkninger. Til denne

“You were originally a disciple of Rasmus Nielsen. Like others, you were subject to the attraction of this deft, sparkling virtuoso of intellectual skill, this Ole Bull of philosophy with his spark of life, against whom posterity is so cold because he was far too prevalent in his time.”

(G. Brandes, Tale for H. Høffding, 1903)



K. Kroman 1868



C. Bohr 1874



A. Lehmann 1874



# Who was Rasmus Nielsen?

1809 bondefødt in Rorslev, Middelfart

1820 intellectual talents recognized by local priest

1829 begins studies at Viborg katedralskole

1830 SK matriculates at KU

# Who was Rasmus Nielsen?

1832 graduated Viborg katedralskole

1837 teologisk embedseksamen

1839 SK's journal: satirical remarks about RN

# Nielsen's Hegelian Period

1840 PhD: *De speculativa historiæ sacræ tractandæ method*

1841 SK PhD: Begrebet Ironi

1841 RN appointed chair of moral philosophy (Poul Møller's chair)

1842 SK remarks satirically about RN's unfinished system in  
*Fædrelandet*

1845 *Den Logiske Propædeutik*

# Relationship with Kierkegaard

1846 SK. *Afsluttende Uvidenskabelig Efterskrift*

1848 SK and RN begin taking regular walks together. SK: RN is the only one of the younger thinkers in Denmark who “may amount to something”.

1849 RN. *Evangelietroen og den moderne Bevidsthed*

SK: “The writings are plundered in many ways . . . And then my conversations!”

# Relationship with Kierkegaard

1849 Martensen. *Den Christelige Dogmatik*

1849 RN. *Mag. S. Kierkegaards "Johannes Climacus" og Dr. H. Martensens "Christelige Dogmatik." En undersøgende Anmeldelse.*

1850 RN. *Evangelietroen og Theologien*

# Nielsen's Scientific Turn

1855 *Om Theologiens Naturbegreb med særligt Hensyn til Malebranche: De la recherche de la verité*

1857 *Philosophisk Propædeutik i Grundtræk*

1857 *Philosophie og Mathematik. En propædeutisk Afhandling*

1859 *Mathematik og Dialektik*

“As my recent writings show, it has been my goal, for several years, to clarify and demonstrate the relationship between philosophy and the separate sciences as comprehensively as possible. The future of philosophy depends in an essential way on a thorough understanding and accurate determination of this relationship.” (1864, p 18)

# The second battle about faith and reason

1864 Nielsen. *Grundideernes Logik*.

“Tro og Viden er uensartede Principper”.

1866 Brandes. *Dualismen i vor nyeste Philosophie*

1866 Høffding. *Philosophie og Theologie*

1867 Nielsen. *Om ‘Den Gode Villie’ som Magt i Videnskaben*



# The so-called Heisenberg cut

- Bohr talked about a moveable boundary (skillelinien) between subject and object
- Contemporary physicists are confused
- John Bell: “The shifty split”

“The first charge against 'measurement', in the fundamental axioms of quantum mechanics, is that it anchors there the shifty split of the world into ‘system’ and ‘apparatus’.” (Against Measurement)

## Commentary

## Quantum mechanics: Fixing the shifty split

Quantum mechanics is the most useful and powerful theory physicists have ever devised. Yet today, nearly 90 years after its formulation, disagreement about the meaning of the theory is stronger than ever. New interpretations appear every year. None ever disappear.

Probability theory is considerably older than quantum mechanics and has also been plagued from the beginning by questions about its meaning. And quantum mechanics is inherently and famously probabilistic.

For the past decade, Carl Caves, Chris Fuchs, and Ruediger Schack have been arguing that the confusion at the foundations of quantum mechanics arises out of a confusion, prevalent among physicists, about the nature of probability.<sup>1</sup> They maintain that if probability is properly understood, the notorious quantum paradoxes either vanish or assume less vexing forms.

Most physicists have a frequentist view of probability: Probabilities describe objective properties of ensembles of "identically prepared" systems. Caves, Fuchs, and Schack take a personalist Bayesian view: An agent assigns a probability  $p$  to a single event as a measure of her belief that the event will take place.<sup>2</sup>

Such an agent is willing to pay less than  $\$p$  for a coupon that will pay her  $\$1$  if the event happens, and she is willing to underwrite and sell such a coupon for more than  $\$p$ . Surprisingly,

active, she would pay somebody to take a coupon from her that might cost her another  $\$1$ .) Avoiding certain loss is the only constraint on an agent's probability assignments.

The probability of an event is not inherent in that event. Different agents, with different beliefs, will in general assign different probabilities to the same event.

The personalist Bayesian view of probability is widely held,<sup>3</sup> though not by many physicists. It has profound implications for the meaning of quantum mechanics, which Fuchs and Schack call quantum Bayesianism—QBism for short. Since quantum states determine probabilities, if probabilities are indeed assigned by an agent to express her degree of belief, then the quantum state of a physical system is not inherent in that system but assigned by an agent to encapsulate her beliefs about it. State assignments, like probabilities, are relative to an agent.

QBism immediately disposes of the paradox of "Wigner's friend." The friend makes a measurement in a closed laboratory, notes the outcome, and assigns a state corresponding to that outcome. Wigner, outside the door, doesn't know the outcome and assigns the friend, the apparatus, and the system an entangled state that superposes all possible outcomes. Who is right?

For the QBist, both are right: The friend assigns a state incorporating her

expressions of our knowledge. John Bell tellingly asked, "Whose knowledge? Knowledge about what?" The QBist makes a small but profound correction: Replace "knowledge" with "belief." Whose belief? The belief of the agent who makes the state assignment, informed by her past experience. Belief about what? About the content of her subsequent experience.

Bell also deplored a "shifty split" that haunts quantum mechanics. The shiftiness applies both to the nature of the split and to where it resides. The split can be between the quantum and the classical, the microscopic and the macroscopic, the reversible and the irreversible, the unspeakable (which requires the quantum formalism for its expression) and the speakable (which can be said in ordinary language). In all cases the boundary is moveable in either direction, up to an ill-defined point. Regardless of what is split from what, all versions of the shifty split are vague and ambiguous.

For the QBist, there is also a split. It is between the world in which an agent lives and her experience of that world. Shiftiness, vagueness, and ambiguity all arise from a failure to realize that like probabilities, like quantum states, like experience itself, the split belongs to an agent. All of them have their own split. What is macroscopic (classical, irreversible, speakable) for Alice can be microscopic (quantum, reversible, un-

“Ordinary language, by its use of such words as thoughts and sentiments, admits typical complementary relation between conscious experiences implying a different placing of the section line between the observing subject and the object on which attention is focused.”

“In fact, the varying separation line between subject and object, characteristic of different conscious experiences, is the clue to the consistent logical use of such contrasting notions as will, conscience and aspirations, each referring to equally important aspects of the human personality.”  
(Bohr 1953, pp 389-390)

“In emphasizing the necessity of paying proper attention to the placing of the object-subject separation in unambiguous communication, the modern development of science has created a new basis for the use of such words as knowledge and belief.” (Bohr 1955, p 61)

Efter Afslutningen af sine Forstudier begyndte Nielsen Udgivelsen af et stort Værk, hvis Navn var *Grundideernes Logik*. Kun to Dele udkom (1864—66) — og de udgjorde kun to Trediedel af det paatænkte Værks første Niendedel! Atter her viste det sig, at Nielsens Fantasi ilede forud for hans Tanke. Han saa i Aanden, at der til at beskrive Vexelforholdet mellem det Subjektive og det Objektive, eller som han stadigt kalder det, Viden og Magt, behøvedes en uendelig Analyse, da ethvert Subjekt forudsætter et Objekt, og ethvert Objekt igen et Subjekt. Naar man ikke vil slutte af paa spekulativ og teologisk Maade, er det en Holmgang, der aldrig kan faa Ende — og det var derfor intet Tilfælde, at Værket ikke blev afsluttet. Videnskabeligt set maa man her lade sig nøje med at paavise det stadige Forhold mellem Subjekt og Objekt som en Lov: enhver Egenskab, man tillægger Subjektet, kan selv gøres til Genstand (Objekt) og maa have sin

Grund i visse objektive Forhold; og ethvert Objekt, eller ethvert objektivt Forhold opfattes paa en ved det opfattende Subjekts Natur bestemt Maade — og saaledes kan man blive ved i Kraft af Loven for Forholdet mellem Subjekt og Objekt.

Nielsen opfattede nu ikke Sagen paa denne Maade. Hans Tankegang var, at da ethvert Objekt maa objektiveres, d. e. forudsætter et Subjekt, og da det menneskelige Subjekt ikke kan opfatte (objektivere) Alt, maa der, hvis Objekternes Realitet skal hævdes, være et absolut („ontologisk“) Subjekt, for hvilket den absolute Realitet er til. Han overser, at Spiilet maa begynde igen her; selv en Gud er bunden til Loven om Forholdet mellem Subjekt og Objekt. Forsøget paa gennem „Grundideernes Logik“ at begrunde en abstrakt Teisme er derfor ikke lykkedes. Vi kunne ikke komme længere end til at bestemme og beskrive et Subjekt, i Forhold til hvilket visse Fænomener (Objekter) gælde, ligesom Astronomen maa bestemme et Punkt (paa Jorden, paa Solen eller hvorsomhelst), ud fra hvilket Himmellegemernes Stillinger og

# Høffding, *Erkendelsesteori*

Selve den Subjektivitet, for hvilken al mulig menneskelig Viden, baade hvad Omfang og hvad Sammenhæng angaar, kunde staa fuldt og klart, vilde dog tænke under bestemte Forudsætninger, være et menneskeligt Subjekt ( $S_m$ ). Et rent S (uden den Indeks, der betegner visse Forudsætnin-

<sup>1</sup> Se herom *Relation som Kategori* p. 74—76.

<sup>2</sup> *Die Realisirung*. Dritter Band. 1923. p. 427.



# Høffding, Erkendelsesteori

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Nr. 1. HARALD HØFFDING:

ger) kan vi ikke tænke os. Men et idealiseret Menneske-subjekt ( $S_m$ ) maatte besidde en Forstaaelse af, hvorfor forskellige empiriske Subjekter ( $S_\alpha S_\beta S_\gamma \dots$ ), alle hørende ind under  $S_m$ , maatte komme til forskellige Opfattelser.<sup>1</sup>  $S_m$  er selv i stadig Udvikling, og den fulde Sandhed vil ikke blot bestaa i en objektiv Lære, men ogsaa i en Forklaring af, hvorfor ikke alle forskende Aander opfatter Sagerne paa den Maade, den objektive Lære angiver.



# Høffding, Den Menneskelige Tanke (1910)

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## *IV. Tankens Opgaver.*

Naar vi betragte Noget som Objekt, maa vi angive Beskaffenheden af det Subjekt, i Forhold til hvilket det gør sig gældende. Og naar vi betragte Noget som Subjekt, maa vi dels søge den objektive Sammenhæng, der bestemmer dets Beskaffenhed og derved de Emner og Former, der staa til dets Raadighed, dels agte paa, at vi ved denne Under-søgelse gøre det selv til Objekt for et Subjekt (hvis det er os selv, saa for os selv i en noget anden Tilstand, i hvert Tilfælde i et andet Øjeblik, end før). Vi have aldrig et rent Subjekt (S), men stedse et objektivt bestemt eller dog et objektiveret Subjekt (S<sub>o</sub>). Og vi have aldrig et rent Objekt (O), men stedse et subjektiveret Objekt (O<sub>s</sub>). S og O ere blotte Abstraktioner. Hvad vi kunne have for os er stedse S<sub>o</sub> og O<sub>s</sub>.

# Why has Nielsen been neglected

1. Abstract and heavy writing style
2. Challenged scientists' authority
3. On the wrong side of Det Moderne Gennembrud

”Komplementaritetsfilosofien, som er Bohrs højst personlige og meget københavnske sammenfatning af kvantemekanikkens erkendelsesteori, stort set ikke er blevet forstået af det internationale fysikersamfund.”

Peder Voetmann Christensen, Springet fra København, Information, 7. okt 1985

”Men hvorfor prøver man så ikke at forstå den filosofi, som førte til Bohrs sikre forudsigelser? Det var jo ikke en krystalkugle, men logisk tænkning, som lå bag.

Jeg tror, at svaret skal søges i, at Bohrs filosofi netop er meget københavnsk. Den bygger på nogle forudsætninger, en særlig begrebslogik, som er udviklet i 1800-tallets København, men som ikke specielt har noget med fysik at gøre.”

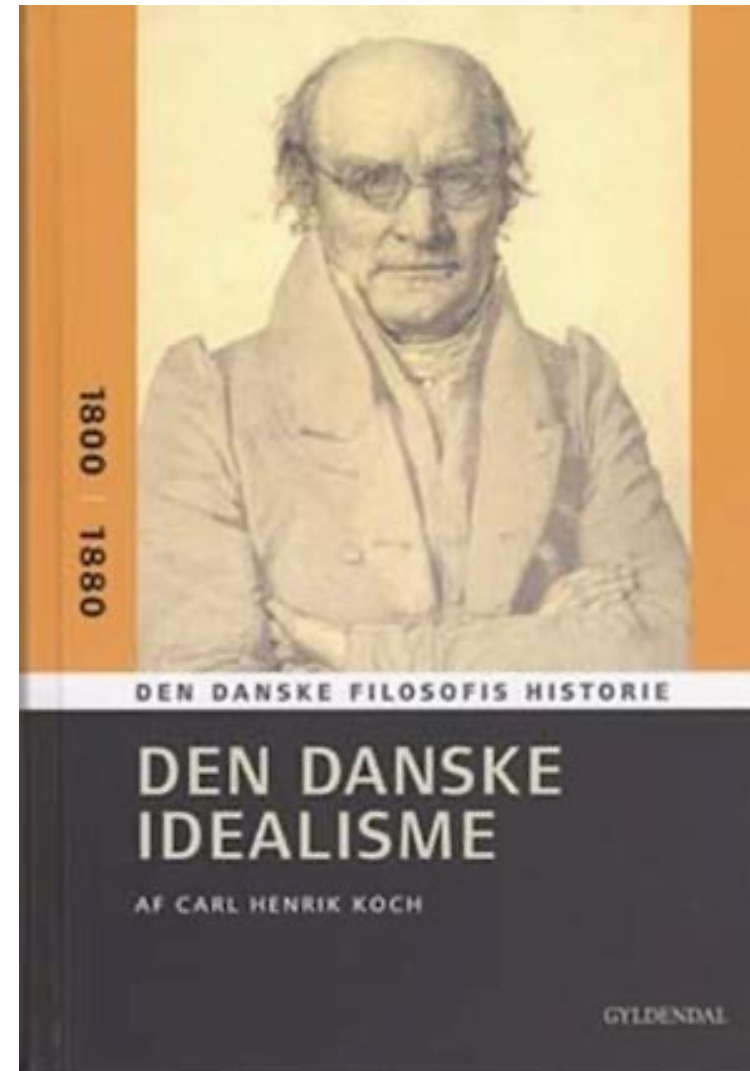
MINDESKRIFT  
OVER  
**RASMUS NIELSEN**

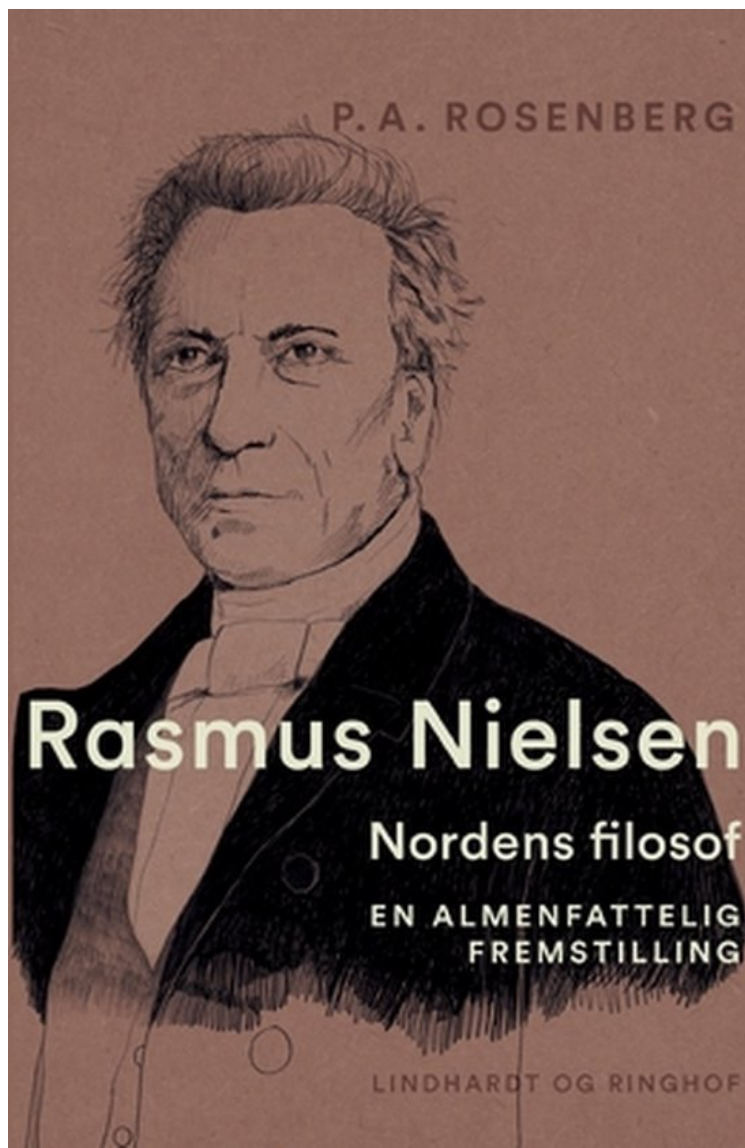
UDGIVET PÅ HUNDREDAARSDAGEN  
EFTER HANS FØDSEL

AF  
V. KLEIN og P. A. ROSENBERG



KØBENHAVN  
DET SCHØNBERGSKE FORLAG  
ERNST BIERBERG & MICHAEL H. JENSEN  
1909





## Kierkegaard og Rasmus Nielsen

af HELGE HULTBERG

*Til Steffen Steffensen*

»Samtidighed« er et af de ord, som Søren Kierkegaard for altid har været med til at præge. »Det Forbigangne er ikke Virkelighed: for mig; kun det Samtidige er Virkelighed for mig.«<sup>1</sup> På dette trin er det endnu helt alment holdt, men naturligvis er det specielt samtidigheden med Jesus, det drejer sig om. Først når vi forsøger at gøre os samtidige med ham, forstår vi, hvem vi er, og vi må indrømme, at vi ikke slår til. Eller vi kniber udenom: Den forstandige siger i samtidighedens situation: »Han er bogstaveligen Ingenting.«<sup>2</sup> Nu 1800 år efter er det let nok at sværme for Jesus, at kalde ham Guds søn, men det tæller ikke:

»Pas vel paa dette om Samtidigheden; thi ikke kommer det an paa, hvad Stads Du gør for en Afdød, nei; men dette, hvad Du gør i Samtidighed, eller at Du gør det Forbigangne saaledes nærværende, at Du kommer til at lide som var Du samtidig dermed, dette afgjør hvad Menneske Du er. Det derimod at gøre Stads for en Afdød – nu det forstaaer sig, det afgjør ogsaa, hvad Menneske Du er, at Du nemlig, ifølge Jesu Christi Dom, er en Hykler, ja en Morder, den Afdøde modbydeligere end De, der sloge ham ihjel.«<sup>3</sup>

Noget lignende gælder i forholdet til Søren Kierkegaard. Han var vel ikke Guds søn i snævrere mening, selv om han nok af og til har været på nippet til at tro det, ejheller var han vel en apostel, men der hørte alligevel en hel del til at erkende ham i samtidighedens situation, at se, at han var noget, villigt at udsætte sig for bremsens stik og ikke affærdige ham som fantast. Jeg tror ikke, de øjne var lykkelige, der så Søren Kierkegaard på jord. Han var en provokation, han overdrev så gyseligt. Vi forstandige og veletablerede, der nu ærer ham og bygger mausolæer for ham, bør nok forsøge at gøre os samtidige med ham, og da vil mange af os nok måtte indrømme, at vi ville have været med til at stene ham.

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Z#

Entwicklungsgang und  
Grundprobleme der Philosophie  
Rasmus Nielsens.

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Inaugural-Dissertation

zur Erlangung der Doktorwürde der hohen philosophischen  
Fakultät der Friedrich-Alexanders-Universität Erlangen

vorgelegt von

Eduard Asmussen  
aus Flensburg.

Tag der mündlichen Prüfung: 23. Febr. 1911.

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Flensburg

Buchdruckerei Lohse & Larßen  
1911.

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