

Niels Bohr on the Knowing Subject

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Why do we find Bohr obscure?

When contemporary physicists and analytic philosophers read Bohr, they are turned off by his “jibber jabber”

“Volition and causation are equally indispensable elements in the relationship between subject and object, which is the most central problem of epistemology [erkendelsesproblemets kerne].”

Our context versus Bohr's

“A curious thing about the ontological problem is its simplicity. It can be put in three Anglo-Saxon monosyllables: 'What is there?'" (Quine, “On what there is”, p 21)

“Danish thinking has been most interested in psychological and ethical questions, and it has usually been critical of the practice of system-building.” (Høffding, Danske Filosofer, p 2)

The subject-object distinction made ontological

- ① Heisenberg cut of the physical world into classical and quantum parts
- ② Wigner cut between the mental and physical

John Bell against the shifty split

“The elimination of this shifty boundary has for me always been the main attraction of the ‘pilot-wave’ picture.”

“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’.”

QBism against the shifty split

Mermin 2012

readers' forum

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.¹ 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 de-

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,² 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

pressions 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.

The split isn't an ontological thesis

“For Bohr, such a cut did not originate in dynamical (ontological) considerations, but rather in functional (epistemological) considerations.”
(Camilleri and Schlosshauer 2015, p 73)

Thesis: Bohr's approach to the subject-object distinction is rooted in 19th century epistemology and psychology — especially the little-known Danish tradition

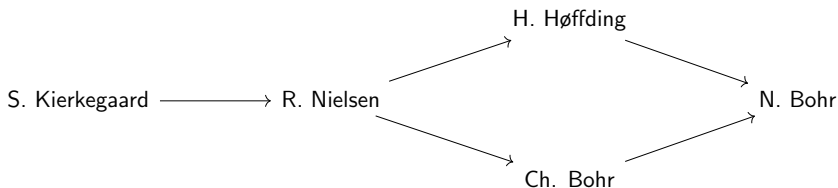
Why didn't we see this before?

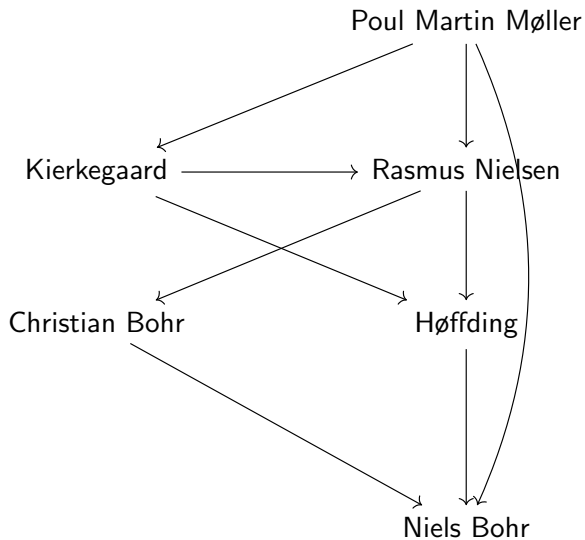
“Misled by superficial coincidences, [Jammer] imagines that Bohr’s thought has been influenced, through Høffding, by Kierkegaard and William James. There can be no doubt that his surmise is unfounded. Bohr was a completely independent thinker; from early youth, he developed his epistemological ideas single-handed.

... [Jammer] somehow went astray and ponderously built in a completely fictitious ‘Kierkegaard-Høffding’ ideology into the discussion of Bohr’s work.”

(Rosenfeld, *Nuclear Physics*, 1969)

Hypothesis: Rasmus Nielsen transformed Kierkegaard's epistemological and psychological ideas into something that was accessible to scientific thinkers such as Bohr.





Critical philosophy: The knower reflecting on itself

“All theorizing must be considerate of the nature of our minds”
(Rasmus Jaksland channeling Bohr)

“Critical philosophy argues that a distinction must be made between the ways in which, according to the nature of our thought, we approach subjects in order to gain what for us is understanding — and the nature of being itself.”
(Høffding, *Den Menneskelige Tanke*, 1910)

Hegel: the subject-object distinction is *aufgehoben*!

- The Spirit can overcome the limitations of finitude that Kant took to constrain human subjects. (*Geschichte der Philosophie*)
- Through the dialectical process and an infinite reflection, all presuppositions can be eliminated so that Subject and Object become one

Hegel, Phenomenology of Spirit

“Spirit, therefore, having won the Notion, displays its existence and movement in this ether of its life and is Science. It is its process of becoming, the circle that winds back upon itself, the circle that presupposes its beginning and reaches its end only in its beginning.”

Hegel, History of Philosophy

“A new epoch has arisen in the world. It would appear as if the World-spirit had at last succeeded in stripping off from itself all alien objective existence, and apprehending itself at last as absolute Spirit, in developing from itself what for it is objective, and keeping it within its own power, yet remaining at rest all the while. The strife of the finite self-consciousness with the absolute self-consciousness, which last seemed to the other to lie outside of itself, now comes to an end. Finite self-consciousness has ceased to be finite; and in this way absolute self-consciousness has, on the other hand, attained to the reality which it lacked before. This is the whole history of the world in general up to the present time, and the history of Philosophy in particular, the sole work of which is to depict this strife. Now, indeed, it seems to have reached its goal, when this absolute self-consciousness, which it had the work of representing, has ceased to be alien, and when spirit accordingly is realized as spirit.”

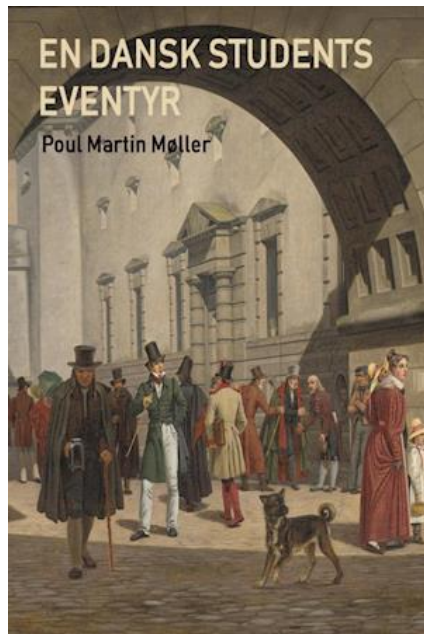
Poul Martin Møller (1794–1838)

- Hegel's philosophy introduced to Denmark by J.L. Heiberg (1791–1860)
- P.M. Møller was the first Danish philosopher to break from Hegel
- Wrote aphorisms, poetry, novellas instead of philosophy articles and books
- Teacher of Søren Kierkegaard
- Kierkegaard dedicated *The Concept of Anxiety* to Møller

Poul Martin Møller

“What made a really deep and lasting impression on [Niels Bohr] was the unpretentious ‘Tale of a Danish Student’, in which Poul Martin Møller has given such a delightfully humorous illustration of Hegelian dialectics.”

Rosenfeld, “Niels Bohr’s contribution to epistemology”, 1963



En Dansk Students Eventyr

- Møller's novel gives a humorous description of a young man (*licentiaten*) who engages in an infinite reflection
- The target of Møller's satire: Hegel's claim that a human being can achieve objectivity via infinite reflection
- SK makes the objection explicitly.
- But SK doesn't leave us with any suggestions about the positive role of *viden* or *videnskab*.



“Father often returned, and when, in describing the the Licentiate’s difficulties in making a decision, he found an apt illustration of his thoughts on the complementary features of psychology.”

Hans Bohr in Rozental anthology

“Nor do I need bring to mind the amusing story about the licentiate in *The Adventures of a Danish Student*, which I related at my talk in Pasadena to elucidate the complementary use of terminology in psychology. The point here is, of course, that even though every unambiguous communication requires distinction between a subject and an object, the subject implied in a given situation can wholly or partially be included in the objective content of a communication about another situation.”

NB to Delbrück, July 25, 1959

Søren Kierkegaard (1813-1855)

“It may at times occurred to you, dear reader, to doubt somewhat the accuracy of that familiar philosophical thesis that the outer is the inner and the inner is the outer.”

Either-Or

“Hegelian philosophy culminates in the thesis that the outer is the inner and the inner is the outer.”

Concluding Unscientific Postscript

Afsluttende uvidenskabelig Efterskrift

til

de philosophiske Smuler.

Mimisk = pathetisk = dialektisk Sammenskrift,
Eksistentielt Indlæg,

af

Johannes Climacus.

Udgiven

af

S. Kierkegaard.

The knower is a concrete individual

“So we return to the two paths of reflection, and have not forgotten that it is an existing spirit that poses the question, quite simply a human being. Nor can we forget that his existing is just what will stop him going both ways at once, while his anxious question will prevent him from frivolously and fantastically becoming subject-object. Which of these two paths, then, is the path of truth for an existing spirit? For only the fantastic I-I is finished with both paths all at once, or proceeds methodically down both paths simultaneously, a gait so inhuman for an existing human that I do not risk recommending it.” (Postscript, Hannay translation, p 162)

“The path of objective reflection now leads to abstract thinking, to mathematics, to historical knowledge of various kinds, and always leads away from the subject, whose existence or non-existence becomes, and from the objective point of view quite rightly, infinitely indifferent — yes, quite rightly, for as Hamlet says, existence and non-existence have only subjective significance. This path will lead maximally to a contradiction, and in so far as the subject fails to become wholly indifferent to himself, this only shows that his objective striving is not sufficiently objective.”
(Postscript, p 163)

Complementarity between reflection (overvejelse) and decision (afgørelse)

“Once subjectivity is taken away, and passion from subjectivity, and infinite interest from passion, there is absolutely no decision [afgørelse] at all, on this problem or any other. All decision, all essential decision, lies in subjectivity. At no point does an observer (and that is what objective subjectivity is) have any infinite need of a decision, and at no point sees it.” (Postscript, p 29)

Impossibility of a final theory

“There can be no system for life itself. . . . System and finality correspond to each other, but life is just the opposite. From an abstract point of view, system and existing cannot be thought together; because systematic thought in order to think life must think of it as annulled and hence not as life. Existence is the spacing that holds things apart; the systematic is the finality that joins them together.” (Postscript, p 100)

- Kierkegaard criticizes Hegel's epistemology, but doesn't offer any positive account of the role of objective knowledge (*Viden*) in human life
- The forgotten link: Rasmus Nielsen developed a Kierkegaard-inspired philosophy of science
- Nielsen was originally a Hegelian, but changed completely when he read the *Postscript*

Rasmus Nielsen (1809–1884)

- 1857 *Philosophie og Mathematik. En propædeutisk Afhandling*
- 1859 *Mathematik og Dialektik*
- 1864 *Grundideernes Logik*
- 1873 *Natur og aand: bidrag til en med physiken stemmende naturphilosophie*
- 1880 *Almindelig Videnskabslære i Grundtræk*
- 1881 *Om det oprindelige forhold mellem religion og videnskab*

Nielsen's scientific turn

“As my recent writings show, it has been my goal, for a number of 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)

- Nielsen and Sibbern alternated teaching “det indledende filosofikum” (introductory philosophy course) for many years.
 - This course was mandatory for all first-year students at the university, in any subject.
- Circa 1860, students complaining that Nielsen demanded too much knowledge of math and science.

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

“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)



Heegaard



Brandes



Høffding



Kroman



Lehman



Ch. Bohr

G. J. P. J. Bolland.

Forelæsninger

13. 1/2 C. S.

over

„Philosophisk Propædæntik“

fra

Universitetsaaret 1860—61,

af

N. Nielsen.

II.

Philosophien og de særskilte Videnskaber.

Almindeligt	30
A. Philosophiens Forhold til Mathematiken: Uendelighedsproblemet	39
a) Uendelighedsbegrebet	40
b) Uendelighedsproblemet	45
α) Begreb og Problem	46
β) Mathematisk Opfattelse	47
γ) Filosofisk Opfattelse	48
c) Det Uendeliges Analyse	50
α) Grænser	53
β) Overgange	56
γ) Articulationer	65
B. Philosophiens Forhold til Chemien: Forandringsproblemet	81
a) Chemien som særegen Videnskab	82
α) Chemiens Oprindelse	83
$\alpha\alpha$) Mystisk Speculation: Oldtid og Middelalder	84
$\beta\beta$) Familien efter Metode: kvalitativ Analyse	87
$\gamma\gamma$) Metodes fastsættelse: kvantitativ Analyse	90
β) Chemiske Kræfter	92
$\alpha\alpha$) Slægtstaber	93
$\beta\beta$) Betingelser	96

	Side
b) Forandringsproblemet i Chemien	121
a) Atom og Equivalent	124
β) Atomconstitution og Krystalform	130
γ) Atom og Substans	135
c) Forandringsproblemet i Philosophien	143
a) Atomet som Discretionspunkt	145
β) Atomet som Functionspunkt	151
γ) Atomet som det substantielle Moment	160
Resultat	167
C. Philosophiens Forhold til Physiologien: Livs=	
problemet	177
a) Livets Væsen	200
a) Organismen	208
β) Den organiske Type	236
γ) Det organiske Formaal	261
b) Livets Trin	286
a) Plantelivet	291
aa) Grundformer	292
ββ) Metamorphoser	304
γγ) Individuationer	313
β) Dyrelivet	328
aa) Dyr og Plante	329
ββ) Dyr og Dyrerækker	362
γγ) Dyreriget	386
γ) Menneskelivet	399
aa) Dyr og Mennesket	399

Objectiveringslov

“No object without a corresponding objectification; it is an a priori law that underwrites all empiricism, a basic law that in science is, if possible, even more unshakable than Newton’s law of gravity. From this it can be seen, that a critical boundary, a boundary line, on whose one side we have the objectivizing subjectivity, while the object is standing on the other side, is confused and meaningless.” (1880, p 41)

The boundary between apriori and aposteriori is moveable.

“When the boundary between apriori and empirical is supposed to be conceived of as definite and exact, then troubles arise.” (1880, p 30)

“A fixed, unmovable boundary line between the apriori and aposteriori cannot be set.” (1880, p 37)

“Admittedly it is, as far as the truths and the sense organs are concerned, undeniable that one and the same substratum, by being objectified in different systems, should appear as different objects; but this confirms precisely what the Basic Law says. If the substrate is denoted by X , the determinations therein by X_o , X_1 , X_2 , then these determinations, when expressed in the A system, would give a_o, a_1, a_2, \dots and the whole corresponding Object would be O_a ; in the B system it would be O_b ; in the C system it would be O_c . But is this not a proof that the Objective cannot be recognized? Not at all; it is precisely a proof of the interaction between Objective and Subjective.” (1880, p 54)

“Al søgen efter et sidste subjekt er i strid med målet om objektiv beskrivelse, som kræver en modstilling af subjekt og objekt.”
(Den menneskelige erkendelses enhed, 1960)

“Nielsen believed that, to describe the interrelation between the subjective and the objective, an infinite analysis was needed, since every subject presupposes an object, and every object in turn a subject.”
(Høffding, Danske Filosofer, p 189)

Harald Høffding

“Just as form and content are abstractions, since in every act of cognition we have a combination of them, so it is with subject and object.” (1910, p 297)

“We could make our own subject an object for us, just as when we study it psychologically, e.g. to find out the forms by which it works in its cognition. These forms, which are systematized in the study of the categories of cognition, must be taken as facts. They are made subjects when reflection is applied to them. Every cognition takes place from a certain point of view, which it can be meaningful to ascertain [konstatere]. We then objectify the subject.” (1910)

“When we consider something as an object, we must indicate the nature of the subject in relation to which it exists. And when we consider something as a subject, we must partly seek the objective context that determines its nature and thereby the contents and forms that are at its disposal, and on the other hand we need to note that by this investigation we ourselves make that subject into an object (if it is ourselves, then for ourselves in a somewhat different state, at any rate at a different moment, than before). We never have a pure subject (S), but always an objectively determined or yet an objectified subject (S_o). And we never have a pure object (O), but always a subjectivized object (O_s). S and O are mere abstractions. What we have before us is always S_o and O_s .” (1910, p 298)

“The act of becoming self-conscious, of making one’s I (one’s conditions, one’s work, one’s circumstances) into an object for itself, can always be repeated. The I that becomes self-conscious can itself become the object of a new act of self-consciousness, and so on. Such a series ($S_1 \prec S_2 \prec S_3 \prec S_4 \dots$) has already been mentioned above in connection with the possibility of an epistemological investigation into epistemology.” (Totalitet som Kategorie, p 36)

“Den Akt at blive sig selv bevidst, gøre sit Jeg (sine Tilstande, sit Arbejde, sine Kaar) til Genstand for sig, kan formelt stadig gentages. Det Jeg, der bliver sig selv bevidst, kan selv blive Genstand for en ny Selvbevidsthedsakt, og saaledes fremdeles. En saadan Række ($S_1\{S_2\{S_3\{S_4....\}$) er allerede omtalt ovenfor i Anledning af Muligheden af en erkendelsesteoretisk Prøvelse af Erkendelsesteorien.” (Totalitet som Kategorie, p 36)

Open questions

How does Kantian critical philosophy (i.e. knowing the subject's capacities) get combined with empirical science in the 19th century?

- Helmholtz
- Mach
- Etc?

Conclusions

- Bohr's talk about subject and object is jibber-jabber only if European philosophy (and literature) of the 19th century is jibber-jabber.
- I stand against those who deny the deep humanistic origins of scientifically fruitful ideas.
- Bohr's view about subject-object builds creatively on the tradition of Møller, Kierkegaard, Nielsen, and Høffding.
- Bohr's "erkendelsesteoretisk belæring" should be judged as a radical alternative to Quinean metaphilosophy rather than as a particular interpretation of QM (i.e. solution to John Bell's measurement problem) within the framework of Quinean metaphilosophy.

To do list

- Learn the languages
- Read
- Know the history — science, philosophy, and culture in general

The stick analogy

“One need only remember here the sensation, often cited by psychologists, which every one has experienced when attempting to orient himself in a dark room by feeling with a stick. When the stick is held loosely, it appears to the sense of touch to be an object. When, however, it is held firmly, we lose the sensation that it is a foreign body, and the impression of touch becomes immediately localized at the point where the stick is touching the body under investigation.” (The Quantum of Action and the Description of Nature, 1929, p 99)

“But Bohr would also point to psychological experience in daily life in connection with the difficulty of distinguishing between subject and object, in order to facilitate understanding of the new situation in physics, where his view appeared too radical or mysterious even to many physicists. In this connection he chose as a particularly simple example the use of a stick when trying to find one’s way in a dark room. Here the dividing line between subject and object is placed at its end, when the stick is grasped firmly, while, when it is loosely held, the stick appears as an object.”
(Oskar Klein, p 92 in Rozental)

“...in order to make clear the necessity of sharply separating the means of observation from the observed system, he would adduce the familiar example of the blind man’s stick: If you hold a stick firmly in your hand, it can serve as a sort of prolongation of the latter to explore the surroundings by touch; but if you hold it loosely, it becomes itself an object whose presence is revealed to the hand by the sense of touch, and it loses thereby its function of instrument of observation.” (Rosenfeld, p 124 in Rozental)

“On one occasion while on a walk in the woods near Copenhagen Bohr picked up a stick and pointed out that, when one uses it as a probe and pokes various objects with it, one’s feeling seems to be at the end of the stick, not in the hand that is holding it, although of course it is the hand that directly experiences the feeling. The stick seems like an extension of one’s arm. . . . By such a simple observation which most people overlook, Bohr showed the attention that he gave to psychological questions.”
(Dirac, p 306 in Rozental)

“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. We are here presented with a close analogy to the relationship between atomic phenomena appearing under different experimental conditions and described by different physical concepts, according to the role played by the measuring instruments.”
(Physical Science and the Study of Religions, 1953, p 389)

“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.”

(Physical Science and the Study of Religions, 1953, p 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.” (Unity of Knowledge, 1954, p 61)

Sources

- Pais, pp 439–441
- Rosenfeld, “Niels Bohr’s contribution to epistemology”
- Rosenfeld, Review of Max Jammer
- Rozental. *Niels Bohr: His Life and Work as Seen by His Friends and Colleagues*
- C.H. Koch. *Den Danske Idealisme*

Rosenberg on Nielsen

Her fremsætter Nielsen den 'Objektiveringslov', som senere blev et saa betydningsfuldt Led i hans Metafysik: Objekterne kan ikke objektivere sig selv, og da Objekter uden Objektivering er umulige, forudsætter Objektiviteten en objektiverende Subjektivitet. Paa den anden Side kan Subjektiviteten ikke undvære Objektiviteten, eftersom dens Selvbegriben og Selvmagt saa vilde blive uden Indhold.

Rosenberg on Nielsen

Opfatter vi Forholdet udialektisk faar vi en kritisk Adskillelse som hos Kant, der ganske fornagler Problemet om Subjektets og Objektets indbyrdes Forhold, eller en mystisk Realisme som hos Schelling, der fortøner Problemet i Taage. Men naar Objektiviteten og den bærende Subjektivitet paa ethvert Punkt dialektisk ses at forudsætte hianden, da forstaas 'Naturens aandrige Aandløshed', og man øjner Muligheden af Problemets Løsning — saavidt muligt er paa menneskelige Vilkaar. (Rosenberg p 13)

“Bohr would point to those scenes in which the licentiate describes how he loses the count of his many egos, or disserts on the impossibility of formulating a thought, and from these fanciful antinomies he would lead his interlocutor along paths Poul Martin Møller never dreamt of — to the heart of the problem of unambiguous [entydig] communication of experience, whose earnestness he thus dramatically emphasized.”

Rosenfeld, “Niels Bohr in the thirties”