Anton Pannekoek: Ways of Viewing Science and Society

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DOI
10.2307/j.ctvp7d57c.3
10.1515/9789048535002-002

Publication date
2019

Document Version
Final published version

Published in
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Astronomer and Marxist Anton Pannekoek was a remarkable figure. As an astronomer, he pioneered quantitative astrophysics and founded the renowned Astronomical Institute in Amsterdam that now carries his name. Before World War I, however, he was employed as a Marxist theorist by the Social Democratic Party of Germany, making him one of the leading intellectuals of international socialism. Because of his significant contributions to such diverse subjects as astronomy and socialism, Pannekoek's life and work uniquely capture the fascinating connections between conceptions of nature, society, and their representations in the early decades of the twentieth century. This book aims to study these connections through the prism of Pannekoek's biography. In doing so, it sets out to explain Pannekoek's particular epistemic, aesthetic, and political choices, while placing them in the broader context of the early twentieth century.

Pannekoek tried to keep connections between his political and academic life hidden from view. He had pragmatic reasons to do so. His academic career had suffered from his controversial political reputation on more than one occasion, most dramatically in 1919 when his appointment to deputy director of the Leiden Observatory was obstructed by the Dutch government.[1] From the mid-1910s onwards, he kept his socialist efforts at a distance from his career in astronomy, and even ended up writing two separate autobiographies: one focusing on his career in the labour movement, while the other discussed his astronomical research.[2]

Remarkably, this separation has been carried over into scholarship on his life and work. This either discusses Pannekoek's role in the labour

1 This episode is discussed in detail in: Baneke 2004; and his 'Pannekoek's One Revolution', in this volume, 87-108.

2 Pannekoek 1982.

Tai, Chaokang, Bart van der Steen, and Jeroen van Dongen (eds), *Anton Pannekoek: Ways of Viewing Science and Society*. Amsterdam, Amsterdam University Press 2019
DOI: 10.5117/9789462984349_CH01

movement, or in astronomy – but rarely their possible relations.[3] This book, on the other hand, seeks to identify and elucidate the relations between Pannekoek's various contributions to science and political theory. This offers the opportunity to gauge the unity and singularity of Pannekoek's work on the one hand, while providing more insight into the wider relations between academia, politics, and ways of viewing the world on the other. Finally, to address the last aspect, the book will also engage the visual arts, both historically and in its attempts to capture the social and natural world.

Multiple chapters in this volume draw attention to the visual aspect of Pannekoek's work – in particular to his engagement with photography and his drawings of the Milky Way. This focus on aesthetics and the visual offers insight into Pannekoek and his time, as well as in current relations between the arts and sciences. Throughout the modern era, both have influenced each other in crucial ways. This was especially true in the early modern period, but even after their institutional separation began to emerge in the nineteenth century, their mutual influence never fully disappeared.[4] This may be exemplified by the way in which Pannekoek's drawings of the Milky Way have captured not only the scientific, but also the artist's imagination, as revealed by the work of contemporary artist Jeronimo Voss, who engaged with Pannekoek's images to find novel representations of both the cosmos and the ideals of communism.[5] These were presented in the installation *Inverted Night Sky*, which was exhibited at the Stedelijk Museum Bureau Amsterdam in May and June of 2016.[6] At the same time, the conference 'Anton Pannekoek. Ways of Viewing Science and Society' was held at the Royal Netherlands Academy of Arts and Sciences in Amsterdam, of which this book is the result.

By engaging with the aesthetics of Pannekoek's drawings, we can learn more about the relation between science and art as they persist into the present. Moreover, a focus on the visual aspect of Pannekoek's work elucidates key elements of his scientific methodology. For a long time, historians of

3 When Pannekoek's autobiography was published in 1982, for example, it contained two introductions that separately discussed his socialism and his astronomy. The lack of any attempt to combine the two was already criticized by Klaas van Berkel (1984). For recent scholarship that does attempt to arrive at a unified understanding of Pannekoek, see Tai and van Dongen 2016; Tai 2017.

4 On the mutual development of art and science in the early modern period, see, e.g. Bennett 1982; Edgerton 1991; Kwa 2005; Smith 2006; Long 2011; for their separation in the nineteenth century, see Daston 1998; Jones and Galison 1998; for examples of their mutual influence in the late modern period, see Henderson 1983; Galison 1990; Wilder 2009; Kojevnikov 2016.

5 For more on Pannekoek's influence on artists, see Lütticken 2018.

6 Voss 2016; For descriptions and images of the exposition, see SMBA 2016; Voss 2017.

science ignored images as mere tools, intended only to illustrate knowledge that was mainly conveyed in words and equations. Yet, scientific images are objects worth studying in their own right when trying to understand how science is practised.[7] In particular, the aesthetic and technical choices scientists make in producing and reproducing images do not just reveal aspects of the knowledge that they wish to convey; they also reflect how scientists believe nature should be observed – indeed, what skills and virtues are required to do these observations.[8] Thus, by looking at how Pannekoek decided to represent the Milky Way, it becomes possible to explore what he believed proper scientific practice was and how he believed scientific knowledge should be constructed.

Pannekoek's life is a rich source of information on the relations between visual culture, scientific scholarship, and leftist politics in the early twentieth century. Of course, he was not the only left-wing radical who moved among these various domains.[9] Similar connections can be found in the lives of socialist physicists like Friedrich Adler, Léon Rosenfeld, and Yakov Frenkel, to name only three examples. Adler was trained as a physicist and at one time had been in close contact with Albert Einstein. He is perhaps best known, however, for his assassination of the Austrian Prime Minister Karl von Stürgkh in 1916, which he hoped would start a socialist revolution in Austria. While imprisoned, he struck up a correspondence with Einstein on the foundations of relativity theory. He tried to reconcile Einstein's relativity principle with the classic concept of a privileged reference frame, much like he attempted to reconcile the revolutionary ideals of the Bolsheviks with his support of the social-democratic Second International.[10] In the case of Belgian quantum theorist Rosenfeld, the connection can be found in his vehement defence of the principle of complementarity in quantum mechanics – mainly against criticism by Soviet physicists, who considered it idealist and subjective; Rosenfeld argued that the principle was the result

7 For an overview of how historians started to research scientific images, see Pang 1997; Jones and Galison 1998; Kusukawa 2016.

8 See, e.g. Daston and Galison 1992; 2007; Winkler and van Helden 1992; Schaffer 1998; Nasim 2013.

9 It is worth mentioning that two of Pannekoek's closest socialist companions, Herman Gorter and Henriette Roland Holst, were also key members of the innovative and progressive impressionist 'Tachtigers' movement in Dutch literature; thus, they moved between literary and socialist circles, as Pannekoek crossed the boundaries between the sciences and socialism. In their case, the subject matter and purpose of their poetry was drenched in socialist themes. For Herman Gorter, see de Liagre Böhl 1996; Zwart 2019; for Henriette Roland Holst, see Etty 1996.

10 Galison 2008.

of a practical application of the dialectic method.[11] Soviet condensed matter physicist Frenkel, finally, used the social concept of collectivism, as it was understood by early twentieth-century radicals, as a metaphor to explain the collective behaviour of electrons in metals, crystals, and plasmas.[12] These examples raise the question whether a similar close connection between political thought and scientific work can be revealed in the case of Pannekoek. Can we get a better understanding of both Pannekoek's astronomy and his Marxism if we investigate how they might relate to one another?

The role of aesthetics at the crossroads of scholarship and political activism is particularly pertinent in the case of Otto Neurath and Rudolf Carnap. Neurath was a socialist philosopher and political economist who famously visualized statistical data through the invention of pictorial 'isotypes', in collaboration with modernist artist Gerd Arntz. By displaying statistical information visually, he strove to enable the masses to access and interpret it.[13] Carnap was the author of *Der logische Aufbau der Welt* (1928), in which he attempted to develop a framework that reduced all empirical knowledge to direct sensory experience. His philosophy brought him in close contact with the architects of the Bauhaus art school, who shared his left-technocratic vision of the world as built up from simplest elements; at the invitation of Walter Gropius, Carnap gave several lectures at the Bauhaus in Dessau.[14] Both Neurath and Carnap were prominent members of the Vienna Circle, the group of philosophers who shared the explicit goal of making philosophy 'scientific' by stripping it of its metaphysical content. This desire was shared by Pannekoek and it is therefore no coincidence that he published an article on the 'essence of natural laws' in *Erkenntnis*, the journal co-edited by Carnap and affiliated with the Vienna Circle.[15]

A scientist's (presumed) close relations with radical politics and avant-garde art could be cause for suspicion for both the authorities and the public at large. This is not only illustrated by Pannekoek's thwarted Observatory position, but also by the delayed appointment of Albert Einstein to a visiting professorship at Leiden University in 1920. In that year, politically charged debates on the truth and significance of relativity theory reached their apex. Einstein was first appropriated by the Dada art movement in a collage by artist Hannah Höch, while reactionary critics of relativity accused

11 Jacobsen 2007.

12 Kojevnikov 1999.

13 Cartwright et al. 1996; Leonard 1999; Mattick 2016.

14 Galison 1990; 1996. For a discussion of Neurath's connections with the Dessau Bauhaus, see Potochnik and Yap 2006.

15 Pannekoek 1932.

him of being a political revolutionary and giving a false representation of nature, which they identified as 'scientific Dadaism'. Einstein himself had a somewhat traditional taste in art and was not a communist but rather a democrat and pacifist – but this did not stop others from labelling him as a radical and accusing his scientific theories of being politically subversive.[16] Influenced by these debates in Germany, the Dutch government, in turn, confused Albert Einstein with the German art critic Carl Einstein, who was in fact a true far-left revolutionary. Carl Einstein, an early promotor of cubism and African tribal art, had been a leading member of the German soldiers' council that had mutinied during the retreat from Brussels in 1918. As a result of this confusion, Albert Einstein's appointment as visiting professor to the Leiden physics department was held up for nearly a year in 1920. Dutch officials wished to be absolutely certain about his political persuasions, as they wished to avoid a repetition of the botched appointment of Pannekoek at the Leiden Observatory a year earlier.[17]

In 1934, there was yet another incident in which a leftist scientist was barred from a Dutch university. This time, Marxist mathematician Dirk Jan Struik was withdrawn as candidate for a guest professorship at Delft University of Technology following objections from the Dutch government.[18] Although Struik was more than two decades younger than Pannekoek, their lives and careers show remarkable similarities. Struik, too, strove to keep socialism and science separate domains of his activity. After deciding to become a socialist professional, rather than a professional socialist, Struik's Marxist beliefs were mainly reserved for his historical writings. He founded the interdisciplinary Marxist journal *Science and Society* and pioneered a dialectic-materialistic approach to the historiography of science in his monograph *Yankee Science in the Making*.[19]

As the above examples show, studying Pannekoek and others at similar junctures in the early twentieth century offers us not only biographical insights, but it also promises to elucidate the ways in which Pannekoek and his contemporaries balanced scientific and political ambitions. Furthermore, it will show us how contemporaries reflected on how progressive, 'revolutionary' science and politics interacted, and the role that the era's innovations in visual culture played in this. These scholars all advanced extraordinary intellectual innovation, while sharing the tumultuous rhetoric of revolution

16 Goenner 2005; van Dongen 2007.
17 van Dongen 2012.
18 Alberts 1994, 281.
19 Alberts 1994.

– for which they were considered a vanguard by some yet abhorred by others. This book focuses exactly on these themes: on how understanding the links between science and society informed representations of nature as well as scientific and political choices in the revolutionary cultures of the early twentieth century. Clearly, Pannekoek offers a uniquely rich starting point for such an endeavour.

Although Pannekoek worked as an astronomer for most of his professional life, it is his political career that has received the largest share of attention from historians and biographers so far. Interest in his political work was revived in late 1960s as the New Left began to pay attention to Pannekoek due to his opposition to both moderate social democrats such as Karl Kautsky and to dogmatic Marxists such as Vladimir Lenin. Former collaborators of Pannekoek subsequently republished his work, and provided a synthesis of his ideas in an effort to rekindle the council communist programme.[20] In the following decades, scholarly reconstructions of Pannekoek's political development were produced, while activist interest in council communism mostly subsided.[21] Contemporary historiography is of course less interested in reconstructing the council communist programme but rather aims to understand the council communist movement in its proper historical context.[22]

Pannekoek's astronomical career has received less attention. Although some of his contributions have found their way into more general surveys in the history of astronomy,[23] these do not offer more than a superficial indication of his research and methodology. Only recently historians of science have attempted more thorough investigations of Pannekoek's astronomical research in an effort to understand and contextualize his scientific research.[24] Yet, there is still much left to be explored before a comprehensive overview of all of his major contributions to astronomy can be provided. This volume indeed aspires to deepen our understanding of Pannekoek's scientific contributions, and to do so by engaging equally his contributions to epistemology and socialist theory. Only then can we begin to unravel their intricate relations.

Astronomer Edward P.J. van den Heuvel, former director of the Anton Pannekoek Institute for Astronomy, first offers a biographical overview of

20 See Brendel 1970; Kloosterman 1972; Smart 1978; Bricianer 1978; Sijes 1982.

21 See, in particular, Boekelman 1980; Gerber 1989; Malandrino 1987; Bock 1992; 1993.

22 See, e.g. van der Linden 2004; van der Steen 2006.

23 See, e.g. Hearnshaw 2014; Baneke 2015.

24 Houziaux 2001; Tai and van Dongen 2016; Tai 2017.

Pannekoek's life based on many conversations with former colleagues and students of Pannekoek. Van den Heuvel shows how Pannekoek's rejection for the Leiden position turned out to be a blessing in disguise as he subsequently was offered a position at the University of Amsterdam, where he had the opportunity to shape his own research agenda independently (in Leiden, he would have had to work under Willem de Sitter). Because his newly founded Astronomical Institute lacked an observatory, Pannekoek became involved in the emerging field of theoretical astrophysics, which developed in tandem with highly innovative studies in atomic physics.

Focusing more on Pannekoek's political career, Gerrit Voerman asks why Pannekoek ended up in numerous heated conflicts with socialist leaders such as Pieter Jelles Troelstra, Karl Kautsky, and Lenin – conflicts that effectively marginalized him as a socialist activist. Voerman points to the principled nature of Pannekoek's character and his preference for theoretical analysis over practical considerations. This meant that he rejected any form of compromise and would become frustrated when the outcomes of his analyses were not acceded to. He was willing to accept the personal consequences of his steadfastness and break off relations with close collaborators if consistency of his political positions dictated such a course of action.

Klaas van Berkel searches for commonalities between Pannekoek as astronomer and Pannekoek as socialist by reflecting on why he made this distinction in his biography in the first place. Van Berkel finds that the distinction is a historical construct that had been created by Pannekoek because of the incidents in which his socialist activism had hindered his astronomical career – not just in 1919 when his Leiden appointment was blocked, but also in 1903 when he was reprimanded by Dutch prime minister Abraham Kuyper for his outspoken support of a general labour strike that year. According to Van Berkel, the most fundamental element that was shared between Pannekoek's approaches to astronomy and socialism was an emotional commitment: a utopian longing for wholeness and purity in both nature and society.

The historical context of Pannekoek's astronomy is the focus of the following contributions. David Baneke provides an overview of Pannekoek's influence on the astronomy community in the Netherlands. After a detailed analysis of Pannekoek's role in the reorganization of the Leiden Observatory and his rejection as assistant director there, he discusses Pannekoek's close relations with Utrecht's Marcel Minnaert, another communist astronomer. Together they established the Dutch school of astrophysics, which first focused on the properties of stellar atmospheres. Pannekoek further contributed to Dutch astronomy by supporting the creation of a Dutch

astronomical society and journal. Baneke contends that Pannekoek's actual 'revolution' is found not in the political realm but in the modernization of Dutch astronomy, both institutionally and academically.

Robert W. Smith situates Pannekoek in the wider development of astronomy in the early twentieth century, during which it underwent rapid changes. Not only were ideas about the shape and size of the galaxy in flux, the notion of what astronomy should study, and how and where this should be studied changed as well. Pannekoek, as Smith argues, was at the forefront of many of these developments: his methods and concerns were both influential and representative of the era. Not only was he one of the first astronomers to provide supporting evidence for Harlow Shapley's new model of the galaxy, he was also one of the earliest practitioners of the new quantitative astrophysics that applied the latest developments in atomic physics and quantum mechanics to the stars. Smith concludes that, as an astronomer, 'Pannekoek [...] was both very much of, as well as a maker of, his time.'

Pannekoek considered Marxism to be a science in its own right. This position was shared by many of his socialist contemporaries and predecessors, including, as Bart van der Steen explains, Karl Marx and Friedrich Engels. They had introduced the term 'scientific socialism' for their own approach to socialism. Engels had contended that their approach was preferable because, rather than simply imagining better societies, they used a scientific method to analyse how socialism would evolve out of the contradicting tendencies inherent to capitalism. Even so, the exact content and method of scientific socialism remained strongly contested. In his contribution, Van der Steen reconstructs Pannekoek's understanding of what scientific socialism implied. He finds that three distinct but closely related definitions of scientific socialism can be found in Pannekoek's writing. Socialism was 'scientific' because 1) it made predictions about the future (which entailed that the socialist revolution was imminent); 2) it provided a method for analysing past and present social developments; and 3) because it argued for a worldview that strove for truth through scientific research. This final position offered Pannekoek the opportunity to align his socialism with his astronomical research.

Pannekoek's understanding of scientific socialism deviated from that of many of his contemporaries, as Annemarie Rullens shows. Pannekoek considered scientific socialism a method for analysing human behaviour, which had to be developed further by the working classes. Thus they would gain the consciousness that would enable them to establish a socialist society. Rullens contrasts this view with that of Pannekoek's contemporary Willem Bonger, a prominent Dutch socialist and professor of criminology at the

University of Amsterdam. According to Bonger, society had to be transformed by using the latest insights offered by statistics, social science, economics, and even biology. As member of the Social Democratic Workers' Party (SDAP), he advocated for policies aimed at this goal. For Bonger, scientific socialism was not a philosophical stance, as it was for Pannekoek. Instead, it contained a practical imperative. This position was shared by many of the generation of Dutch leftist ideologues that came after Pannekoek, and of which Bonger can be seen as a representative.

One of Pannekoek's struggles was to make his astronomical research socially relevant. Jennifer Tucker argues that Pannekoek found a way to achieve this by engaging the public and broadening its understanding of science. Pannekoek outlined a method for amateur astronomers to observe and record the Milky Way in his earlier life, for example. He later wrote several popular histories of astronomy. These emphasized the socio-economical context in which astronomy had developed and the progressive values it promoted – in line with the work of other Marxist historians like Boris Hessen, Edgar Zilsel, and J.D. Bernal. In these studies, Pannekoek highlighted the collaborative and elaborate practical effort involved in astronomical research, and he discussed at length the struggles and errors involved in the scientific process. As such, he intended to show the scientific worker 'in overalls'.

Pannekoek's historical studies are also the subject of Bart Karstens' contribution. He addresses how Pannekoek's research should be positioned within contemporary developments in historical sociology of science. As Karstens indicates, Pannekoek's historical research has been appropriated by members of the so-called 'strong programme' in the sociology of scientific knowledge, like Stevin Shapin and Barry Barnes: they saw in Pannekoek an early example of their preferred type of analysis. According to the strong programme, both the development and the content of scientific knowledge is strongly determined by social factors. After analysing Pannekoek's discussion of the discovery of the planet Neptune, Karstens argues that this appropriation of Pannekoek was misguided: far from an early example of the strong programme, Pannekoek's approach most closely resembles that of contemporary sociologist Robert Merton. In his case, too, social factors may influence the direction and pace of scientific research but not its content.

Pannekoek's Milky Way drawings provide an excellent opportunity to establish the deeper epistemic links between his astronomy and Marxism. An analysis of these drawings is provided by Chaokang Tai, who argues that Pannekoek's methods of investigating and depicting the Milky Way reflected his Marxist understanding of how the mind processes information.

According to Pannekoek, the mind instinctively and intuitively synthesizes valuable information about the world from the continuous flow of disparate human observations. To forego such insights would leave a scientist without a well of knowledge, which was the reason Pannekoek held that drawings of the Milky Way could display insights that photographic images could not. When Pannekoek did employ photography, he used a method that allowed the photographic plate to mimic the properties of the human eye, effectively mechanizing human observation – but even then, the end result had to be displayed through drawings.

Omar W. Nasim also searches for the connection between Pannekoek's astronomy and socialism in his Milky Way research. But rather than discussing the role of the mind in Pannekoek's research, Nasim focuses on the role of the hand. He points out that both in his *Marxism and Darwinism* and in *Anthropogenesis*, Pannekoek assigned great significance to the role of manual labour in the development of mankind. According to Pannekoek, the use of increasingly sophisticated tools led to the development of speech and abstract thought. Nasim shows that this emphasis on the value of manual labour was reflected in Pannekoek's Milky Way research, in which hand drawn images of the Milky Way were to be trusted over mechanically produced photographs: it is by the hand that we know. Like Tai, Nasim recognizes that Pannekoek indeed employed photography in his Milky Way studies, but that in the end, his methods were really grounded in laborious handwork.

In combination with his socialist writings, Pannekoek's Milky Way drawings also provided a crucial inspiration for Jeronimo Voss' work *Inverted Night Sky*. In his conversation with cultural theorist Johan Hartle, included in this volume, Voss reflects on his exhibition and the inspiration that Pannekoek's life and drawings of the Milky Way offered. It leads Voss to explore the historical ties between imaginations of the cosmos and communism, and reflect upon how these can enrich both contemporary art and social criticism. Voss is used to transgressing boundaries and aspires to, in his own words, 'a universalist perspective that goes beyond [...] the traditionally separated domains of visual art, documentarism, science, politics, and every-day life' – just as Pannekoek did, one may add. Thus, Voss has created dome structures with projections of Pannekoek's Milky Way drawings that collapse various techniques and that offer both a unique inverted perspective on our nearby cosmos, while they are blended and framed with social commentary.

Alena J. Williams offers a 'close reading' of Voss's art, which she relates to how revolutionaries from Pannekoek's time to today have used images and conceptions of the cosmos to imagine both revolutionary ideals and their catastrophes. A case in point was Louis Auguste Blanqui, a revolutionary

who played a leading role in the Paris Commune of 1871: he took to astronomical musings to process the dramatic defeat of the Commune and to rekindle his hopes for a revolutionary future. Williams shows how Voss is inspired by Blanqui's hypothesis 'that all possible variations of our own past, present, and future are real material facts located within infinite space' as it promotes 'a worldview that conceptualizes history as a product of collective decisions rather than as an independent stream of time'. Voss investigates Pannekoek's life, politics, and especially his visualisations of the Milky Way from this perspective, according to Williams. Voss's work and Williams's contemplations on them give greater urgency to Pannekoek's aesthetic choices and their possible political implications.

The articles in this volume reaffirm that Pannekoek's contributions to astronomy and socialism cannot be considered as independent from each other. By investigating his work in both science and political theory, along with his broader epistemology, a multifaceted view emerges that not only reveals the many connections and similarities between his socialist and scientific career, but also clearly shows that they are deeply interconnected in Pannekoek's approach, methods, and goals. Moreover, Pannekoek's case uniquely illustrates the arrival of modernity, and its upheavals: as new ways of being were introduced, new ways of viewing were required – as has famously been documented in the arts, reflected in the sciences, and expressed in the social revolutions that spread across Europe. Pannekoek stood at the epicentre of these developments and contributed to them at least as much as he reflected them: innovation in perspective was often translated into the language of revolution, and Pannekoek was a revolutionary in spirit at least as much as he was an intellectual in temperament.

Acknowledgements

We thank the Royal Netherlands Academy of Arts and Sciences (KNAW), the Amsterdam University Fund (AUF), the Netherlands Research School for Astronomy (NOVA), the Leids Kerkhoven-Bosscha Fonds (LKBF), and Stichting Pieter Zeeman Fonds for their support of the 2016 conference 'Anton Pannekoek (1873-1960): Ways of Viewing Science and Society' of which this book is the result. We are also grateful to the Vossius Fund for the History of the University of Amsterdam, the Anton Pannekoek Institute for Astronomy, and the Jan van Paradijs Fund for their generous financial support to make the open access publication of this book possible.

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