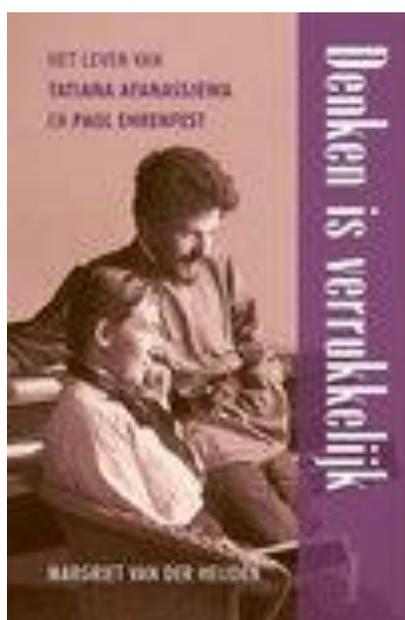


The Delight of Thinking:*The Life of Tatiana Afanassjewa and Paul Ehrenfest*by **Margriet van der Heijden**

Published by Prometheus, Amsterdam, January 2021

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**Original Title:***Denken is verrukkelijk, het leven van Tatiana Afanassjewa en Paul Ehrenfest***Number of Pages:** 432**Rights sold to** (See Translation Database): Publisher (language)**Included with Excerpts:**

Short biography author (p. 2)

Additional book related information (P. 2)

Translated review from Dutch newspaper *NRC Handelsblad* (pp. 22-26)Translated article *NOS*, Dutch Public Broadcasting (pp. 26-27)

The Press About . . . (pp. 27-28)

Fan Mail from Readers . . . (pp. 28-33)

Translated Excerpts:

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Chapter 10: Pages 78-82, 84-86 (pp. 12-15)

(Parts of the) Epilogue: Pages 349-355 (pp. 16-21)

(Note to Reader:

*Although not included here in this
sample, each chapter of the book itself
is extensively documented with footnotes.)*

Margriet van der Heijden is a particle physicist, who did her PhD work at CERN, Geneva, and now works as a writer and science journalist. Her articles related to physics and mathematics often appear in the Dutch newspaper *NRC Handelsblad*. She has also written several nonfiction children's books including *De wiskundetrompet* (The Math Trumpet: And Other Stories about Shapes and Numbers) and *Drinken vissen water?* (Do Fish Drink Water?). Van der Heijden teaches at Amsterdam University College.

Shortlisted for the Libris History Prize (September 2021)

This award is reserved for easily accessible historical books with an original subject that are based on thorough historical research and appeal to a wide audience.

Khadija Arib, former speaker of the Dutch House of Representatives and chair of the jury, said when announcing the list: “. . . incredibly touched by this book . . . and it reads like a novel.”

Long Overdue Recognition

In 2020 Leiden University established an Ehrenfest-Afanassjewa thesis award [more info](#) (which they had planned to name the Ehrenfest Prize). In the spring of 2021 the yearly Tatiana Afanassjewa Lectures [more info](#) were also launched thanks to this book and in 2022 a new street in the Leiden Bio Science Park [more info](#) will be named after Afanassjewa.

The Delight of Thinking

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Part 1: Young

Chapter 6

Don't Ever Smoke

- Shared Passions Cement Love

[Excerpts from pages 52-54]

When Tania arrived in Göttingen with her aunt Sonya, a path had already been paved by a small group of women. Almost every semester an American female student attended the mathematics lectures. Göttingen's most famous mathematician, David Hilbert, had mentored the Russian mathematicians Lubov Zapolskaya and Nadezhda Gernet, who respectively in 1901 and 1902 received doctorates there. And the English mathematician Grace Chisholm was often seen at the university, along with William Young who was her husband and colleague.

The most renowned female mathematician had already died. Sofia Kovelevskaya, a Russian, had been the world's first female professor of mathematics. As a child she became intrigued by strange symbols: too poor to buy wallpaper, her parents had hung mathematical lecture notes on the wall in her bedroom. Years later she went on to study mathematics with Carl Weierstrass in Berlin, who "illegally" allowed her to attend lectures. Her dissertation in Göttingen received a summa cum laude designation in 1874, yet she was not allowed to be present.

And even though her mathematical colleagues appreciated her work, Kovalevskaya was unable to obtain a professorship in Germany or Russia and was only permitted to teach elementary school. She had begun writing novels, her talents became fairly fragmented, her love life was turbulent, and Weierstrass had to talk till he was blue in the face to finally arrange an appointment in Sweden. She did important work there until her death from epidemic influenza in 1891, at age 41—far too young.

Despite this, or perhaps precisely because of these examples, Tania felt intimidated in Göttingen when she first set foot in the lecture halls and especially the library reading room. There were so many volumes in the cabinets. Where to begin? Who were the important authors? In which books would she find the basics and which articles described interesting developments?

As an assistant at Bestuzhev Women's Higher Education Institution in Imperial Russia and a mathematics teacher of the lower grades at Mariinsky gymnasium, a preparatory school for girls in Saint Petersburg, she had realized a year earlier that there was so much more she

needed to know. Her decision to go to Göttingen was motivated by this and by having Gernet and Zapolskaya as role models. In essence she also wanted to learn more about physics and she hoped the program and research done in Göttingen would be more innovative.

The latter was, of course, true. The great mathematician and educator Felix Klein's attempts to link mathematics and physics with technology had created an electrifying and enthusiastic atmosphere. Johannes Stark conducted extensive experiments with radiation. Hermann Simon led an institute for applications of electricity; Emil Wiechert was busy establishing a geophysics institute; the work of Ludwig Prandtl begun in 1904 would lead to the famous institute for aerodynamics; and Carl Runge was appointed in 1904 to chair the new department of applied mathematics.

Though all of this was still out of reach for Tania. At the long table in the quiet reading room, high above the botanical garden where gardeners were raking the autumn leaves, she marked out her own modest territory, with her nose in books and papers spread out in front of her. Here she felt less exposed to the curious glances of the other students in the lecture hall who wondered who this woman was. After a year of teaching at a gymnasium and assisting at Bestuzhev, she had to get used to living as a student again. In addition, there was still the occasional criticism in Göttingen about allowing foreign women to study, which had blown over from Halle and Leipzig, and a life among male students was in any case a novel experience.

Things only got easier after one of those students went to bat for her. Paul Ehrenfest, direct and curious, had inquired about the petite Russian who had suddenly appeared in Klein and Hilbert's lecture halls. He had asked around about why she never attended the weekly club meetings of the mathematics students and had been annoyed by the explanation: women were only welcome at festivities. It took time and energy to convince his fellow students that Tania should be invited. "But he managed it," Tania later wrote. "Next he went and inquired among the Russian students, who were just as curious as he was to see if I would accept the invitation. Well, I was happy with anything that offered me an opportunity to familiarize myself with life in Germany. And I longed for scientific discourse with other mathematicians and physicists."

Finally, all of this helped Tania feel at home. Sometimes she got invited for high tea or dinner by one of her professors, and the fact that her uncle had been a mathematics professor in Saint Petersburg was a good calling card. More and more often she invited fellow students to visit Kirchstrasse, where she rented an apartment with Aunt Sonya, who was still chaperoning her niece. Ritz, Herglotz, Hahn and of course Ehrenfest often visited. Aunt

Sonya enjoyed the bustling atmosphere, pouring tea, serving cookies, rushing the cook, and she encouraged Tania's friends to play on the grand piano in the parlor. Herglotz later remarked in a letter that the atmosphere there was "always lighthearted and cheerful".

And then there was Tania. Because of her delicate frame and youthful looks, it was not obvious that she was older than most of the other students; she would turn 27 during the winter semester. Increasingly, she was seen with Paul: he stocky with bushy hair, twinkling eyes, and agile hands. She petite, calm, with almond shaped eyes and an amused smile, was surprised by his casual way of speaking and mastery of Viennese expressions. He delighted in the way she rolled her *r*'s. While she watched with amusement as he tried take in everything during lectures, he enjoyed when she engaged in logical reasoning.

Their conversations, which had started at a long table in the restaurant on Theaterplatz, soon went beyond mathematics and physics. In the hallway in front of the library reading room, on strolls through the expansive botanical garden, in the coffeehouse on the townhall square, and at Tania's home, they discussed music, literature, Vienna and Saint Petersburg, friendships and professors, and how to proceed with their studies. They discovered that they both loved playing the piano and that neither of them liked half-timbered houses.

[Excerpts from pages 56-57]

Yet, Paul's support did not mean that the rest of the world also considered Tania of equal standing. Women like Kovalevskaiakaya, Zapolskaya, Gernet and Chisholm – as well as Tania – were basically seen as exceptions that confirmed the rule: clever, tenacious, but kept in isolation not really threatening to the status quo. And what that meant is evident from a letter written around the same time by the Göttingen professor Ludwig Prandtl to his fiancée Gertrud Föppl: "Unfortunately, we men can seldom give back enough for what our wives give us in devotion and love. A wife wholeheartedly commits herself to the household for the sake of her husband – while having to share him with his professional interests . . ." And this is also clear from a letter in which Gertrud's mother subsequently assured the professor that she had raised her daughter "to pursue the deep happiness that comes from faithfully fulfilling one's domestic duties."

But Tania had much different concerns. She wanted to think with Paul, really think about things that mattered. And she wanted to do that thinking and working with him for the rest of her days. She wrote in Paul's notebook on December 12, 1902, "*Nie rauchen*, Don't ever smoke" – she apparently had a *long* life with him in mind.

Part 1: Young

Chapter 10

First Publications

- Unemployed but Busy Working

[Excerpts from pages 78-82]

Sometimes Tania laid her baby, wrapped in white swaddling cloths, on the grand piano. Then she would play for her daughter who stared back with wide eyes. She resembled a doll when they placed her in the baby carriage's wicker basket and gently pushed her through the Viennese streets on large spoked wheels. At home Paul took endearing photos of Tania breastfeeding. Aunt Sonya joyfully lifted her great-niece into the air. And "Tanitsjka was an easy baby, and so alert, she slept through the night; falling asleep after her bath by eight o'clock. Aunty asked her one evening, 'Where is papa?' and she immediately looked in the direction of your study – she was on the balcony at the time," Tania wrote in mid-March to Paul who was visiting the theoretical physicist Walther Ritz in Switzerland.

But it was not to be the Viennese idyll they might have imagined. Now that Tania and her aunt were no longer tourists, as they had been in earlier years, they discovered a different side of Vienna. To visitors, the city appeared to be *gemütlich*, welcoming, with coffeehouses, pastries, concerts and entertainment. Connoisseurs of culture also considered Vienna the city of *Bildung* with an intellectual and artistic avant-garde that included composers like Arnold Schonberg and Gustav Mahler, writers like Arthur Schnitzler, and scientists like Sigmund Freud. But ultimately – as everyone who stayed there longer realized – in the capital of the Austro-Hungarian Empire, the old Catholic aristocracy pulled the strings. And they placed greater store in lawfulness and conservatism – important to the army and the civil service – than in a brilliant and creative mind.

It was nothing for Tania who, with a little help from fate, had just liberated herself from her authoritarian uncle. And once you realized this, it was as difficult to ignore as the condescending anti-Semitism that had woven its way through all layers of society. Vienna offered Jewish subjects of the Austro-Hungarian Empire opportunities, but also demeaned them. Jobs in government service, diplomacy or the army were still not available for the large groups of Jews from Galicia and Moravia who through hard work and study sought to build a better life. And the fact that they had found a haven in the flourishing business and banking world and the field of journalism, and incidentally made up a large part of the cultural avant-

garde, also aroused envy. It was as if both success at the top and poverty in the Jewish slums somehow justified the (blatant) expressions of anti-Semitism.

In his youth Paul had already seen how the anti-Semitic mayor Karl Lueger and his Christian Social Party fueled this evil tendency by politicizing it. Jewish workers were said to have “dangerous socialist ideas” and to take away jobs. The policies of the liberal “Jewish” elite were to the detriment of ordinary Austrians. In short: “It was impossible, especially for a Jew in the public eye, to ignore the fact that he was a Jew, for the others did not,” writer Arthur Schnitzler observed. “Vienna oppresses me, perhaps more than is good [for me],” wrote Freud, who, like Paul, was the son of a Jewish merchant from Moravia. And in fact Paul experienced the same feeling. “When a Jew speaks of ‘we’ – not in the sense of his race – the rest of the group begins to ‘make the sign of the cross’,” he wrote many years later. “A Jew cannot use this word compellingly.”

So Paul and Tania, to a greater or lesser extent, both felt out of place in Vienna. Tania as a free-thinking Russian with “deviant” ideas about work and life; Paul as a Jewish man without a job. And it did not get any better when they were only allowed piecemeal access to the world in which they did feel at home: that of science. Of course, Tania still regularly rode the streetcar along the stately avenues of downtown Vienna and through the winding streets of Alsergrund to Turkenstrasse to sit in the shabby lecture hall as an “audience member” listening to Viennese scholars. But in a city where people still had to get used to women at the university, a young mother studying was altogether outlandish. Besides, in Vienna, Tania’s Russian Bestuzhev diploma was no more than a cryptic piece of paper.

Also Paul did not feel at home at the university on Turkenstrasse. The relatively small group of physicists there, under the leadership of Franz Exner, was focused mainly on experimenting and was under the spell of a new phenomenon: “radioactivity”. Paul’s interest was much more theoretical. It was his misfortune that the great theoretical physicist of Vienna, his teacher and mentor Ludwig Boltzmann, had committed himself to a clinic for depression in the spring of 1906. Fortunately, in the fall of 1905, Paul and Tania – who was pregnant at the time – had attended a series of lectures by Boltzmann.

[Excerpts from pages 84-86]

In the weeks that followed, as the wind scattered the falling leaves through Vienna’s streets; mist rose from the horses in the autumn air; the first snow powdered the city parks white; and Tanitsjka celebrated her first Christmas with a Christmas tree in icy Saint Petersburg, Paul also tried to unravel the essence of Planck’s work. He combined his notes from Leiden and

Vienna and step-by step compared Planck's calculations on "black bodies" with Boltzmann's work. He had already expressed his feeling that this comparison was flawed while having a conversation that summer in Weesen with the French physicist Bauer. It had continued to gnaw at him in the Viennese coffeehouses and in his apartment high above the Alois-Drasche-Park. But it was only during another visit to Weesen in the early summer of 1906 that he finally put his vision down on paper. Spring was in the air, there was still snow on the mountain peaks and this time *T* was there, happy to be pushed in her baby buggy while staring at Lake Wallon with her bright blue eyes.

But the reality for both Einstein and Ehrenfest was that their articles were poorly aligned with the vision of prominent physicists at the beginning of the twentieth century. Men like Hendrik Lorentz, Arnold Sommerfeld, or Max Abraham hoped to trace all forces back to electro-magnetic fields and even to be able to describe mass as the product of electromagnetism. For example: "The world would then consist exclusively of negative and positive electrons, and of the electromagnetic fields generated in space by them," Abraham had written.

It was no longer fashionable, à la Newton, to describe the cosmos as a magnificent clockwork in which one mass set another in motion, or to use gearwheels as a metaphor. Force fields were now all the rage. Because of this, Einstein's postulate that light was granular also seemed a bit behind the times. It was too reminiscent of the "outdated" Newton who had given the world mechanics and the idea of a universe that works like a clock. Something similar probably applied to Paul's remarks about electrons. The research being done was, by in large, the labor of self-employed, unpaid, or moonlighting young physicists.

Einstein was promoted in 1906 from a third-class clerk in the patent office in Zurich to second-class clerk and briefly considered going into teaching. Meitner decided in the summer of 1906 that she would teach at a girls' school for the time being and continue her experiments in the evenings. And Paul and Tania? Their co-authored work was a simple finger exercise compared to Einstein's work and the thoughtful experiments Lise Meitner had conducted with Exner's supervision. And Paul's own quantum article not only lacked the broad overview, daring, and flawless intuition of Einstein, but also a clear mathematical foundation. Because of this, the chances of a warm reception in another university town seemed unlikely, while theoretical physics in Vienna had just about come to a standstill given Boltzmann had been admitted to a clinic.

What to do? Paul's parents had amassed some wealth, but the inheritance had been divided among the five sons and Paul's share was shrinking substantially. Meanwhile, Aunt

Sonya saw that he and her niece could not find their footing in Vienna. Could they go to Switzerland? During a visit to the country in March 1906, Paul once again sounded out Walther Ritz about the possibility of a position. Tania had written to Paul shortly after his departure: "I always expect to see you, whenever a door opens or I hear footsteps, I think any moment now, you will arrive. May God protect you." But after Paul's safe return, all hopes of a job in Zurich or Bern were dashed. Yet, their dream of continuing to think, write, and study was not.

During that summer they terminated the lease on their apartment in Vienna and put their affairs in order so that after their vacation in Weesen they could return to Göttingen. How uncertain the future there might be, and notwithstanding the fact they had poked fun at half-timbered houses, mathematics and theoretical physics were alive and flourishing. And it was the natural sciences that provided the pleasure, togetherness, and clear thinking that made them feel at home.

Epilogue

[Excerpts from pages 349-355]

In the late 1930s, a series of letters traveled between the American city of Saint Louis Missouri and the Dutch city of Leiden. In the United States, Hugo Ehrenfest was extremely worried about his brothers and their families living in Vienna. His oldest brother Arthur had already died in 1931, but his widow Regine was stranded in the Austrian capital while their son Fritz was trying to escape the Nazis via Greece. Hugo's older brother Emil and his younger brother Otto had lost their thriving businesses and fortunes, were destitute and living in fear.

Hugo hoped the life of Emil, who was old and sick, would soon end. To his relief he had been able to arrange American visas for Otto, his wife Fanny and their two sons, as well as Arthur's son Fritz. But he disagreed with what Tania Ehrenfest-Afanassjewa had proposed in one of her letters. She hoped to get Regine out of Vienna too, and Pepperl, the widow of Hugo's father Sigmund. For this she wanted to use funds once set aside by her and Paul so their son Pawlik could study at university. But Hugo felt this was unwise. Tania could better use that money to move, for example, to Switzerland with her daughter Galinka. She was terribly concerned about her because she was considered Jewish under the Nazi-rules. Regine and Pepperl were too old to just "uproot", and besides, Hugo, did not have the means to be financially accountable for any more relatives: "Tania, I feel a very great admiration for you as a human being, but you are a Russian – I am an American. You are and always were ready to give away EVERYTHING you have. I feel compelled to think of the future of my wife, children and grandchildren. . . . Tania, don't try alleviate everyone's suffering; that is an impossible and hopeless aspiration!"

Did Hugo write this because he had a deep understanding of his sister-in-law? When Tania first entered the life of his youngest brother Paul, Hugo was already living in America. And while Paul had visited him there twice, Tania had been focused on her Motherland Russia. So what they knew of each other was almost exclusively from letters and stories. Perhaps the American vision of the socialist USSR largely colored Hugo's viewpoint, but it is unmistakable that the letters are filled with mutual admiration.

Indeed it is true that Tania Ehrenfest-Afanassjewa was living at a dreadful time, and that she had also gone through some difficult and terrible periods with Paul Ehrenfest. Both of them had coped in their own ways. For a long time they faced life challenges together –

driven by the desire to escape the often stifling environment in which they had grown up, to be able to make their own choices and to live according to their own principles.

The brilliant and inquisitive Paul, the youngest – the “surprise” child – in a large and hard-working family, had looked up to his older, intelligent brothers who were climbing the social ladder in Vienna. In his parents’ prosperous grocery store, with its “supermarket” concept, he learned to feel comfortable among people from all different backgrounds. At the same time in every-day life and at school, he was constantly reminded that as a Jewish boy in Vienna he would never really fit in.

The pleasant and remarkably smart Tania was raised in Saint Petersburg by her uncle Pyotr and aunt Sonya in affluent surroundings, but also with an abundance of rules and regulations. That she went on to get a higher education at a college specifically for women had only become possible once her authoritarian uncle had died. Her mother, a widow and daughter of a freed serf, did not play much of a role in her upbringing. Women, Tania must have learned early on, were not given much say in life.

With Paul she managed to escape the stifling aspects of her childhood, and the same held true for him. The driving force behind that escape was their shared passion for mathematics and physics, in addition to – because that was there too – a mutual love of music and literature. Their desire to be of significance in the world of mathematics and physics, to exert a lasting influence, as Paul once described it, led them from Göttingen to Vienna, back to Göttingen and Saint Petersburg, and finally to Leiden. Along the way they, and certainly Paul, became friends with just about everyone who was anyone in the field of physics, and additionally – and this was especially true of Tania – with many others who took the didactics of mathematics to a higher level.

They were never your average couple. Not in Vienna, where Paul in his Russian smock and with his Tolstoyan ideals stood out, and Tania as a woman in a lecture hall was a strange apparition. Nor in Saint Petersburg where Paul, as a Viennese Jew with a Russian beard, meddled with the stodgy atmosphere of the scientific institutions, and where the Russian-Orthodox raised Tania preferred discussing probability theory gathered around a blackboard with friends to visiting the salons of the well-to-do. Even if they were not dangerous revolutionaries or nihilists, many from the established order found their idiosyncratic and critical mindset somewhat threatening, or at least disturbing. This too made it far from evident that Paul might find employment or Tania could take exams at a “normal” university (for centuries exclusively reserved for men). Though, at the same time, their

independence set an example for a new generation of physicists: their fortnightly discussions at that blackboard in their living room included men like Alexander Friedmann – known for his pioneering theory of an expanding universe – the famous Abram Ioffe, and a line-up of other luminaries from Russian (and later Soviet) physics. They would come to think of Paul as a founder of Russian theoretical physics.

From 1912 onwards, Paul and Tania played a similar, inspirational role in the Dutch provincial town of Leiden where their newly built Russian-style villa – designed by Tania – was quite a sight. It had plastered instead of brick walls and neoclassical lines and pediments instead of a modest Dutch stepped gable or gable roof. The mailbox was in the wall of the study, the front door was on the other side of the house with the bell at the garden gate and in the kitchen, on the street side, was a large hatch through which vendors could deliver their wares – any Dutch logic was missing. Next to the tulips in the garden, Russian poppies bloomed year after year.

It was an oasis for young Dutch students such as Burgers, Struik, Coster and to some extent Kramers and Minnaert, and in later years Uhlenbeck, Goudsmit, Tinbergen, Casimir, Rutgers, and Dieke. There they kept up-to-date with the latest developments in the field of physics and mathematics. There basically every topic was open to discussion. There Paul played on the grand piano and the children hung their drawings on the doors and walls. And there Einstein refueled after he had completed his general theory of relativity, amidst the horrors of World War I in the rest of Europe, which made it clear as Einstein wrote: “. . . what a sad species of cattle we belong to.”

That Einstein was soon a familiar face in the Witte Rozenstraat – at least as much as the distance Berlin-Leiden would allow – was no wonder. Paul’s brother Hugo once wrote to his younger brother that he had a nose for recognizing talented people with whom he then easily made contact. And so it was: almost as soon as World War I ended and travel became possible again, Niels Bohr came to stay and in the years that followed Paul and Tania opened their home “to people and ideas” from all over. Among the names written on the wall of the attic guest room are the signatures of sixteen Nobel Prize winners, and for instance Lise Meitner, who of course should have received a Nobel Prize too.

Connecting people and ideas was also the crucial role Paul and Tania played in the scientific world. Their own physics work consisted of intelligent and thoughtful comments on often very subtle and complex problems. . . . Yet, this work never stood on its own feet, like

Einstein's theories or Schrödinger's wave equation. It did not deliver formulas that are still extensively discussed today and might also be analyzed in the future.

Paul's qualities lay elsewhere. He was "a gallerist" of science at the top level: he consistently recognized the quality – or lack thereof – in the work of others, he could place it in precisely the right context, knew how to enthuse others about it, and with the same enthusiasm he then brought physicists from all over the world in contact with each other. But most of all, and also partly because of his 'gallerist-qualities', he was unequalled as a teacher and a mentor. Even decades later his former students still applauded his crystal-clear explanations and the masterful way in which he could summarize complicated issues by merely writing the essential formulas on the blackboard in an unprecedented orderly fashion. They praised his humor, the way he played with language, the charm with which he could break the ice and his sometimes frighteningly sharp but always enlightening Socratic questioning. But the best proof of his enormous commitment to his students is that their own careers were, almost without exception, successful.

Meanwhile, what was long forgotten, overlooked or outrightly ignored in the Netherlands, was the role and influence of Tania Ehrenfest-Afanassjewa. She had held a paid position in Saint Petersburg as a mathematics instructor. With Paul she had co-authored a renowned article examining Boltzmann's work. Still she, of all people, ended up in Leiden in 1912 where women were found behind the kitchen stove or perhaps seated in the *salon* – but in any case stuck at home. The unwritten rule that married women did not go out to work, unless dictated by immense necessity, was in fact implemented by Royal Decree in 1924. And even though Tania had designed her own home and largely paid for it, and had a series of publications to her name, in the Netherlands she was legally considered an "incapable wife". She was not allowed to open her own bank account, withdraw money or make any major purchasing decisions herself, and indeed, what she found most upsetting: she was not allowed to work.

Did that ultimately contribute to driving Paul and Tania apart? Tania worked at home. She organized discussion nights about mathematics. She wrote scientific articles, some of which were published and a few even presented, via Onnes and Lorentz, to the Royal Academy of Sciences. Yet, her participation from the side-lines remained unpaid – as if it were not real. Even in 1924 when she introduced a discussion in the Netherlands with a

pamphlet about geometry, which sparked a major debate about teaching mathematics, leading to the founding of a journal for the didactics of mathematics and a committee for educational reform, she was still left empty-handed when it came to paid work. There was no place for her on the committee; the pamphlet did not result in a job.

“It would be splendid if all my wife’s and my own publications could be published together in chronological order just once. It is very important to me that my wife’s essays be published as completely as possible,” Paul had written in 1926. In reality, Tania once again faced restrictions in Leiden, much like before when she was a student in Saint Petersburg: again it was as if women doing science could at best be a hobby, a glorified form of embroidery, to be carried out on a modest level once the house was in order.

The question of whether things might have turned out differently can never be answered with certainty. Paul and Tania faced many other challenges. The revolution and the civil war in Russia distressed Tania. That her railroad shares had become worthless and their financial security had been wiped out caused a state of panic, particularly in Paul. Tania must have looked on with increasing hopelessness as Paul attributed his lack of creativity and original work to anxiety because he was constantly having to earn extra money with lectures and menial exam-related tasks. On the other hand, Paul could only look on with dismay how Tania’s worries about Wassik, their youngest son with Down syndrome, resulted in her letting her research lapse in the early 1920s; research efforts that were her last resort in the provincial town of Leiden. It was an important reason to bring the little boy to the Trüper Institute, a home for children with developmental impairments and disorders in Jena, Germany.

Later on, in retrospect, Paul’s demise in 1933 – his self-chosen death in which he took Wassik’s life too – was often attributed to the revolution of quantum mechanics in physics. Paul could no longer keep up with the volatile developments. He was concerned about the complicated and abstract mathematics in which quantum mechanics was expressed. And he, the man who had always been clever at coming up with clear and insightful metaphors, despaired at the thought that this theory could no longer be “visualized” with analogies and examples from the sensory world: could quantum mechanics really be grasped by anyone?

Yet, this is just as oversimplified as depicting Tania, as regularly occurred in the past, as a rational and cold woman wearing a stern-looking white ribbon around her neck during colloquiums, who constantly wanted to prove herself, who forbade smoking and drinking, and who between 1926 and 1933 preferred helping build up the educational system in the Soviet

Union over being with her family and husband in Leiden. The spirit of the times and the position of women when Tania was young – and for decades to follow – made it easy to act as if her ideas about teaching mathematics visually and actively had been whispered to her by Paul; to relegate her role in the writing of their article on statistical mechanics to that of a sounding board and assistant; and to downplay her later work in heat theory as tinkering in a musty corner. It is true, her work was not original in the sense of daring and ground-breaking, but it also seemed impossible to achieve this in a field in which the unspoken expectation is that women are doomed to fail, in which a woman must constantly prove and justify herself. Yet, it was precisely Tania's clear and solid logical reasoning, her straightforward approach, which also made her work original. It gave her insights into several paradoxes in thermodynamics and led to conclusions about negative temperatures and about the ambiguity of equilibrium conditions that were far ahead of their time – by the way much like her refreshing ideas about the didactics of mathematics. And for that matter, her influence on Tinbergen, with whom she continued to correspond throughout her lifetime, has also been systematically underestimated.

It was just as easy for decades to contrast the independent Tania with her head full of mathematics and physics to the prevailing ideal of the compassionate, caring, charming and obliging wife, and then to bemoan Paul. Yet, it seems reasonable to assume that it is precisely Tania's balanced, amiable and indeed at times somewhat stand-offish adherence to their shared ideals and goals that kept Paul on course when he was tossed between euphoric gaiety and extreme lethargy. They had given up their religions for each other: a marriage between a Jew and a Russian Orthodox woman was forbidden in Vienna. Together they had bid farewell to a bourgeois existence with a good cigar, a fine glass of cognac, an elite education for the children followed by climbing the social ladder by way of a student corps. Inspired by, indeed, "Tania's" Tolstoy, they chose to home school their children, eat vegetarian, and live without drinking and smoking. But the one who on occasion adamantly defended their lifestyle or inflicted it on others, was Paul. Maybe because it was he, at moments, who most needed to cling to certainty.

Translated review from the Dutch quality newspaper *NRC Handelsblad*

The Dramatic Life of a Scientific Power Couple

Physicists A fascinating double biography, set against the tumultuous history of their times, delves into the remarkable lives of the physicists Paul Ehrenfest and Tatiana Afanassjewa. In the provincial city of Leiden, they did their best to build a new life.



Tatiana Afanassjewa and Paul Ehrenfest

on vacation in Kannuka, Estonia, early 20th century

Photo: Ehrenfest Heirs

Margriet van der Heijden:

The Delight of Thinking: The Life of Tatiana Afanassjewa and Paul Ehrenfest.

Prometheus, 432 pages. € 39.99

Four stars ****

Michel Krielaars

February 4, 2021

Physicists are pure thinkers; seldom are they visited by the muses. Everything revolves around formulas, straight and curved lines, atoms, and electrons. Yet, after reading Margriet van der Heijden's biography *The Delight of Thinking: The Life of Tatiana Afanassjewa and Paul Ehrenfest*, you come to understand that such a calling can indeed involve a degree of musical splendor.

Not only does the author, herself a particle physicist, know how to make the most important developments in mathematics and physics comprehensible for lay people, she also beautifully succeeds in placing both her main characters in their time. She does this in a most literary way, with considerable psychological insight, historical knowledge and feeling for local color. In her biography Ehrenfest and Afanassjewa emerge not only as two inspired natural scientists, but also as passionate people with eventful lives.

For this book, Van der Heijden was the first to draw on both spouses' correspondence, written mainly in Russian and translated for her by the slavist Hans Driessen. In the Ehrenfest family archives she also discovered two personal letters from Einstein, dated 1933 and 1939, which contain unique and moving passages.

This biography reads first and foremost as a fascinating history, taking you from the Fin de Siècle in the Habsburg Empire via Tsarist Russia and the German town of Göttingen to the early years of the Soviet Union and ending up in the mundane city of Leiden, where Paul Ehrenfest became a professor of theoretical physics in 1912. Van der Heijden depicts the reserved, inflexible atmosphere at Leiden University as in a naturalist work by the Dutch novelist Marcellus Emants. As if her biography could only end with her male protagonist committing suicide.

The Delight of Thinking begins in the late nineteenth century in Vienna, where Paul Ehrenfest (1880-1933) grows up in a Jewish grocer's family with four older brothers. His parents, who amass a small fortune with a modern supermarket concept, encourage their sons to continue their educations. As a result, the boys go on to become respectively: an engineer, doctor, electronics technician, businessman, and physicist. Van der Heijden portrays this assimilated Jewish milieu in a subtle way, with a keen eye for the social obstacles that the anti-Semitism of the Austrian nobility and higher civil service creates for Jews.

Einstein

In Vienna, Ehrenfest studies natural sciences with Ludwig Boltzmann, in those days Austria's most famous physicist and philosopher. During a lecture, this founder of statistical mechanics says he does not require his students to do their absolute best, but rather to give him their devotion, trust, and friendship. This is precisely what Ehrenfest himself would later strive for

as a professor. For only by debating with your students as friends can you, according to him, arrive at new insights.

In 1901, Ehrenfest leaves for Göttingen Germany having just received his Masters degree. In this Valhalla of natural sciences he meets the Russian Tatiana –Tania – Afanassjewa (1876-1964), a young woman of standing from Saint Petersburg, who has studied mathematics and physics in Russia at a new higher education institute for women, the Bestuzhev Courses. Tania and Paul share their scientific passion, read Tolstoy together, and play Brahms on the grand piano. Could you ask for more?

By 1907, Ehrenfest, has received his PhD, married Tania, and the couple trade anti-Semitic Vienna for Saint Petersburg. Tania teaches mathematics at the university there, while Paul becomes friends with Russian contemporaries in his field. When they realize Russian natural science is still somewhat old-fashioned they organize *kruzhoks* at home, discussion groups with Russian friends, colleagues, and graduate students who will later call Ehrenfest the founder of Russian theoretical physics.

Since Ehrenfest cannot secure a professorship in Russia, he tries his luck in central European cities like Prague. There, the friendly Albert Einstein is about to trade his chair for a professorship in Zurich, where he will develop his famous theory of relativity. The men become each other's closest friends. Indeed, they need each other, Van der Heijden emphasizes. Ehrenfest, for instance, can articulate and analyze Einstein's theories like no other. He also sorts out his formulas down to the last detail, because his friend Einstein is accurate in his assumptions but sloppy in the details. Because of his precision, Ehrenfest contributes greatly to Einstein's fame.

Failure

Van der Heijden credibly suggests this intense friendship is also the source of Ehrenfest's later unhappiness. While the Nobel Prize-winning Einstein, Lorentz, and Kamerlingh Onnes have each made their own important discoveries, Ehrenfest does not have any definitive research to his name. This increasingly contributes to his feeling of failure.

Meanwhile, Tania has also grown frustrated because, as the highly educated wife of a civil servant, she is not permitted to work in Leiden. She learns to live with this. In their large Russian villa located on Witte Rozenstraat, which she designed for her family, she organizes geometry colloquia, similar to the kruzhoks in Saint Petersburg. Over the years their home becomes an intellectual gathering place, where nearly all of the world's great physicists come to visit. While alcohol and tobacco are not allowed, there is still plenty of discussion. Ehrenfest's students also delight in being able to freely talk about their subject in such a relaxed atmosphere.

Ehrenfest's significance for physics, according to Van der Heijden, lies primarily in his ability to use lively wording and Socratic questioning to explain complex issues to his students in a crystal clear way, accompanied by intelligent comments. She rightfully notes that it was thanks to these comments that the development of quantum theory, for instance, likely proceeded faster. In addition, this connecting of people and ideas, something Tania also excelled at, led his students to have successful international careers.

Affair

The desire to teach takes Tania back to Russia in 1925, where it is now quite common for women to work. There she devotedly teaches at institutions of higher learning. But she also sees the downside of the new utopia, especially when Stalin's industrialization policy causes a famine that kills millions.

Once again Van der Heijden transports you into a fascinating world of sympathetic, great thinkers, who have little regard for their Bolshevik rulers, but are willing to sacrifice everything for science and the future of their country. This is at times poignant and commands respect, especially once you realize that some will be killed during Stalin's reign of terror.

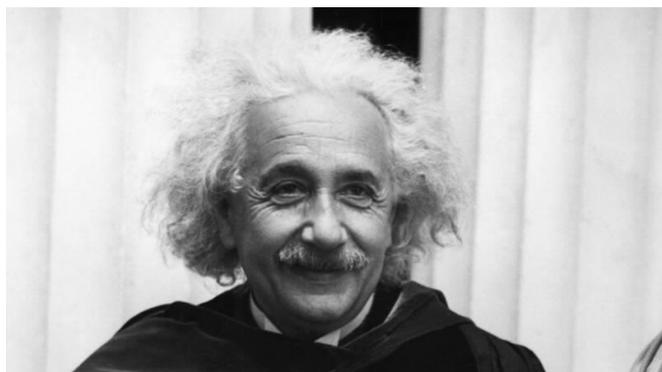
Tania's departure for Russia results in Paul becoming estranged from her. He starts an affair with a distinguished Amsterdam art critic and considers divorce. But he cannot live without Tania, with whom he has so much in common. And then there are still four children, the youngest of whom, Wassik, has Down syndrome and is living in a costly institution. Together with his small son, Ehrenfest takes his own life on September 25, 1933 during a bout of depression. It is the dramatic end of an inspired life, which Van der Heijden has skillfully

portrayed in the minutest of details. This last quality alone makes this biography read like a novel, although everything in it is true.

Translated article NOS (Dutch Public Broadcasting)

“Unknown Letters of Einstein Discovered in Leiden”

02-02-2019



Albert Einstein, 1938

Three previously unknown letters from Albert Einstein have resurfaced in the archives of the Rijksmuseum Boerhaave in Leiden. The famous physicist wrote these to his Russian colleague Tatiana Afanassjewa. According to the Dutch newspaper *NRC Handelsblad*, the letters were discovered by science journalist Margriet van der Heijden. She is working on a double biography about the Russian mathematician and her husband, the Austrian-Dutch physicist Paul Ehrenfest.

In the early twentieth century the pair lived in the Dutch city of Leiden. Ehrenfest had succeeded Hendrik Lorentz in 1912 as professor at the university there. Einstein regularly stayed with them at their home on Witte Rozenstraat. The widowed Tatiana Ehrenfest-Afanassjewa donated her husband's archive to the museum in the 1960s.

“Too Detailed”

According to the newspaper, Afanassjewa sent her manuscript *Die Grundlagen der Thermodynamik* (The Basics of Thermodynamics) to Einstein in 1947. The letters reveal that Einstein read it with great interest. He respectfully returned the manuscript by writing “from

which I myself have learned a considerable amount.” He did, however, find the work too detailed.

At the time that he wrote these letters, Einstein was living in the US and working at the famous Institute for Advanced Studies (IAS) in Princeton, New Jersey. Emeritus Professor of the History of Physics, Anne Kox, spoke to *NRC*, “Such finds shed new light on Einstein and his contacts, on the history of science.”

In California, Caltech is taking stock of Einstein’s work. The Einstein Papers Project has now catalogued some 30,000 letters and other documents. These three letters will be added to that treasure trove of materials.

Albert Einstein is without a doubt one of the most famous scientists in the world, perhaps the most famous of all.

The Press About . . .

The Delight of Thinking:

The Life of Tatiana Afanassjewa and Paul Ehrenfest

by **Margriet van der Heijden**

“A double biography that reads like a novel.”

-*The Dutch Review of Books*

“A wonderful portrait of two driven scientists.”

-Dutch daily newspaper *Trouw*

“Impressive”

“With this book, Van der Heijden captures not only the reader’s mind but above all the heart”

-Dutch daily newspaper *De Volkskrant*

“A very filmic style, with lots of attention to detail”

“ . . . an incredibly strong connection to her characters, without losing her independence and objectivity at any point.”

-mappalibri.be, *for quality books*

“A double biography that foregrounds science as an ongoing conversation.”

-*Dutch Literature Fund*

“A fascinating double biography. . . . an inspired life, which Van der Heijden has skillfully portrayed in the minutest of details. This last quality alone makes this biography read like a novel, although everything in it is true.”

**** Dutch daily newspaper *NRC*

“Beautiful balance between conjecture and fact . . . this makes *Delight of Thinking* a superb, readable book. Van der Heijden's stamp is visible without overshadowing the lives of Tatiana Afanassjewa and Paul Ehrenfest.”

-biografieportaal.nl

An instructive lesson I take away from reading this book is that you don't necessarily have to have studied history to become a historian. We all know it: particularly natural scientists tend to lapse all too-easily into a naive, totally unreflective triumphalism. For Van der Heijden, a physicist with a PhD, nothing of the sort. Just take what might be called the core methodological problem of our profession: the need, without completely identifying with the period you are writing about, to nevertheless avoid the infamous “presentism” in the sense of writing towards the results you already know. Not only has Margriet van der Heijden managed to smoothly avoid this pitfall throughout her book, she has also found a marvelous way of dealing with this fundamental danger: “In retrospect, once ideas have been fully developed, it seems as if the route to that end point was already there from the beginning” (p. 91). In the spirit of this realization she has written this entire book, which has already found many readers, and which fully deserves many more.

-Dr. Floris Cohen, science historian
for shellsandpebbles.com

“When is it being released in translation?”

-Twitter

Fan Mail from Readers . . .

Dear Ms. V.d. Heijden / Dear Margriet,

I have just read your wonderful double biography. I hope translations will follow, because after all who reads Dutch (even your protagonists had their difficulties with it)? . . .

Again my compliments, and indeed the debate about the correspondence principle continues to this day.

Kind regards,
Joost Kircz
Former editor *North-Holland Physics* (1980-1990s)

*

Dear Margriet,

I immensely enjoyed reading your wonderful biography of the Ehrenfest-Afanassjewa couple. What a fantastic book! I also hope you will publish an English translation soon, because I suspect there will be lots of international interest . . .

It is clear from your book what a wonderfully important role his wife played in his work about statistical mechanics and in his life as a whole, and that her strong support was an instrumental part of what kept Ehrenfest going.

What also hit me hard in your book is the circumstances of Ehrenfest's suicide and murder of his son with Down syndrome. About ten years ago, I was invited to lecture on Dutch physics and astronomy by the Kavli Institute for Theoretical Physics in Santa Barbara, and it struck me then that American physicists think his suicide was only because he immensely doubted his own contributions to physics.

From your book, it is clear that this was much more complicated: his relationship with Nellie, the guilt he felt towards his wife, the rise of Nazism in Germany, and then also concerns about the future of his son with Down syndrome. The suicide of his idol Boltzmann struck me as well.

Very interesting in your book is that you also mention Tatiana's influence on my teachers in Utrecht: Freudenthal and Minnaert. I recognize in what you write the intuitive style of didactics that these two must have borrowed from Tatiana.

Kind regards,
Emeritus Professor Ed van den Heuvel

*

Dear Margriet,

I read *Denken is verrukkelijk* last week and found it wonderful. Fascinating in terms of content and written in an easy-going style. The first two chapters alone are already fantastic: Paul and Tania's childhoods brilliantly brought to life, complete with sounds and smells. You must have done a ton of research!

Although, I suspect like many of your other readers, much of my sympathies lie with Paul, my heart is particularly touched by Tania's fate and the events of her life. So I also see this book as a testament to her.

Kind regards,
Simon Burgers
Grandson Dutch Physicist Jan Burgers, who appears in the book

*

Hello Margriet,

I read your book '*Denken . . .*' with great pleasure. Extremely impressive: the incredible amount of letters and archive materials you have sifted through and read.

Quite remarkable how much contact there was amongst the scientists themselves via the mail, but also the many journeys by train over immense distances, and all of this a hundred years ago around the time of the world wars . . .

Warm regards,
Henk Tiecke, particle physicist

*

Very enjoyable. As a non-scientist, the story was easy to follow and I found the descriptions of life at the beginning of the 20th century fascinating. Also the general atmosphere as well as the personal circumstances of various individuals. Add to that: I've lived in Leiden for around 14 years and some things simply appeared before my eyes (and I will certainly take another look at others) . . . Wonderful read.

Corry Reijmerink, librarian / secretary

*

Dear Margriet van der Heijden,

What a splendid book, this double biography of Afanassjewa-Ehrenfest. Well-balanced, subtle, Tania and Paul described from many vantage points, empathic, always with exactly the right wording (as far as my taste goes), so that I understand what they were up against in their lives: being Jewish, secular, female, foreigners or a combination thereof – always facing barriers.

Impressive how you describe the scientific developments of those years . . . you did an excellent job . . .

So thanks for this splendid book!

Alied Blom Amsterdam
Dutch teacher, TU Delft

*

Dear Ms Van der Heijden,

Yesterday I read your double biography of Tatiana Afanassjewa and Paul Ehrenfest.

Exciting and frequently very emotional to see how these two overcame times that were often difficult. I think you did an amazing job describing this in such detail . . .

I checked a biography of Einstein (by Banesh Hoffmann) in which Tatiana is only briefly mentioned as Paul's spouse . . . So it's lovely that you have given her credit where credit is due and created a lasting tribute which, besides the scientific world, her children and grandchildren will undoubtedly also appreciate . . .

Kind regards,
Peter Slingerland

*

Your magnificent book *Denken is verrukkelijk* contains a wealth of information. As an Honorary Member of the Solvay Institutes, I was delighted to see you devote so much attention to the role of the Solvay Conferences.

Not only is there delight in thinking, your book is a delight.

My gratitude for so clearly depicting, besides Paul's life, the great achievements of his wife Tatiana Afanassjewa. Likewise, it is good to see how you describe Paul's relationship (affair sounds sordid in this case) with Nelleke Posthumus Meyjes. In the Dutch world of physics this was always written about with disdain, even by the greatly respected Hendrik Casimir.

Kind regards,
Henk Lekkerkerker
Professor of Chemistry
Utrecht University

*

Your book is seventh by Broese Booksellers, unbelievable! . . .

What truly comes across in your book is the powerless position of women who want and can do more, irrespective of the support of the men around them (Lorentz!). But these men still prefer to have an obedient wife there to cater to their every need. We're still struggling with that.

The most beautiful sentence in the book is on p. 204: "As her belly swelled, the Russian Tsarist Empire collapsed". What a glorious sentence! The world in a nutshell.

Jan Hilgevoord, philosopher/physicist

*

I immensely enjoyed the read . . . and your choice to portray them in such an accessible way is lovely. Keeping a general audience in mind, the more substantial physics and math aspects of course had to be toned down, as a result your book reads like an exciting novel – although it's actually based on a true story.

Gert Heckman, professor of mathematics

*

Dear Ms. Van der Heijden, Dear Margriet,

What has stayed with me, is the way you depict the development and strength of the personalities of Paul and particularly Tatiana against a backdrop of the major events of the first half of the 20th century contrasted with the specific circumstances under which they lived, especially amidst the narrow-minded Dutch . . .

*

As soon as I received your book (despite corona) I immediately started to give it a thorough read. The book is worthy of that attention, and as the writer you have laid the foundation!

As a physicist, I already knew a few things about Ehrenfest. But your book adds a lot to that. It is a “sociology” of the greatest physicists, an overview of three decades of physics, a psychological look at the relationship between two special people, and an indictment of the position of women in science.

One can't help but feel compassion for Paul while Tania becomes more and more sympathetic. Your book is exciting in this way as well, reason enough for me to read it in one sitting . . .

Dr. Johan Vos, engineer

*

I am writing to thank you for this beautiful double biography of Tatiana Afanassjewa and Paul Ehrenfest. As far as I know, it is the first (double) biography that gives a complete picture of these two wonderful people who devoted their lives to thinking. In my opinion, it would be hard to delve any deeper into their lives . . .

You write, with justification, about the crummy position and view of women in science. Of course, this is also linked to a certain image of men in science. That Ehrenfest didn't fall into this category is perfectly clear to me from your book. It would also be good to do something about the male image of so-called successful scientists . . .

. . . I think your book is wonderful.

Marcel Boumans
Pierson Professor History of Economics
Utrecht University

*

Your book about P&T Ehrenfest is delightful and I enjoyed it! Compliments, *chapeau* and hats off!

...

I loved your book and it's an amazing read! I hope there will also be an English translation soon, because I think that after Klein's half-biography many are looking forward to the complete life story of Ehrenfest, "the best teacher of physics".

Wishing you much success and enjoyment.

Kind regards,
Physicist Herman de Lang
Former editor *Dutch Journal of Physics*

*

I am currently reading *Denken is Verrukkelijk* with great pleasure and interest . . . a wonderful book, thank you.

kind regards,

Dr Liesbeth Dullaart-Pruyser, psychiatrist

*

I just finished reading your book *Denken is Verrukkelijk* and I'm very impressed.

Maarten de Jong
Professor of Experimental Astroparticle Physics
Leiden University

*

It is a great pleasure for me, and no doubt many others, to read your book *Denken is verrukkelijk*. So extensively documented and so well-written, a delight to read!

Kind regards,
Anne Stoffel
Russian-Dutch translator