

## From Russia with Love to *Infovis*: Graphic Train Schedules Reflect the History of Finland

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*A brief bio and email for all authors appear on the last page.*

## From Russia with Love to *Infovis*: Graphic Train Schedules Reflect the History of Finland

In 1994, in the middle of a department removal at the University of Helsinki, a young research assistant of Statistics (the first author of the present paper) found some strange-looking, dusty old books published by the State Railways of Finland. Each book was full of beautifully designed, colored charts on a fragile paper. The charts seemed to represent train schedules in graphic form, accompanied with all sorts of technical information about trains, tracks, and stations. The oldest book was from 1918, a very sad year in the history of Finland, because of a civil war that broke out soon after Finland had gained its independence from Russia in 1917.

Figure 1 displays one chart from the 1918 book. It reflects the history of Finland in a particularly interesting way. According to its title on the upper right corner it is a graphic train schedule of the track from Vyborg (“Viipuri, Wiborg”), at that time one of the largest cities of Finland, all the way to St. Petersburg (“Pietari, Petrograd”), the capital of the Russian Empire.

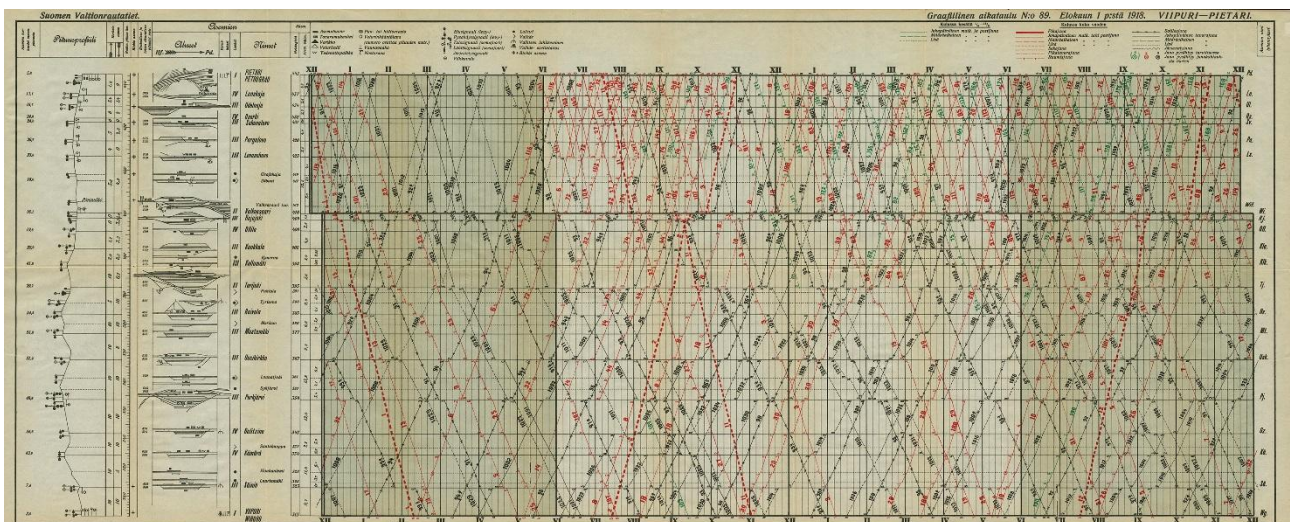


Figure 1. A graphic train schedule published in Finland in 1918. Single-sided fold-out, approx.

900×360mm. Full resolution (147 MB) TIFF image, together with supplementary material

downloadable at <http://koponen-hilden.fi/trainschedule1918/>

Some years after finding the books, I realized that Edward Tufte's famous book, *The Visual Display of Quantitative Information*, displays on its front cover a rather similar chart published in France in 1878. Tufte's book helped to understand the function and background of those old books, at least partially, as it was now clear that when the 1918 book was published, the idea of graphic train schedules had been known at least for 40 years. However, it was not at all easy to see the connection between France and Finland, because those countries have never been directly connected by a railway. This tiny mystery seemed to remain unsolved, and the books were almost forgotten to collect dust for many more years.

It was not until 2012, when we happened to find out that a much older graphic train schedule had been found from Russia, and Wainer et al had submitted a paper about it in *Chance*. We became quite curious about its title (*Stigler's Law of Eponymy and Marey's Train Schedule: Did Serjev Do It Before Ibry, and What About Jules Petiet?*) so we sent an email to Professor Wainer, who kindly replied and sent us a copy of their manuscript. It opened our eyes and solved the tiny old mystery at once.

The graphic train schedule revealed by Wainer et al had been published in St. Petersburg in 1854, only three years after the railway between St. Petersburg and Moscow was opened. At that time, Finland was a small part of the Russian Empire, though autonomous in many respects. The first railway in Finland entered service in 1862, when VR (Valtion Rautatiet, State Railways) was established and regular service between Helsinki and the town of Hämeenlinna began. In 1870, the railways of Finland and Russia were connected, when the route to St. Petersburg was opened. Still today, regular train service runs between Helsinki and St. Petersburg ([www.junat.net/en/pietari](http://www.junat.net/en/pietari)). That is technically simple, because Finland and Russia share a track gauge of 1,520mm, which is wider than the 1,435mm Standard Gauge used in most of Europe, including France.

Based on the Wainer et al's paper and the proximity of Finland and Russia, it was straight-forward to infer that the design and skills of making graphic train schedules must have been transmitted to Finland from Russia instead of France. Hence we decided to take the dusty train schedule books that were found almost 20 years earlier and look at them from a new point of view.

A photograph of the oldest book from 1918 appears in Figure 2. The book includes a total of 20 fold-out graphic train schedules for various parts of the Finnish railway network at that time, similar to the one we have carefully selected, unfolded, scanned, and displayed in Figure 1.



Figure 2. The cover and binding of the book of graphic train schedules published in Finland in 1918. The saddle-stitched book measures about 116×188mm and includes a total of 20 fold-out graphic schedules of about 900×360mm, such as the one depicted in Figure 1, for various parts of the Finnish railway network at that time. The text on the cover translates as: “Finnish State Railways – Graphical Schedule nr 89 for trains [valid] from August 1st 1918 until further notice”.

One may ask, when the first graphic train schedules were made in Finland. From archives and histories of VR we have found mentions of graphic schedules already in 1888, but we have not seen any older specimens similar to the present one from 1918. There may well have been graphic schedules in Finland even prior to the French (1878) schedule, possibly from the beginning of operations in 1862. Whatever the earliest publication date is, it seems likely to us that as Russian railway engineers were the pioneers in making graphic train schedules already in the 1850s, their Finnish colleagues learned the design and the skills from them, probably not from the French.

As the year 1918 is historically interesting for both Finland and Russia, the graphic train schedule shown in Figure 1 deserves a more detailed discussion of its historical context. But first, we would like to explicate its contents and the details of its graphic design.

### Contents and Design of the 1918 Graphic Train Schedule

The graphic train schedule shown in Figure 1 follows the general design of its predecessors: the station names of the route are on the vertical axis of the chart while the time runs horizontally. Here, the times are written with Roman numbers and divided by vertical lines in intervals of 10 minutes. The schedule shows 24 hours, starting from 12 am. The night (12 am to 6 am) and the evening time (6 pm to 12 pm) are shown on a darker background, compared to the day time (6 am to 6 pm), which appears on a white background.

The slight offset in the top part of the chart marks the fact that a part of the track – the last 32 kilometers (20mi) before St. Petersburg – was on the Russian side of the border, although the track was administered by the State Railways of Finland. (We return to this interesting detail later.)

The trains are marked with slanted lines of various types. Steeper slope means faster trains. Sometimes trains must wait at the stations, causing line breaks in the chart. Three colors are used for the trains: red, green, and black. Trains marked with red operate throughout the year. Solid lines refer to daily traffic, typically trains taking passengers or mail (or both). The thick red line refers to express trains. The other line types refer to various types of special trains, such as periodically running trains. Trains marked with green operate only during the summer time (1<sup>st</sup> of June to 18<sup>th</sup> of September), and black refers to freight trains, military trains, and other special trains. Each train is also marked with its identification number, consisting of 1–4 digits. Small numbers printed close to the train lines with the same color aid in reading the precise times of the train leaving from or arriving at a station.

On the left side of the chart in Figure 1, there is plenty of technical information about the stations (see also a detailed view in Figure 3 or the full resolution image on the supplementary web page mentioned in the caption of Figure 1). Starting from the left edge, there are the stations' altitudes, that is, distances above sea level (probably referring to Baltic Sea, similarly with Serjev's 1854 chart as noted by Wainer et al), a length profile, the maximum climb (in km to both directions), measure of the track length (in km from Helsinki) and other details about each station, such as their layouts, side tracks, equipment, facilities, and an overall classification (I – IV). Finally there are the names of the stations and their locations on the track (in km from Helsinki) as well as the distances (in km) between the stations.

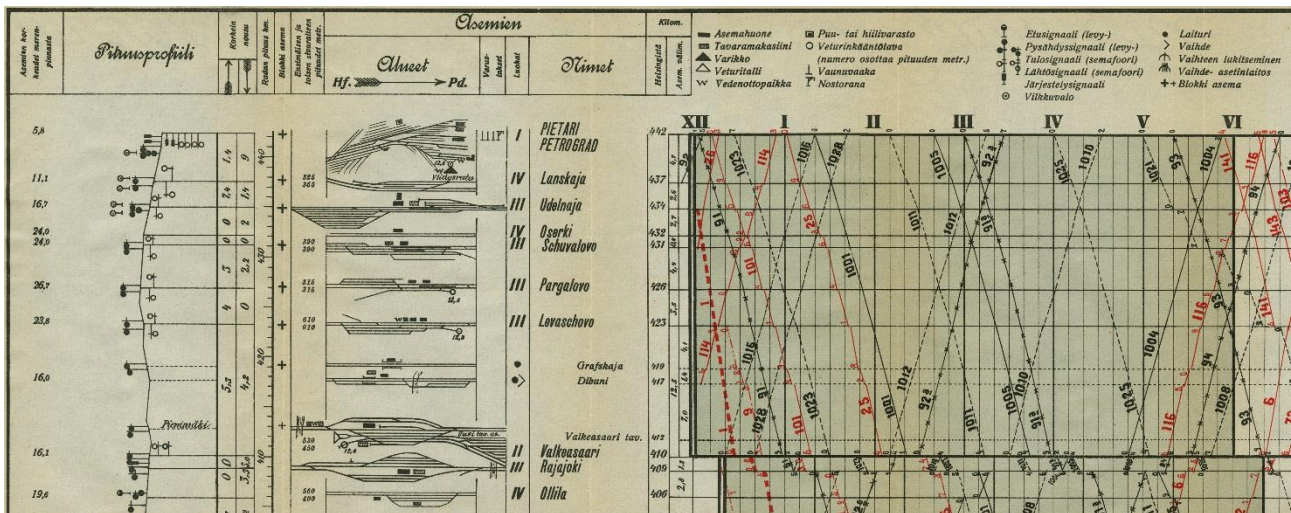


Figure 3. A detail from the graphic train schedule of Figure 1, showing the height profile of the track with altitudes, station names, and track sections, together with schematic representations of switching tracks and other facilities at the stations.

Above the actual chart there are the legends for the symbols of the station equipment and facilities (in the center) as well as for the types of trains (in the upper right corner). The official abbreviations of the station names (like “Pd.” for Petrograd and “Wg.” for Wiborg) appear on the right end of the chart. All in all, the graphic train schedule includes a large amount of detailed, technical information that is clearly targeted to railway engineers and other professionals. The texts appearing on the chart, including present-day names for the stations, are translated and explicated in more detail in the supplementary material downloadable at <http://koponen-hilden.fi/trainschedule1918/>

Looking at the general design of the graphic train schedule in Figure 1, one can notice close similarities with the Javanese graphic train schedule from 1937 shown in Tufte’s *Envisioning Information* (pp. 24–26) and mentioned by Wainer et al in their *Chance* article. On both of them, the map in the top panel of Serjev’s schedule from 1854 has been done away with, and the height profile runs on the left, directly linking the altitudes to the station names and track sections (see also

the detailed view in Figure 3). Schematic representations of switching tracks and other facilities at the stations are shown. Also, the use of color is more expressive in the 1918 schedule, with three spot colors and one for toning, compared with only black and a light brown for toning on the 1937 Javanese schedule. (However, we don't know whether the color scheme shown in Tufte's book is the original for the Javanese train schedule, as it is known that Tufte has redrawn many of the graphics he features in his books.)

### Crossing and Building Borders between Finland and Russia

Recall that Figure 1 displays the graphic train schedule of the track from Vyborg (“Viipuri, Wiborg”), at that time one of the largest cities of Finland, all the way to St. Petersburg (“Pietari, Petrograd”), the capital of the Russian Empire. The distance between these two cities was only 129km (80mi). Figure 4 displays a view of the Finnish railway network in 1918 on the map of Finland and Russia, with the Vyborg–St. Petersburg track shown with a red line. The railway was owned and operated by the State Railways of Finland, even though the railway administration resided in St. Petersburg and the last 32km part of the track was on the Russian territory (as indicated on the train schedule in Figure 1 with a slight offset in the top part of the chart). The last station on the Finnish side of the border at that time was the small town of Rajajoki (lit. “Border River”).





Figure 4. A view of the Finnish railway network in 1918 on the map of Finland and Russia. The red line shows the route from Viipuri (Vyborg) to Petrograd (St. Petersburg) that was the busiest part of the Finnish railway network. The last 32km part of the track, from the small town of Rajajoki to St. Petersburg, was on the Russian territory.

The Vyborg – St. Petersburg line that was opened for traffic in 1870, used to be the busiest part of the Finnish railway network. The government of Finland had wanted to build the

railway for export and to have an overland route to Europe at the beginning of rapid industrialization. The Russian Empire also supported it for export, and especially for military purposes. Perhaps as an omen for the future, the railway was known as “The Bone Track” in its early years. The construction work had been a part of the relief efforts after the Great Famine, and many weakened workers did not survive.

Frequent freight trains transported paper and butter to Russia and returned with wheat, tobacco and oil. Passenger transport was also busy, consisting of small merchants back and forth to the commercial metropole of St. Petersburg, commuting workforce, military troops as well as Russian upper class to their new holiday dachas along the coast of the Gulf of Finland.

Suddenly, in 1918, all this came to an end, and the train schedule from Vyborg to St. Petersburg – “[valid] from August 1st 1918 until further notice” – was actually never in use!

In order to understand what happened in 1918, we must dig deeper into the history for a moment. Finland had gained its independence from Russia after the Bolshevik Revolution in 1917. Because of a power vacuum, the short but terrible Finnish civil war broke out in January 1918. The eastern railway was taken by the Reds (the Socialists), and military as well as funeral carriages filled the track. By May 1918, the Whites (the Nationalists) had won the war, but the country was in ruins.

At the same time the national border between Finland and Russia (see the map in Figure 4) was under construction. Russia took over the 32km part of the railway track on its territory in May 1918. The Finnish railway staff stationed in St. Petersburg had to flee from the city, which was not an easy task. The border was closed and there was only one crossing, a small bridge in the town of Rajajoki (see Figure 4). In addition, adequate papers and a fortnight in a quarantine camp were required. The Bolsheviks were afraid of mass escape, whereas the Finns feared for epidemics.

The border zone between Finland and Russia would be under severe turbulence for years, because Bolshevik Russia was still at war. During 1918, the central government bodies of Russia moved from St. Petersburg to Moscow. In 1919, the railway bridge at the border zone was blown up, and hence the Vyborg – St. Petersburg railway track was ultimately cut off. A Finnish graphic train schedule from 1920, still printed using the same template as in 1918, confirms this with a ghostly difference: the last destination is now the border town Rajajoki, while the rest of the sheet (the part with a slight offset in the top of the chart) is totally white and empty.

### State of the Art: 160+ Years of Graphic Train Schedules

A graphic train schedule is a brilliant example of infovis: it displays a large amount of information in a condensed, visual form. Its vertical dimension represents a railway route with train stations and horizontal dimension represents a chosen interval of time. The slanted lines drawn on the schedule symbolize train connections on either of the directions between the stations, and hence the slopes of the lines visualize the speeds of the trains.

As Wainer et al discuss in their *Chance* paper, the original inventor of this brilliant technique may still be unknown. Nevertheless, a graphic train schedule is an important tool that has been in use for over 160 years by railway engineers in planning new routes in various countries. It offers a quick view of the existing connections on a track, and a handy way to answer essential questions, such as, whether it would be possible to safely add a new connection to a certain track at some specific interval of time. The same task would be extremely difficult to accomplish reliably with the ordinary numeric train schedules meant for the general public.

In 2017, Finland celebrates its 100 years of independence. The tradition of designing and making graphic train schedules has continued even for a longer period of time. The schedules are nowadays based on open data, and there is a website, where trains can be tracked in real-time on the graphic train schedules of the selected track. See, for example,

<http://julia.dy.fi/live/graphical?s=kvimt> that shows the Finnish part of the current track (opened after the World War II) from Kouvola to Russia, through the border town of Vainikkala. Because of the war loss of Finland, the border was transferred westwards (see Figure 4), and hence the additional 120km (80mi) part of the track (as well as the city of Vyborg) belong to Russia.

Figure 5 displays a screen capture from the above mentioned website on 2<sup>nd</sup> January 2017. The view is limited to the Finnish side of the track, although the trains continue regularly to Russia, either to St. Petersburg or to Moscow. The route from Luumäki to the border in Vainikkala appears in a separate panel in the top part of the chart. Highlighted (with the mouse over the chart) is the train number AE 782 operated by VR Group Ltd (the contemporary name of the State Railways of Finland) travelling from HKI (Helsinki) to PTR (St. Petersburg) that has crossed the border about 8:10am. On the right side of the chart there is an event log of the traffic, showing train numbers and their locations at specific times while the page is open in the web browser.

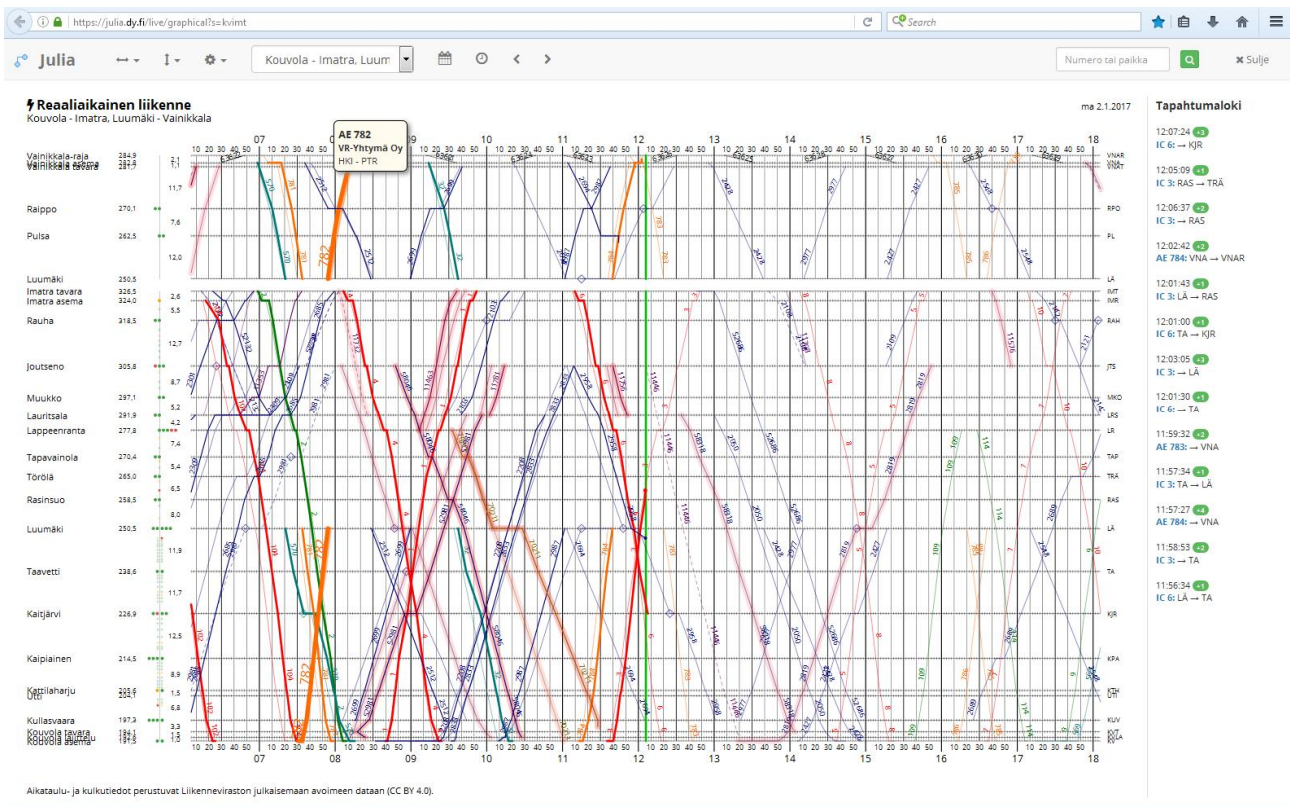


Figure 5. A screen capture on 2<sup>nd</sup> January 2017 from a web based graphical train schedule available on <http://julia.dy.fi/live/graphical?s=kvimt> showing a real-time view of the route from Kouvola through Luumäki either to Imatra or (in the small separate panel in the top part of the chart) to the border town of Vainikkala, from where the trains continue to Russia.

In addition to the four times a day Helsinki–St. Petersburg express train, the track section is today used by local trains, commonly known as “elektrichkas”, serving commuters to St. Petersburg and Vyborg from the suburbs and the countryside. The elektrichka trains still make many of the stops mentioned in the 1918 schedule, though most of the stations have been renamed since. (For the present-day names of the stations, see the supplementary material downloadable at <http://koponen-hilden.fi/trainschedule1918/>). In 2017, the journey from Vyborg to St. Petersburg on a commuter train takes about two and a half hours, which is about one hour faster than in 1918.

### Further reading

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## About the authors:

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