Visualize ComplexCity

Chair of Information Architecture, ETH Zürich

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Visualization can help us to understand before unknown properties and relationships.

It uses the human perception capabilities to make information more understandable and helps to clarify and reason about otherwise abstract ideas.

Main article: List of Russian commanders in the Patriotic War of 1812

General of Infantry Mikhail Bogdanovich Barclay de Tolly served as the Commander in Chief of the Russian Armies, a field commander of the first Western Army and Minister of War, Mikhail Illarionovich Kutuzov replaced him, and assumed the role of Commander-in-chief during the retreat following the Battle of Smolensk.

These forces, however, could count on reinforcements from the second line, which totaled 129,000 men and 8,000 Cossacks, with 434 guns and 433 rounds of ammunition.

Of these about 105,000 men were actually available for the defense against the invasion. In the third line were the 36 recruit depots and militias, which came to the total of approximately 161,000 men of various and highly disparate military values, of which about 133,000 actually took part in the defense.

Thus, the grand total of all the forces was 488,000 men, of which about 428,000 gradually came into action against the Grand Army. This bottom line, however, includes more than 80,000 Cossacks and militiamen, as well as about 20,000 men who garrisoned the fortresses in the operational area.

Sweden, Russia's only ally, did not send supporting troops. But the alliance made it possible to withdraw the 45,000-man Russian corps Steinheil from Finland and use it in the later battles (20,000 men were sent to Riga).[55]

Invasion [edit]

Crossing the Niemen [edit]

The invasion commenced on 24 June 1812. Napoleon had sent a final offer of peace to Saint Petersburg shortly before commencing operations. He never received a reply, so he gave the order to proceed into Russian Poland. He initially met little resistance and moved quickly into the enemy's territory. The French coalition of forces amounted to 449,000 men and 1,146 cannons being opposed by the Russian armies combining to muster 153,000 Russians, 938 cannons, and 15,000 Cossacks.[56] The center of mass of French forces focused on Kaunas and the crossings were made by the French Guard, I, II and III corps amounting to some 120,000 at this point of crossing alone.[57] The actual crossings were made in the area of Alexioten where three pontoon bridges were constructed. The sites had been selected by Napoleon in person.[58] Napoleon had a tent raised and he watched and reviewed troops as they crossed the Niemen.[59] Roads in this area of Lithuania hardly qualified as such, actually being small dirt tracks through areas of dense forest.[60] Supply lines simply could not keep up with the forced marches of the corps and rear formations always suffered the worst privations.[61]

March on Vilnius [edit]

The 25th of June found Napoleon's group past the bridge head with Ney's command approaching the existing crossings at Alexioten. Murat's reserve cavalry provided the vanguard with Napoleon the guard and Davout's 1st corp following behind. Eugene's command would cross the Niemen further north at Pilvy, and MacDonald crossed the same day. Jerome command wouldn't complete its crossing at Grodno until the 28th. Napoleon rushed towards Vilnius pushing the infantry forward in columns that suffered from heavy rain then stifling heat. The central group would cross 70 miles (110 km) in two days.[62] Ney's III corps would march down the road to Sudervė with Oudinot marching on the other side of the Neris River in an operation attempting to catch General Wittgenstein's command between Ney, Oudinout and Macdonald's commands, but Macdonald's command was late in arriving to an objective too far away and the opportunity vanished. Jerome was tasked with tackling Bagration by marching to Grodno and Reynier's VII corps sent to Białystok in support.[63]

As Irregular cavalry, the Cossack horsemen of the Russian steppes were best suited to reconnaissance, scouting and harassing the enemy's flanks and supply lines.

The Russian headquarters was in fact centered in Vilnius on June 24 and couriers rushed news about the crossing of the Niemen to Barclay de Tolley. Before the night had passed orders were sent out to Bagration and Pluto to have the offensive. Alexander left Vilnius on June 26 and Barclay assumed overall command. Although Barclay wanted to give battle he assessed it as a hopeless situation and ordered Vilnius's magazines burned and its bridge dismantled. Wittgenstein moved his command to Perkele passing beyond Macdonald and Oudinot's operations with Wittgenstein's rear guard clashing with Oudinout's forward elements.[63] Doctorov on the Russian Left found his command threatened by Phalen's ill cavalry corp. Bagration was ordered to Vileyka which moved him towards Barclay though the order's intent is still something of a mystery to this day.[64]

On June the 28th Napoleon entered Vilnius with only light skirmishing. The foraging in Lithuania proved hard as the land was mostly barren and forested. The supplies of forage were less than that of Poland and two days of forced marching made a bad supply situation worse.[64] Central to the problem were the expanding distances to supply magazines and the fact that no supply wagon could keep up with a forced marched infantry column.[65] The weather itself became an issue where according to historian Richard K. Riehn:

The thunderstorms of the 24th turned into other downpours, turning the tracks — some diarists claim there were no roads in Lithuania — into bottomless mires. Wagon sank up to their hubs; horses dropped from exhaustion; men lost their boots. Stalled wagons became obstacles that forced men around them and stopped supply wagons and artillery columns. Then came the sun which would bake the deep ruts into canyons of concrete, where horses would break their legs and wagons their wheels.[65]

A Lieutenant Mertens — a Wurttemberger serving with Ney's III corps — reported in his diary that oppressive heat followed by rain left them with dead horses and camping in swamp-like conditions with dysentery and influenza raging though the ranks with hundreds in a field hospital that had to be set up for the purpose. He reported the times, dates and places, of events reporting thunderstorms on the 6th of June and men dying of sunstroke by the 11th.[65] The Crown Prince of Wurttemberg reported 21 men dead in Ilovaisk. The Bavarian corps was reporting 345 sick by June 13.[66]

Desertion was high among Spanish and Portuguese formations. These deserters proceeded to terrorize the population, looting whatever lay to hand. The areas in which the Grande Armée passed were devastated. A Polish officer reported that areas around him were depopulated.[66]

The French light Cavalry was shocked to find itself outclassed by Russian counterparts so much so that Napoleon had ordered that infantry be provided as back up to French light cavalry units.[66] This affected both French reconnaissance and intelligence operations. Despite 30,000 cavalry, contact was not maintained with Barclay's forces leaving Napoleon guessing and throwing out columns to find his opposition.[67]

The operation intended to split Bagration's forces from Barclay's forces by driving to Vilnius had cost the French forces 25,000 losses from all causes in a few days.[66] Strong probing operations were advanced from Vilnius towards Nemenčine, Mykolaičkes, Ashmyany and Molėtai.[66]

Eugene crossed at Prenn on June 30 while Jerome moved VII Corps to Białystok, with everything else crossing at Grodno.[67] Murat advanced to Nemenčine on July 1 running into elements of Doctorov's III Russian Cavalry Corps en route to Djunaszev. Napoleon assumed this was Bagration's 2nd Army and rushed out before being told it was not 24 hours later. Napoleon then attempted to use Davout, Jerome and Eugene out on his right in a hammer and anvil to catch Bagration to destroy the 2nd army in an operation spanning Ashmyany and Minsk. This operation had failed to produce results on his left before with Macdonald and Oudinot. Doctorov had moved from Djunaszev to Svir narrowly evading French forces, with 11 regiments and a battery of 12 guns heading to join Bagration when moving too late to stay with Doctorov.[68]

Conflicting orders and lack of information had almost placed Bagration in a bind marching into Davout; however, Jerome could not arrive in time over the same mud tracks, supply problems, and weather, that had so badly affected the rest of the Grande Armée, losing 9000 men in four days. Command disputes between Jerome and General Vendamme would not help the situation.[68] Bagration joined with Doctorov and had 45,000 men at Novi-Sverzen by the 7th. Davout had lost 10,000 men marching to Minsk and would not attack Bagration without Jerome joining him. Two French Cavalry defeats by Platov kept the French in the dark and Bagration was no better informed with both overestimating the other's strength, Davout thought Bagration had some 60,000 men and Bagration thought Davout had 70,000. Bagration was getting orders from both Alexander's staff and Barclay (which Barclay didn't know) and left Bagration without a clear picture of what was expected of him and the general situation. This stream of confused orders to Bagration had him upset with Barclay which would have repercussions later.[69]

Napoleon reached Vilnius on the 28th of June leaving 10,000 dead horses in his wake. These horses were vital to bringing up further supplies to an army in desperate need. Napoleon had supposed that Alexander would sue for peace at this point and was to be disappointed; it would not be his last disappointment.[51] Barclay continued to retreat to the Drissa deciding that the concentration of the 1st and 2nd armies was his first priority.[52]

Barclay continued his retreat and with the exception of the occasional rearguard clash remained unhindered in his movements ever further east.[53] To date the standard methods of the Grande Armée were working against it. Rapid forced marches quickly caused desertion, starvation, exposed the troops to filthy water and disease, while the logistics trains lost horses by the thousands, further exacerbating the problems. Some 50,000 stragglers and deserters became a lawless mob warring with local peasantry in all-out guerrilla war, that further hindered supplies reaching the Grand Armee which was already down 95,000 men.[54]

March on Moscow [edit]

Barclay, the Russian commander-in-chief, refused to fight despite Bagration's urgings. Several times he attempted to establish a strong defensive position, but each time the French advance was too quick for him to finish preparations and he was forced to retreat once more. When the French army progressed further, serious problems in foraging surfaced, aggravated by scorched earth tactics of the Russian army,[51][54] advocated by Karl Ludwig von Phull.[57]

Political pressure on Barclay to give battle and the general's continuing resistance (viewed as intransigence by the populace) led to his removal from the position of commander-in-chief to be replaced by the boastful and popular Mikhail Illarionovich Kutuzov. Despite Kutuzov's rhetoric to the contrary, he continued in much the way Barclay had, immediately seeing that to face the French in open battle would be to sacrifice his army pointlessly. Following an indecisive clash at Smolensk on August 16–18, he finally managed to establish a defensive position at Borodino.

The Battle of Borodino [edit]

Main article: Battle of Borodino

The Battle of Borodino (Russian: Бородинская битва, *Borodinskaya bitva*; French: *Bataille de la Moskowa*), fought on September 7, 1812,[58] was the largest and bloodiest day of the French invasion of Russia, involving more than 250,000 troops and resulting in at least 70,000 casualties. The French *Grande Armée* under Emperor Napoleon I attacked the Imperial Russian Army of General Mikhail Kutuzov near the village of Borodino, west of the town of Mozhaysk and eventually captured the main positions on the battlefield but failed to destroy the Russian army. About a third of Napoleon's soldiers were killed or wounded; Russian losses, while heavier, could be replaced due to Russia's large population, since Napoleon's campaign took place on Russian soil.

The battle ended with the Russian Army, while out of position, still offering resistance [*citation needed*] The state of exhaustion of the French forces and the lack of recognition of the state of the Russian Army led Napoleon to remain on the battlefield with his army instead of the forced pursuit that had marked other campaigns that he had conducted.[59] The entirety of the Guard was still available to Napoleon and in refusing to use it he lost this singular chance to destroy the Russian army.[60] The battle at Borodino was a pivotal point in the campaign, as it was the last offensive action fought by Napoleon in Russia. By withdrawing, the Russian army preserved its combat strength, eventually allowing it to force Napoleon out of the country.

The Battle of Borodino on September 7 was the bloodiest day of battle in the Napoleonic Wars. The Russian army could only muster half of its strength on September 8 and was forced to retreat, leaving the road to Moscow open. Kutuzov also ordered the evacuation of the city.

By this point the Russians had managed to draft large numbers of reinforcements into the army bringing total Russian land forces to their peak strength in 1812 of 904,000 with perhaps 100,000 in the vicinity of Moscow — the remnants of Kutuzov's army from Borodino partially reinforced.

Capture of Moscow [edit]

On September 14, 1812, Napoleon moved into the empty city that was stripped of all supplies by its governor, Feodor Rostopchin. Relying on classical rules of warfare aiming at capturing the enemy's capital (even though Saint Petersburg was the political capital at that time, Moscow was the spiritual capital of Russia), Napoleon had expected Tsar Alexander I to offer his capitulation at the Poklonnaya Hill but the Russian command did not think of surrendering.

As Napoleon prepared to enter Moscow he was surprised to have received no delegation from the city. At the approach of a victorious general, the civil authorities customarily presented themselves at the gates of the city with the keys to the city in an attempt to safeguard the population and their property. As nobody received Napoleon he sent his aides into the city, seeking out officials with whom the arrangements for the occupation could be made. When none could be found, it became clear that the Russians had left the city unconditionally.[61]

In a normal surrender, the city officials would be forced to find billets and make arrangements for the feeding of the soldiers, but the situation caused a free-for-all in which every man was forced to find lodgings and sustenance for himself. Napoleon was secretly disappointed by the lack of custom as he felt it robbed him of a traditional victory over the Russians, especially in taking such a historically significant city.[61]

Before the order was received to evacuate Moscow, the city had a population of approximately 270,000 people. As much of the population pulled out, the remainder were burning or robbing the remaining stores of food, depriving the French of their use. As Napoleon entered the Kremlin, there still remained one-third of the original population, mainly consisting of foreign traders, servants and people who were unable or unwilling to flee. These, including the several hundred strong French colony, attempted to avoid the troops.

Retreat and rebuilding [edit]

Both Armies began to move and rebuild. The Russian retreat was significant for two reasons; firstly, the move was to the south and not the east; secondly, the Russians immediately began operations that would continue to deplete the French forces. Platov, commanding the rear guard on the 8th of September, offered such strong resistance that Napoleon remained on the Borodino field.[62] On the 9th of September Miloradovitch assumed command of the rear guard adding his forces to the formation. Another battle was given throwing back French forces at Semolino causing 2,000 losses on both sides, however some 10,000 wounded would be left behind by the Russian Army.[63] The French Army began to move out on Sept. 10th with the still ill Napoleon not leaving until the 12th. Some 18,000 men were ordered in from Smolensk, and Marshal Victor's corps supplied another 25,000.[64] Miloradovich would not give up his rear guard duties until the 14th allowing much of Moscow to be deserted, and retreated under a truce at last.[65]

Fire of Moscow [edit]

French Carabiniers-à-Cheval during the Russian Campaign.

Main article: Fire of Moscow (1812)

Upon entering Moscow, the Grande Armée found the city largely abandoned. Fyodor Rostopchin who was the military governor of Moscow, had ordered the city evacuated, including all the city administrators and officials, leaving behind only a few French tutors, foreign shop keepers and those that were the lowest class of society.[66] No one was on hand to meet the Emperor Napoleon when he arrived at the city gates on 14 September. In addition to abandoning the city, Rostopchin had ordered the prisons to be opened. On the first night of French occupation a fire broke out in the Bazaar. There was no administrative means on hand to organize fighting the fire, and no pumps or hoses could be found. Later that night a couple more fires broke out in the suburbs. These were thought to be due to carelessness on the part of the soldiers.[67] Some looting occurred and a military government was hastily set up in an attempt to keep order.

The following night the city began to burn in earnest. Fires broke out across the north part of the city, spreading and merging over the next few days. Rostopchin had left a small detachment of police, whom he charged with burning the city to the ground.[68] Houses had been prepared with flammable materials.[69] The city's fire-engines had been dismantled. Fuses were left throughout the city to ignite the fires.[70] French troops endeavored to fight the fire with whatever means they could, struggling to prevent the armory from exploding and to keep the Kremlin burning down. The heat was intense. Moscow, composed largely of wooden buildings, burnt down almost completely. It was estimated that four-fifths of the city was destroyed.

Retreat and losses [edit]

Sitting in the ashes of a ruined city without having received a Russian capitulation and facing Russian operations against his supplies forced Napoleon and his diminished army out of Moscow.[71] He started his long retreat by the middle of October 1812. At the Battle of Maloyaroslavets, Kutuzov was able to force the French army into using the same Smolensk road on which they had earlier moved East and which had been stripped of food by both armies. This is often presented as another example of scorched-earth tactics. Continuing to block the southern flank to prevent the French from returning by a different route, Kutuzov again deployed partisan tactics to constantly strike at the French train where it was weakest. Light Russian cavalry, including mounted Cossacks, assaulted and broke up isolated French units.[72]

Supplying the army became an impossibility – the lack of grass weakened the army's remaining horses, almost all of which died or were killed for food by starving soldiers. With no horses the French cavalry ceased to exist and cavalrymen were forced to march on foot. In addition the lack of horses meant that cannons and wagons had to be abandoned, depriving the army of artillery and support convoys. Although the army was quickly able to replace its artillery in 1813, the abandonment of wagons created an immense logistics problem for the remainder of the war, as thousands of the best military wagons were left behind in Russia. As starvation and disease took their toll desertion soared. Most of the deserters were taken prisoner or promptly executed by Russian peasants. Badly weakened by these circumstances, the French military position collapsed. The Russians inflicted further defeats on elements of the Grande Armée at Vyazma, Krasnoi and Polotsk. The crossing of the river Berezina was the final French catastrophe of the war, as two Russian armies inflicted horrendous casualties on the remnants of the Grande Armée as it struggled to escape across pontoon bridges.

In early November 1812 Napoleon learned that General Claude de Malet had attempted a coup d'état back in France. He abandoned the army and returned home on a sleigh, leaving Marshal Joachim Murat in charge. Murat later deserted to save his kingdom of Naples, leaving Napoleon's former stepson Eugène de Beauharnais in command.

In the following weeks, the Grande Armée shrank further and on 14 December 1812 it left Russian territory. According to the popular legend only about 22,000 of Napoleon's men survived the Russian campaign. However, some sources say that no more than 380,000 soldiers were killed.[73] The difference can be explained by up to 100,000 French prisoners in Russian hands (mentioned by Eugen Tarlé, and released in 1814) and more than 80,000 (including all wing-armies, not only the rest of the "main army" under Napoleon's direct command) returning troops (mentioned by German military historians). According to Russian state broadcaster Voice of Russia, nearly 150,000 of Napoleon's soldiers remained in Russia, quickly assimilating (often Russifying their names) and finding employment varying from French language teachers to the Russian aristocracy and officials, to assisting in the establishment of Russian settlement through Siberia.[72]

Most of the Prussian contingent survived thanks to the Convention of Tauroggen and almost the whole Austrian contingent under Schwarzenberg withdrew successfully. The Russians formed the Russian-German Legion from other German prisoners and deserters.[55]

Russian casualties in the few open battles are comparable to the French losses but civilian losses along the devastated campaign route were much higher than the military casualties. In total, despite earlier estimates giving figures of several million dead, around one million were killed including civilians — fairly evenly split between the French and Russians.[74] Military losses amounted to 300,000 French, about 72,000 Poles,[74] 50,000 Italians, 80,000 Germans, 61,000 from other nations. As well as the loss of human life the French also lost some 200,000 horses and over 1,000 artillery pieces.

The losses of the Russian armies are hard to assess. A 19th-century historian Michael Bogdanovich assessed reinforcements of the Russian armies during the war using the Military Registry archives of the General Staff. According to this the reinforcements totaled 134,000. The main army at the time of capture of Vilnius in December had 70,000 men, while its number at the war start was about 150,000. Thus, the total loss is 210,000 men. Of these about 40,000 returned to duty. Losses of the formations operating in secondary areas of operations as well as losses in militia units were about 40,000. Thus, he came up with the number of 210,000 men and militiamen.[5]

Weather as a factor [edit]

Following the campaign a saying arose that the Generals Janvier and Fevrier (January and February) defeated Napoleon, alluding to the Russian Winter. The campaign was over by mid-December, though. At the same time, there is some truth to the saying. The coming winter weather was heavy on the minds of Napoleon's closest advisers. The army was equipped with summer clothing, and did not have the means to keep it protected from the cold.[75] In addition, it lacked the ability to forge calkin to rough shoe the horses and enable them to walk over roads that had become iced over. The major killing effect of the cold weather upon his forces occurred during their retreat. Hypothermia coupled with starvation led to the loss of thousands. In his memoir, Napoleon's close advisor Armand de Caulaincourt recounted scenes of great loss, and offered a vivid description of mass death through hypothermia:

The cold was so intense that bivouacking was no longer supportable. Bad luck to those who fell asleep by a campfire! Furthermore, disorganization was perceptibly gaining ground in the Guard. One constantly found men who, overcome by the cold, had been forced to drop out and had fallen to the ground, too weak or too numb to stand. Ought one to help them along - which practically meant carrying them? They begged one to let them alone. There were bivouacs all along the road - ought one to take them to a campfire? Once these poor wretches fell asleep they were dead. If they resisted the craving for sleep, another passer by would help them along a little farther, thus prolonging their agony for a short while, but not saving them, for in this condition the drowsiness engendered by cold is irresistibly strong. Sleep comes inevitably, and to sleep is to die. I tried in vain to save a number of these unfortunates. The only words they uttered were to beg me, for the love of God, to go away and let them sleep. To hear them, one would have thought sleep was their salvation. Unhappily, it was a poor wretch's last wish. But at least he ceased to suffer, without pain or agony. Gratitude, and even a smile, was imprinted on his discoloured lips. What I have related about the effects of extreme cold, and of this kind of death by freezing, is based on what I saw happen to thousands of individuals. The road was covered with their corpses."[76]

This befell a Grande Armée that was ill equipped for cold weather. The Russians considered it a relatively mild winter, underscoring the fact that cold kills, and that too cold is cold beyond what you have prepared for. In the case of the French, their intentions of concluding the campaign before the cold weather set in was as murderous as the cold weather itself.[77]

Inadequate supplies played a key role in the losses suffered by the army as well. Davidov and other Russian campaign participants record wholesale surrenders of starving members of the Grande Armée even before the onset of the frosts.[78] Caulaincourt describes men swarming over and cutting up horses that slipped and fell, even before the poor creature had been killed.[79] There were even eyewitness reports of cannibalism. All this underscores the fact that the French were unable to feed their army. Starvation led to a general loss of cohesion.[80] Constant harassment of the French army by Cossacks added to the losses during the retreat.[78]

Though starvation and the winter weather caused horrendous casualties in Napoleon's army, losses arose from other sources as well. The main body of Napoleon's Grande Armée diminished by a third during the first eight weeks of his invasion before the major battle of the campaign. This decrease was partly due to garrisoning supply centers, desertions, disease, and casualties sustained in minor actions. The central French force under Napoleon's direct command crossed the Niemen river with 286,000 men, but by the time of the Battle of Borodino his force was reduced to 161,475.[81] He lost at least 30,000 of them there, to gain a narrow and Pyrrhic victory almost 1,000 km (620 mi) deep into hostile territory.

Napoleon's invasion of Russia is listed among the most lethal military operations in world history.[82]

Patriotic War of 1812. Advance of Napoleon's army (June 24 - October 2, 1812)

Monument to Kutuzov in front of the Kazan Cathedral in Saint Petersburg. The Kazan Cathedral and the Cathedral of Christ the Saviour in Moscow were built to commemorate the Russian victory against Napoleon.

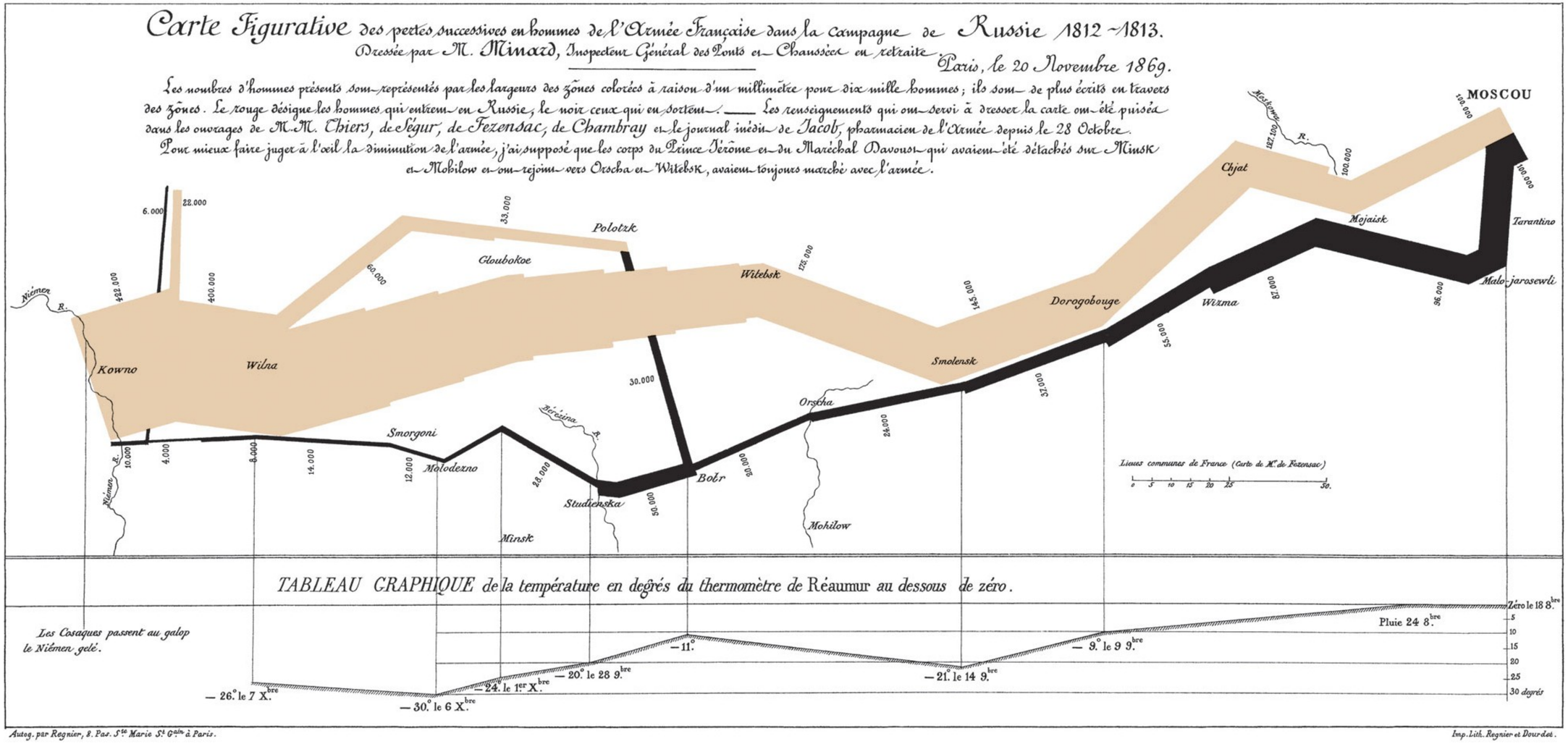
General Raevsky leading a detachment of the Russian Imperial Guard at the Battle of Saltanovka.

Eagles monument in Smolensk, commemorating the centenary of the Russian defeat of Napoleon.

Source: wikipedia.org

French Invasion in Russia 1812: Text

Introduction



Source: wikipedia.org

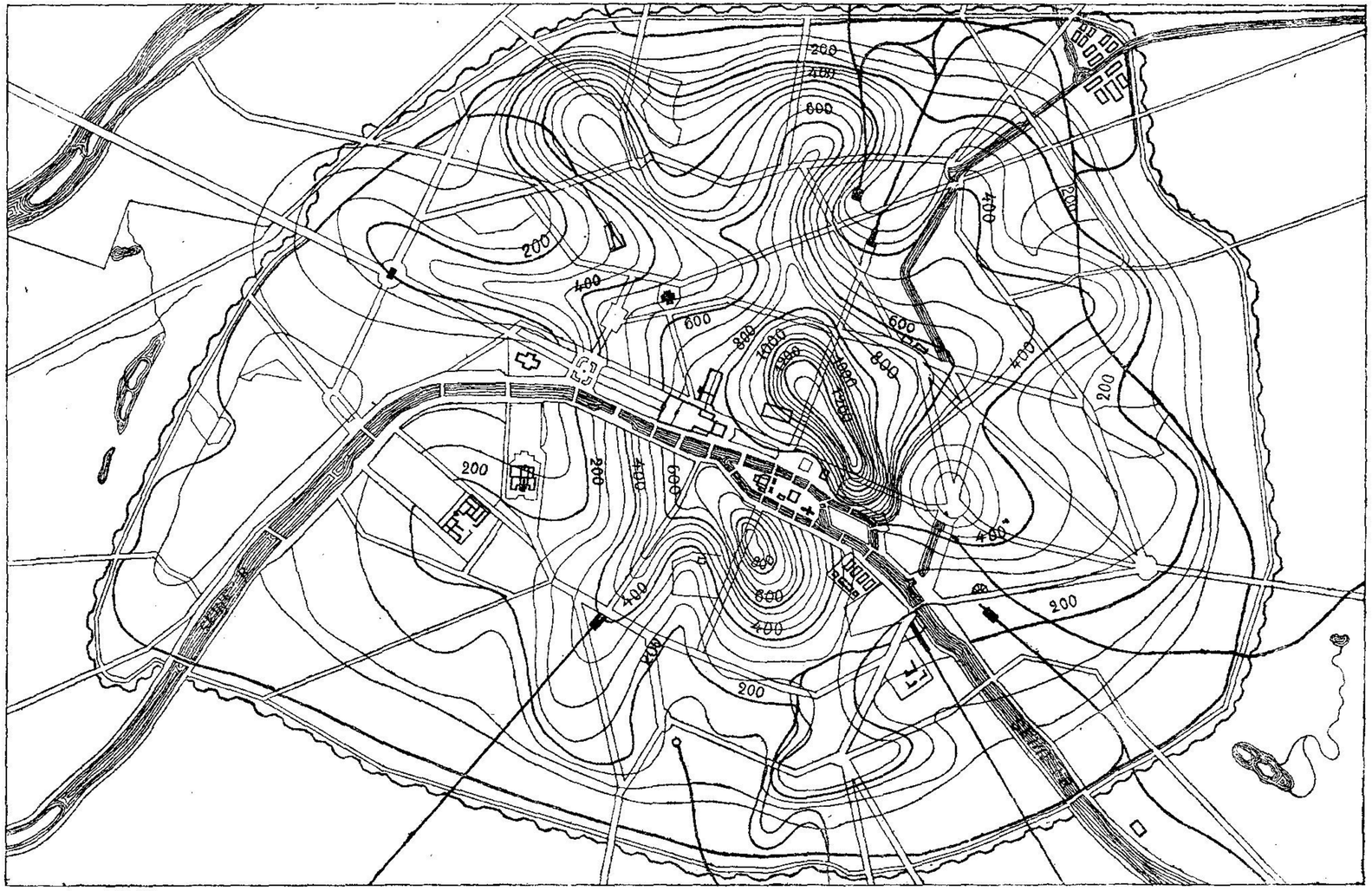
French Invasion in Russia 1812: Visualization

Visualize ComplexCity

Source: globalsecurity.org

Cholera epidemic in London 1854

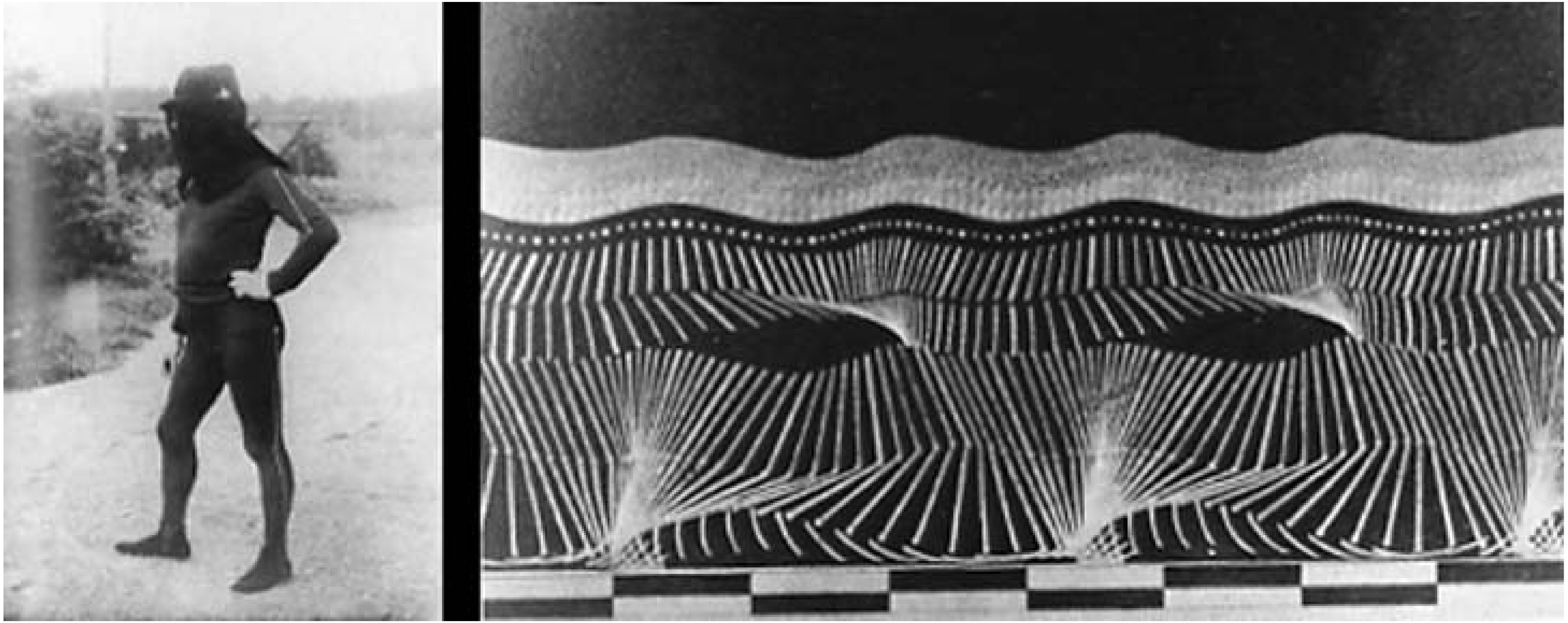
Introduction



Source: euclid.psych.yorku.ca

Contour Map of Population Density in Paris 1874

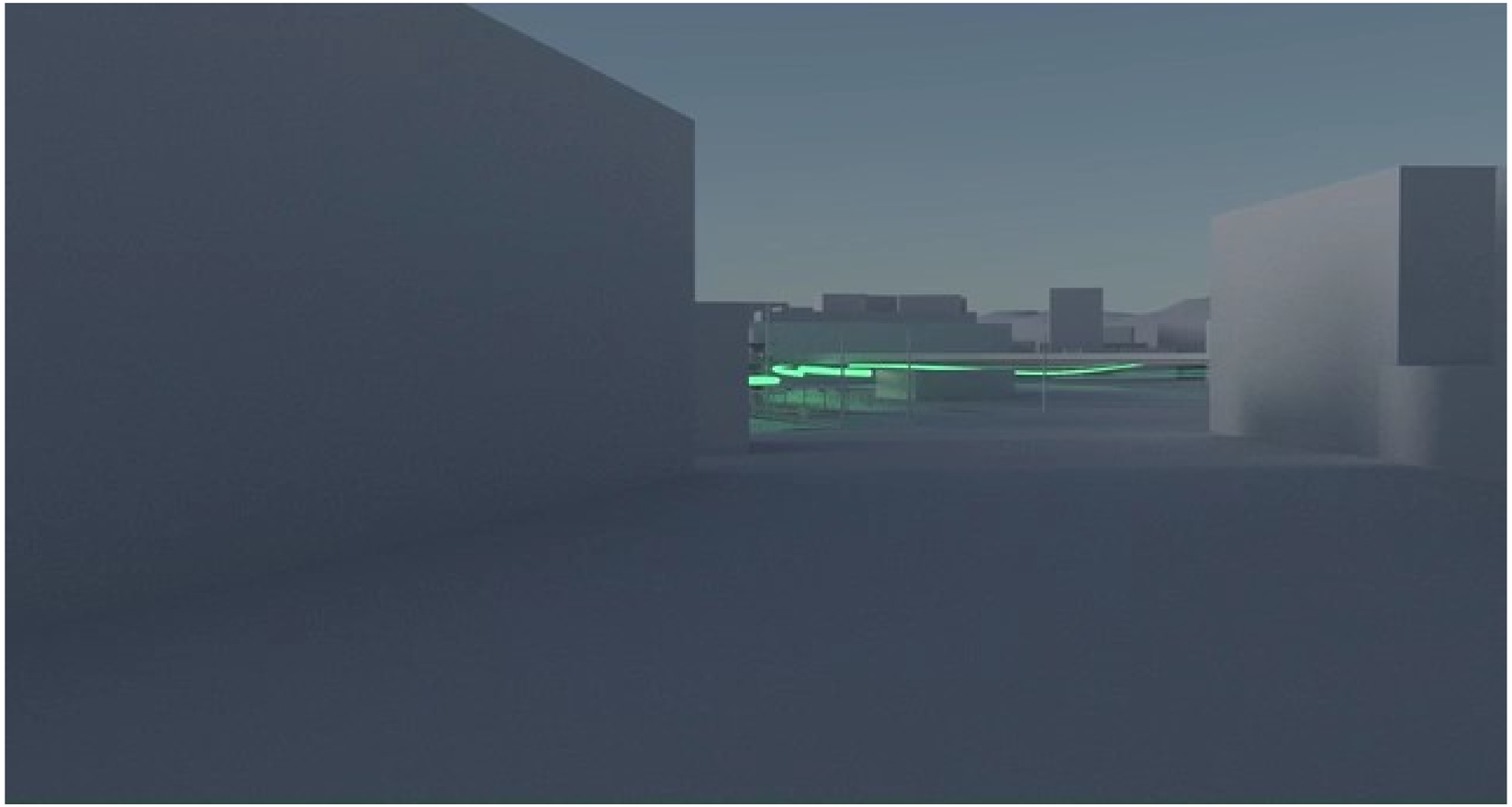
Introduction



Source: triviumproject.com

Dynamic Graphics

Introduction



Source: www.ia.arch.ethz.ch

Animation

Introduction

The lecture consists of four blocks.

- Today's introduction: Admin & Blender
- 1st block: Programming
- 2nd block: Animation
- 3rd block: Animation & Programming
- 4th block: Project

Course Outline

Visualize ComplexCity

You will learn the basic of Python programming.

- The way of thinking in programming.
- Basic concepts and structures.
- Reading & processing big data input.

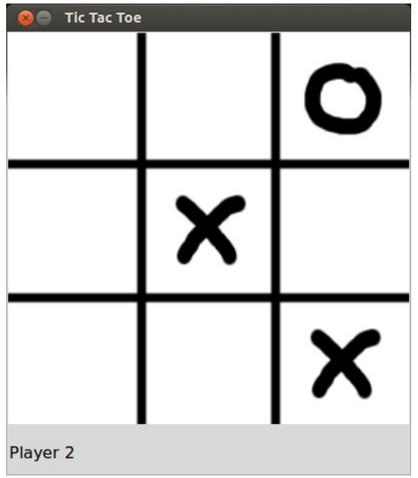
- Exercise I:

  Use the learned concepts and solve small puzzles, e.g. output the following:

  ```
  #
  ##
  ###
  ```

- Exercise II:

  Implement the core of a tic-tac-toe game.



You will learn the basic techniques of making animations with Blender.

- Motion blur.
- Path animations.
- Basic concepts.

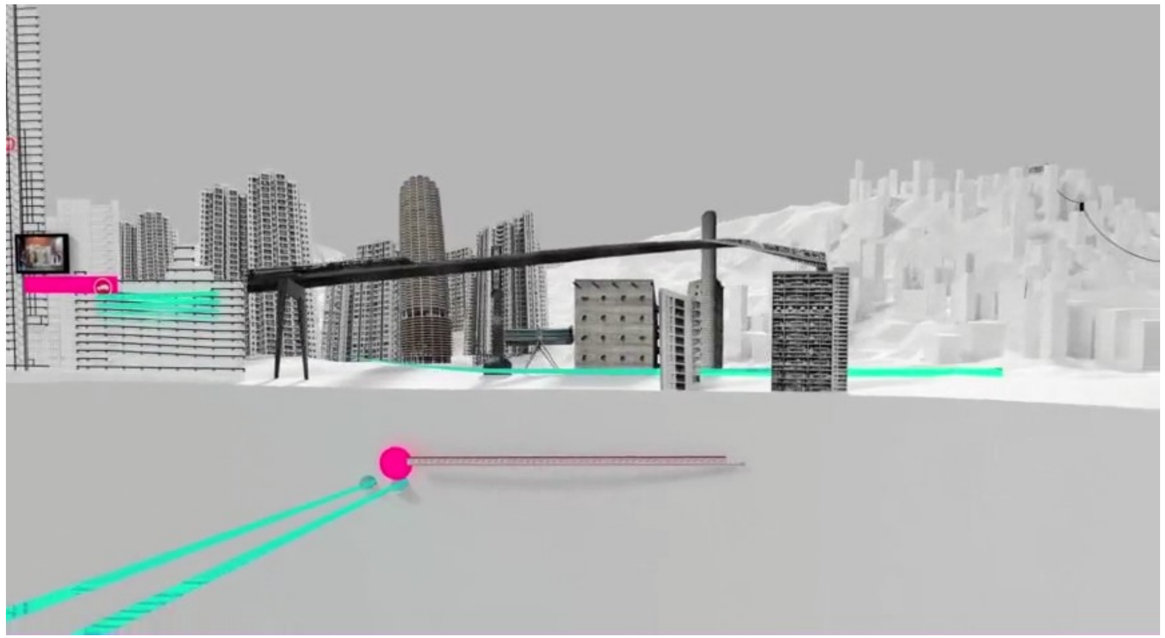
And use it to explain an urban feedback loop.

- Exercise I:

  Develop a storyboard for a feedback loop.

- Exercise II:

  Render an animation of the feedback loop.



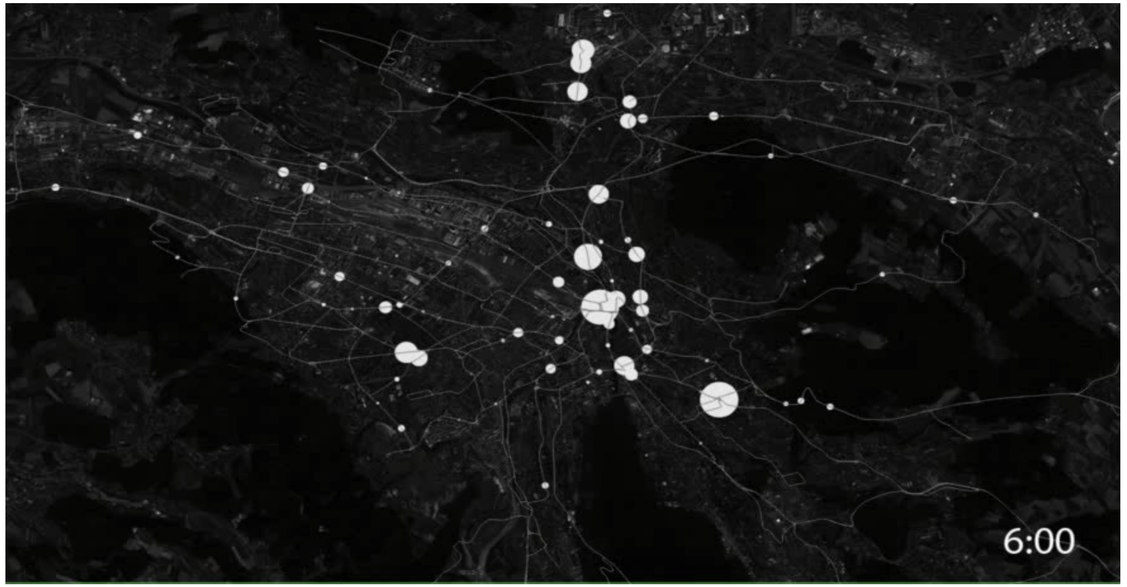
- You will use your new skills to make an animation of the public transport in Zurich.
- We will use a data set of an international competition by swissnex.
- You will learn, how to read in the data set and automatically produce visualizations in Blender.

- Exercise I:

  Create a static map of the data set.

- Exercise II:

  Create an animation using the data set.



You will use the learned skills of using programming and animation to develop an animation.

We suggest one of the following topics:

- Densification
- Vertical City
- Traffic

But we are open to your own ideas, such as an animation you can use for your design class or any crazy ideas you might have.

You need to have the following software installed on your laptop:

- The newest build of Blender
- Python
- Your favourite programming IDE, e.g. Ninja-IDE (http://ninja-ide.org/)
- Tkinter Python library (https://wiki.python.org/moin/TkInter)
- Python Image library (http://www.pythonware.com/products/pil/)
- To test, if a libraries is installed, open the Python console and type:

  import Tkinter, Image

- More on that next week.

To pass the course, you need:

- 80% attendance.
- 6 out of the 7 exercises solved.
- Completion of the final project.

How to Pass the Course

Visualize ComplexCity

You can find all the course material on our course website:

http://www.ia.arch.ethz.ch/category/teaching/fs2014-visualize-complexcity/

We will provide you with:

- Slides
- Tutorials
- Exercises
- Tipps and tricks for the course.