Computer simulations: lessons from the past

Inspired by the EPO Decision G1/19, Susana Rodrigues, Patent Consultant at Inventa, evaluates three fatal historic events that could have concluded differently if innovative computer simulations had been available.

What would have been the consequences of certain past events if a computer simulation had been put at work preventively, solving fatal technical problems?

In this article, three examples of technical problems that led to disasters, because they were lacking a proper technical solution, are discussed. Computer simulations can offer proper solutions to technical problems, either as such or as part of a process, and, therefore, they are very welcome when it comes to preventing the past from being repeated in the future. That's what we can do... in the present.

If, in this very year of 2023, you ask ChatGPT chatbot what computer simulations are used for, you will probably see an answer like this displayed on the screen:

1. Modelling and prediction - computer simulations can be used to predict the behavior of the stock market, the spread of a disease, or the behavior of a new drug in the human body.

2. Design and testing - engineers can use computer simulations to test the aerodynamics of a new airplane design, or to design and test a new computer chip.

3. Training and education - flight simulators are used to train pilots, and medical simulations are used to train surgeons.

4. Research - computer simulations can be used to study the behavior of subatomic particles, the evolution of galaxies, or the functioning of the brain.

5. Entertainment - video games are a form of computer simulation, as are virtual reality experiences.

That's quite a good answer, no doubt about it. However, for those who develop new and inventive simulations based on a computer device and wish to apply for a patent seeking to get rights over their invention's commercialization, not all the uses displayed are eligible for that.

Susana Rodrigues

"Computer simulations can offer proper solutions to technical problems."

Entertainment is excluded from patentability because "not being entertained" can hardly be considered a technical problem, or putting it in a straightforward way, games and similar entertainment products fall in the non-inventions category. The European Patent Office (EPO), for instance, considers methods for playing games, if claimed as such, excluded from patentability, under Art. 52(2)(c) and (3) of the European Patent Convention (EPC).

Research can have a great diversity of branches into a field of technologies too vast for being discussed in this article.

The remaining uses above, which yet point at a large wingspan of fields computer simulations can cover, may be patentable and bring a totally different approach in what concerns "technical effect".

In order to help patent applicants, inventors, and examiners identify computer simulations that are eligible for granting a patent, the EPO Enlarged Board of Appeal shed light on the subject by issuing Decision G1/19 on March 10, 2021. This decision intends to answer three relevant questions related to how patentable computer-implemented simulations can be when claimed as such.

The three questions are:

1. *In the assessment of inventive step, can the computer-implemented simulation of a technical system or process solve a technical problem by producing a technical effect which goes beyond the simulation's implementation on a computer, if the computer-implemented simulation is claimed as such?*

2. *If the answer to the first question is yes, what are the relevant criteria for assessing whether a computer-implemented simulation claimed*

as such solves a technical problem? In particular, is it a sufficient condition that the simulation is based, at least in part, on technical principles underlying the simulated system or process?

3. *What are the answers to the first and second questions if the computer-implemented simulation is claimed as part of a design process, in particular for verifying a design?*

The headnote of said Decision G1/19 replying to the first question, reads: "1. A computer-implemented simulation of a technical system or process that is claimed as such can, for the purpose of assessing inventive step, solve a technical problem by producing a technical effect going beyond the simulation's implementation on a computer."

Before moving on to answers 2. and 3. of G1/19, let's take a look into the past.

1904: on the 8 of February, in Baltimore, a city of Maryland State in the U. S., a fire outbroke in a basement of a store for dry goods. The fire spread quickly onto the neighboring wooden-based buildings which were connected to each other. Local fire brigades fought against the flames with the equipment and knowledge available at the time, until they realized that their fire hoses weren't able to extinguish the flames on the upper floors of the many buildings. They called fire brigades from other districts for help and their call has been attended. Firefighters from Washington D.C. arrived in Baltimore. "When D.C. firefighters arrived on the scene, they discovered that their equipment was not compatible with Baltimore hydrants. In those days, firefighting equipment met no national standards and varied city by city. Poorly matched and hastily bound couplings emitted weak streams of water. Firefighters ran out of hose as buildings collapsed." – Dolores Monet wrote (see source). The fire lasted for two days, more than 1,500 buildings were burned down, and the disaster was named The Great Baltimore Fire.[1]

> **The conclusion of most experts pointed at inadequate training provided by the airline to the pilots, since they were using a simulator that wasn't predicting fully real situations.**

Technical problem: lack of knowledge related to the way and the speed at which the fire would spread in such configuration against the fire brigade's equipment and hoses capacity and, also, mismatch of the equipment fittings from

Résumé

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fire brigades of different districts (in other words, lack of national standards).

Possible solution to the technical problem: computer simulation for modelling and predicting.

1989: In April, at the Hillsborough Stadium in Sheffield, England, an FA Cup semi-final match was scheduled between Liverpool and Nottingham Forest at Hillsborough, a neutral venue. The sold-out game was expected to draw more than 53,000 fans. To prevent problems, fans for the two teams were directed to enter from different sides of the stadium. Due to the limited number of turnstiles to give access to the stadium, a bottleneck formed, and half an hour before kick-off, thousands of fans were still outside. Hoping to ease congestion, Yorkshire Police approved the opening of exit gate C wherethrough thousands of fans entered and, as fans rushed, a deadly crush resulted, with people desperately trying to escape. A few minutes after kick-off the match was halted. Police never fully activated the major incident procedure, poor communications and coordination further complicated rescue efforts. In total, 97 people were killed and more than 760 were injured.[2]

Technical problem: inadequate dimensioning of the entrance turnstiles within the design of the stadium building to let fans of both sides of the match orderly enter.

Possible solution to the technical problem: Computer simulation used for design and testing combined with modelling and prediction.

2001: Two months following the 9/11 attacks on the World Trade Centre, more precisely on November 12, an Airbus A300 of American Airlines Flight 587 took off bound for the Dominican Republic, with 260 people on board. Shortly afterward, the plane spiraled out of control and crashed, killing all 260 people on board and five people on the ground.

The National Transportation Safety Board (NTSB) reported that the overuse of the rudder mechanism by the captain caused the plane's vertical stabilizer (the tail fin) to detach from the plane in mid-air. Without the vertical stabilizer, no plane can fly. The pilot was responding to turbulence caused by another plane which had taken off minutes before, and he over-responded not only by applying too much pressure on the rudder pedal, but also by using the rudder excessively. The conclusion of most experts pointed at inadequate training provided by the airline to the pilots, since they were using a simulator that wasn't predicting fully real situations.[3]

Technical problem: the training on a flight simulator wasn't reflecting reality and the instructions learned were inadequate and confused the pilot.

Possible solution to the technical problem: Computer simulation used for training and education.

"To solve important technical problems, preventing them from becoming fatal, by bringing new and inventive solutions to the most diverse fields."

Conclusion

The future will certainly profit from many computer-implemented simulations patented as inventions – and possibly "as such"- that are able to solve important technical problems, preventing them from becoming fatal, by bringing new and inventive solutions to the most diverse fields.

Bearing in mind the two remaining answers to the above-mentioned Decision G1/19: "2. For that assessment [of an inventive step] it is not a sufficient condition that the simulation is based, in whole or in part, on technical principles underlying the simulated system or process." and "3. The answers to the first and second questions are no different if the computer-implemented simulation is claimed as part of a design process, in particular for verifying a design", a computer simulation that is applied to be granted a patent must thus go beyond its implementation on a computer to reach a technical effect. That might be achieved, for example, by its adaptation to a specific technical implementation or by an intended technical use of the data resulting from the simulation[4], as it is suggested above, following the described examples of the past.

1 Source: https://owlcation.com/humanities/Baltimores-Great-Fire-of-1904-and-Its-Legacy

2 Source: https://www.britannica.com/event/Hillsborough-disaster

3 Source: https://www.baruch.cuny.edu/nycdata/disasters/aircrafts-american_2001.html

4 Section 3.3.2, Chapter II, Part G – Patentability, EPO "Guidelines for examination".

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