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# Mathematics between genius and madness - John Nash's 80th birthday

On an April evening in 1959, a man struggles in vain as two plain-clothes police officers carry him to their car, which is parked in front of a house in a Boston suburb. They drive to the nearby small town of Belmont and take him to the **McLean Hospital[1]**, a large psychiatric clinic. This puts a temporary end to the career of John Nash, the best American mathematician of his generation, and it takes decades before he can lead a normal life again and reap the recognition he has earned for his work.

**John Forbes Nash junior[2]** was born 80 years ago, on 13 June 1928, in the small town of Bluefield, West Virginia. His father worked as an electrical engineer and his mother was trained as a teacher. Nash attended high school, but took little part in normal schoolboy life. In 1945, he went to the technical college in Pittsburgh now known as **Carnegie Mellon University[3]**. There he initially studied chemistry, but switched to mathematics and won a scholarship in 1948 to attend an elite east-coast university.

**John F. Nash**

Nash chose **Princeton[4]** University, whose mathematics **department[5]** was the best in the country, enduringly characterised by immigrants from Europe. Stars like Emil Artin, Alonzo Church, William Feller and Solomon Lefschetz worked there, as did the superstar, John von Neumann. The demigods Albert Einstein and Kurt Gödel looked in occasionally from the neighbouring **Institute of Advanced Study[6]**. Within two years Nash completed his **dissertation[7]** (PDF) on **game theory[8]**, in which he presented the concept of a non-cooperative game and the optimal strategy subsequently named after him, the **Nash equilibrium[9]**.

One popular example of such a game is the **"Battle of the Sexes"[10]**. A man and a woman at different points in a city want to spend the evening together. Their mobile phones are out of order, so they can only set off with the guidance of common sense, hoping of course to find each other at the venue. They can choose either a football match, which the man prefers, or a concert, the woman's preference. Who goes where?

Nash's theory says there are two equilibria, two possible solutions that could save the evening: the man and woman see each other either at the football match or at the concert. How they come to their decisions is left unconsidered. It's simpler if the game is played several times in succession: a probability should emerge of the partners meeting as often as possible by going either to the stadium or to the concert hall. In general, Nash equilibria exist where no participant can enhance his benefit solely by changing his own strategy.

Besides the Nash equilibrium, while at Princeton the young mathematician also developed the Nash **bargaining solution[11]** and invented the Nash **embedding theorem[12]**, a surprising result that emerges from pure mathematics. In 1951 he began teaching at **MIT[13]** in Boston, where among other things he solved Hilbert's 19th **problem[14]**. During the summer holidays he worked at the **RAND Corporation[15]**, the legendary Californian think tank, where he also took up programming. In 1957 he married Alicia Larde, a student from an upper middle-class family originating in El Salvador.

The extent to which Nash's illness was hinted at by his eccentric manner and ungovernable sex life will be left un-discussed here.Eventually he had a breakdown in spring 1959, when he was plagued by such acute delusions that hospitalisation was unavoidable. After two months in the McLean Hospital, he resigned from MIT and spent a year in Europe with his wife, unsuccessfully seeking political asylum. After his return to the US, two stays in clinic brought only temporary improvement and Nash remained in the grip of paranoid **schizophrenia[16]**. He did however occasionally experience lucid moments and was able to do scientific work. He received an **award[17]** for business management in 1978.

After three decades, Nash succeeded in shaking off his illness. At the same time, the increasing popularity of game theory was drawing the attention of specialists to his writings, and many researchers were glad to apply his ideas. The happy outcome is well known: in 1994, together with John Harsanyi and Reinhard Selten, John Nash won the **Nobel prize[18]** for economics. He was transformed into a global personality by the film **"A Beautiful Mind"[19]**, based on the biography of the same name by **Sylvia Nasar[20]**.

Since receiving his Nobel prize, if not earlier, Nash has been what is so sweetly described as a normal human being and is able **to speak[21]** objectively about his past. He is **working[22]** at Princeton University again, where a **conference[23]** with prominent guests is being held in his honour.

(*Ralf Bülow*)

(**trk[24]**)

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