BIZCOMMUNITY

How architect Yona Friedman used math to design utopian cities of the future

By Theodora Vardouli

6 Mar 2020

Architecture has lost a great visionary. Budapest-born French architect Yona Friedman died at age 96 on 20 February.

Yona Friedman's model of the Spatial City, on the left, and his library, on the right, at his apartment at Boulevard Garibaldi in Paris, March 2012. (Theodora Vardouli)

Friedman left us with a lot to remember. Some obituaries commemorated his pioneering work — some of it with UNESCO — on self-sufficiency, empowerment and do-it-yourself architecture. Others have restated the influence his emblematic "Spatial City" (*Ville Spatiale*) — a three-dimensional grid floating above urban and natural territories and populated by mobile dwellings — had on an entire generation of architectural experimentation.

Others yet have recognised his bold theories about social transformation and the necessity of fluid mobility in buildings and cities — or recalled his experiments using computers to help inhabitants plan the Spatial City when architects were only just beginning to explore using computers.

> *Visionary architect Yona Friedman has passed away. https://t.co/M0HKncksQN pic.twitter.com/9C7oT0etOx*— *Archinect (@archinect) February 21, 2020*

Perhaps Friedman's most remarkable feat was the presentation of bold visions about the future of cities, human societies and how to allocate environmental resources, with a level of detail that made them appear like imminently realisable scenarios. His "realisable utopias" — as he called them — moved between a sober plan and a daring dream.

Technology as infrastructure

As a scholar of architectural computing, I have been studying Friedman's work for several years with interest and intrigue. My aim has been to uncover historical and critical insights that his work can offer to contemporary visions of digital architecture and computational design.

Friedman's ideas about ethical interventions of technology on people's design choices can enrich contemporary

discussions about open source architecture and how non-architects can be empowered to design.

At the same time, Friedman's discussion of technology as an infrastructure that sets limits on permissible choices was a prophetic metaphor for design processes that are now tied with computers and computational methods.

For example, Friedman imagined the Spatial City as a three-dimensional grid where each cell was a building block and inhabitants could recombine these building blocks to produce different spatial configurations.

Defining design as a process of combining and configuring discrete entities is common in contemporary discussions of digital architecture. However, there is also growing critique to this "Lego-like" approach to design, which may clash with both practical realities of building and limit how we understand creativity.

In my research, I have also examined how Friedman used visual representation as a way to move between mathematical and architectural ideas.

'Scientific architecture'

Around 1964, at the peak of his fame with the Spatial City, Friedman decided he would not draw another line. Instead, he would try to justify that his architectural ideas were a product of careful reasoning.

He pursued visiting scholar appointments in North American universities. There, he came in contact with an emerging genre of research that positioned mathematics and logic as the foundation of architecture and planning. Friedman published several articles that mathematically described the mechanisms by which the Spatial City would function.

Friedman began to represent architecture through mathematical diagrams of discrete elements, such as rooms, and their relationships. These graphs, as the diagrams were called, also showed how people moved through a space — for example, as seen in Friedman's 1978 plans for designing David d'Angers Lycée in Angers, France.

Graph representations of floor plans and of human activities were not new. They had appeared in building science in the early 1960s. But Friedman was key in expanding their uses beyond the practical problem of designing efficient buildings. Instead, he used them as the basis of a new theory of scientific architecture.

Architecture by yourself

Among other things, the book proposed a speculative computer system, the "Flatwriter," that would automate the production

of floor plans based on a future user's habitual activities. Journalist and critic Michel Ragon, co-founder with Friedman of an influential art and architecture group, urged French planners to take Friedman's ideas seriously.

Friedman's mathematical theories, he argued, would inform work on the so-called "evolutionary dwelling" (*habitat evolutif*). This was a form of flexible social housing that architects and planners were experimenting with for the design of new towns in the late 1960s.

In the United States, Friedman's work aligned with emerging developments in computer-aided design. Around 1973, MIT's Architecture Machine Group invited Friedman as a visiting researcher in a project called "Architecture By Yourself". The project included the development of a computer system called YONA (Your Own Native Architect) that would enable non-architects to design their own houses.

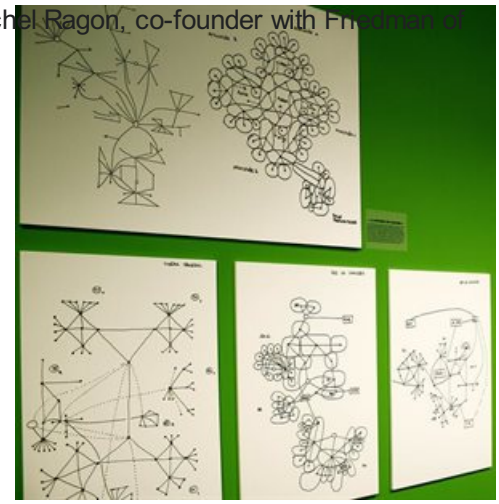

Exhibit showing Friedman's graph method. At top, 1978 plans for designing David d'Angers Lycée, a school in Angers, France. (trevor.patt/Flickr/Yona Friedman: Genesis of a Vision. Archizoom gallery, EPFL)

Skeletal language

In 2012, I interviewed Friedman in his Paris apartment and asked him why he had adopted graphs. He recalled that he first encountered graphs through the eminent mathematician Frank Harary, who was also known as "Mr. Graph Theory."

Harary promoted the visual and aesthetic aspects of graph representations. Graphs could be drawn with pencil and paper and were intuitive to interpret. Friedman reported being attracted by that quality.

What Friedman did not talk about, however, was that the drawings of graphs' points and lines spoke the same skeletal language as drawings of the spatial city's nodes and rods. Friedman's mathematical explorations then show a unique capacity to use visual similarity and a consistent language of representation as a way to build bridges between concrete architectures and their mathematical abstractions.

As architects continue to grapple with such abstractions in the context of computational design, Friedman's work has a staying power. Friedman moved between mathematical abstractions, algorithmic ideas and architectural proposals poetically and evocatively. The outcome was one of perhaps the most prescient cultural commentaries on what skeletal structures — real and conceptual, physical and mathematical — could mean for architecture.

ABOUT THE AUTHOR

Theodora Vardouli, assistant professor, Peter Guo-hua Fu School of Architecture, McGill University