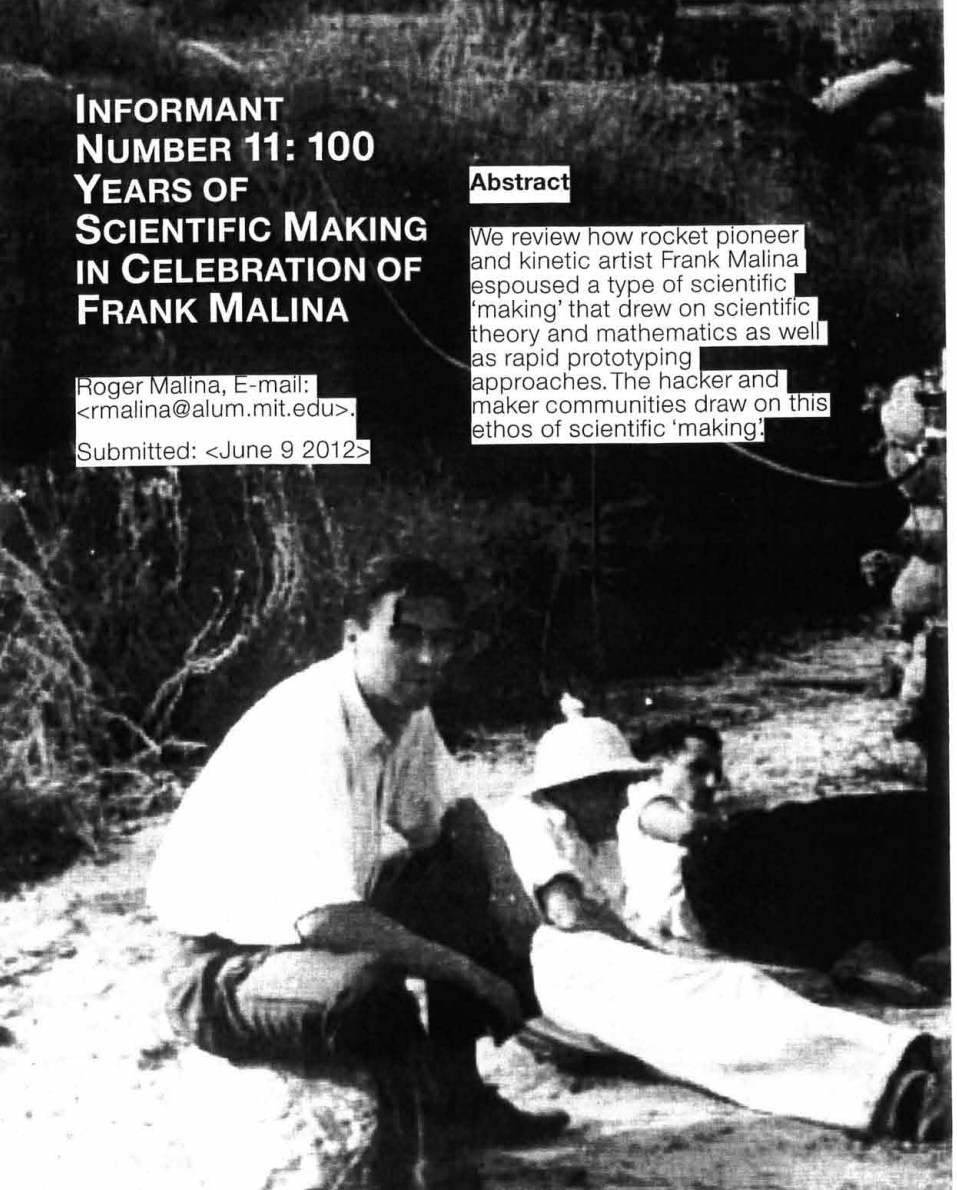

Informant Number 11: 100 Years of Scientific Making in Celebration of Frank Malina

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Submitted: <June 9 2012>

Abstract

We review how rocket pioneer and kinetic artist Frank Malina espoused a type of scientific 'making' that drew on scientific theory and mathematics as well as rapid prototyping approaches. The hacker and maker communities draw on this ethos of scientific 'making'.

My father, Frank Joseph Malina (1), was born a hundred years ago on October 2 1912 in Brenham, Texas. The son of Czech immigrants, his parents were music teachers, but had run grocery stores and a hotel; they wanted their son to be a musician. Music was a respectable profession; my father went on to become a rocket scientist, a field that was not respectable did not exist when he was born.

Brenham was a small farming community and my father tells of his boredom and finding refuge in the town library. There, among other books, he read Jules Verne and became infected with the dream of space travel. And to go to space you had to make things, invent things.

My father majored in mechanical engineering at Texas A and M and went on to study aeronautics at the California Institute of Technology, Caltech. There he started studying under Theodore Von Karman (2) who has started one of the first experimental aeronautics labs, a wind tunnel and the Guggenheim Aeronautical Laboratory. Von Karman is now recognized as one of the top research engineers of the twentieth century but as a young professor he had a lot of resistance introducing scientific reasoning and mathematics into engineering practice. Engineering was often a trial and error affair; Von Karman believed that you could make things scientifically. My father went on to become a leading pioneering of American Rocketry and, with Von Karman, founder of NASA's Jet Propulsion Lab. The team led by my father is credited with launching the first human-made object into space.

When my father started working on rockets he was a student; his fellow students were all headed for the booming aeronautics industry, the internet of its time; they couldn't believe he would waste his education on a field as absurd as rockets. Rockets were in such bad repute that they use the word Jet Propulsion rather than the word Rockets. My father and a motley group of students started making rockets. As a student group they had no funding, just the informed consent of Von Karman; their first funding came in cash in a brown paper bag. Two of the crew, Jack Parsons and John Foreman (3), were amateur rocketeers; one an amateur chemist, the other into white magic. They kept blowing things up on campus and became known as The Suicide Squad and were forced to move into an Arroyo. The group went on to found a leading aerospace

company, Aerojet General Corporation and was major contributors to what became the space program. They were makers.

During the McCarthy years in the USA my father got caught up in the communist red scare, was indicted, lost his passport and lived as a refugee in Paris just as his startup company made him a millionaire. The FBI files of the period are now public (4); in these files there are interesting interviews with "informant No 11". Informant No 11 claimed my father was a communist and had tried to delay the winning of the war. Informant No 11 asserted that my father insisted on doing too many experiments and mathematical calculations rather than just building and firing rockets. My father had of course learned this view of scientific making from Theodore Von Karman. The group had developed mathematic models of air flow in nozzles to guide the design of larger and better ones; they did calculations of multi stage rockets to optimize the weight to propellant ratio; they carried scientific experiments of novel rocket fuels. For them, successful making required the best scientific theory, the best mathematics and the best prototyping and experimenting; a scientific "making". The group disbanded. Ironically one of their team, Tsien Hsue-shen (5), was expelled from the US against his will and went on to head the Chinese rocket program and became a member of the Chinese politburo. Little did Informant Number 11 know how he would change the course of history.

Unable to continue working as a scientist, my father in midcareer became an artist. When I was growing up I would come home from school to find my father, the research engineer, painting in our living room. As he experimented with various forms of painting, collage, assemblage, and moiré grids he come obsessed with introducing real motion into his paintings, In the mid-fifties he started exhibiting what became to be known as 'kinetic art' (6) and he became one of the pioneers of that art movement . He started putting light bulbs and motors into his paintings to make the patterns move. To his dismay his paintings would sometimes burst into flames because the heat from the light bulbs was too intense. He solved this problem in a classic 'eureka' moment one Christmas. We were at the dinner table and next to us was a Christmas tree with one of the first available garlands of flashing Christmas tree lights. In the middle of dinner, my father stood up suddenly, rushed to the Christmas tree and grabbed the lights to put them into his kinetic painting. Problem solved.

As my father continued to develop his kinetic paintings, he started studying psychology, visual perception and cognitive sciences. He didn't understand why artists didn't use the theory and science of perception to help them in their art making. How could you use the science of color and motion to create specific moods?; what speeds were best suited for particular kinds of artistic expression?; how did the brain integrate sound and sight? Just as my father had applied mathematics to rocket nozzle design he applied the most recent science to help him in his art making. There was a prevalent view that artists should paint and not talk or write about their work; there were even 'gate-keepers' known as art critics who explained what the artists intended. My father was aghast. As a scientist he had written about his ideas and his work, even though his avocation was not as a writer.

Why should he not, as an artist, be able to write about his ideas and discoveries?

My father went on to found the international art-science Journal Leonardo (7) now celebrating its 45th year. Artists write about their work, explain their ideas and document their discoveries in the open literature; until then most artists kept their inventions as secrets of the trade. For him scientific making involved also collaboration with your peers and sharing your ideas.

Today's hacker and maker cultures are inheritors of many aspects of the ethos of scientific making that my father believed in. Use theory and mathematics to short circuit unnecessary experimentation; experiment and prototype before building the real thing; share your problems and discoveries with your colleagues; create ways for scientists and engineers to collaborate with artists and designers; pursue your idea even if the Academy thinks it is stupid (universities are conservative and change slowly); put together teams of the best people, whether or not they have the right diploma; it sometimes helps to give your idea a new name. Today the proliferating technologies from 3-D printing to on-line collaboratories to new forms of publishing and curating work, enable in new ways the kind of scientific making my father espoused. But the institutional blockages for collaboration between science, engineering with art and design are still immense; un-necessary roadblocks exist and new opportunities stymied.

Over the last two years, with funding from the U.S. National Science Foundation, discussions have been held between scientists and engineers and artists and designers. A network, SEAD (9), is being set up to help identify roadblocks and opportunities, to bridge the academic and non-academic, for profit and nonprofit research communities, the formal and informal hacker and make communities. The citizen science communities are beginning to have a real impact on the way science is done and the direction scientific research will take; how can we build flexible, evolving collaboration communities that bridge disciplines and institutional frameworks ?. We have issued a call for White Papers from members of the community (9) and will be forwarding a meta-analysis of all the recommendations the various stake-holders. We encourage the hacking and make communities to participate in the discussion and actions of the SEAD network.

Oh Yes. And watch out for Informant No 11. You never know when he will kill your idea dead or maybe change the course of history to help create the Chinese Rocket Program and the Kinetic Art Movement.

References and Notes

1. Frank Malina web site is at: http://www.olats.org/pionniers/malina/malina.php . A recent documentary provides an excellent overview: http://www.jpl.nasa.gov/podcast/content.cfm?content=1029
2. Theordore Von Karman: http://www.nas.edu/history/members/karman.html
3. Jack Parsons http://en.wikipedia.org/wiki/John_Whiteside_Parsons > There is a voluminous literature of the many aspects of Parsons.
4. Excerpts from the Frank Malina FBI files are available at http://malina.diatrope.com/frank-malina/frank-malina-fbi-files/ .
5. Tsien Hsue-shen : see Iris Chang's book Thread of the Silkworm: http://www.amazon.com/Thread-The-Silkworm-Iris-Chang/dp/0465006787
6. Frank Malina, " Kinetic Painting : The Lumidyne System ", Leonardo, Vol. 1, N° 1, pp. 25-33 (1968) available at http://www.mitpressjournals.org/doi/abs/10.1162/leon.2007.40.1.81 . See also the book Kinetic Art: Theory and Practice : http://www.amazon.com/Kinetic-Art-Practice-Frank-Malina/dp/048621284X
7. The Leonardo organisations, ISAST:International Society for the Arts, Sciences and Technology and OLATS: Observatoire Leonardo des Arts et Technosciences, have published the work of over 7000 new Leonardos. Find their work documented at www.leonardo.info and www.olats.org
8. SEAD: network for Science Engineering Art and Design: http://sead.viz.tamu.edu/index.html
9. The White Paper call is at: http://sead.viz.tamu.edu/white_papers.html