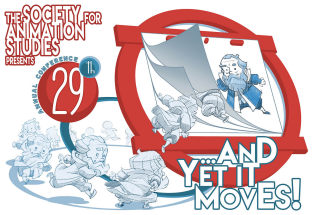
Panel I2

Sala delle Colonne 1

Science and Animation II



Vibeke Sorensen, Alexander Melkozernov

Galileo's Legacy: Scientific and Experimental Animation

Galileo Galilei is one of the fathers of the scientific method. His revolutionary invention of a telescope allowed one to see objects that were unseen by the naked eye. For Medieval believers seeing something that is not there was regarded as heretical. Galileo understood the need for better instruments to extend visual perception, such as improved lenses and optics for better telescopes so that he could see further, so that his observations and measurements of the planets in our Solar System would be more accurate. By confirming Copernicus' Heliocentric theory that the Earth rotates around the Sun, Galileo contributed to shifting a balance between faith and doubt in favor of reasoning. This cost him imprisonment by the Church Inquisition.

Nowadays, technological advances allow us to see (feel, measure, detect) things which were unthinkable to exist, and lived only in the imagination. Animation as a way to visualize scientific discoveries and concepts is a result of scientific exploration of phenomena, especially the perception of motion. In modern sciences, such as synthetic biology, cosmology or theoretical physics, scientific animation is used to explain the unseen and the incomprehensible. In a direct link to Galileo, scientific visualization uses mathematics describing visual form and motion to simulate the phenomena being explored. When the simulation conforms to the real thing, and is repeatable, it is considered a validation of the scientific theory being tested, including the equations and algorithms that underlie and explain them. Further, because so many phenomena are at a scale beyond normal human perception, scientific animation is the only way to see them. Examples include space animations for NASA as well as visualizations of nanoparticles and physical, chemical or biological phenomena at a very tiny scale. One of the ideas of extended perception through new scientific 'lenses' is sonification that links sound, image and other senses.

Scientific data, including 'Big Data' can better be understood when presented to us not as a list of numbers but as sound and image, as we can detect patterns and also perturbations and inconsistencies better this way. Experimental animation has long explored sound-image relationships in 'visual music' including wave phenomena. John Whitney Sr. is one of the main pioneers in the 20th century. Like Galileo, he too studied pendulum movement, and understood that waves are common to both sound and image. He thus sought a mathematical process to link them precisely, and produce both sound and image together. Similar to the abstract animation pioneer Oskar Fischinger, Whitney's goal was to produce a moving visual work that produced in the mind, the same emotional effect of music. Whitney was the first to use a computer in this way and therefore he is widely considered 'the father of computer graphics'. Since then, visual music, experimental animation, and scientific visualization have flowered and today they are considered animation genres. Yet, they are intertwined, informing each other and continuing to make use of the scientific method. In fact experimental artists and animators who use the scientific method could technically call themselves 'scientists,' although very few of them do. Similarly, many scientists feel allied with the arts because, while they use the scientific

method, they also work with aesthetics and 'irrational' or visionary leaps in their conceptualization of their theories which of course subsequently have to be rigorously tested. Galileo may be the common ancestor that brings artists and scientists together in the future, as art and science are linked more and more through the common instrument for extending, testing, and interacting with our perception of our world and Universe, the computer. Given its expanding possibilities and definition in the hybrid physical-digital domain, in particular in multimodal media, new forms of animation are emerging. This presentation will provide a historical and theoretical overview of the role of Galileo's legacy in visual music, experimental animation, and scientific animation with contemporary cutting edge examples bridging art and science such as Big Data and multimodal, animated installation. Scientific animation examples will be curated by Dr. Alexander Melkozernov of Grand Canyon University, Phoenix, Arizona, USA.

Biography

Vibeke Sorensen, Professor and Chair, School of Art, Design and Media, Nanyang Technological University, Singapore
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Vibeke Sorensen is an artist, composer, and professor working in digital multimedia and animation, stereography, interactive architectural installation, and networked visual music performance. Her work in animation and experimental new media spans more than four decades and has been published and exhibited worldwide, including in books, galleries, museums, conferences, performances, film festivals, on cable and broadcast television, and the internet.

Since 1980, she taught and developed programs in media art at Virginia Commonwealth University, Art Center College of Design, California Institute of the Arts, and Princeton University. From 1994-2005 she was Professor and Founding Chair of the Division of Animation and Digital Arts (DADA) in the School of Cinematic Arts at the University of Southern California (USC). Since 2009, she has been Professor and Chair of the School of Art, Design and Media (ADM) at Nanyang Technological University (NTU) in Singapore.

Her recent work "Illuminations" (2013) is a large scale illuminated folding screen, an interactive visual-music animated installation incorporating plant biofeedback, ubiquitous computing, and electro-acoustic music that she composed. "Vishwaroop" (2014) is a 4K generative dome animation with music by sitar virtuoso Kartik Seshadri, and "Mood of the Planet" (2015) is a kinetic light-sound sculpture incorporating global, real-time big data, Twitter, animation and music produced and composed by Sorensen. Her recent animated work, "Mayur" (2015), with music by Kartik Seshadri, is a 4K (4096 x 2160) animation informed by Asian textiles, symbols, and cosmologies.

Dr. Alexander Melkozernov, **consultant**. College of Science, Engineering and Technology, Grand Canyon University, Phoenix, Arizona, USA
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Alexander Melkozernov is a Russian born US scientist and educator with a strong interdisciplinary background at the crossover of Biology, Biochemistry and Biophysics. He obtained his Ph.D. in Biology specializing in Biophysics from the Institute of Biological

Physics of the Russian Academy of Sciences. Since the graduate school Alexander was fascinated by natural photosynthesis, and how green plants use the energy of sunlight and water to produce food. After moving to the USA, he worked as a research scientist at Arizona State University, Tempe, where he was involved in biochemical, biophysical and bioinformatics studies of the molecular mechanisms behind the efficient bioenergy conversion processes in the photosynthetic molecular machines. His research portfolio includes several research projects, numerous publications in peer-reviewed journals and participation in national and international conferences. Another of Alexander's passion is teaching. For more than 6 years he had been teaching chemistry and biology disciplines to college students, lately at Grand Canyon University, Phoenix. Fascinated by the beauty of the biological photosynthetic structures, Alexander keeps interest in the origin of scientific and artistic creativity, modern relationships between science and art and teaching complex biological concepts to artists.