ESCAPING INTO THE FUTURE

A Self-conversation On innovation in Science, Arts and Technology

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ABOUT THE AUTHOR

After the Diploma in Classical Guitar, he approached electronic music at the beginning of the nineties by attending the Summer Courses at the Centro di Sonologia Computazionale in Padova under the supervision of G. Tisato and S. Sapir; subsequently he continued his studies with A. Vidolin. He obtained the Diploma in Electronic Music at the Conservatorio A. Boito in Parma, under the supervision of F.Giomi. He is a member of the AIMI (Associazione di Informatica Musicale Italiana) and of IXEM (Italian EXperimental Music), for which he has contributed to a compilation of emerging Italian composers. He is currently collaborating with the Centro Tempo Reale, founded by Luciano Berio in Florence, where he lectures on digital sound and is a guest composer, and the MARTLab at the Conservatorio L. Cherubini in Florence, for which he has analyzed the compositional algorithmic strategies of Pietro Grossi's compositions. Ha has written several electro-acoustic compositions for magnetic tape, traditional instruments and live electronics, some of which have received awards at electronic music competitions. He has also written music for performances, video, dance, installations and the environmental soundscape for the video Offerta Immaginaria of the Russian director A. Tarkovskij. A major installation work, Nomadic Time, has been exhibited at the Centro di Cultura Contemporanea in Palazzo Strozzi, Florence. Some of his compositions are published by the Web 2.0-based label Nukesatori, Milan. Ongakuaw is involved in the theoretical/experimental investigation of biotic compositional techniques on which he has written several published contributions. He works and composes at the Ongaku Studios in Florence, teaches the Musical Acoustics course at the Conservatorio G.B. Martini in Bologna, and he is a Cosmology Professor at the Scuola Normale Superiore di Pisa. Web site: www.ongakuaw.eu.

WHAT IS THE RELATIONSHIP BETWEEN SCIENCE, ART AND TECHNOLOGY?

All three activities revolve around the idea of research; the concept of exploring new ideas. The kind of ideas that are not understood and not-yet-created. A now classical example of innovation is the development of the World Wide Web. In 1989 the computer scientist Timothy Berners-Lee was investigating ways in which scientific information could be shared among internationally dispersed teams of researchers. The innovation power of such idea was so large that immediately after the network became a platform for software development, with the numbers of linked computers and users rapidly growing and turning into a large business marketplace. The manner in which research is conducted varies depending on the field being addressed. Since science operates by a method that consists of variations leading to the test of a given hypothesis that can be proven correctly and incorrectly at any time thereafter. Technology does not search for those ideas that have a general value, but instead for the implementation derived from its scientific evidence that work here and now for a particular purpose. Which brings us to the art: Technologically-based art may allow the use of technology decoupled from its function or reliability, thus opening the path to innovative (and apparently sometimes useless) breakthroughs. In this aspect, artistic production is more akin to that of science: A scientist rarely asks whether a given research is useful; instead his/her curiosity and instincts lead him/her to identify issues of potential interest.

THE "SERIOUS" SCIENTIST VS. THE "PURE" ARTIST: ARE THERE SHARED GOALS BETWEEN YOUR WORK IN SCIENCE AND ART?

Science and art are separated in practice, but the distance is diminishing gradually, particularly during the past year. The reason for this separation has to do with the division of roles in society, more so than with natural factors. For example, to show my work as an artist in the scientific world would undermine my credibility as a "serious" scientist; on the other hand, however, the art world, although more easily dazzled by scientific authority, would not consider me as a "pure" artist. Contamination between the two areas, although seemingly urgent under the pressure of fast computer literacy and technological society, is still epidermic

HERO'S AEOLOPILE
Knight's American Mechanical Dictionary, 1876.

An aeolipile (or aeolipyle, or eolipile), also known as a Hero engine, is a rocket style[1] jet engine[2] which spins when heated. In the first century AD, Hero of Alexandria described the device,[3] and many sources give him the credit for its invention.

The aeolipile Hero described is considered to be the first recorded steam engine or reaction steam turbine.[4] The name – derived from the Latin word "pila" – translates to "the ball of Aeolus"; Aeolus being the Greek god of the wind. *Text and image extracted from Wikipedia.org*

WHAT IS INNOVATION IN SCIENCE?

and very unbalanced in favor of science. Indeed it is art that requires more science rather than science to seek greater input from art. However the balance is shifting from day to day, so that we might fear future extinction of artistic production and thought as we know them, when we instead should work on a merger plan. The merger will be positive whereby both science and art will immensely benefit from a gradual assimilation of new ideas. The contact point between the two disciplines is innovation guided by speculation.

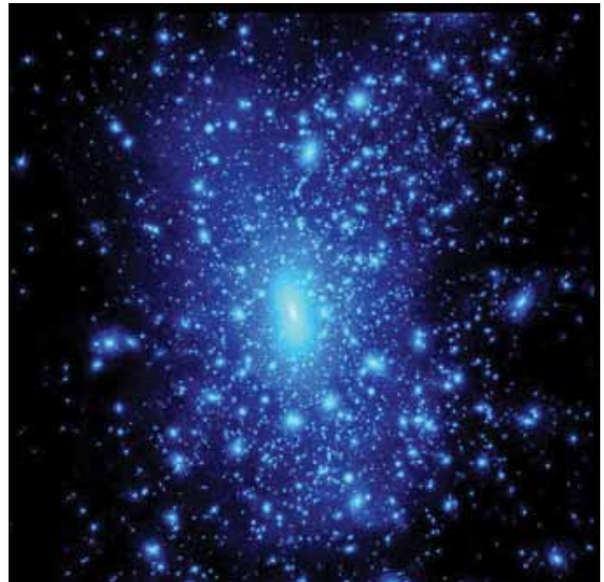
Innovation is the discovery of new phenomena or processes. It highlights applications of a discovery not yet identified. We know that Heron of Alexandria at the peak of the Roman Empire invented the steam engine, the Aeolipile, but his discovery cannot be categorized as innovation: His engine was perfectly working and revolving, thanks to steam power, to a considerably high frequency. It could have had several applications, as indeed it occurred later in the 19th century when several machines which allowed the industrial revolution were invented which descend from exactly the same principle discovered by Heron. However, the social/cultural roman environment was not ready yet to glimpse through the variety of possible uses (and military ones were no exception) of the invention. This shows that even the most innovative ideas must come at the "right" time, admittedly a fuzzy and difficult thing to predict

There are many *known unknowns*: That is to say, there are things we know we do not know. But this does not necessarily jeopardize our general understanding our surroundings. For example, we miss the fine details of how a galaxy or a star form, but we do not doubt that our theories describe the global properties of these objects with sufficient precision to interpret the experimental data. No need to know that when seeing a hungry lion that it is better to stay away! Clearly, understanding the details is intellectually stimulating; and the history of science proves that understanding these "details" has led to great changes in scientific thought (textbook examples are the theory of relativity and quantum mechanics).

However, there are fundamental questions that do not fall among the *known unknowns*. Examples are the nature of dark matter and the origin of the mysterious vacuum energy that accelerates cosmic expansion; the nature of gravity and its thermodynamic interpretation; the consequences for the space-time; the theories of the holographic universe and the multi-verses. Many aspects of these questions have a strong impact for the future evolution of the cosmos. Why should we be interested in the future of the universe, when cosmology has always been devoted to understanding its origins to explain its current structure? Does it make sense to worry about how the future may look? I argue that innovation should push forward the frontiers of imagination based on trust of the intelligence by which mankind is endowed. Even today we have supercomputers (such as the Jaguar by Cray) that allows for a number of calculations per second that are equal to those of our brain. Developments in technology in the next two to three decades will be impressive, as we have never witnessed before.

IS THE FUTURE A FIELD FOR SCIENCE-FICTION?

Most of our visions of the future come from imaginative writers as Verne, Wells, Asimov, Clarke and many movies on the subject. However, making predictions is the core activity of science. A scientific theory is more valid and useful as many falsifiable (à la Popper) predictions can produce. Predictions are then imprinted in science's DNA. Investigating how our universe will evolve in the future relying on the whole arsenal of sound physical knowledge available to us is therefore a plausible claim. Some of these predictions are not falsifiable directly by ourselves, but our descendants will be able to do so (if they are still interested). Although some degree of internal consistency can always be verified, a theory about the future does not qualify as totally scientific. However, the price of this loss will be amply repaid by the immense usefulness of that theory as a guide to the many critical and strategic choices that our species will be faced with soon.



WHAT ARE THE CONSEQUENCES OF THE EVOLUTION OF INNOVATION ON THE HUMAN SPECIES?

Some questions about our future seem crucially wire science, technology and evolution in a Darwinian sense. From the first sequence of DNA synthesized by nature, we have come to our brain, the most sophisticated machine in the known universe. However, there is no reason to think that it will be the last. Evolution will continue without stopping in ambition to create more intelligent beings. Our brains, based on the transmission of electrochemical signals of very low speed, cannot go beyond a certain computing power, a limit that machines will surpass shortly. At that point the machines, our descendants and allies, will further evolve intelligence on silicon rather than organic substrates (with obvious advantages relating to strength, durability, reliability, accuracy, size, speed etc). The intelligence will then expand, detached from its support of DNA, proteins, cells, and neurons, to make the whole universe its home and a repository of usable energy and matter. It is therefore important to find answers to the following questions: Are there traces of advanced intelligences from other planets and, if so, why haven't they been already identified ? Are we ourselves and the whole universe the result of a much more developed intelligence? What type and amount of resources will be available and what technological difficulties will arise in their use? The technological means we will use to travel into deep space will depend on the development stage of nano-technology. Perhaps the biggest mistake we can commit in predicting this already near future is to think that exploration has to be conducted by humans, and some other human-created machine will instead do this in our place.

WHAT IS THE VALUE OF ART WITH NOVELTY?

Art is first and foremost perceptual stimuli; whether sensory or cognitive, in a reductionist sense, art is a vehicle of knowledge that connects the user with new (sometimes disruptive) elements. It is also an instrument of innovation. Its value is twofold. Due to the freedom from the variation-selection mechanism, the design of impossible realities is allowed, and examples in virtual reality (or better yet "real virtualities") are today growing increasingly common. Moreover, in its path it can afford to rebuild the world following laws that are different from natural ones, helping to experiment solutions which nature could not prosecute (due to the stratified nature of evolution) and that eventually technology will implement. Under this category falls a yet relatively small niche of artists who are interested in the so-called Artificial Life. These artists attempt to rebuild life from scratch, by re-examining and twisting the very basic processes, informed by scientific research, underlying living organisms. This results in a kind of synthetic biology that can be used to create various artworks mutuating evolutionary rules from nature. Examples of creations inspired by the above paradigm are the image generators based on evolutionary computations by Scott Draves or the interactive sound hardware developed by Simon Penny.

The second, and perhaps more important, value is to contribute to the understanding of the future we run into, for which there is an urgent need to prepare ourselves. The challenges ahead will require decision orders of magnitude harder than those taken so far, and to be made on much shorter timescales, given the exponential acceleration of technological development led by super-intelligent machines. Providing us with a glimpse of this future and triggering a broad and comprehensive discussion on ways to tackle it is the biggest challenge facing contemporary art. This challenge holds the promise of finally reunite art with her twin sister, science.