Special Contribution

Invisible Halo

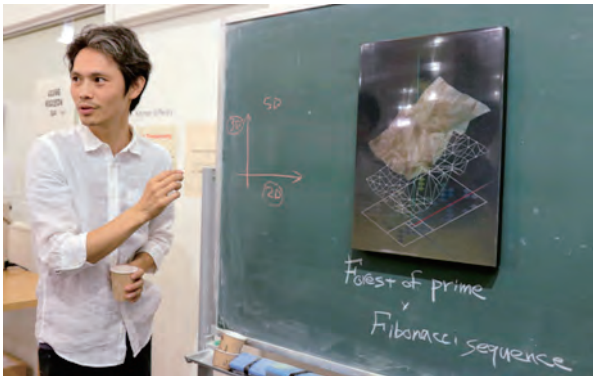
Yasuo Nomura

A workshop was held based on a theme: "To output images of landscapes in the minds of researchers." By means of an artistic approach, we tried to visualize mathematical expressions familiar to researchers, in order to conceptualize them through the writing out of keywords such as colors, shapes, temperatures, flavors, style of research, the periods of time during which researchers were able to concentrate. The picture represents the author's conceptualization of the zeta function.

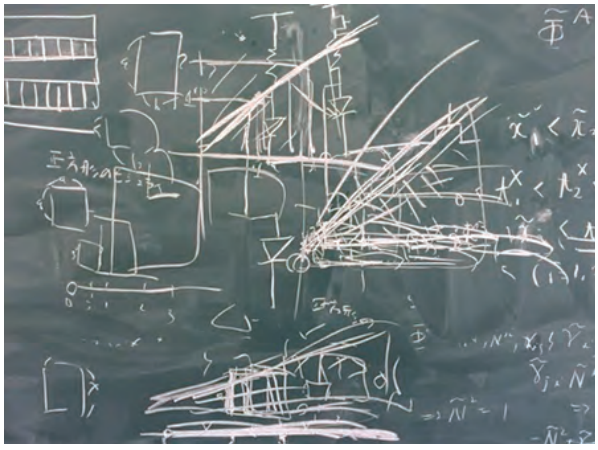
For four weeks from August 17th to September 11th, I stayed at the Kavli IPMU as a visitor in the artist-in-residence program. There, I created a piece of art at the corner of an office allocated to me. Though somewhat different than what usually appears in this journal, I would like to write something which serves as a memorandum record of knowledge acquired by one artist (myself) through interactions with researchers at the forefront of science. I may have incorporated my own misguided interpretations of scientific theories here and there; however, I would like to ask that you please overlook such instances as they constitute part the essence of artistic creativity within the context of this discussion.

Halos are a very special meteorological phenomenon for me. On a winter night more than 10 years ago, I observed by chance, a scene wherein the moon was shining in the night sky and surrounded by a clear threefold rainbow. The indescribable feeling of wonder I had at that time gave me a strong sense of curiosity with respect to the many unknowns of the world. A few years later, I came by chance to know that such a phenomenon is referred to as a halo. Since then, whenever I stood at an important crossroad, I would look up at the night sky and would find myself looking right at a halo. For me, halos became something of a valuable fortune teller for my own life.

My visit to the Kavli IPMU might very well have been guided by such a halo. One of the research groups I came to know here was working in pursuit of halos comprised of space's mysterious and hugely abundant dark matter. These kinds of halos are different from phenomena of rainbows that I had observed previously. I heard, however, that their pursuit is an attempt to answer questions on the effects of dark matter (which is still invisible entity to mankind at present), on the surrounding space through the analysis of gravitational lensing and other phenomena. Surrounding our home, the Milky Way galaxy, there is a spherical region wherein almost all the matter contained is considered to be dark matter. In astronomy, this region is referred to as the galactic halo. I felt a strong sense of synchronicity towards this phenomenon. During my creative activities, synchronicity and inspiration are the most important



I gave a presentation of my own paintings at my welcome party. The researchers gathered there took an interest in paintings and models, both created with a motif of prime numbers.

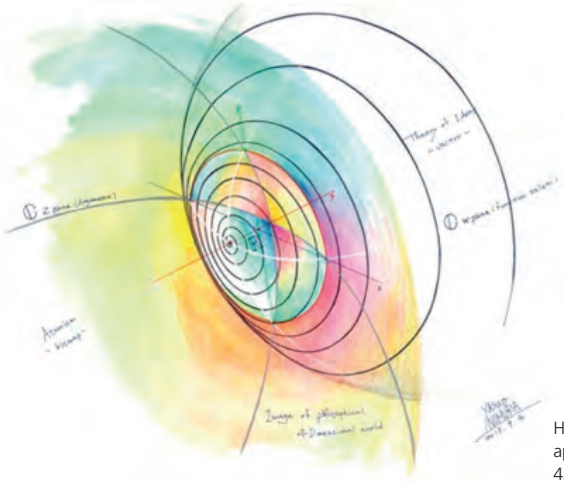


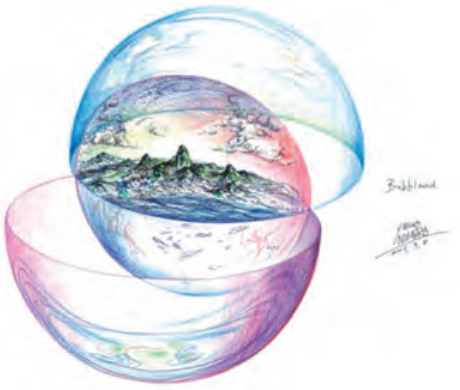
Every day at tea time, I exchanged ideas with researchers using familiar blackboards at the Kavli IPMU.

source of creativity. When I encountered these things, I have repeatedly experienced the opening of a road in front of me leading to the direction I was to go next. When one bravely steps ahead into a frontier, one often experiences unexpected intuition. My stay at the Kavli IPMU was exactly such an occasion.

I am a painter. For this precious occasion, which enabled me to directly come in touch with the forefront of science, I set the following theme: "To verify if it is possible to reproduce higher-dimensional theory into a two-dimensional picture, and, if possible, to find a method and a clue to do so." As you know, painting is a world on a plane surface. Within contemporary art, painting is already considered classical. In a way, it is considered to be an almost dead medium because every possible representation has been exhausted. My own personal view is that the discovery of non-Euclidean geometry (considered to be a great turning point in the dramatic progress of science in the nineteenth and twentieth centuries) might be the remote cause of the death of painting. Techniques consummated by painters that allow for the skillful reproduction of three-dimensional space on a two-dimensional plane, went well with the human sense of sight.

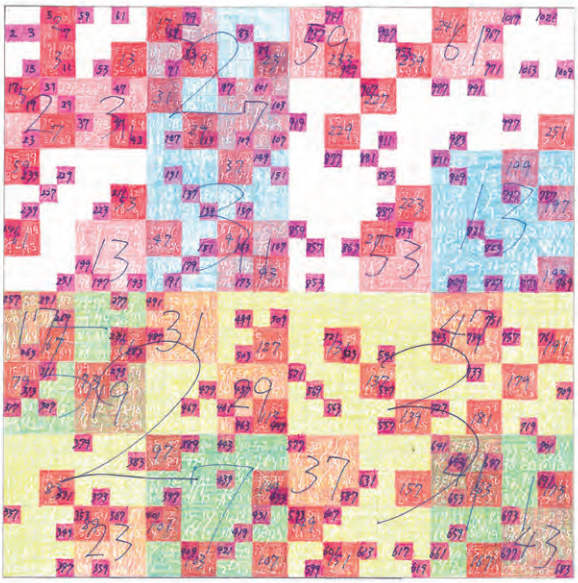
However, in the process of pursuing the more fundamental aspects of nature over that which is visible, a wide range of knowledge has been accumulated in the field of science, which logically introduces higher-dimensional entities that go beyond our immediate human senses. From a certain point, I think bearers of conventional painting, namely, painters including myself, have not been able to keep pace with the accumulation of concepts that have been becoming more and more abstract. I cannot help think that the present situation of contemporary art (which is concentrated on the capitalism-based art of marketing) shows that those who have dropped out from the sphere of accumulation of human knowledge are aiming to prolong the life of art based on their own insider logic. I would like to breathe new life into this kind of trend.

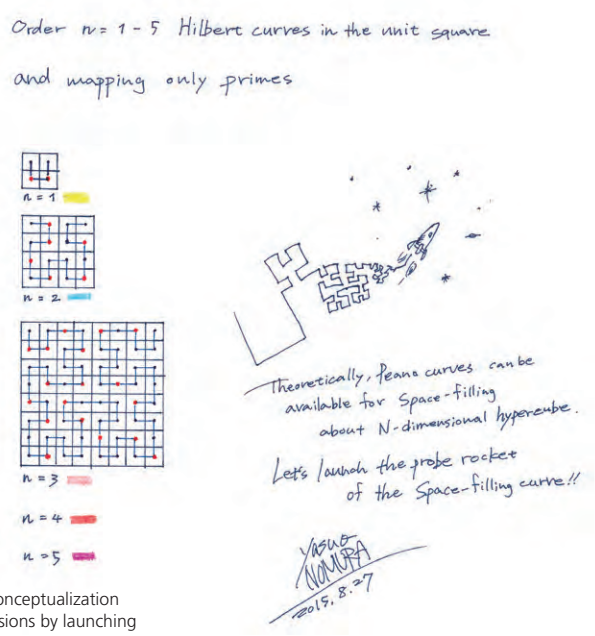




How can we understand the world of complex numbers? These images show the appearance of three-dimensional space using dimension 2 × dimension 2 = dimension 4. Mathematicians have requested a logical "brush up" of these conceptualizations. This constitutes an issue to be addressed going forward.

Mission to primes

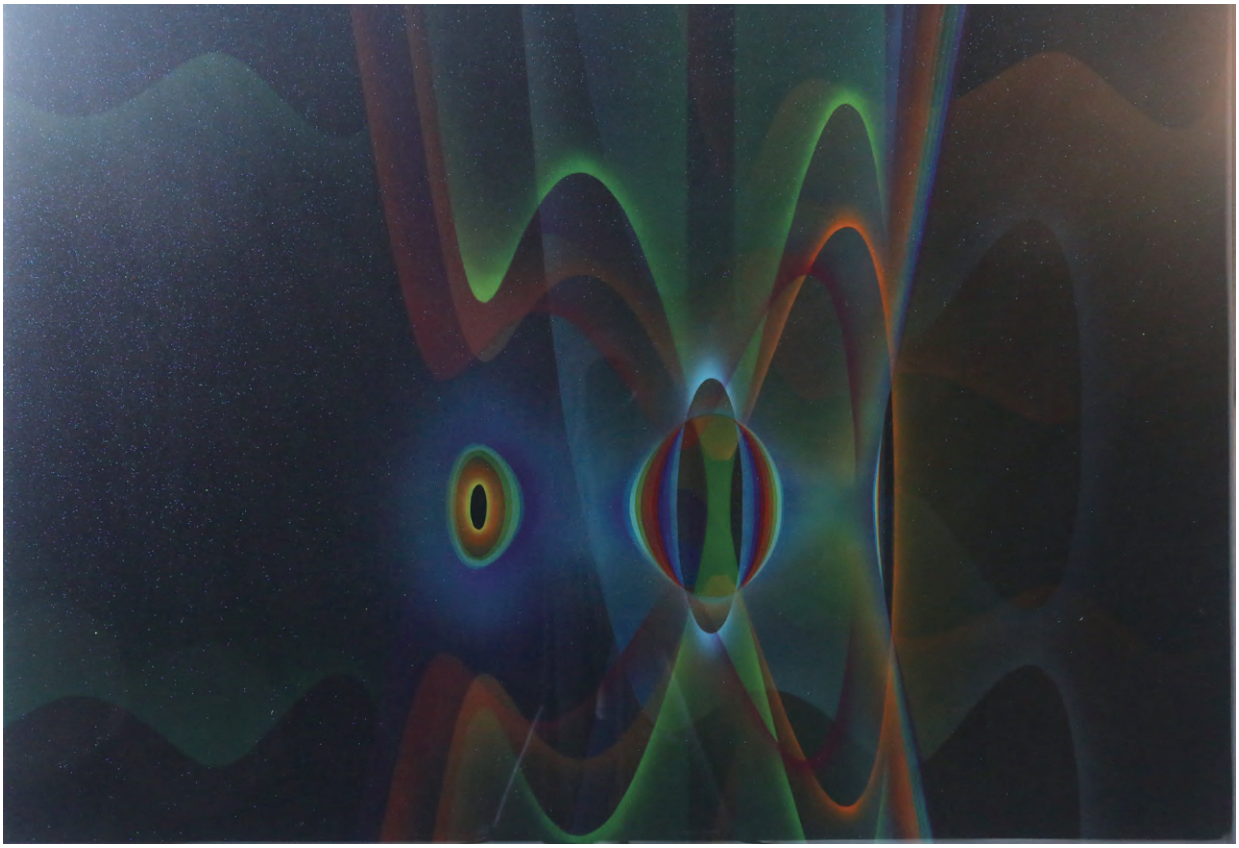




Toward unraveling the mystery of the distribution of prime numbers: an artist's conceptualization of a project of trying to find regularity in the direction of unknown higher dimensions by launching a rocket flying along the trajectory of a Peano curve (which can fill a higher-dimensional space), with plotted positions of prime numbers along its trajectory.

Needless to say, theories at the forefront of modern science are highly abstract, and all deal with the invisible. At first, air, magnetic forces, and gravitational forces, among other things, were also "invisible" to us. I think it is thanks to the approach of visualizing what is invisible ("visualize" in this case meaning to "understand the nature of"), and the act of grasping concepts, that science has accumulated knowledge such as the world of elementary particles (which are dictated by quantum mechanics), the world of super strings (which unify everything), neutrinos (which pass through the Kamiokande), dark matter (the main component of matter in the Universe), as well as other theories and concepts. Since the discovery of non-Euclidean geometry, abstraction by means of mathematical expressions has shown that we can think over the concept of "dimensions", which is something that lies beyond our senses.

I want to learn this process, and in this way I want to think over the essence of painting once again based on present-day human knowledge. If we want to capture the "beauty" of nature by looking



Invisible Halo #h / 2015 / 728x515mm / acrylic, silicone and glitter on panel

at its fundamental laws, we have to visualize what is invisible after we painters have grasped these concepts of higher-dimensional physical laws that modern science presents.

I think that Galileo's famous phrase "the Universe is written in the language of mathematics" may be interpreted as "only mathematical descriptions make it possible to visualize what is invisible." This time, I wanted to hear by all possible means how most researchers conceptualize these higher-dimensional theories. In fact, I found that many researchers do understand and "feel" invisible objects by means of the language of mathematics, which they use as a means for mutual communication. Higher dimensions are invisible to researchers just as they are invisible to us painters, though they deal with them every day. What is peculiar about researchers is that they do have a means to "see" what is invisible without resorting to using their visual senses. This I think is truly astonishing. It is probably the most creative and most beautiful point that mankind has ever reached with respect to the accumulation of concepts. How can we capture the invisible halo? Mankind may not be able to directly look at the fundamental "beauty" that lies within nature through all eternity, but it may be possible to capture the perceptive effects it creates within the encompassing environment. I came to believe firmly that for this purpose, we artists must train in order to acquire the language of mathematics. That is the only way.

I would like to thank Kavli IPMU Director Murayama who showed a generous understanding of this artist-in-residence program, Administrative Director Haruyama, researchers who openheartedly responded to my daily ideas, the administrative staff, and, in particular, a member of the Kavli IPMU Public Relations group, Aya Tsuboi, who enthusiastically coordinated and worked hard to make this program a reality. I sincerely hope that interactions between the arts and sciences will further develop hereon.