

Introductory remarks

Screening of the video *CHAOS*

Culture, Education and Science, Consulate General of France in Hong Kong and Macau

Thank you, Ms. Julie Metta, for the kind introduction.

You do not come to listen to my speech, particularly not to listen to an old professor who is over seventy and who knows not much more about chaos theory than you because he is not working in this area. You come to watch the video, and so do I. But in addition to that I was persuaded by Julie to come to popularize mathematics.

Paul Halmos, a mathematician, once said, “It saddens me that educated people don’t even know that my subject exists.” I feel as sad as he, so I come to at least let people know that a mathematician exists!

Allen Hammond, editor of *Science*, once described mathematics as “the invisible culture”. I hope that, after watching this video, you will agree that mathematics is visible!

In ancient China the third-century mathematician LIU Hui (劉徽) said, “[九數...]至於以法相傳，亦猶規矩度量可得而共，非特難為也。當今好之者寡，故世雖多通才達學，而未必能綜於此耳。(The subject [mathematics] is not particularly difficult by using methods transmitted from generation to generation, like the compasses [*gui*] and gnomon [*ju*] in measurement, which are comprehensible to most people. However, nowadays enthusiasts for mathematics are few, and many scholars, much erudite as they are, are not necessarily cognizant of the subject.)”

Why is it like that? Here is a passage taken from a book: “Central to my argument is the idea that ***** distinguished by a self-conscious attention to its own ***** language. Its claim to function *as art* derives from its peculiar concern with its own materials and their formal patterning, aside

from any considerations about its audience or its social use.” Can you guess what the missing words are?

This passage is taken from the book by Julian Johnson, *Who Needs Classical Music? Cultural Choice and Musical Value* (2002). The missing words are “classical music” and “musical”. However, the passage would ring equally true if “classical music” is replaced by “mathematics”!

In the same book the author says, “... that it relates to the immediacy of everyday life but not immediately. That is to say, it takes aspects of our immediate experience and reworks them, reflecting them back in altered form. In this way, it creates for itself a distance from the everyday while preserving a relation to it.” Mathematics is also like that. This explains why it is not easy to bring mathematics to the general public.

Now let me come to the video.

Albert Einstein and Leopold Infeld maintained: “In the whole history of science from Greek philosophy to modern physics there have been constant attempts to reduce the apparent complexity of natural phenomena to some simple, fundamental ideas and relations. This is the underlying principle of all natural philosophy. ”

In the history of science, Isaac Newton brought order into our universe by introducing such simple principles and applying mathematics to them. The English poet Alexander Pope praised Newton’s contribution in these lines: “Nature and Nature's laws lay hid in night: God said, Let Newton be! And all was light.”

This immense success in describing the world around us led some to believe that with sufficient prior knowledge the rest would be determined. The French mathematician Pierre-Simon Laplace put it this way: “An intelligence which, at a given moment, would know all the forces by which Nature is animated and the position of every object in the universe if indeed it was powerful enough to submit these data to analysis, would embrace in a single formula the movements of the greatest bodies of the

universe and those of the lightest atom; nothing would be uncertain for it, and the future as the past, would appear before its eyes.” This philosophy is known as determinism.

However, as the Chinese saying goes, “天有不測風雲，人有旦夕禍福。” (The weather is unpredictable with a storm arising on a clear day, just as blessing and calamity may happen any time unexpectedly.)” Does this go against the blind optimism of determinism?

This brings us to chaos theory. In 1972 the mathematician/meteorologist Edward Lorenz gave a lecture with the attractive title “Predictability; does the flap of a butterfly’s wings in Brazil set off a tornado in Texas?” This is the source of the famous notion of “the Butterfly Effect”. Unfortunately, as is too often the case in popularization of mathematics, only half of the message had been gotten across to the general public. In a lecture of 2012 the French mathematician Étienne Ghys asks, if chaos theory only claimed that the future is unpredictable, would it deserve the name "theory"? He made this video to explain further.

Let me close with a small example by just folding a piece of paper in half repeatedly and observe the pattern of in-out creases. It will lead to complicated and beautiful patterns, the dragon curve fractal [demonstration followed]. The moral is: simple things to begin with can become rather complicated as time goes on!

Friends, enjoy the video *CHAOS* produced by Étienne Ghys, Jos Leys and Aurélien Alvarez.

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