

Wondering about science.

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Over

In one sense the purpose of science is to do away with wonders. It is a discourse which explains things. In the sense here considered "wonder" is a thing as yet unexplained by science. This is the sense in which science is said to "enlighten" us: it permits us to progressively understand and master things, instead of being awed by them. As science progresses, the world around us (and we ourselves) becomes less and less wonderful, and more and more wonder-empty. However science cannot hope to explain everything, and it must content itself with pushing wonders ever farther into the background.

This is why in an other (and more interesting) sense our feeling of wonder deepens as science progresses. It follows the wonders as they recede into ever deeper abyss. As the world (and ourselves) grows almost wonder-empty, we grow ever more bewildered. We ask questions like: "why is there anything at all, instead of there being nothing?" The less wonderful the world becomes, the more we wonder why it is there (and even if indeed it is there), and the less wonderful we become ourselves, the more we wonder how it is that we wonder.

Before entering this labyrinth (as is the intention of this essay), a word of caution. It has to do with the word "wonder". It is doubly ambiguous. On the one hand it means an emotion, on the other the cause of that emotion. And if it means an emotion, it means an ambiguous one: either "to wonder at", or "to wonder if". Ambiguous terms are rich in meaning, which is not good for a rational, clear and distinct discourse. Fortunately, there are Latin equivalents for the typically Germanic word "wonder" in English. Namely "miracle" and "marvel". They stem from the verb "mirari" which we know from other English words like "mirror" and "admiration". (By the way: the fact that English often disposes of Germanic and Latin equivalents renders it such a subtle language.) Of course: "miracle" and "marvel" are themselves not very clear and distinct concepts. Still: they may be helpful in what is to follow.

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Aristotle held that philosophy (and thus science) is due to admiration, "propter admirationem enim". People who do not admire anything ("blasé" people) will not produce a science. But this is not all that Aristotle meant by "admiration". He meant that people who accept wonders to be wonders will not produce a science either. In fact: he does not make any difference between those two types of people. Because both are not really surprised if something unexpected happens. Philosophy (and thus science) is made by those who do not expect miracles to happen, but who do not fall on their knees if they do happen.

"Admiration" is a very strong word. It means that fleeting moment during which we face something we had not expected. Modern tradition stresses the element of doubt within that moment. And indeed: doubt is a strong experience, it may have us question our very foundations. Russell says that if he saw a horse's head appearing at a street corner, and if that head were followed by a cow's body, this would shake his belief in science. But doubt is not the sole element of admiration. It

is not the sole source of philosophy and science. The other element is awe, and it leaves us speechless. This may be the reason why Modern tradition keeps silent about it. It admits that philosophy and science are doubtful, but not that they are also awful. The Ancients were more conscient of this double character of admiration than were the Moderns. But now we (the "Post-moderns") are re-learning the lesson. As science advances, and as it does away with one wonder after the other, it shows again how doubtful and awful it is. We had forgotten how terribly strong the word "admiration" is, but now we are re-discovering what Aristotle meant by that term.

Still: we can no longer share Aristotle's experience of admiration. The reason is that we no longer have his sense of what is unexpected. "Wonder" has a different meaning for us. In fact: one may imagine somebody to write a history of Western civilisation which would have the shifts of the meaning of "wonder" as a guide-line. This is (more or less) how such a history would look like:

At its first stage (the pre- and proto-historical one), the world and man within it were being experienced, understood and evaluated as obeying to a circular order: day was followed by night and night by day, summer by winter and winter by summer, life by death and death by rebirth. However, that circular order was open to external intervention: all of a sudden the sun might stand still, rains and floods might interrupt the circle of the seasons, or somebody might die and might be resurrected. Those sudden and unexpected interruptions of the established order were "wonders". And although they were relatively rare and unexpected, they had their place in the world and in life within the world. Wonders were how what is external (transcendent) to the world manifested itself within the world: wonders were "hierophaniai". Therefore they were not to be doubted ("admired" in the Aristotelian sense), but had to be deciphered: they were messages from the transcendent. The world was wonderful, miraculous, marvellous, because it was open to external interventions which gave meaning to life within it.

Then, Aristotelian-type admiration stepped in. When faced with those unexpected events, people on the Ionian coast were struck with awe and doubt, which prevented them from deciphering those wonders. Instead, they began to ask questions about them, to wonder about them. Philosophy and science were born. The result was that the world and human life therein began to be understood differently. There was still the circular order, but now that order was understood to be itself external to the world, (underlying the world). It was a "mathesis universalis". What we perceive are only appearances of the fundamental order. There are unexpected appearances (like the sun standing still), but they are merely apparent. They are no wonders, because in "reality" the circles are unperturbed by them. If we "admire" those unusual appearance we can explain them (reduce them to the fundamental order). But that order itself is a "wonder". Take the motion of the heavenly bodies as an example: some of them move erratically (the planets), but we can "save these appearances" by drawing circles upon circles. The world was wonderful, miraculous, marvellous, not because of what appeared to happen there, but because those appearances

could be "saved" (explained) by having recourse to the underlying, harmonious circular order. Thus, wonders were pushed back from the appearance into the underlying world, they became "deeper".

In Northern Italy during the 15th century some people were struck with admiration (doubt and awe) when facing the unexpected capacity of ours to "save appearances" by drawing circles. They began to feel that what is wonderful, miraculous, marvelous is not the underlying order itself, but the fact that we may apply it. They began to "admire" the underlying order, ask questions about it, wonder about it. Modern science was born. The result was a new understanding of the world and of human life within it. First, it was found that appearances may be "saved" by having recourse to various orders: one may explain the motion of the sun by using the Kopernican or the Ptolomaic system, the difference being one of convenience. But later, a much more marvellous thing was found: namely that underlying orders may be used not only to "save appearances" (explain them), but also to manipulate appearances (to produce unexpected appearances, "wonders" in the original sense of that term). For instance: one may use algorithms which express the order which is followed by electrons, and produce television sets with it. There is nothing wonderful about those algorithms, and nothing wonderful about television sets, because it is ourselves who make them, but the fact that the algorithms result in television sets is a miracle which defies explanation. Thus it is not the theories which underlie Industrial revolution, nor the products of Industrial revolution which are "wonders", but it is the fact that we can change appearances by applying theories which is a miracle, a wonder. The world is no longer wonderful, but Man is. It is he who produces the unexpected. This radical humanism transfers all the wonders from outside into our innermost, and thus, renders them even "deeper".

We are entering a new stage in this shift of the meaning of "wonder". We begin to face with doubt and awe the unexpected thing that we ourselves are. We begin to ask questions about ourselves, to wonder about what is so marvellous about us. The results of this shift are not yet in, but they are approaching. They are assuming the shape of "projections". As we look into our innermost to discover the miracle that we are, (as we begin to analyse ourselves), we find that there is nothing there that could not be projected into the outside. We find no hard nucleus there, no "self", no "I", no "identity", but only a swarm of virtualities which may be transferred to things like artificial intelligences, decision machines or creative computers, and which will "work" there at least as efficiently as they do within what we are used to call "ourselves". The wholly unexpected thing we are facing now is not the fact that we are not very admirable: we knew that all along, and the recent past has proved it. The wholly unexpected thing is the fact that we are nothing but bundles of virtualities which knot and un-knot, and which float within overlapping networks. This is an intolerable situation: the world has become wonder-empty, and so have we ourselves, and the profound wonder is now the fact that this is so.

Now if you read the outline of Western history as here proposed, you will have no doubt several objections. And the most important is as follows: even if one accepted the four stages here proposed, they do not constitute a series, but

they overlap with each other. Even now, at this late stage, we would all fall on our knees if the sun were to stand still all of a sudden. Of course: immediately afterwards astronomical, optical, psychological or cultural explanations would offer themselves to prove that this is no wonder but something which should have been expected. Still: if we speak of "wonder", we cannot help but include such experiences. Or, to give another example: even now, at this late stage, we cannot help but admire the wonderful equilibrium which orders life on Earth (each species in its own ecological niche, and each organism equipped with appropriate organs), although we "know" perfectly well that that equilibrium is far from perfect, and that in any case it is the result of blind chance and could just as well have been quite different. In other words: even now, at this late stage, the pre-historical and the Aristotelian meanings of "wonder" are still with us.

This is a valid objection. And it will constitute the basis for the argument that follows. The argument will run this way: as the world and ourselves become wonder-empty, and as wonder is being transferred to this wonder-emptiness itself, it becomes possible to create wonders in the ancient meanings of that term. It becomes possible to create events which are even more wonderful than is the sun standing still, and harmonies that are even more wonderful than is the ecological order, and algorithms which will result in products which are even more wonderful than are those of Industrial revolution. In fact: once we discover that there is nothing wonderful about the world and ourselves, we can project every type of wonder into the void outside and inside. Because we shall have then discovered that this is what science is about: not to explain wonders (there are none to be explained), but to project wonders. Still: there is this question (and it is the source of endless wonder): wonders to what purpose?

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At the present stage of scientific progress this^{is} how (more or less) we understand the world and ourselves within it: a dust composed of particles expands as a consequence of an initial explosion, and while doing so tends toward an ever more even distribution. The cloud of particles is thinly spread (full of intervals) and as it expands it grows thinner. However, clusters of particles may accidentally form, in opposition to the general tendency toward an ever thinner distribution. We may call the particles "energy", and the clusters "matter". But if we do so, we must keep in mind that those are terms relative to each other: "matter" is closely packed energy, and "energy" loosely distributed matter. As the particles spread (and accidentally cluster), they follow specific patterns. We may call those patterns "fields", and then say that "matter" is a "curb within a field", a bundle. We may distinguish between several "fields", but will have to admit that those fields overlap and mingle. We ourselves are such clusters where several field overlap, mingle and bundle.

We can imagine such a world vision by feeding the algorithms which are responsible for it (Einstein's equation and so forth) into a computer. Wire nets will appear on the computer screen, those wire nets will be seen to interfere with each other and to form bag-like protuberances. One such protuberance may be iden-

tified with the planet Earth, another (more complex one) with the biomass that covers the planet, and yet another (even more complex one) with ourselves. If we animate the image we may watch how the protuberances form, grow more complex, and then ever more shallow, until they disappear and merge back into the wire net. The spectacle will end when all the protuberances have disappeared and the net stretches without any form evenly into every direction. This final stage may be called "thermic death"

Now as we watch this computer-generated film, having in mind the subject of this essay (which is "wonder"), we are struck by the following curious idea: everything we are used to call "matter" is a wonder. It is due to an accidental collision of particles, and is therefore unexpected. And the more complex a matter is, the more it is wonderful, because it is due to more improbable collisions. Thus a hydrogen atom (which is an accidental collision of only two particles) is less wonderful than is a complex chain of molecules, and this is less wonderful than is our nervous system. This idea is curious for two reasons: (1) the term "wonder" can now be quantified, and (2) we can produce wonders at will (and to any degree) by computing particle collisions (this is called, on the level of nuclear physics, a "fusion"). But of course this curious idea (which is not so curious after all, because it is beginning to work) begs an even more curious question: if "we" is an ephemeral protuberance of overlapping wire nets, how can it project ever more complex protuberances?

There are many answers to this curious question, but one may select one answer which agrees with the computer generated film: by a highly improbable (but statistically calculable) series of coincidences "we" is a protuberance wherein ever more complex (even less probable) protuberances may be projected. To put this in more traditional terms: "Man" is a highly improbable product of chance which is accidentally capable of intentionally producing improbable situations. Or: in "man" accident turns around and becomes intention. This answer has the advantage over many others that it is in no need of spurious terms like "mind" or "spirit".

Let us face it with courage: science has now reached a stage which permits the deliberate production of any degree of wonder by particle computation. On the lowest wonder level it can have particles collide and thus produce "plasm" which is a link between energy and matter. On a somewhat higher wonder level it can produce "artificial" chemical elements. And those levels can be multiplied at will: science can produce "artificial" molecules, "artificial" polymeres, "artificial" living organisms, "artificial" intelligences, "artificial" humans, "artificial" clusters of such levels as nature has not reached so far. And it can jump levels: for instance it can compute particles to cluster in such a way that they form "artificial" human bodies (perfected holograms) and equip those bodies with "artificial" intelligences. To put it differently: there is no imaginable limit to the wonders science can now produce, if we agree that "wonder" is an improbable particle cluster.

This is so absurd that it is difficult to swallow. What it says is this: The world and ourselves are "wonders" in the sense that they are improbable products of blind chance, and now that we know this we can increase the rate of wonder production by deliberately computing the chances. The whole thing is absurd, and be it an-

ly for the following reason: all the wonders, be they the result of blind chance or of human deliberation, are condemned by the Second Principle of Thermodynamics to be re-absorbed by the general tendency toward ever more uniform (probable) distribution. All the protuberances, be they as simple as is the hydrogen atom or as complex as human artifacts (culture) must in the end disappear within the wire net without leaving any traces. So why should we deliberately accelerate this absurd process by producing artificial wonders?

One answer to this question is: because there is nothing else for us to do. Once we have discovered that there is nothing wonderful about the world and about ourselves, that it is all a blind game of chance which will exhaust itself automatically, what else can we do but play it a little bit more intelligently? To produce a little bit more intelligently conceived atoms, and molecules, and living organisms and intelligences, a little bit more intelligently conceived wonders? This is the answer scientists and technicians (including artists) are giving (if indeed they are conscient of what they are doing). But there is another type of answer, and the remainder of this essay will try to give it.

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Our sense of wonder has progressively deepened, as it changed from submission to admiration. We have now reached the bottom. It was philosophy and science which reduced us to this position: they are doubtful and awful. From where we stand now, we can submit to nothing and admire nothing. But as we stand there, incapable of submitting to wonders and of admiring them, a new sense of wonder takes hold of us: the unexpected, improbable, totally "unfutable" character of our situation. Here we are, no longer capable of submitting to wonders and of admiring them, but perfectly capable of producing them, and of programming their production. In fact: is this not the position of the "transcendent" with regard to the wonderful world, before philosophy and science had us doubt it? The new sense of wonder which is taking hold of us is this: we have become like God, just as capable of doing wonders, and just as devoid of purpose. Of course: one may put this less dramatically: when faced with unexpected events we projected God outside the world, and, step by step, we have recovered our projection. And now, having re-integrated God, we have nothing to cling to. But this will not diminish our sense of wonder.

The answer to this can only be: let us try to assume this position. Let us make wonders (one after the other) in the face of the absurdity that we are and that surrounds us. Let us answer the absurd by a double absurd. This is not a very new answer: all the religions give it. Religious rituals are absurd gestures in the face of the absurdity of the world and of life within it. If future scientific progress with its accelerated production of ever new wonders were understood to be a ritual gesture, then it may be said that science (and technology) are becoming the religious articulations which are adequate to this deep sense of wonder which pervades us.