Art, science and democracy

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I would like to begin with some reflections on the relationship between science and art. For me personally, the encounter with the arts has been an essential catalyst which forced me to think about what science is and how it is related to both art and politics.

Visual artists and scientists are both followers of ancient disciplines that human beings have been pursing for as long as we have been human. In the caves whose walls are adorned with the paintings of ancient hunters there have been found bones and rocks inscribed with patterns that show that people were counting something in groups of 14, 28 or 29. Alexander Marschack of the American Museum of Natural History has interpreted these as observations of the phases of the moon. It is interesting that he somehow didn't notice that they might also be records of an early method of contraception. In either case, they show that twenty thousand years ago human beings were using mathematics to organize and conceptualize their experience of nature.

The practices of visual art and science have most likely changed little over the millennia, even as their social contexts have altered beyond recognition. In the practice of each we see that craft and imagination, tradition and novelty, pleasure and rigor are not opposed but allied, as indeed they must be if they are to be used to attain the discovery of new insights. For this reason both visual art and science continually expand our understanding of what we human beings are capable of. We are creatures who love surprise and novelty and there is no activity, not even fashion or pop music, that better feeds our desire for the unexpected more than either art or science.

And we visual artists and scientists do easily understand each other. We feel an affinity because we are all craftspeople who work with our hands. What we do is labor intensive, difficult and easily prone to failure. No one knows better than us the extent to which nature is recalcitrant to our attempts at representation, how poorly enabled we are to take up these efforts and how easy it is to slip away from the search for the genuinely novel and significant and produce instead a hackneyed or modish response. No one understands better than us how many of our ideas turn out to be wrong or uninteresting and how much tedious repetition is involved in creating something that has never been made before. Many artists have book shelves full of science and many scientists have walls full of paintings. I've never heard either an artist or a scientist complain about the two cultures problem; for us there is no problem and no communications gap.

The idea that there is a problem with the relationship between art and science was invented, so far as I've been able to tell, by humanists who sometimes seem to have equal difficulty understanding what either artists or scientists do. In my

experience, I've found that there is a two cultures gap, but it is not where C.P. Snow thought it was. The gap I see has scientists and artists on one side, along with engineers, architects, musicians and legal theorists, and humanists on the other. The gap seems to separate those who work with texts from those who work with materials, whether those materials are clay or geometry, metal or algebra. On the one side are those who, like artists and scientists, work with their hands to make things out of materials that are found in nature. On the other side are the humanists who work, not with their whole hands, but only with the tips of their fingers. Of course what the humanists do is certainly worth doing; the history of human culture has produced a proliferation of texts that need and deserve study. The appropriate methods to approach texts are based on interpretation and criticism rather than invention and craft. However, these methods are insufficient to understand what artists and scientists do because they can only be applied to texts, and one thing that visual artists and scientists have in common is that they do not work with texts.

But even if there is no communications gap between science and the visual arts, this does not mean that they are the same thing. As the Brazilian-American sculptor Saint Clair Cemin has said in an interview with the photographer Vic Muniz, "Both strive for universal knowledge, but not of the same kind...In science one works to extract universals from the particular. In art, at least the type of art that I do, we begin from particulars and we go to even more particulars. In this process universal knowledge is extracted from a process (art) that is already pure knowledge to begin with."

Only an intellectual milieu that has convinced itself that there is no such thing as beauty or truth could be confused about the difference between art and science. Not only because art is sometimes about the creation of beauty while science is about the creation of truth, but also because both beauty and truth figure in the methods of art and science. A scientist without a sense of beauty is no more likely to discover something of value than is an artist ignorant of the technology of his or her medium. Yet still a scientific theory or a mathematical theorem can be wrong in the way that a painting cannot be. Both a theory and a painting can fail, but when they do the lessons that are to be learnt are very different. There is simply no getting around the fact that an artist has a freedom that a mathematician does not. On the other side, ownership of a painting can be an expression of wealth, but a painting, or even a whole new style of painting, cannot create wealth in the sense that a scientific discovery can.

But beyond their different ways of contributing to wealth and progress, artists and scientists both contribute to society as communities that keep alive values that are central to our democractic civilization. We see this, for example, in the myth of Galileo, which identifies science with the stance of the rebel, who ignores the teaching of authority and sees for himself what the truth is. This myth was popularized in the twentieth century by Bertold Brecht, for whom Galileo may have served as a vehicle for making sense of his own tangle of rebellions and commitments.

But in our period in which, as Brian Eno says, the most valuable currency is attention, the stance of the rebel is easy. The currency of attention does not distinguish between art and advertising or argument and propaganda. As a result we live in a world in which the stance of the rebel is adopted as easily by those who seek to deny rights to others as it is by those who are protecting their own freedoms. The natural result is that criticism is often reduced to irony and irony is itself degraded to the point it can be invoked merely by the reproduction of familiar images. But the trajectory of postmodernism tells us that irony and even protest are not enough: Damien Hirst may claim he is a brand, but indeed is the White Cube Gallery anything but a boutique for expensive collectibles? No, at this time when we have no lack of well educated and well off rebels, when Marxism is so deservedly repudiated it is hard to even imagine the conviction of our grandparents, and no one seems to mind very much that in some parts of the United States a fair proportion of the vote hasn't been counted for years, some new thinking is needed. In this situation the interesting question is not what we should be against, but what should we be for?

Many years ago I read the following in a book review: "Science is that human activity in which we aim to show towards nature that respect that in a democracy we endeavor to show towards each other." I must confess that I have never been able to find its source, but I have been thinking a lot about this quote recently. I hope I may be excused for using it unattributed. The stance of respect seems to me the necessary companion to the stance of the rebel, for respect signifies that we live out our lives inside an intricately structured and enormously complicated world, containing among myriads of other living creatures, many individuals like ourselves. For us human beings, the world we find ourselves in is comprised of nature, imagination and society. Science, art and politics are the ancient crafts by which we seek to understand and define our situation in these worlds. The stance of the rebel comes from the discovery that there is much in these worlds which is unacceptable. The stance of respect arises from another discovery, that to change the world requires that we acknowledge that each of our lives is but a brief moment in the vastly complicated networks of relationships that comprise our shared worlds.

Respect for each other is necessary because none of us, even the most powerful, can make any part of our human world better, for any but the briefest span of time, without gaining the agreement of those others who are effected by the changes we seek. And over the long run, this agreement must be freely given. It may be won by argument, it may be the result of negotiations between people or groups with competing or conflicting goals, but it cannot be coerced.

Respect for nature is necessary because however beautiful we may find the constructions of our imagination, if they are meant to be representations of the natural world we must take those constructions humbly to nature and seek its consent. We do this by observation and experiment. It is this act of giving primacy to nature over our imaginations that empowered Galileo's rebellion from human authority And those who define their relationship to nature in this way form a community bound together by this ethic of respect. For there is no scientific method. As Feyerabend and Einstein both tell us, scientists are

opportunists who will use any method that helps them answer the questions they ask. Science works because generations of such opportunists have learned that they will not get very far unless they adopt a shared ethics. This ethics requires each to report honestly the results of their observations and reasoning at the same time that they are required to work as hard as they can to formulate and advocate their own ideas. It requires us each to act freely, but never to forget that those who will come after us, and neither ourselves nor our colleagues, will be the ultimate judges of the worth of our efforts. This ethic demands respect for each other, as in a democracy, and respect for nature. What makes it work is that the stance of respect empowers each individual who follows it, by giving them the ethical basis needed to adopt the stance of the rebel, while at the same time requiring them to take seriously the others in their community.

I am not a painter or a sculptor, so I hesitate to speak too loudly about a craft I have never tried to practice. I can only imagine what it is like to seek every day to discover form out of marble and plaster. I do have some experience in the craft of finding form in mathematics, and perhaps this can serve as an analogy of sorts. In each case we have our tools and our materials. In the case of mathematics the materials are nothing but the logic of systems of relationships defined by some simple postulates or assumptions. We work, as artists must, with hope, for we never can be completely sure we will find what we seek. We are often not even completely sure that the system of relations we are studying is consistent. As a consequence we work every day with the knowledge that we fall easily into error, that any step in an argument or a calculation could contain a fault. The tools we use consist of methods that long experience has shown are reliable for detecting error in our own work. These tools allow us to find and work at an edge where the most dizzying flights of imagination coexist with the most careful logical arguments.

So what we mathematicians and physicists do is perhaps like sculpture in that we learn to work at an edge where we are balanced between our imaginations and our materials, using tools passed down from a long tradition of discovery and practice. We work hard to be at that edge, because when we are there we learn, both from our materials and our imaginations. And when the surprises come equally from each side, from ourselves and what happens in front of us when we apply our tools to our materials, and when we can no longer tell the difference, this is when we are about to do something really wonderful.

It is also at these moments that we understand the reason our traditions teach respect for nature, for our materials and our tools. For we see that a byproduct is respect for ourselves, and for what is produced by our own imaginations. And, this, in turn, leads to a greater appreciation and respect for others with the same capability, which is to say for all other human beings.

So I would like to claim that this is one thing that art and science are for. Beyond the beauty and use of their products, art and science are important for the training they give each practitioner in an ethics grounded on joining the stance of the rebel with the stance of respect. When one has learned to do this, one can participate meaningfully in a community founded on a shared ethics. In this

community each individual is truly free, but each is bound to the community by the respect we feel for those others who are willing to put everything at risk in every working day, in the knowledge that this is the only way to create something worth preserving. That is, art and science are worth doing because they teach us what is necessary to live in a democracy.