

Artist and Scientist: Recognizing and Resolving their Differences

Ken Stange

Nipissing University

North Bay, Ontario, Canada

Creativity is the defining characteristic of our species, and it is manifested in two domains: the arts and the sciences. It is a strange twist in the history of ideas that these two endeavours that share a common motivation and common goals, but just apply different methodologies, should have become alienated from each other. This conflict is gradually being resolved, but the similarities and differences in creativity in art and in science is still largely misunderstood. This paper focuses on the different evaluative criteria applied to artistic and scientific creative accomplishment and the different methodologies involved in creation, as well as how this relates to the choice of endeavour a creative individual chooses. This includes an examination of the personality traits that incline a person toward one or the other domain. It also touches on the causes and the recent – at least partial – resolution of the infamous “Two Cultures” schism C.P. Snow remarked on over fifty years ago. (This resolution is largely based on the realization that science is handmaiden to the arts and that science has a largely unacknowledged aesthetic component.) Both art and science can benefit greatly by a reasoned examination of how they can help each other to reach new levels of accomplishment – but only if they stop perceiving each other as in opposition. Science and art are just different ways to attempt to apprehend the wondrous, mysterious, perceptual world in which we live.

Introduction

Art and science, these are the two greatest achievements of our species, and they are arguably unique to *homo sapiens*. Humans are special in possessing a drive for a deeper understanding of the world than what is merely pragmatic and necessary for survival. There is no better phrase to describe this desire to probe beneath mere sensible reality than 'creative drive', and there is no better word to describe this probing activity than 'creativity'. So it is a strange twist in the history of ideas that these two endeavours, art and science, which share a common motivation and common goals, but just apply different methodologies, should become alienated from each other. But they have.

C.P. Snow, who was both a scientist and an artist, remarked on this in his controversial 1959 Rede Lecture where he coined the now-common phrase, "The Two Cultures", to describe art and science as virtually warring cultures where the artist was profoundly ignorant of science and the scientist profoundly ignorant of art. Much to Snow's (perhaps naïve) surprise, his remarks alienated both scientists and artists, both of whom understandably didn't like being told they were ignorant of an important part of what makes us humans special.

Nevertheless, C.P. Snow was right. Artists not knowing to what the Second Law of Thermodynamics refers, and scientists not knowing to what Third Person Narrative refers, are both appalling signs of ignorance of some of the basic canons of the other's domain. The artist who naively accepted astrology as science, or the scientist who blithely dismissed poetry as no more than meaningless word salad, were not unusual. And Snow was justified in lamenting this fact.

It is an historical question, which I won't attempt to answer here, where and when the rift first occurred. Da Vinci obviously saw no contradiction in being interested in both science and art, nor did the ancient Greeks who saw mathematics as intimately related to art and music. But at least as far back as the English Romantic poets, there has been frequently expressed hostility between the two camps. For example, Keats certainly was no fan of Newton, accusing him of "unweaving the rainbow."

Snow writes, "The clashing point of two subjects, two disciplines, two cultures...ought to produce creative chances. ... It is bizarre how very little of twentieth-century science has been assimilated into twentieth-century art." (Snow, 1959). But before the end of the twentieth century things *had* changed (Stange, 1998). Many aspects of contemporary science, both its ideas and its technology, *have been* assimilated into, and profoundly influenced, art. The trend has continued; e.g., consider such films as the recent blockbuster, *Avatar*, that expands the cinematic medium through the latest technology and takes as its theme a scientific issue.

However, despite the increased interaction of the scientific and artistic endeavours, there remains a misconception about the nature of scientific creativity. Science is still usually viewed as a less creative endeavour than art, as a questionnaire I recently administered to my Introductory Psychology students confirmed.

One characteristic common to both artists and scientists is playfulness, but that is not a characteristic usually associated with scientists in the general public's mind (Stange, 2010). It seems science is still viewed as a very serious and largely mechanical process, something that may be partially explained by how it is taught, with a strong emphasis on following the rules of rigorous methodology.

Often this misconception is met with the well-intentioned but erroneous claim that the creativity of artists and scientists is identical. However, this is just as naïve and wrong-headed as to only attribute creativity to the arts. While it is true that science and art both share the same goal of apprehending reality, they do have different methods and so attract different personality types. This is part of the theme of my book, *The Secret Agents* (Stange, 2008), which attempts to examine the complex relationship of creativity in the arts and in the sciences.

Some particularly interesting and relevant differences between the arts and the sciences are the evaluative criteria applied to artistic and scientific accomplishment and the different methodologies involved in creation, as well as how this relates to the choice of endeavour a creative individual chooses to pursue.

Evaluating Art And Science

The process of evaluation in the arts is different than in the sciences, but it shares some characteristics. To understand the similarities and differences it is worthwhile to outline the whole creative process, and point to the differences at each stage up to final evaluation of the creative product.

One reasonable outline, based on the metaphor of 'problem solving', is as follows.

1. Formulate the problem
2. Study what is known about the problem
3. Think about the problem
4. Propose solutions to the problem
5. Test various solutions
6. Accept, reject or refine a specific solution
7. Make public the solution for evaluation.

1. Formulate the problem.

In science this means seeing something inexplicable in terms of existing theories, and precisely defining what has to be explained. The scientist uncovers or *discovers* things that are currently a mystery. One common erroneous belief is that because scientists are interesting in solving mysteries they don't *like* mysteries. But in reality, for every mystery they solve, new ones arise, and that is what they love. Scientists love mysteries, just as much as fans of detective novels do. At the beginning of the twentieth century talented science students were discouraged from going into physics, because it was felt all the mysteries of physics had been solved, and all that remained was to tie up a few loose ends. But then Einstein and quantum mechanics arrived on the scene, and physics became *the* hot ticket.

In art this means making up a problem to solve. Artists *invent* their problems, and then sets to solving them. How can I capture on canvas the play of light on that lily pond? How can I complicate an imaginary character's life and make it an interesting story? How can I express the complex emotion I'm feeling in verse or music? Or, more and more often now, how can I use the latest technology to make something totally new that is of aesthetic interest?

In both the secret is a clear formulation of the 'problem'.

2. Study the problem.

In science this means first determining what others have discovered and then gathering more data, if possible. What are the alternative hypotheses that attempted to solve the mystery?

In art this means determining what others have done to deal with similar problems. What techniques have other artists developed that might apply?

In both knowing what is already known is essential. The wheel does not need to be reinvented, nor does polyphony. This is where education is important. In science, one needs to know what has been learned to know what is still a mystery. In art, one needs to know what has been created, to know what yet hasn't been.

3. Think about the problem

In science this means thought experiments and outlining ways of empirically testing possible solutions to the problem.

In art this means initial sketches or first drafts.

In both there is often an incubation period. This is a time when conscious thinking about the problem is suspended, and the subconscious appears to be working on it in the background. Anecdotal evidence abounds that it is useful to shelve a problem, for then when it is taken off the shelf, a 'Eureka' solution seems to magically appear. This is what is usually called *inspiration* in both fields.

4. Propose solutions to the problem

In science this means putting together a research proposal for testing a possible solution: i.e., a hypothesis. In modern science this often requires finding funding dependent on peer review of the worth of the proposal.

In art this means setting to the creative task. In some cases this also requires finding financial support from grants or patrons, even if for no other reason than to buy time to work.

In both there has to be a profound belief in the solution and the motivation to do the necessary work. One universally shared characteristic of successful artists and scientists is a profound commitment to their projects and deep intrinsic motivation.

5. Test various solutions

In science this means putting the predictions resultant upon the proposed hypothesis to an empirical test, be it an experiment or a systematic observational or correlational study.

In art this means completing the creation, be it a book, a musical composition, a painting, or any other work of art.

In both this is where idea is given substance, where the abstract is made real. In both there is often a long, often tedious, period of revision and fine-tuning.

6. Accept, reject or refine a specific solution

In science this means reviewing the results of the empirical test to determine if the results predicted by the hypothesis are confirmed. If not, then the hypothesis is discarded.

In art this means personal evaluation of the product of one's labours and deciding if it is successful. If it isn't, the product is discarded. The canvas is painted over, the manuscript trashed.

In both this is the last evaluative stage before external evaluation and validation.

7. Make public the solution and public evaluation of it

In science this means the solution being first put up for critical peer view for journal publication and then subjected to empirical replication or even, in some cases, initial empirical validation. One example of the latter is Einstein's General Theory of Relativity, which was first subjected to peer view and after being accepted as worthy of consideration was only empirically validated by Rutherford's observations years later, when a solar eclipse made testing of the theory's predictions possible.

In art this means the solution being first put up for peer view by an editor or curator and then subjected to the empirical test of the aesthetic response to it by a wider audience. A good example of this a literary work being accepted for publication and subsequently evaluated by critics and the reading community.

In both cases the initial evaluation is usually by the creator's peers; e.g., the editors of a scientific or literary journal. The difference in the evaluative process occurs at the second crucial stage. With science this secondary evaluation is objective and indisputable. The solution to a problem in science always involves prediction of observable events. If a theory fails here, it is discarded. The power and glory of the scientific method is that it is a self-correcting system. In art, however, audience evaluation is subjective and not as clear-cut and, furthermore, often changes over time. Neither Shakespeare nor Van Gogh

attained their current elevated status until years after their deaths. The crucial audience evaluation is that of posterity, not of contemporaneous popularity.

Personalities of the Artist and the Scientist

As can be deduced from the above differences and similarities in doing art and science, it is inevitable that there will also be differences and similarities in the personalities of those attracted to art or science or both. A useful way to organize such a comparison is in terms of what psychologists' call "The Big Five". These are the most widely accepted 'primary' personality traits and they are polar. The following list places first the polarity that is usual for the creative artist and scientist.

- Openness (adventuresome and curious vs. cautious and conservative)
- Conscientiousness (obsessive and organized vs. easy going and careless)
- Introversion (introverted and private vs. extroverted and outgoing)
- Disagreeableness (disputative and competitive / agreeable and cooperative)
- Neuroticism (nervous and high-strung vs. calm and unflappable).

In any attempt to delineate the similarities and differences in the personality of creative artists and scientists, these five traits are a convenient paradigm. The following broad generalizations are based on various empirical studies, biographical data, and anecdotal evidence. They are all certainly disputable, and there are many exceptions. This probably is because the amount of variance in a sample of creative individuals is greater than in the general population, for individualism is the hallmark of the creative personality. Nevertheless, the following comparisons and contrasts are based on empirical evidence and are plausible given the differences inherent in doing science or art.

Openness to Experience

In science this is manifested in a curiosity that focuses on the natural world.

In art this is manifested in a curiosity that focuses on human relationships and personal, subjective experiences.

In both cases there is an adventurousness and curiosity that surfaces at an early age. Both the scientist and the artist love to experiment, in the broadest sense of that word, but the artist experiments on himself and the scientist on the external world. The openness to experience in science is socially safer than in the arts, for it only occasionally challenges societal norms and rules of decorum.

Conscientiousness

In science this is manifested in the extreme rigor involved in the designing of an empirical test that will eliminate any extraneous variables that could contaminate the results.

In art this is manifested in the obsessive concern with detail and fine-tuning of any artistic product or production.

In both cases the motivation and commitment involves extreme conscientiousness. The tendency to be a perfectionist is an attribute of those who score high on conscientiousness, and that is certainly true of both artists and scientists. However, this conscientiousness about their specific endeavours and passions does not necessarily apply to other aspects of their lives. In fact, it is often notably lacking in attending to mundane matters. Rembrandt's conscientious attention to detail in his painting is in stark contrast to the way he mismanaged his financial affairs. And only too common is the scientist's neglect of family commitments in pursuit of a research project.

Introversion

In science this is manifested in the all-consuming interest in understanding the physical world, where social interaction is usually only a means to an end—not an end in itself. Science has more and more become a collaborative effort, so now scientists' constant meeting with their research colleagues may disguise their fundamental lack of concern with non-utilitarian sociability.

In art this is manifested in the inherently solitary nature of creating a work of art. This is obvious with writers who spend long hours alone with their manuscripts; however within the collaborative arts the same priorities apply as with science. For example—and most surprisingly—even performing artists actually score lower on extroversion than the average population.

In both cases the creative drive is a very personal and private one, and one that requires focusing on the task at hand that has to take priority over mere social interaction.

Disagreeableness

In science this is manifested in the challenging of conventional wisdom, including conventional scientific explanations. The scientific method is based on critical evaluation, and any scientist proposing a theory fully expects to be subjected to rigorous and disagreeable scrutiny.

In art this is manifested in challenging the current art establishment and its definition of what constitutes legitimate art. Every major art movement or innovation has been inspired by a rejection of the current status quo. Often this marginalizes the artist, and so artistic subcultures, such as The Beats or The Surrealists, are common.

In both cases this personality trait combined with introversion makes the creative individual difficult to live with, a fact supported by both biographical and statistical evidence. Few and far between are the artists or scientists with a reputation for being agreeable chaps. Einstein's later persona could be cited as a counter example, but an honest biography of his early life, where he was an exceptionally obnoxious student, is less flattering. Brahms is typical. He once exited a party with one of the few apologies he ever uttered: "If I failed to insult anyone, I apologize."

Neuroticism

In science this is manifested in the compulsive pursuit of the research, represented by stereotype of the mad scientist. In actuality, scientists are not like Doktor Frankenstein and are usually very responsible and concerned citizens. But there is no doubt they are sometimes so emotionally committed to their work that they can behave irrationally. The intense focus on their work can indeed make them appear stereotypically absent-minded and monomaniacal. And the far from objective and reasoned vicious attacks on colleagues with alternative views is well documented by historians of science.

In art this is manifested by the eccentricity associated with artists in all genres. The stereotype of the flamboyant artist with a very ‘alternative’ lifestyle is not entirely without a grain of truth. There *are* artists who follow Flaubert’s dictum to ‘live like the bourgeoisie’ so that their creativity and individualism is completely channelled into their art. However, the unappreciative—even hostile—environment in which most artists have to survive is such that the unobtrusive bourgeois lifestyle is not an option.

In both cases the evidence for instability in creative individuals is indisputable. This ranges from moderate neuroticism to full-blown psychosis—most notably, according to contemporary research and diagnostic guidelines, in the form of bipolar disorder. The causes are both environmental and hereditary. The environment of a creative individual constantly challenging the status quo is bound to be a hostile and stressful one. It may be less so for scientists (whose challenges are less arcane and public and who usually have a safe haven in Academe) than it is for artists. The data on the frequency and extent of dysfunction support this, but it certainly exists for both. Speculation about a hereditary link focuses on what might be called ‘the covariant effect’. That is to say that two traits, one functional and one dysfunctional, can be inextricably connected. If, in terms of natural selection, the dysfunctional trait isn’t as detrimental as the functional one is valuable, these traits will continue to be passed on together. Creativity is the trait that has given our species its current domination over all other species. It may be that a connected weakness in emotional stability is simply of lesser importance in evolutionary terms. Whatever the complete explanation is, the empirical evidence supports Seneca: “There is no great genius without some touch of madness.”

Conclusion

All of the above generalizations admittedly are gross over-generalizations, but they are only intended as an initial outline of a more specific delineation of the creative process in the artist and in the scientist. Psychologists debate the question of whether or not there is a ‘g’ (general) intelligence factor; i.e., whether intelligence is a single characteristic, and one that is simply notable in whatever pursuit the person has chosen, or if there are multiple types of intelligences which a person might possess—ranging from only one (e.g., the ‘idiot savant’) to the amazingly many (the ‘Renaissance Man’). Clearly some very intelligent people in one area can behave most unintelligently in others. So too with creativity, which in the past was considered—and actually really is—a major component of intelligence. Someone can certainly be eminently creative in science and uncreative in art—and vice versa.

The naïve idea that there is a similar ‘g’ factor for creativity doesn’t aid our understanding of the nature of creativity. As with intelligence, there is a large overlap in the characteristics of its specific manifestations. And, as with intelligence, there are very significant differences. What *does* aid our understanding is examining these differences, while also noting the similarities.

Both creativity and intelligence are words that have many different definitions, but they are universally viewed as positive attributes, attributes that make human beings special, the attributes that are responsible for civilization. Increasing the precision of the most meaningful definition of these attributes, and trying to determine their nature, is a worthwhile endeavour—an endeavour to which both science and art can contribute.

References

Snow, C.P. (1959). *The two cultures*. Cambridge: Cambridge University Press.

Stange, K. (1998). Intertwining The Two Cultures In The Year Two Thousand
Proceedings of the 1998 mathematics & design: proceedings of second international conference (ed. Javier Barrallo), Universidad del Pais Vasco Press, pp. 309-316.

Stange, K. (2008). *The secret agents: creativity in the arts and sciences*. {Unpublished book available for reviewing online by contacting Ken@Stange.com}

Stange, K. (2010). The Solemn Frivolity of Art And Charming Frigidity of Science. *The International Journal of Arts & Sciences*. (In press, Oct. 2010)