

**Artistic Exploration in Scientific Research And Technology**  
**Dr. Bitasta Das**  
**Department of UG Humanities**  
**Indian Institute of Science, Bengaluru**

**Lecture – 17**  
**Art vis a vis Science and Technology**

Hello friends, in the last class we have seen the importance of inter disciplinary approach towards learning. How more and more the need has been felt to break the boundaries of discipline and to create more different knowledge than before. In today's class, let us see how innovation can be brought about by bringing Art Science and Technology together.

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So, science and technology; this two terms are more often than not talked about together as if they are interchangeable, but they have certain differences let us see what are the differences are.

In general words, science is the; the exploration of knowledge of the natural environment, whereas technology is using this knowledge for having making innovations and bettering human life.

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Differences	Science	Technology
Definition	A methodical means of acquiring new knowledge on specific subjects through observation and experimentation	The practical application of knowledge derived by science for specific purposes
Purpose	To discover knowledge, determine causes of phenomena, and make predictions	To solve problems and dilemmas, improve productivity, increase efficiency and effectiveness, to implement changes
Motto	Science is knowing	Technology is doing
Reaction to change	Laws proven by science is absolute.	Technology is prone to change.
Focus	Discovery, understanding	Invention, application
Function	Making predictions and understanding phenomena	Make work easier, solve problems, fulfill needs
Methods of evaluation	Analysis, deduction, developing theories	Analysis, planning, synthesizing design
Development	Discovery, with support and control through experiments	Design, invention, production/implementation
Required skills	Experimental, analytical and logical skills	Planning, design, construction, problem solving, decision making, quality assurance, and interpersonal skills
Example branches	Biology, mathematics, geology, human behavior	Agriculture, applied physics, engineering, biotechnology

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So, these are the certain differences between science and technology; let us see what they are. Definition; science a methodological means of acquiring new knowledge on specific subject through observation and experiment, so science and tales finding new kind of knowledge. Why we see in rainbow, why the colors of the leaves are green or why the sky appears blue.

This is having a methodological approach to explore new knowledge to understand things around us. Whereas, technology the practical application of knowledge derived by science for specific purpose. So, technology is when you use this knowledge for specific purpose; more often a not it is to make human life better or human life more comfortable than before. So, technology entails that we use scientific knowledge to apply it for our day to day needs and necessities.

Purpose to discover knowledge; the purpose of science is to discover knowledge, determine causes of phenomena and make prediction. So, the purpose of science is to explore and to find new knowledge that we did not know before ok. So, something that we had not known in the past, science tries to explore that knowledge and discover this new knowledge, this is one purpose of science is to discover new knowledge.

Determine causes of phenomena and make predication; why something is how it is like why water flows, why there is air, why ; why the air flows in a certain direction or why chemical react in certain way. So, these are the questions that science ask, why certain

phenomena occurs? So, this is one purpose of science is to understand or to explain why certain phenomena in the nature happens and also to make predictions. So, after you discover this knowledge you make predictions that if you bring two atoms together this kind of reactions might happen.

So, this are the prediction science tends to make whereas, the purpose of technology is to solve problems and dilemmas improve productivity, increase efficiency and effectively to implement changes. So, the purpose of technology is rather practical, it is to solve problems and dilemmas, it is to give some answers to some questions like having a magnifying glass for example, it is to make a life better to see smaller objects better we have discover magnifying glass. So, the the science behind a magnifying glass tell us that certain kinds of glass will make an object look bigger whereas, the technology is applied to make the magnifying glass itself, increase efficiency and effectivity to implement changes. So, these are the different purposes of science and technology.

Motto; the motto of science is knowing, the motto of technology is doing whereas, science it stops at understanding a phenomena, its stops at explaining a phenomena, technology takes it a little forward it uses this knowledge to make something else; it is it is very practical kind of application where you use the knowledge to make something it is in the doing it do something with the knowledge we have.

Reaction to change; so, science laws proven by science is absolute whereas, technology is prone to change. So, you very rarely you see that theories in science changed, it is the theories that had been discovered in the past have remains same in science because they have been a proven phenomena, they have very less scope of change, where as technology can update itself time to time, it can keep on having new innovations and it can keep on updating itself. So, technology is prone to change.

Focus; the focus of sciences discovery and understanding where as the technology the focuses invention and application that we have discussed earlier also that science discovers and understands whereas, technology uses this discovery for invention of new techniques or new instruments etc.

Function of science is making predictions and understanding phenomena, this is what science does is understand a phenomenon and make prediction whereas the function of technologies make work easier solve problem fulfill needs. So, as I said before that

technology is used to better life either of human being or environment sometimes other organisms but more and more it is used to better the life of human being. So, that is the function of technology to make work easier, solve problems, fulfill needs etcetera.

Method of evaluation its analysis, deduction, developing theory. So, in science what is the method? For the method is like you observe something then you analyze your observation, then you deduct make a deduction; deduction means to arrive at certain conclusion looking at the observation and after analyses, you deduct something out of your observation and analysis, then make a grand theory out of it. So, you say if you observing why organism behave in a certain way as it behaves, observe it for certain time to analyze its behavior, then you say that in this condition this organism will behave in so this way.

So, this is what science does; it observes, analyses, deducts, then it creates grand theory; whereas, in technology its analysis planning, synthesizing, design. analyze a problem, you plan how to resolve it, you then synthesize design; you make a design to innovative to make something out of it. Development; in science it is discovery with support and control to experiment and as we have discussed earlier that science focuses on discovery and it uses experiment for making this discovery, technology development is done through design invention production implementation.

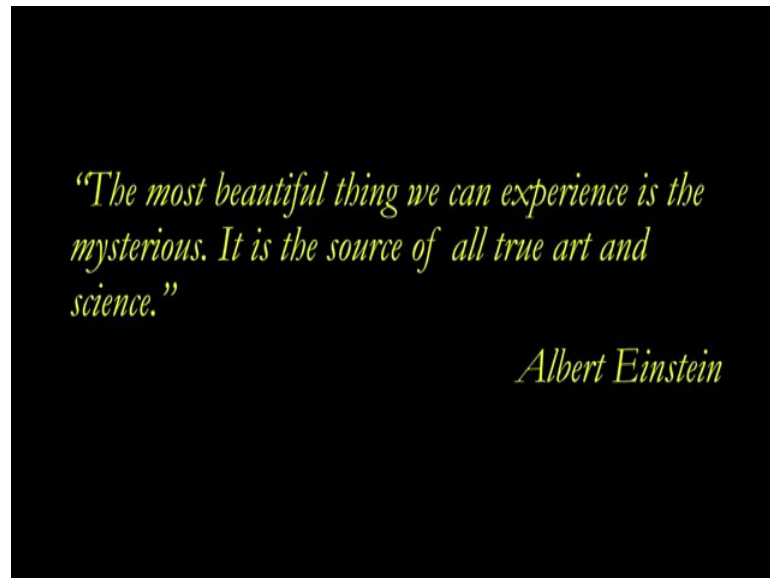
The development of technology occurs through design, inventions, production and implementation. So, the processes are little different than science. The required skills for science is experimental, analytical and logical skills. So, a person has to be have this kind skills or tools experimental of mindset, analytical and logical skills.

And one who is practicing technology, planning, design construction, problem solving, decision making, quality assurance and interpersonal skills. So, this person in the field of technology should possess some of the characteristics. Example branches by for example, of what is science is, biology, mathematics, geology, human behavior are science whereas, technology is as we have discussed before that it is applying this knowledge to do something.

So, agriculture, applied physics, engineering, biotechnology are branches of technology. So, here technologies more of doing a practical usage whereas, science is making discovery, making new discovering new kinds of knowledge. So, now, we have a fair

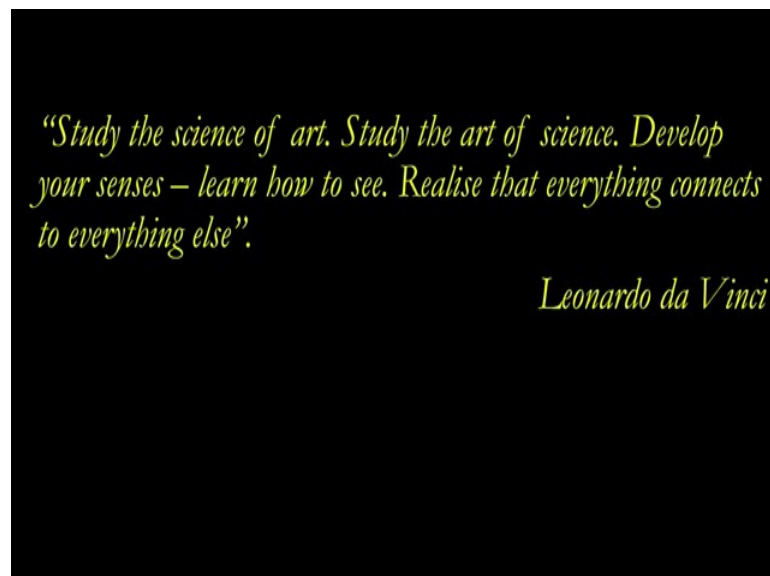
idea of what science and technology is, so now let us see how this seemingly distant field of knowledge science and technology, when it comes comes near to art what kind of responses it brings about?

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So, Albert Einstein had said that the most beautiful thing we can experiment experience is the mysterious, it is the source of all true art and science. So, Einstein had said that everything beautiful is mysterious and it is true for art and science. So, there is no difference in essence, both science and art are beautiful in them because they mysterious.

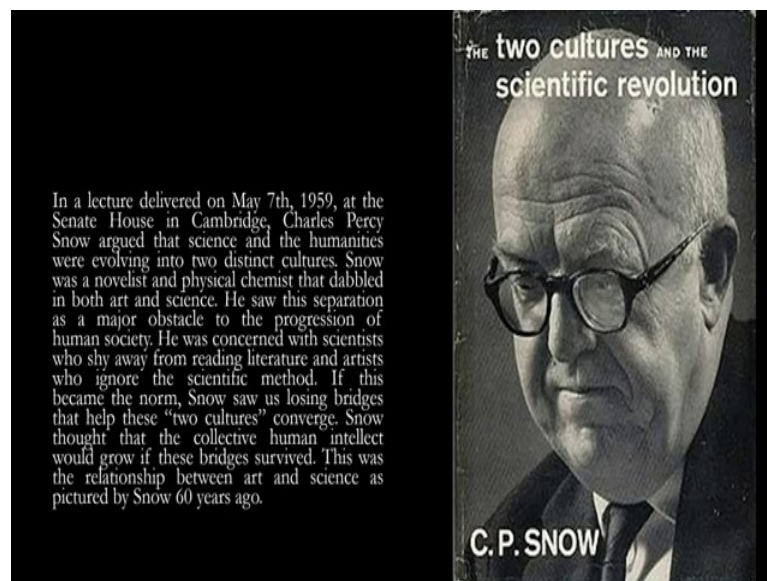
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So, this was the previous one was an example from a person who is well known in the field of science, and this is an example of a person who is well known in the field of art Leonardo da Vinci. And he said that “Study the science of art. Study the art of science. Develop your senses - learn how to see. Realize that everything connects to everything else”. So, even Leonardo da Vinci’s had was of the opinion that there is no intrinsic or there is no essential difference between science and art.

There they have certain common factors, he also feel feels that even science and art of equally important and you should be knowing both of them. So, people from both science and art feel the importance or feel the necessity to know the other or to appreciate the other. This is one very unique characteristics that, though we think that science and technology is much different from arts, but people practicing it; the reputed people who practice it, often feel that there is a unifying element between science and technology and art. So, would here there are two examples by Einstein and Leonardo da Vinci, who says that science and art are equally important and are equally beautiful.

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So, we have discuss this in one of a previous classes that, CP Snow was one of the first person who pointed out, who actually lamented that the intellectual world is divided into two whereas, the art artists are in one corner, the technological people or the science people are in the other corner and though they hardly interact with one another. In a lecture delivered on May 7, 1959 at the Senate House in Cambridge. Charles Percy Snow

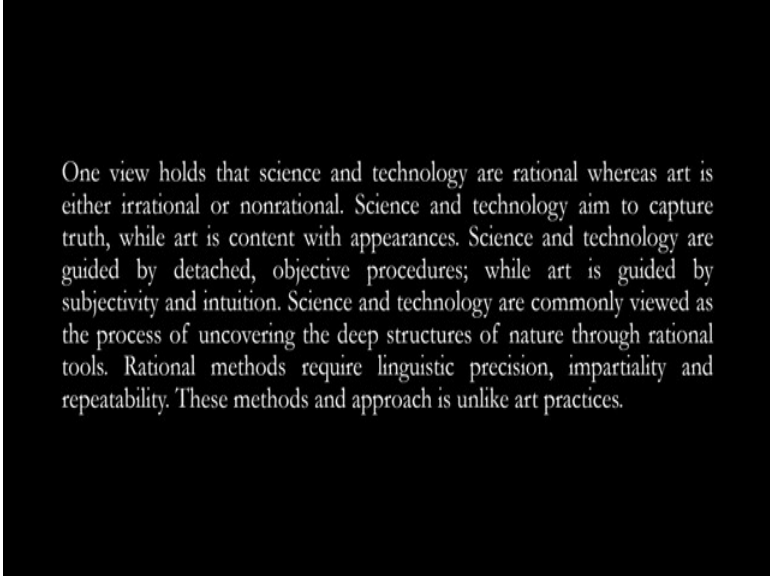
argued that science and humanities were evolving in the two distinct cultures. Snow was a novelist and physical chemist that dabbled in both art and science.

So, he himself as a person who was a practitioner of both science and humanities. He saw the separation as a major obstacle to the progression of human society, he felt that this division between the science and technology and art and humanities this (Refer Time: 12:53) is creating a lot of problem in human society. Because people practicing this two fields do not or hardly talk to each other or hardly they exchange between each other.

He was concerned with scientist who shy away from reading literature and artist who ignore the scientific method. He was deeply pain or deeply worried about why this two sets of people or intellectual people do not have anything in common, they do not like to engage with one another's work. If this became the norm Snow saw us losing bridges that help this two cultures converge. So, he very famously had coined this term "two cultures" saying that the humanities then an art is in is one culture and whereas, the science and technology another culture. So, this two cultures hardly talk with each other.

Snow thought that the collective human intellect would grow if this bridge survived. So, he said that collective human intellect the intellects of the humankind would grow would survive only if these two worlds come together to have a meaningful dialogue. This was the relationship between art and science as picture by Snow 60 years ago. So, this was something that he had talked about 60 years ago in 1959. So, the debate are still going on that why people from both the field do not talk to each other or why this two fields do such a discipline do not talk to each other.

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One view holds that science and technology are rational whereas art is either irrational or nonrational. Science and technology aim to capture truth, while art is content with appearances. Science and technology are guided by detached, objective procedures; while art is guided by subjectivity and intuition. Science and technology are commonly viewed as the process of uncovering the deep structures of nature through rational tools. Rational methods require linguistic precision, impartiality and repeatability. These methods and approach is unlike art practices.

So, one of the strong view is that science and technology are rational whereas, art either irrational or non rational. So, this is one of the view very strongly held by certain section of people, a certain section of intellects that science is every rational; science and technology are very rational field of enquiry whereas, art and humanities are non-rational or they are irrational

Science and technology aim to capture truth while art is content with appearance. Science and technology are guided by detached objective procedures while art is guided by subjectivity and intuition. So, these are some of the differences or detachment that people have pointed out that science and technology are very objective whereas, art and humanities are often very subjective; it is often related to the person concerned the perceptive of the person practicing it.

Science and technology are commonly viewed as the process of uncovering the deep structures of nature through rational tools. Rational method requires linguistic precision impartiality and repeatability, these methods an approach are unlike art practices. So, there is a sense of condescending attitude that science and technology are often impartial, they are very detached they are not related to the person concerned who is practicing it whereas, art is a very subjective biased kind of approach art has. So, actual knowledge is produced in science and technology fields and the practitioners of art do



not actually produce very objective kind of knowledge. This is a very strong view which ones one section of people hold.

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*Aldous Huxley in Literature and Science (1963)*  
explained,

“For science in its totality, the ultimate goal is the creation of a monistic system in which-on the symbolic level and in terms of the inferred components of invisibly and intangibly fine structure-the world's enormous multiplicity is reduced to something like unity, and the endless succession of unique events of a great many different kinds gets tidied up and simplified into a single rational order.”

So, let us see of how it has been seen in history. Aldous Huxley in literature and science in 1963 explained; “For science in its totality, the ultimate goal is the creation of a monistic system in which-on the symbolic level and in terms of inferred component of invisible and intangible fine structure-the world’s enormous multiplicity is reduced to something like unity, and the endless succession of unique events of a great many different kinds gets tidied up and simplified into a single rational order.”

So, Huxley tried to explain that the objective of science or the focus of science is to explain the multiplicity of things that we see in around us to give one explanation, why the science focuses on giving one and the correct explanation of the things we seen around them; around us. So, we I would see something differently, you would see something differently, but what science tend to do is that it gives a one explanation for why we see the things and science attempts to give the correct and the true definition or why we see things certain way.

You are in my view would not count what science explains would be the ultimate true. This is one of the aims that science attempts that to give the ultimate answer to the things we see around us.

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### He also states,

Poets and, in general, men of letters are permitted, indeed are commanded, by the rules of their game, to do all the things that scientists are not allowed to do. There are occasions, obviously, when it is right for them to be verbally prudent; but there are other occasions when verbal imprudence, carried to a pitch if necessary, of the most extravagant foolhardiness, becomes an artistic duty, a kind of categorical imperative.

He also states that poets and in general men of letters are permitted indeed are commanded by the rules of their game to do all the things that scientists are not allowed to do.

So, he says that the poets and people who write the writers generally the humanizes, they are permitted to do things that the scientist are not allowed to. They are allowed to bring their subjective experience or the subjective feelings and emotions whereas, scientist are not allowed to do that, they are supposed to keep the emotions aside and do their research and do their work. There are occasions; obviously, when it is right for them to be verbal imprudence, but there are other occasions when verbal imprudence carried to a pitch if necessary of the most extravagant foolhardiness becomes an artistic duty a kind of categorical imperatives.

So, he says that there are certain times when the artist or the humanist can speak in a very prudent manner, in a very precise manner, but there are often a artist or the humanities person practicing humanities is allowed to or has the liberty to talk what he feels like, he or she feels like it they are allowed to do that in the field there in. So, this was historically thought to be the difference between a person practicing science and a person practicing humanities and arts.

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### So, we find the following polarities

Science is conceptual, dispassionate and critical. Art is nonconceptual, passionate and engaged. Science, unlike art, requires rationality. Art demands the union of ego and object. Science demands the separation of self and object and results in works that depict objects abstractly as radically separate from the human and the natural.

So, we find the following polarities between in the thoughts that we have mentioned just now. Science is conceptual, dispassionate and critical; whereas, science is very critical, dispassionate, objective art is non-conceptual passionate and engaged. And art is very passionate one brings about his or her emotions and feelings into it and so, it is very passionate and engaged with its supposed to be engaging with the people they are trying to convey the message.

Science unlike art requires rationality art demands the union of ego and objectives. So, science requires rationality according to this view and whereas, the art and humanities can; unite ego and objective; ego of the person who is practicing and and object that the person is researching on. So, he can bring his own opinions on the object he or she is researching on. Science demands the separation of self and object and result in work that depicts objects abstractly as radically separate from the human and the natural.

So, science demands that you keep your emotions and your feelings and opinions aside and understand object as it is. Understand it; understand your object of enquiry in a very objective manner, in a very dispassionate manner.

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## Two Monist views

Cognitive monism treats art as a subdivision of science. Aesthetic monism treats science as a subdivision of art.

The first considers art a means to attain truth through rational or cognitive methods. The second considers science an intuitive method for seeking harmony or order.

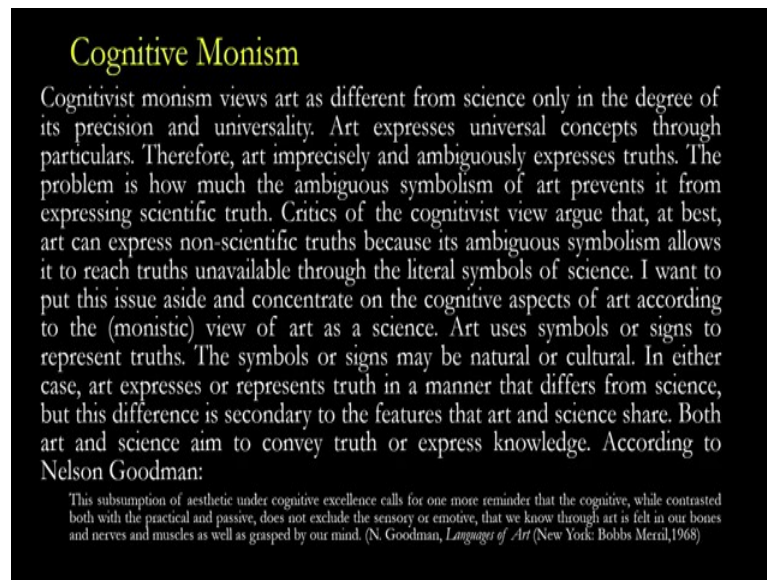
According to both types of monism, the error in viewing art and science as polar opposites is in assuming that the differences between art and science are essential, rather than simply differences of degree

But there are also other views which says that this polarity might not be true, there is certain essential similarity between the arts and science and technology. So, there are two actually monist views that has been talked about in the past let us discuss them. Cognitive monism treats art as a subdivision of science; aesthetic monism treats science as a subdivision of art.

So, here we see that there are two views one is cognitive monism and other is aesthetic monism. So, cognitive monism sees art as the subdivision of science whereas, aesthetic monism sees science as a sub division of art. The first consider art as a means to attain truth through rational or cognitive method, the second consider science as intuitive method for seeking harmony or order. So, this two view actually tries to subsumed other within its fold. According to both types of monism, the error in viewing art and science as polar opposite in assuming that, the difference between art and science are essential rather than simply difference of degree.

So, there is the essential similarity between this two view is that, the difference between art and science and technology is in the degree, it is not that they are essentially or interestingly different. So, a science and science technology art are in the same plane, whereas only what a difference in the degree of there outlook. So, they are not essentially different than one another. So, this are that underlying understanding in the monist views.

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So, let us discuss both of them one by one, cognitive monism. Cognitivist monism view art as different from science only in the degree of its precision and universality. So, cognitive monism says that science is precise, but art is also precise only what they differ is that in the degree of the precision. Art expresses universal concepts through particulars therefore, art imperiously an unambiguously express truth.

So, because art tries to unravel or tries to explain universal concepts through particulars, through examples. Therefore, it might appear to be imprecise or it might appear to be ambiguous, while expressing truth. The problem is how much the ambiguous symbolism of art prevents it from expressing scientific truth. So, how much of the particularism might come into play; so, it might appear to be imprecise or it might appears to be ambiguous.

Critics of the cognitive view argue that at best art can express non-scientific truth because its ambiguous symbolism allows it to reach truth unavailable to the literal symbols of science. So, there are critics of the cognitive view who says that, art can also be a tool for expressing the truth, but a tool of precision, but the the methods using art and not well enough to be explaining the universal truth. So, this is one critic that against a cognitive monism.

Art use a symbol or science to represent truth, the symbols of science maybe natural or cultural. So, art uses symbols of truth symbols that to express truth, but this symbols can

be natural or cultural in either case art express or represent truth in a manner that differs from science. So, in either case art also explains the things around us around in the world, but it uses symbol that are much different from what science uses; that is difference is secondary to the features that art and science share.

Both art and science aim to convey truth or express knowledge. According to Nelson Goodman this subsumption of aesthetic under cognitive excellence calls for one more reminder that cognitive, while contrasted both with the practical and passive, does not exclude the sensory or emotive, that we know through art is felt in our bones and nerves and muscles as well as grasped in your mind. So, Nelson Goodman tries to explain this cognitive monism in the way that it says that yeah, art might also try to explain the truth around in the universe, but it cannot do away with the emotive part of it, art has to be emotive, art has to express feelings.

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## Aesthetic Monism

According to aesthetic monists the scientist is an artist in his own manner. Science, like art, is irrational. Though science appears to be cool and rational, and scientists profess to be objective and detached, in reality scientists are passionate. Theories are accepted or rejected according to aesthetic standards of simplicity and unity. Theories are discovered and proposed according to irrational beliefs and visions.

Science is not thus the simple, pure, crystal-clear fount of all reliable knowledge and coherence... Its method is not that of detachment but rather of involvement. It rests, no less than our other ways of achieving meaning, upon various commitments which we personally share. (M. Polanyi and H. Prosch, *Meaning* (Chicago: University of Chicago Press, 1975))

Where art and science differ, according to aesthetic monism, is in subject matter. Science gives truths about nature; art gives truths about the meaning of life.

Aesthetic monism; according to aesthetic monists the scientist is an artist in his own manner science. So, this is the view which holds that science is part of art; science is a sub division of art science like art is irrational. So, this view holds that science is also irrational like art. Though science appears to be cool and rational and scientist profess to be objective and detached in reality, scientist are passionate.

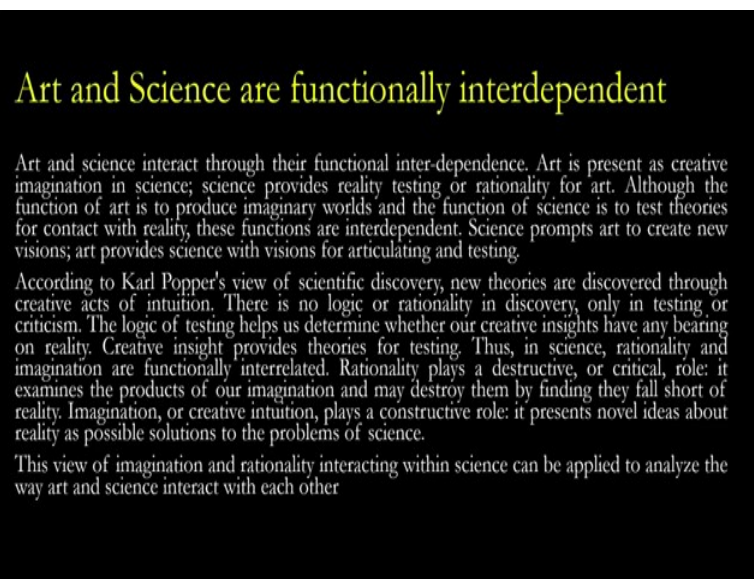
Though say it is say that to assume that scientist are dispassionate is wrong scientist are also passionate, scientist also cannot know do away with their emotions. Theories are

accepted or rejected according to acoustic standards of simplicity and unity. So, theories also not there not also safe from critical analysis, they are also accept it or reject it that times because of the simplicity of the the expression or the standards the way in which they are represented.

Theories are discovered and propose according to irrational beliefs and visions. Science is not thus the simon-pure, crystal-clear fount of all reliable knowledge incoherence. Its method is not that of detachment, but rather of involvement, rests no less than other way of achieving meaning upon various commitments, which we personally share. So, this was written by Polanyi and Prosch in the book Meanings.

Where art and science differ according to aesthetic monism is in subject matter. So, art and science are not different in radically different, but what they differ is the subject matter they are looking at. Science gives truth about; science gives truth about nature, art gives truth about the meaning of life. So, what the point where they differ is the matter they are looking at. Science where as science gives you truths about nature and art tries to give you truth about life. So, this is where they differ otherwise there is not much different between the two. So, these are the two views about monistic views about science technology and art.

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**Art and Science are functionally interdependent**

Art and science interact through their functional inter-dependence. Art is present as creative imagination in science; science provides reality testing or rationality for art. Although the function of art is to produce imaginary worlds and the function of science is to test theories for contact with reality, these functions are interdependent. Science prompts art to create new visions; art provides science with visions for articulating and testing.

According to Karl Popper's view of scientific discovery, new theories are discovered through creative acts of intuition. There is no logic or rationality in discovery, only in testing or criticism. The logic of testing helps us determine whether our creative insights have any bearing on reality. Creative insight provides theories for testing. Thus, in science, rationality and imagination are functionally interrelated. Rationality plays a destructive, or critical, role: it examines the products of our imagination and may destroy them by finding they fall short of reality. Imagination, or creative intuition, plays a constructive role: it presents novel ideas about reality as possible solutions to the problems of science.

This view of imagination and rationality interacting within science can be applied to analyze the way art and science interact with each other

Art and science of functionally interdependent; art and science interact through their functional interdependence art is present as creative imagination in science.

Science provides reality testing or rationality for art. Although the function of art is to produce imaginary worlds and the function of science is to test theories for contact and reality, these functions are interdependent. Science prompts art to create new vision art provide science with vision for articulating and testing. So, more and more it has been felt that science and art are not opposite to each other, but they are functionally interdependent.

There are elements of art and science; there are elements of science in art. So, this is the more and more people are feeling that, they should not be looked at as to divergent area of knowledge, but they have functionality and they are dependent on each other. A scientific approach should also take into account artistic approach, an art artistic approach should also take into account scientific vision.

According to Karl Popper's view of scientific discovery, new theories are discovered through creative acts of intuition. So, Karl Popper is to thought that new theories are can be only discovered when you have very acute, very sharp intuition. There is no logic of all rationality in discovery only in testing or criticism.

The logic of testing helps as determined whether our creative insights have any bearing on reality. So, there has to be a intuition about what we are trying to study. Creative insight provides theories for testing; thus in science rationality and imagination are functional interrelated. Rationality plays a destructive or critical role, it examines the product of our imagination and may destroy them by finding them fall short of reality. So, this is what Karl Popper use to hold.

Imagination or creative intuition plays a constructive role; it presents novel ideas about reality as possible solution to the problems of science. So, this is what Karl Popper holds that intuition and imagination holds positive role in scientific discovery. This view of imagination and rationality interacting within science can be applied to analyze the way, art and science interact with each other. So this is the question about imagination and rationality can be looked at from the point of view how science and art interact with each other.



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## Role of Imagination and Rationality in Science

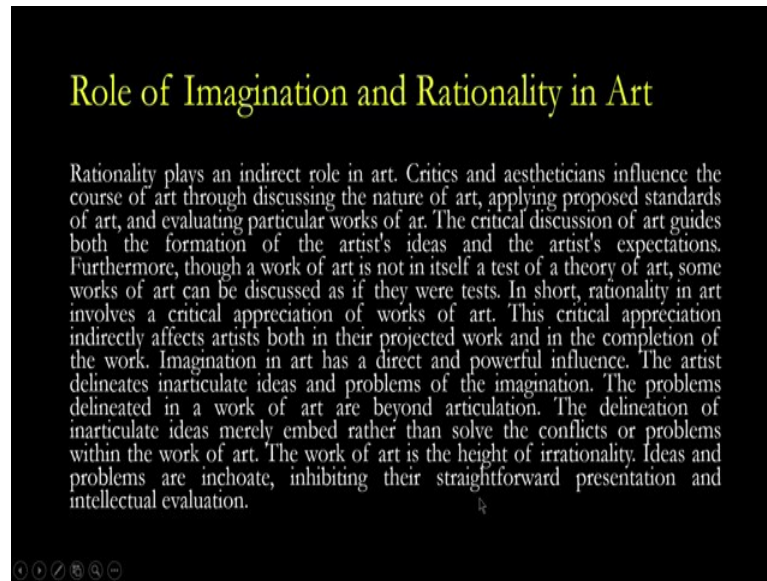
Following Popper's view, rationality has a destructive role in science, while imagination has a creative role. Imagination provides tentative solutions to problems; rationality destroys mistaken solutions by uncovering errors. In contrast to its role in art, imagination in science is restricted to producing articulate theories for testing. Rationality in science aims to eliminate error and so destroy false theories. The aim of science is the discovery of truth. However, rationality in art points out the weaknesses of imagination and encourages imagination to create worlds that momentarily defy (rational) articulation. Apart from its role in articulating the products of imagination as theories and in testing theories, rationality also helps guide scientific practice. Rationality is applied to evaluate scientific practice. We use rationality to set up guidelines for deciding whether it is better to eliminate a false theory or to examine it for any truths before we eliminate it from the body of scientific knowledge.

So, now let us discuss bit about Karl Popper's view on imagination and rationality in science. Following Popper's view rationality has a destructive role in science while imagination has a creative role. Imagination provides tentative solution to problems, rationality destroys mistaken solution by uncovering errors. In contrast with role in art, imagination in science is restricted to producing articulating to producing articulate theories for testing.

Rationality in science aims to eliminating error and so, destroy falls theories. The aim of science in the discovery of truth; however, rationality in art points out the weakness of imagination and encourages imagination to create worlds that momentarily defy rational articulation. Apart from its role in articulating the products of imagination as theories and in testing theories rationality also helps guide scientific practices. Rationality is applied to evaluate scientific practice. We use rationality to set up guidelines for this deciding whether it is better to eliminate a false theory or to examine it for an truth before we eliminate it form body of scientific knowledge.

So, following Karl Popper's views we see that rationality and imagination are both important in both art as well as science and technology. They might have varying degree of usage, but both imagination and rationality is required in science and art.

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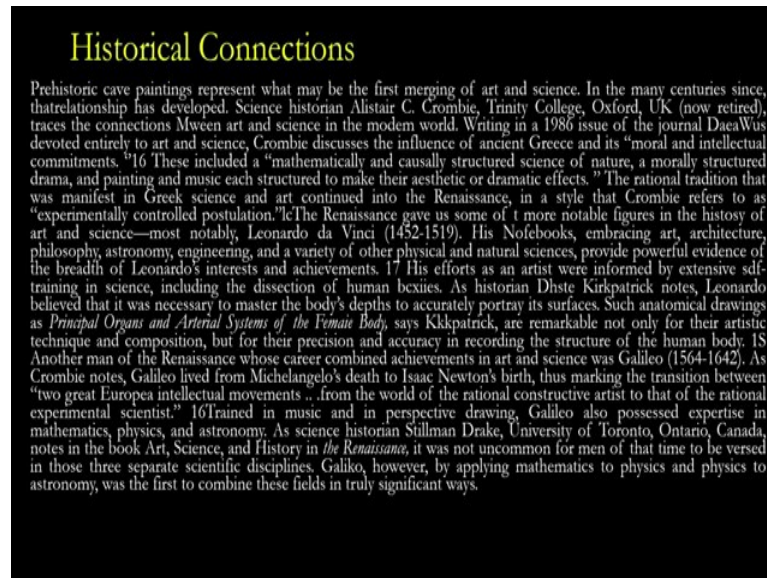


Rationality here let us not discuss, imagination and rationality in art. Rationality plays an indirect route role in art, critics and aestheticians influence the course of art through discussion discussing the nature of art applying proposed standards of art and evaluating particular works of art. The critical discussion of art guides both the formation of the scientist ideas and the artist's expectation.

Furthermore though a work of art is not in itself a test of a theory of art, some work of art can be discussed as if they were test. In short rationality in art involves a critical appreciation of work of art. This critical appreciation indirectly affects artist both in their projected work and in the completion of their work. Imagination in art has a direct and powerful influence. The artist delineates inarticulate ideas and problems of the imagination. The problems delineated in a work of art are beyond articulation the delineation of inarticulate ideas merely embed rather than solve the conflicts or problems within the work of art. The work of art is the heights of irrationality; ideas and problems are inchoate, inhabiting, their straightforward presentation and intellectual evaluation.

So, we see that both imagination and rationality are important in bearing degree in both science and art. And one should not be distinguishing arts and science and technology based on saying that, one is purely imagination and one is purely rational; both rationality and imagination are required in this field of knowledge.

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So, now let us see some historical connections between art and science and technology. Prehistoric cave painting represent what may be the first merging of art and science in the many centuries since the relationship has developed. Science historian Alistair C. Crombie, Trinity college, Oxford UK, traces the connections between art and science in the modern world.

Writing in 1986 issue of the journal devoted entirely to art and science, Crombie discusses the influence of ancient Greece and its moral and intellectual commitments. It included a mathematical and causal structured science of nature, a morally structured drama and painting and music each structured to make their aesthetic or drama effects.

The rational tradition that was manifest in Greek science and art continued into the renaissance in a style that Crombie refers to as extra experimental controlled postulation. The renaissance gave as much of the notable figures in the history of art and science most notably Leonardo da Vinci his embracing art, architecture, philosophy, astronomy engineering and a variety of other physical and natural sciences provide powerful evidence of the breadth of Leonardo interest and achievements.

So, we see that a historically there has been not much difference between people practicing art and people practicing science and technology. We have seen during the renaissance time Leonardo da Vinci who was the professional practitioner of art architecture engineering etcetera.

His efforts as an artist were informed by extensive, self training science including dissection of human bodies as historian notes, Leonardo believed that it was necessary to master the body's depth to accurately portray its surfaces. So, Leonardo used to (Refer Time: 37:42) human body to understand how it functions so, that to project its beauty. So, he was both looking and the anatomy for human body and as well as explaining projecting the feelings and emotions. Such anatomical drawings as principal organs and artificial systems of the female body says, are remarkable not only for their artistic technique and composition, but for their precision and accuracy in recording the structure of the human body.

Another man of the renaissance whose career combined achievements in art and science was Galileo as Crombie notes. Galileo lived from Michelangelo's death to Isaac Newton's birth thus marking the transition between two great Europea intellectual movements from the world of the rational constructive artist to that of the rational experimental scientist. So, Galileo was fortunate enough to live during Michelangelo's death; from Michelangelo's death to Isaac Newton's birth. So, he has seen both the movements the rational constructive from the world of the rational constructive artist to the rational experimental scientist.

Trained in music and in perspective drawing Galileo also possessed expertise in mathematics physics and astronomy. As science historian Stillman Drake notes in the book, art science and history in the renaissance it was not uncommon for men of that time to be versed in those three separate scientific disciplines. So, at that time art science and technology history were all support to be various fields of a enquiry, various fields of knowledge and there was hardly in difference between art and science.

Galileo; however, by applying mathematics to physics and; physics to astronomy was the first to combine these fields in truly significant way. So, at that time in during a renaissance a time, people used to borrow tools from various disciplines to un discover newer things of newer meanings of meanings that they saw around them.

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## Modern Science and Modern Art

Just as technology, whether in the form of 17<sup>th</sup> century microscope or more modern developments, changed the way science was done so did technology change art. One such technological development was the invention of photography in the early nineteenth century. Photography provides another means of recording and interpreting the world—an activity, as we noted earlier, that is fundamental to both artists and scientists. Photography, far from remaining an adjunct to painting, was quick to come into its own as an art form. Later developments, which have extended the range of the human eye even further, also lend themselves to artistic consideration. Jean Jacques Trillat, discusses how images produced by X-ray radiography and electron microscopy relate to abstract painting. Comparing, for example, a motion-filled, modernist painting of a running girl with an electron microphotograph of lead telluride decorated by germs of crystallization, Trillat offers several hypotheses. He posits, for instance, that modern artists have been aware of recent work in physics and have taken inspiration from the images produced by modern devices.

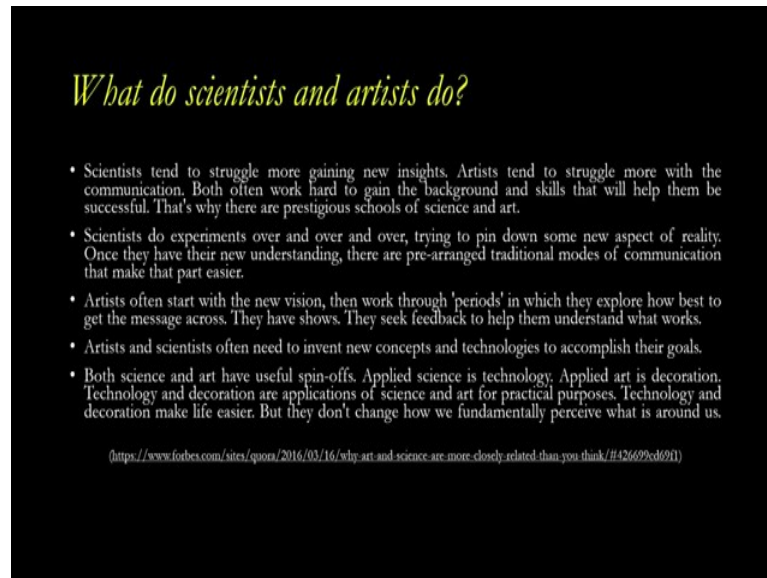
Modern science and modern art just as technology, whether in the form of 17th century microscope or more modern development changed the way science was done; so, did technology change art. So, one influence the other it is not that developments in were happening in one field and which did not touch the other. When developments happen in science and technology, it automatically influence the field of art and when art things were happening in art, it automatically had an influence upon the science and technology. One such technological development was the invention of photography in the early 19th century.

Photography provides another means of recording and interpreting the world. An activity as we noted earlier, that is fundamental to artists and scientists. Photography far from remaining an adjunct to painting was quick to come into its own as an form of art. So, earlier when photography was discovered it was thought to be a part of part of subset of painting, but later on photography was appreciated or acknowledged for its own value.

Later development which have extended the range of the human eye even further also lend themselves to artistic consideration. Trillat discusses how image produced by X-ray radiography and electron microscopy relate to abstract painting. So, how we have; they have been discovering radiography, X-ray radiography and this has intern influenced abstract painting. So, one development in one field has always influenced or impressed upon the other field.

Comparing for example, a motion filled modernist painting of a running girl with an electron microphotograph of lead telluride decorated by germs of crystallization. Trillat offers several hypotheses, he posits for instance that modern artists have been aware of recent works in physics and have taken inspiration from the images produced by modern devices.

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So, now what do scientist and artist do?

Scientists tend to struggle; so, we will see in this points that both scientist and artist have their own struggles and they have their own focus, and they are also trying to reach some where they are also trying to reach truth, and it is not that their struggles are much different than the other. Scientists tend to struggle more gaining new insight, artists tend to struggle more with the communication both often work hard to gain the background and skill that will help them be successful that is why there are prestigious schools of science and art.

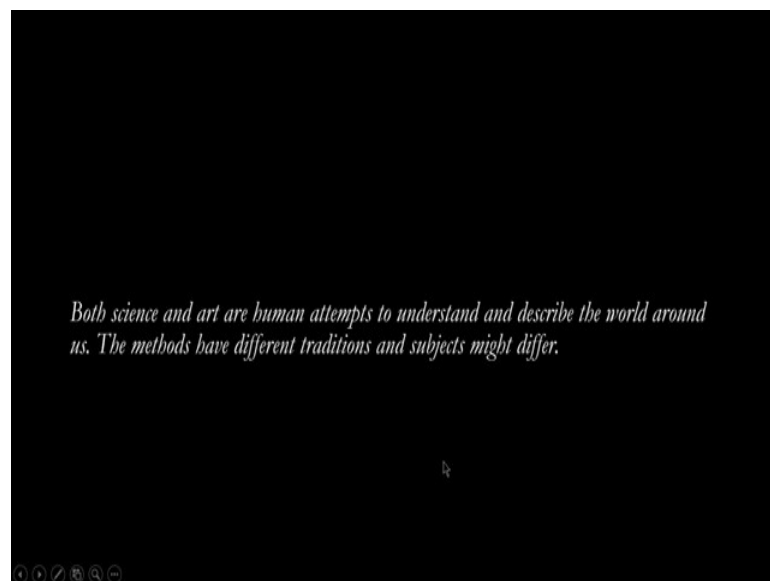
Scientists do experience over and over trying to pin down some new aspects of reality, once they have their new understanding there are pre arranged traditional modes of communication that make the part easier. So, scientist what they do is, they keep on experimenting over and over again until they reach close to reality close to truth. And after they have reached that point they are already certain sets of practices by which they are supposed to communicate what the results, they what have discovered.

Artist often start with the new vision, then work through periods in which they explore how best to get the message at last across. So, whereas, artist have; they have a vision, they have certain idea and they work on the methods to communicate them at the best; they have shows they seek feedback to help them understand what work. So, they try to communicate what is in their mind, what method; what idea they want to convey, and for this they have different ways of communicating. And this is also sometimes a feedback method that something works, something does not work and keep on working upon it until they reach the point where they are able to communicate their idea perfectly.

Artist and scientist often need to invent new concepts and technologies to accomplish their goal. So, artist and scientist both have to keep on working on concepts in technology to accomplished a goal. Both science and art have useful spin off, applied science is technology, applied art is decoration. So, as we have discussed before science when it attains the field of application, it becomes technology whereas, art when it attains the dimension of application it becomes decoration.

Technology and decoration are application of science and art for practical purposes, technology and decorations make the make life easier, but they do not change how we fundamentally perceive what is around us.

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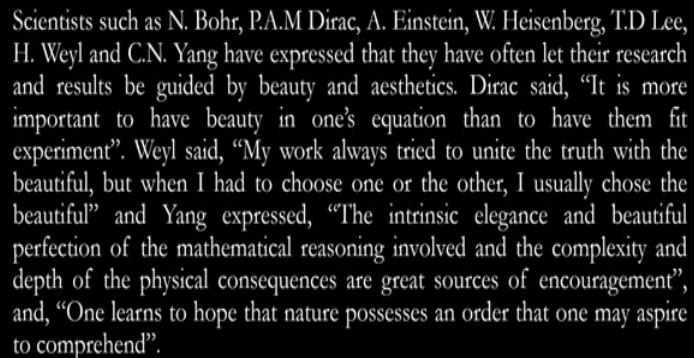
So, both; the application of both science and art is to make life easier, but they fundamentally do not change the way how it perceive what is around us. So, what can be

infer from what we have discuss so, far? You can inferred both science and art are human attempts to understand and describe the world around us this is true that both science is also trying to discover truth around us and art is also trying to discover or to convey the truth around us.

The methods have different traditions and subjects might differ. So, whereas, science express what they want to express to experiments of a theories, art does by things that we have discussed earlier like painting, dance, drama, theatre and so, the communication methods might differ, but what the essentially doing is they are trying to convey truth.

And the subjects might differ whereas, some we have seen that science and technology they try to look at the world around us the in animate objects around us. The non-living things around us mostly whereas, art is about talking about the human condition, the how human leave what are their feelings and emotions they talk about that. So, in this manner the subject of science and technology and art are different.

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Scientists such as N. Bohr, P.A.M Dirac, A. Einstein, W. Heisenberg, T.D Lee, H. Weyl and C.N. Yang have expressed that they have often let their research and results be guided by beauty and aesthetics. Dirac said, "It is more important to have beauty in one's equation than to have them fit experiment". Weyl said, "My work always tried to unite the truth with the beautiful, but when I had to choose one or the other, I usually chose the beautiful" and Yang expressed, "The intrinsic elegance and beautiful perfection of the mathematical reasoning involved and the complexity and depth of the physical consequences are great sources of encouragement", and, "One learns to hope that nature possesses an order that one may aspire to comprehend".

Scientist such as N. Bohr, Dirac and Eistein, Heisenberg, Yang all of them have sometime or the other express the necessity of aesthetics in their work. Have express that they have often lead their research and results be guided by beauty and aesthetics. So, this is very important well known scientists are often said that they let their research be guided by beauty and aesthetics.



Dirac said that it is more important to have beauty in ones equation than to have them fit experiment. So, he said that he holds that there should be a beauty in ones equation rather than being a very lifeless experiment. Weyl said, “My work always tried to unite the truth with the beauty, but when I had to choose one or the other I usually choose the beautiful”.

He says that my work often tries to combine truth and beauty, but if I have to choose one I will always choose beauty. And Yang expressed, “The intrinsic elegance and beautiful perfection of the mathematical reasoning involves and the complexity and depth of the physical consequences are great sources of encouragement” and, “One learn to hope that nature possesses an order that one may aspire to comprehend”.

So, scientist well known scientist will reputed a scientist of always try to combine beauty and science together they never saw aesthetic as different from what they are experimenting with what they are trying to discover. So, these are some of the examples where we have seen very successful bringing together or science and technology and art.

This is another one just look at how science and technology has been used to allow beauty and aesthetics.

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Now, these are some of the references I have used for this lecture.

So, friends, today we have seen how science and science and technology at one hand and art at another hand has been seen in history. Sometime they have seen to be radically different than one another while , but sometimes people have pointed out that they are not radically different, but what might differ is the difference in their degree in they also have both of them have rationality and imagination, but what might differ is the degree of rationality and imagination in each field.

So, we end here today, in the next class we will see some examples of bringing together art along with science and technology. Then from there we will see how we can use the folk art to with science and technology and responses they create.

Thank you.