

The Correlations in Intellectual Activity between the Arts and Sciences: Creativity, Construction and Communication

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Introduction

The schism between the arts and the sciences as detailed by C. P. Snow in his 1959 Rede Lecture is based on a perception brought about by the divergence in the intra-practitioner communications methods used by the two categories of intellectual activity, and not on any real differences. This will be shown by first dividing human activities into three general categories of specialization, showing that the arts and sciences fall into the same broad category of specialization, and finally, outlining how the different sub-specializations within their common specialization remain fluid and interconnected.

The advantage human beings have over other species is not based on their physical nature, but rather their intellectual abilities. Humans can apply their intellect to solve the problems they face, and to grant them a survival (and ultimately a proliferation) advantage. Other species must themselves adapt to survive in and exploit the environmental niche in which they exist. By contrast, mankind has the ability to use his intellect to adapt his environment to meet his needs and physical limitations. These needs can be divided into three fundamental categories: Security, Provisions and Shelter, and Intellectual Pursuits.

There is a need to be secure in person and property. This need is evident in many documents setting up or organizing societies or nations, such as the British “Magna Carta”, the French “Declaration of the Rights of Man and of the Citizen” and the US “Constitution.” While one is certainly at risk without security, it is equally certain that one cannot survive without a source of nourishment. Human populations do not proliferate in a barren wasteland, but they will in a “fertile crescent.” Finally, human beings exhibit a sense of self that distinguishes us from the other animals that inhabit the earth. It is this sense of self that leads to the third fundamental human need, a collection of intellectual activities that attempt to make sense of and ultimately understand the reality which we feel a part of and yet a separation from.

Our earliest views back in the anthropological record show human actions to meet all three of these needs. We find evidence of the manufacture of implements of hunting (¹), many of which can be used as weapons (²). We also find evidence of ritualistic burials, often with artifacts used during life(³), as well as anthropomorphic figures and cave paintings with depictions of man and animals(⁴).

1. Villa P, Boscato P, Ranaldo F, Ronchitelli A. “Stone tools for the hunt: points with impact scars from a Middle Paleolithic site in southern Italy.” *Journal of Archaeological Science* 2009; 36: 850-9.

2. Churchill SE, Franciscus RG, McKean-Peraza HA, Daniel JA, Warren BR. “Shanidar 3 Neandertal Rib Puncture Wound and Paleolithic Weaponry.” *Journal of Human Evolution* 2009; 57: 163-178.

3. Gargett, RH. “Middle Palaeolithic Burial is not a Dead Issue: The View from Qafzeh, Saint-Césaire, Kebara, Amud, and Dederiyeh.” *Journal of Human Evolution* 1999; 37: 27-90.

4. Conard NJ and Bolus M. “Radiocarbon Dating the Appearance of Modern Humans and Timing of Cultural Innovations in Europe: New Results and New Challenges.” *Journal of Human Evolution* 2003; 44: 331-71.

Global Specializations

As a reaction to these fundamental human needs each individual person develops some internal or external accommodations for safety, a means to obtain nourishment and some kind of intellectual life. Human beings, however, are social creatures, and naturally form social networks (^{5,6}). The most fundamental of these networks is the extended family, group or clan. Even at this low level of organization one sees the emergence of a Patriarch or Matriarch; hunters of protein and gatherers of carbohydrates; and teachers, healers and family historians or story tellers (⁷). Individuals began to specialize based on talent, knowledge and skill within these basic social structures. This specialization can be viewed as falling into three broad groupings. The first of these global specializations, based on the accommodations for safety, can be called security. The second global specialization, based on the acquisition of the necessities (and niceties) of life, can be called production. Finally, the third global specialty, based on the human need for some kind of intellectual life is herein called the arts and resembles most closely the modern concept of the Liberal Arts, including the humanities, mathematics and the sciences (applied, natural and social).

It is probable, however, that at this primitive level of organization, and particularly with the limited number of persons available for these specializations, individuals continued to carry out all specializations throughout life. This personal integration of roles carries over to modern times. We consider people who cannot discipline their children, manage their finances or create a living space that has some personalization to be deficient (⁸). Furthermore, as talents and abilities change, so do an individual's chosen or assigned specialization. The aging patriarch or matriarch probably started out as a specialist in production, and then with age and wisdom (and probably physical development) moved into security. In old age, another shift is likely, into the arts, dispensing advice, wisdom and sharing and preserving family or clan history.

While it is clear that specialization can take place due to talent and ability, it should be equally clear why such specialization does take place. With specialization comes increased efficiency which leads to increased numbers in the family group or clan. This increase in individuals carries with it the opportunity for additional specialization and the burden of additional need for supplies and facilities. It should also be clear that these specializations were transitory and subject to outside pressures. The tool maker could stop his activities and join in with the harvest when needed. The hunter could join in the defense of the clan's territory if it was threatened. Specialization remained relatively fluid.

Evolution of Global Specializations

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5. Okada D and Bingham PM. "Human Uniqueness-Self-Interest and Social Cooperation." *Journal of Theoretical Biology* 2008; 253: 261-70.
 6. Pettitt P. "Odd Man Out: Neanderthals and Modern Humans." *British Archeology* 2000; Issue No. 51. <http://www.britarch.ac.uk/ba/ba51/ba51feat.html>
 7. Pugh DS. "Modern Organization Theory: A Psychological and Sociological Study." *Psychological Bulletin* 1966; 66: 235-51.
 8. Brock WA and Durlauf SN. "Discrete Choice with Social Interactions." *Review of Economic Studies* 2001; 68: 235-60.

As populations increased and clans grew into tribes, the evolution of specialization grew along the lines of natural selection. Here natural selection is used in its positive sense, the proliferation of the favored, rather than the negative sense, survival of the fittest (⁹). In locations where farming was favored, stationary farming communities developed. In locations where hunting was favored, more nomadic communities developed. In general, the successful exploitation of the local natural environment led to the development of communities suited to the environment in which they were located. Coupled with the increasing specialization, particular tribes grew in importance based on the development of what the Greeks would later call *téchnē* in each of the global specializations.

Early Political Systems

As early societies “proliferated” in regions favorable to the particular collection of technologies within their specializations and specializations within their populations, cities and later nations (collections of cities) grew out of the original stationary farming communities. This larger scale political structure was possible because of the coalescence of three global specialties, Security, Production and the Arts. While the partitioning of the population into each of these global specialties was far from complete, a ruling class of warrior kings (Security), a merchant class (production) and religious leaders (the Arts) all existed and were vying for some level of independence. In societies such as the Egyptians and Mayans we see this separation as incomplete, where the warrior king was also depicted as the great provider and a living god on earth. At this point, it is important to note that this discussion is centered on the development of western civilization.

Later Political Systems

As societies continued to evolve, global specialties continued to separate. During the Classical Age this separation was nearly complete. However, in Greek and Roman times, while there are clear delineations between the warrior class, the merchant class and the artisans, these distinctions still remained somewhat permeable. This period of time is uniquely important in that it exemplified four themes in the development of societies. The first was a tendency toward complete separation of the global specialties; the second was the division of the global specialties into subspecialties; the third was a clear example of one of the critical forces driving both the creation of subspecialties and their subsequent evolution and recombination; the fourth was the intensification of the push for global specialty independence into a struggle for dominance. It is in the Classical Age that we also see examples of dominance for each of the global specialties. In Phoenicia we see a tendency toward merchant (Production) Kings; in Athens we see a similar tendency toward philosopher (Arts) Kings and in Sparta warrior (Security) Kings.

9. Harrison E. *Cosmology: The Science of the Universe*. 2d ed. Cambridge: Cambridge University Press; 2000. p. 541.

Sub-Specializations within Global Specializations

Dramatic growth in population *density* led to increased specialization in the form of subspecialties. The need for security has always existed, first on the individual level, then the family or genetic level and then, ultimately, the societal level. This need for security extends to property, both real and intellectual and is a fixture of any viable society. At the individual and family level, security is often handled by the individual him or herself. One might have a large dog or a handgun. The sub-specialization for security at the societal level is the military. All societies require organization, regulation and enforcement, the modern expression of which consists of politicians, bureaucrats, and police.

The production global specialization probably originated with successful hunter/gatherers. As their success led to higher population levels there were additional individuals available for other sub-specializations. If both environmental conditions and the technology existed, farming and animal husbandry arose (¹⁰). These increased population levels, which placed additional burdens on production. This ultimately led to the sub-specializations of finance, construction and transportation. The rise of these sub-specializations allowed for the rapid growth of another sub-specialization within production, industry (¹¹), and with it the industrial revolution. Conversely, if either unfavorable environmental conditions existed or the necessary technology was not available sub-specializations occurred along other pathways.

The Arts, like the other global specializations probably arose from a single specialization, in this case, a shaman-like healer. Among the earliest artifacts attributed to Modern Man are bone flutes (¹²), cave paintings (¹³), and small figurines (¹⁴). Each of these artifacts interacts with human beings through our most powerful senses, sight, hearing and touch. They also serve as a means of conveying meaning (and perhaps information) to attract and hold the attention of individuals and groups (¹⁵). They can certainly evoke an emotional response, something that has been shown to enhance learning (¹⁶).

As population densities increased, the arts specialization most likely split into theology and natural philosophy, with both retaining a healing role (¹⁷). Ultimately, population densities both permitted and demanded further specialization. Theologians specialized into theology,

10. Midant-Reynes B. *Prehistory of Egypt: From the First Egyptians to the First Pharaohs*. Malden, MA: Blackwell Publishers Inc; 1992. p. 23-99.

11. Ashton TS. *The Industrial Revolution: 1760-1830*. New York: Oxford University Press; 1998. p. 18-52.

12. Zhang J, Harbottle G, Wang C & Kong Z. "Oldest playable musical instruments found at Jiahu early Neolithic site in China." *Nature* 1999; 401: 366-368.

13. Clottes J, Cave C: *The Art of Earliest Times*. Bahn PG (translator). Salt Lake City: University of Utah Press; 2003. p. 214. (Translation of *La Grotte Chauvet, l'art des origines*, Éditions du Seuil, 2001)

14. Conard NJ "A female figurine from the basal Aurignacian of Hohle Fels Cave in southwestern Germany." *Nature* 2009; 459: 248-252.

15. Conard NJ, Malina M & Münzel SC. "New flutes document the earliest musical tradition in southwestern Germany." *Nature* 2009; 460: 737-740.

16. Roozendaal B, McReynolds, JR, Van der Zee EA, Lee S, McGaugh JL, and McIntyre CK. "Glucocorticoid Effects on Memory Consolidation Depend on Functional Interactions between the Medial Prefrontal Cortex and Basolateral Amygdala." *The Journal of Neuroscience* 2009; 29(45): 14299-14308.

17. Pettis JB. "Earth, Dream, and Healing: The Integration of Materia and Psyche in the Ancient World." *Journal of Religion and Health* 2006; 45: 113-129.

literature⁽¹⁸⁾, and the fine arts⁽¹⁹⁾ while natural philosophers specialized into philosophy, the natural sciences, and applied sciences (such as medicine and engineering). Within the Arts global specialization the *téchnē*, present in all global specializations, took on the new dimension of the Latin *scientia*, where the fundamental question of how changed to the fundamental questions of why. Most importantly, each of these sub-specializations built upon their own knowledge base, the body of information associated with the sub-specialization and the techniques by which new knowledge is derived, retained and ultimately incorporated into the basic canon of the specialization.

Societal Development

A key element in the development of society is the degree to which sub-specialization takes place. Our definition of development is intimately tied to the application of technology (in its basic sense-the application of tools to the solution of problems) to improve standards of living. At a more fundamental level, our perception of development is tied to the degree to which sub-specialization takes place. We perceive societies devoid of sub-specialization as primitive. It is rare, however, to find a society in which there is significant specialization and little technology, a situation that seems to tie these two outcomes. There have been many examples in history, however, where significant decreases in population result in a decrease in specialization, resulting in a technologically advanced yet primitive society⁽²⁰⁾, although such imbalances are usually quickly corrected. If specialization does not recover, the technology is “lost.”⁽²¹⁾ Furthermore, it is difficult to accept that primitive societies surviving into modern times never experienced persons gifted in technology. It is more likely that pressures to increase sub-specialization were absent or pressures to reduce sub-specialization were present.

One critical element in the development of sub-specializations is the increase in population density. But population density only sets the stage for sub-specialization. The factors that actually drive specialization are often environmental. As noted above, significant changes in specialization took place prior to and during the classical period. These changes coincided with one of the earliest confirmed human modifications to the environment. Early Greece was covered by a dense Sclerophyllous forest, but the trees were cut down and soil erosion did the rest. The loss of raw material and fuel (in the form of wood) and arable land placed significant pressure on early Greek society⁽²²⁾, and was a motivating factor to accelerate specialization.

18. Woods, TE Jr. *How the Catholic Church Built Western Civilization*. Washington, D.C.: Regnery Publishing; 2005. p. 115-31.

19. Tanner J. “Nature, Culture and the Body in Classical Greek Religious Art.” *World Archeology* 2001; 33: 257-276.

20. Carvalho-Rodrigues F, Dockery J, and Rodrigues T. “Entropy of Plagues: A Measure for Assessing the loss of Social Cohesion due to Epidemics.” *European Journal of Operational Research* 1993; 71: 45-60.

21. Hunt TL. “Rethinking Easter Island's Ecological Catastrophe.” *Journal of Archaeological Science* 2007; 34: 485-502.

22. Ehrlich PR, Ehrlich AH and Holdren JP. *Ecoscience: Population, Resources, Environment*. San Francisco : W. H. Freeman and Co.;1977. p. 621-629.

Interdisciplinarity

The outside forces leading to increased destabilization of sub-specialization populations include environmental (i.e., climate change, and availability of resources), biological (i.e., disease) and societal (i.e., war) influences. Destabilization results in adjustments to the sub-specialization populations, and, depending on the severity of the destabilization, these adjustments can become very large and span global specializations. An obvious example would be the shift, during World War II, from the fine arts (Art) to propaganda (Security) ⁽²³⁾ or the creation of dazzle camouflage ⁽²⁴⁾ for ships (Production), which was inspired by cubism (Art). An adjustment during the pressures caused by the American Industrialization was the emergence of Civil Engineering, bridging transportation (Production) and applied science (Art). This was personified by Julius Walker Adams, who started out as an assistant engineer for the Paterson & Hudson River Railroad in 1831, and in 1852 became one of the founding members of the American Society of Civil Engineers. The 1929 Charter of the Institute of Civil Engineering explicitly mentions the integration of transportation and applied science. Clearly, the movement toward the use of interdisciplinary methods to solve difficult problems is not new, but rather, is a continuation of the ancient tradition of bridging sub-specializations.

Modern Political Systems

Modern political systems are ones in which the separation of global specializations is not only complete but is institutionalized. There are clear delineations between the Security, Production, and Arts global specializations as outlined in Table 1. Organization and regulation are typically managed by a bureaucracy, and both military and police forces exist to provide external and internal security. In capitalist and socialist democracies banking systems (or central banks) provide the capital to fuel agriculture, manufacturing, construction and transportation. These all work together to deliver goods and services to the population. Finally, the Arts consist of many sub-specializations including the Humanities, the Fine Arts, Philosophy, Science, and Theology.

Table 1: The Three Global Specializations		
Security	Production	Arts
Organization	Finance	The Humanities
Regulation	Agriculture	Fine Arts
Military	Industry	Philosophy
Police	Construction	Science
Personal Security	Transportation	Theology

23. Bruner JS. “The Dimensions of Propaganda: German Short-wave Broadcasts to America.” *Journal of Abnormal and Social Psychology* 1941; 36: 311-37.

24. Latimer J. *Deception in War: The Art of the Bluff, the Value of Deceit, and the Most Thrilling Episodes of Cunning in Military History, from the Trojan Horse to the Gulf War.* New York: Penguin; 2003. p. 160-182.

In each of the modern political states accommodations are made between specializations as they vie for dominance. Intra-national conflict (political conflict) is evidence of this struggle. Such conflict can be between global Specializations. Most nations in the developed world experience competition between Regulation (Security) and Industry (Production). The fall of the Shah of Iran and the subsequent Islamic revolution is indicative of a competition between Theology (Arts) vs. Military (Security). It can also be within a global specialization. The military takeovers in nations such as Haiti are an example of competition between the Military and the Bureaucracy; and the French Revolution can be viewed in part as a competition between Philosophy and Theology. When these accommodations are made they are rarely long lived, and evolve or morph over time as both internal and external pressures modify the underlying sub-specialties upon which the accommodations depend.

International conflicts are often a consequence of two societies having made different accommodations among their internal specialties, attempting to impose their specific accommodation on the other. The Crusades are an easy example of this type of struggle, but most major world conflicts from World War I to the War on Terror can all be examined using this rubric. Such conflicting accommodations may be crucial to the maintenance of the will to fight over extended periods of time, for example the public reaction during the American experience in the Vietnam War; or to continue a struggle when there are overwhelming odds for defeat, for example, the Southern response during the American Civil War.

Progress

The most significant side effect of specialization is efficiency. Gains in efficiency leave a pool of individuals free to further specialize, a process that continued as long as efficiency gains were possible. Occasionally an equilibrium condition is reached, but a continual low level flux in the population of sub-specializations could be expected due to variations in talent, training, and interest among individuals. This continuous low level flux in the populations of sub-specializations could be called progress. Thus, prolonged periods during which sub-specializations increase are seen as periods of great progress. When the rate of increase in specialization is low, society appears to stagnate. With this definition one could explain the apparent contradiction between the sense of progress when viewed at the societal level and at the level of a particular individual (²⁵). An individual does not experience sub-specialization, but rather is in one or another or may transfer between them. This makes progress a societal phenomenon, not a personal one.

Breakdown of Intellectual Activity within a Specialization

The above construct utilizes the concept of global specializations that are then further subdivided into sub-specializations. The identification of which sub-specialization falls into which global specialization is made by examining a breakdown of the intellectual activity being used in each

25. Ortega y Gasset J. *The Revolt of the Masses*. New York: W. W. Norton & Co.; 1993. p. 30-35.

specialization and how it evolved over time. In each specialization this intellectual activity can be divided into three main categories; creativity, construction, and communication.

Creativity

In this context creativity is the process of creating new ideas, concepts, techniques or other intellectual constructs. It also includes new ways of associating existing constructs, as well as insight into how these constructs might be related. The terminology for this category varies between sub-specialties, especially in the naming of creative constructs. For example, in theology, the creative process could involve the creation of new systems of beliefs and new associations of belief systems, while in philosophy the creative process could be the development of new epistemologies.

Construction

Construction is the basic *téchnē* for the activity. It consists of the premise for the activity, the reasons for carrying out the activity, how the activity can be accomplished, and the fundamental rules that must be followed while doing the activity. In the natural sciences construction would include the scientific method, while in theology one would include prayer and meditation. Faith would be included in the *téchnē* of theology as it is one of the “tools” for the propagation of religious belief. In law the application of precedent would be considered part of construction. In engineering, innovation would be considered an essential mechanism for the evolution and dissemination of technology.

Construction consists of more than just the tools and knowledge used in a specialization, but also includes the justifications for the way those tools are employed, the methodologies for the selection of particular tools and more importantly, the body of knowledge specific to the discipline and the mechanisms for adding to that body of knowledge.

Communication

Communication is the mechanism used to communicate ideas, express opinions and create a connection to an audience. This category is not limited to the use of language, but includes and utilizes all of the senses. Thus the feel of a sculpture is part of communications as much as the lighting of a stage or the sound of a musical instrument. There are many levels to the category of communications. For example, there is communications within a sub-specialization, communications between sub-specializations within a global specialization and there is communications with across all specializations.

Communications within a sub-specialization often involves mechanisms to increase both the efficiency and the accuracy of the communication. When this involves language it is often labeled as jargon. However, these shorthand techniques are not limited to the written word. In the natural sciences, mathematics serves as a communications method for conveying ideas in an extremely compact yet unambiguous form. Images can often serve in a similar manner. The number of words necessary to convey all of the information in a simple map, for example, is

staggering. The above two examples illustrate one source of misunderstanding in the category of communications, but not the only one. Another issue in communications comes from the language itself. Consider the basic questions, how does something occur and why does it occur? The answer to these questions from within a scientific discipline is different than what one would get from a religious discipline, but it is not always a simple difference in method or jargon. In this case the “how” question would be based on the tools and knowledge base of the discipline, but in the case of the “why” question, it is not a simple difference of construction, but rather that the meaning of the question is different. More specifically, the question of why do human beings exist in science might be because of the presence of specific molecules in specific concentrations at a specific place. In Christian theology the answer could be, “to love and serve God.”⁽²⁶⁾ These are very different answers to very different questions.

Evolution of Intellectual Activity with the Arts in the West

An examination of the evolution of the three categories of intellectual activity within the Arts global specialization illustrates how sub-specialization occurs and how they change over time. This evolution of sub-specializations is critically important to understand both the differences between and the commonality among all sub-specializations within a global specialization.

Human Separation from Nature

The Arts global specialization is based on the human need that arose with consciousness, or the recognition of a point of view that separated self from nature. This concept brought with it tremendous power and anxiety. The power arose from the realization that we did not need to wait for nature to adapt us to our surroundings, but rather, we could adapt ourselves. Furthermore, we could modify our surroundings to fit our circumstances. Harnessing fire shattered the natural hold daylight had, and it expands the range of food and locations available for consumption and habitation. Even more powerful was the invention of clothing⁽²⁷⁾, a development that more than anything else opened the entire surface of the earth for human exploitation.

With the realization that humans were apart from other animals came personalization of life and death. A consistent component of human activity is a ritual surrounding death⁽²⁸⁾. The cyclic patterns to nature (e.g., daylight, seasons, vegetation and animal herds) were a stark contrast to the linear nature of a human lifespan. Coupled with the realization of life and the certainty of death came the understanding that humans could intervene to both aid and hinder the healing process when injury occurred.

26. Catechism of the Catholic Church [internet] The Vatican [cited 2010 May 25]. Available from: http://www.vatican.va/archive/catechism/ccc_toc.htm

27. Kittler R, Kayser M and Stoneking M. “Molecular Evolution of *Pediculus humanus* and the Origin of Clothing.” *Current Biology* 2003; 13: 1414-7.

28. Bartel B. “A Historical Review of Ethnological and Archaeological Analyses of Mortuary Practice.” *Journal of Anthropological Archaeology* 1982; 1: 32-58.

The Age of Magic

The earliest stage of mans understanding of reality was the age of magic. During the age of magic all material objects, including man, were believed to be infused with motivating spirits. In this age all things were thought to act independently, there was no structure or order, and man was at the mercy of the spirits that motivated each individual object. If a rock was thrown at game, the spirit of the rock would decide if it would hit the animal. Furthermore, the spirit of the animal would decide if the attack would be successful or not. Man was helpless in this age, his wants and desires were inconsequential. This was a time during which the decoupling of man from nature was far from complete ⁽²⁹⁾.

A hallmark of human intelligence is the ability to identify patterns. Human beings are adept at building causal connections between events. Seasons repeat, and certain seasons can be associated with game migrations or the best time to plant or harvest. This ability to learn associations led to a recognition that some activities inevitably led to some outcomes, while others did not. Groups of activities seemed to be related. One could fire-harden some objects, but others simply burned. This learning by association coupled with the biological structures capable of audible communications opened up new opportunities. Skill and talent mattered in the outcome of some activities, but many skills could be communicated. The number and distribution of spirits diminished as the power and impact of man increased.

The Age of Myth

The next stage in the development of intellectual activity is the age of Myth ⁽³⁰⁾. As the processes discussed above during the age of Magic intensified, spirits coalesced into anthropomorphic gods. These gods collectively had power over all things, and, more importantly, they had motivations and desires that mankind could recognize and understand. These motivations eventually developed into a new formal system, and it was this process that eventually led to a set of rules by which man could seek the intervention of the gods. Ultimately, rules that the gods followed in making their decisions became evident. For example, the gods chose to control the weather, but they always provided the same climate. These rules permitted an understanding of reality that opened the way for reliable predictions to be made. It was the success of some of these predictions that led to a collection of intellectual challenges with which we continue to struggle to this day. The question, “Why does God allow suffering to happen?” comes to mind.

It seems reasonable that during this period the sub-specializations within the Arts global specialization increased. As mankind attempted to understand the reality it faced, we see the emergence of those who sought to understand the motivations of the gods (Theologians), those who sought to influence their actions (Theists) and those who sought to understand the reasons behind those unchanging aspects of our existence (Natural Philosophers). Consider the

29. Harrison E. Op Cit: 17.

30. Harrison E. Op Cit: 17.

difference between monuments like Stonehenge (³¹), where the purpose is blended, and the sundial, where it is a simple tool for telling time.

The Rise of Theism

As societies continued to grow, their constituents became further specialized. This continued specialization led to the centralization of power. There existed a pressure to move toward a single leader, a single God, and a principle means of commerce. During periods of relative plenty this pressure is relatively benign, but consider societies under extreme pressure. We see Greece move to a single leader in Alexander, and later Rome moving to an emperor. Such tendencies are not limited to the distant past. Modern governments are not immune to the pressure to consolidate power in the hands of a head of state.

One also sees the movement toward further consolidation in theological constructs. Certainly there were tendencies in pagan societies to have a hierarchy in the society of gods. During history these tendencies sometimes resulted in single god cults, such as Akhenaton in Egypt. For the Romans, the concept of anarchy was derived from instances when the power structure of the pantheon broke down. The most glaring example of this tendency, however, is in the clear popular dominance of monotheistic religions in all western societies.

As soon as the technology exists for commerce between stable and independent states, there is a strong tendency for economic specialization. While this is based on the existence of appropriate resources and talent, the ultimate result is the same, a consolidation of both the types of production and the economic systems under which they operate. Thus, in the West we have the consolidation of political power into a sub-specialization of Security, the consolidation of economic power into a sub-specialization of Production and the consolidation of mystical power into a sub-specialization of the Arts.

The Fluid Nature of the Arts Specialization

The Arts global specialization has remained the most fluid. This is due, in part, to the nature of the specialization. The constructs necessary for the security and production specialization are far more stringent than those of the arts. Imagine the soldier. Can he function on the battlefield without weapons? How about the farmer, if he is separated from his land? On the other hand, burning down a church does not stop a minister from holding services for his flock. A group of scientists can practice their trade even if their equipment was taken away. And what can one do to stop a philosopher from philosophizing?

From the onset, the arts global specialization relied less on the physical constructs and more on intellectual insight. This has acted as a double edged sword, allowing on the one hand, rapid developments within sub-specializations, and on the other, an overlapping fluid nature to the sub-specializations. This results in soft boundaries between the sub-specializations, and a flux of practitioners between sub-specializations. Thus one sees, for example, a philosopher specializing in the philosophy of science attempting to tell a scientist how he should practice his

31. Hawkins GS. "Stonehenge Decoded," Nature 1963; 200: 306-308.

field, or the scientist telling the theologian how to manage belief systems. This cross discipline discussion does not happen in the production global specialization, where the transporter of goods would not tell the producer how to make his product.

Impact of the Fluid Nature of the Arts on Creativity

As noted above, creativity is the process of creating new ideas, concepts, or techniques as well as new ways of associating existing creative constructs. In the arts global specialization man's place in the universe and the nature of his interaction with reality are central themes. Creativity in this context can take the form of new ways to describe reality or new ways to impose rules on reality. The fluid nature between the various component of the arts specialization insured that creative activities in different sub-specialization remain closely related. Early natural philosophers and early theologians looked at the night sky and sought to describe the motion of the stars and planets. The cubist movement in the fine arts and the development of special relativity in the physical sciences both sought ways to uncover the fundamental components of reality. The nature of the interaction of our senses with reality has been a theme running through all of the sub-specialties making up the Arts. In all cases the creative act has been the same, to use the tools (construction) available to the sub-specialization to identify these ideas and then the language (communication) unique to the sub-specialization to communicate them.

Impact of the Fluid Nature of the Arts on Construction

While the *téchnē* of the arts appear to vary widely, what these tools and specialized knowledge do and how they are applied remains uncannily similar in the Arts. Consider prayer in theology and experiment in the natural sciences. These two activities appear to be significantly different, yet at the fundamental intellectual level they share the same intent and the same mode of operation. In prayer a practitioner of a faith system asks a Deity to modify some aspect of reality. When carrying out an experiment the scientist "asks" nature to endorse a hypothesis or theory. In both cases an outside entity (God or Nature) is asked to impose the structure on one's perceived reality, construct or action that the practitioner desires. An example of this applied to the fine arts would be René Magritte's "Ceci n'est pas une pipe" or "This is not a Pipe," where we understand that the image we see is the artists imposition of a view of reality using paint and canvas. Each particular sub-specialization within the Arts has its own tools and knowledge, and is bound by its approach to the use of *téchnē*, its application and the intention behind the constructive act.

The various sub-specializations or disciplines within the arts specialization differentiate themselves by the justifications for the way the *téchnē* is employed, the methodologies by which tools are selected, and ways the body of knowledge associated with the discipline is expanded. As a testament to the fluid nature of this global specialization, a common issue is the application of the construction from one discipline on another. Examples of this are the application of

Intelligent Design to Biology or an attempt to use the scientific method to disprove the existence of God (³²).

Impact of the Fluid Nature of the Arts on Communication

Communications is the mechanism to share ideas, express opinions and create a connection to an audience. Communications takes place on several levels, within a sub-specialization or discipline, across a global specialization or across all global specializations. Despite the fluid nature of the arts, specialized forms of communication, particularly within a discipline, have become formalized. This can be attributed to the variation in tools used. For example, the graphic arts typically employ paint, canvas and brush. Sculpture requires the use of a durable solid and a means to shape that solid. The telescope is an essential tool in astronomy.

Another consequence of the fluid nature of the Arts is the tendency of disciplines to develop jargon as the level of sub-specialization increases. This tendency is amplified as disciplines strive to distinguish themselves from each other and establish themselves in a hierarchy of intellectual activities.

Common Themes within the Arts Global Specialization

For as long as the Arts Global specialization has existed there have been some themes that transcend both time and sub-specialization. Through these transcendent themes one can see both the relationships between sub-specializations and the roots of the apparent schism between them. One example of a transcendent theme is the planets and stars. It is impossible to miss the existence of the sun during the day and the stars, planets and moon at night. Moreover, the importance of these objects, providing warmth and light during the day and as a navigation tool and a mechanism to predict the changing seasons at night, is essential to any organized society.

Plato was intrigued by the stars and planets. Because the planets “wandered” through the heavens they posed difficulties for Plato’s views on the nature of reality. Ultimately, however, he decided those difficulties would need to be solved by a later generation (³³). Observations by Copernicus of the motions of Mars and Saturn led to the undermining of the geocentric universe when he published his theories in “On the Revolutions of the Heavenly Spheres.” This process was furthered by Galileo, when in his “Dialogue Concerning the Two Chief World Systems” he reported his observations of the phases of Venus and the moons of Jupiter. The latter was a demonstration of objects orbiting a celestial body other than the Earth and the former indicated that Venus had to be in an orbit around the Sun. The importance of this reliance on technology to amplify the senses, and using the information obtained to alter the accepted structure of reality cannot be over- emphasized. Later, Johannes Kepler used the careful observations of Tycho Brahe in his “Harmonices Mundi” demonstrating that the planets orbit the sun, and that these orbits are not the ideal circle, but rather an ellipse. The Canticle of Brother

32. Atkins PW. Creation Revisited: The Origin of Space, Time and the Universe. New York: W.H. Freeman & Company; 1993.

33. Plato, Laws VII, 820-21.

Sun and Sister Moon by Saint Francis of Assisi further indicates the ubiquitous nature of the sun, planets and stars in the fabric of reality painted by all of the disciplines within the Arts global specialization.

An examination of these common themes illustrates the interrelationships between the various sub-specialties within the Arts specialization. This examination can be easily accomplished by using pairs of individuals in various disciplines within the Arts specialization.

Examination of a few Fundamental Themes

Three general themes common to all sub-specializations or disciplines within the Arts specialization will be discussed; the identification of fundamental components of reality, that understanding the fundamental nature of reality requires an effort of the intellect, and that reality is ordered and is constrained by fundamental rules. These themes will be examined through the example of pairs of individuals, each from a different discipline. This examination will illustrate the interrelationships between the sub-specializations in the arts.

Table 2: Discussion Pairs				
Pair	Theme	Creativity	Construction	Communications
Heisenberg and Duchamp	Identify fundamental components of reality	The Uncertainty Principle/Conceptual Art	Matrix Mechanics/Non-Traditional Media	Matrix Algebra/The Bride Stripped Bare By Her Bachelors, Even
Galileo and St. Thomas Aquinas	An understanding of reality requires an Intellectual effort.	Heliocentric Universe/Natural Theology	Use of the telescope for astronomical observation/Scripture, Tradition	Dialogue Concerning the Two Chief World Systems /Summa Theologica
Newton and Plato	Bring fundamental rules and order to reality	The Mechanical Universe/The Realm of the Forms	The Universal Law of Gravity/The Theory of Forms or Ideas	The Calculus/The Cave Analogy

Identification of the Fundamental Components of Reality: Heisenberg and Duchamp

One of the key themes in the arts has been the desire to understand the fundamental components of reality. As mankind progressed through the ages of Magic and Myth, attempts to define what is real and what is imaginary took on sub-specialization-specific definitions. Stephen Jay Gould’s concept of the nonoverlapping magisterial⁽³⁴⁾ took on its meaning as these definitions diverged. For example, Copernicus, holding various religious and secular positions could comfortably discuss the relationship between scripture teachings and the concepts of his

34. Gould SJ. "Nonoverlapping Magisteria." *Natural History* 1997(March);106: 16-22.

revolutionary theory in a way that few, if any, modern scientists and theologians are. The scrutiny over the identification of the fundamental components of reality through the lens of a specific sub-specialty has not been limited to Natural Science, Philosophy and Theology, but rather has been one of the key themes throughout the Arts global specialization. Its examination in the fine arts is unmistakable. In Pablo Picasso's "Les Femmes d'Alger (O.J.)" he depicts the human form simultaneously from several viewpoints.

The uncertainty principle of Heisenberg places limits on our ability to look too closely at related representations of our reality. Often interpreted as a measure of the accuracy with which we can quantify our surroundings, it actually calls into question the basic nature of reality itself and what are the fundamental components of that reality.

How well can we define an object's position? We can say an object is between two points in space, and the difference between those two points indicates the accuracy to which we know its location. Conversely, if we measure the energy an object has, for example, its kinetic energy (or the energy it has due to its motion), we again know it between two absolute values, and again, the difference between those two limiting values is a measure of the accuracy to which we know its energy. For example, Heisenberg proposes that the product of the accuracy of an object's energy and the accuracy of its position can only be so small. Essential to this concept is not that there is a fundamental graininess to our ability to measure, but that it makes no sense to simultaneously measure the value of two quantities in our reality more accurately than a fixed limit. In essence this defines a relationship between these two observations or measurements of aspects of reality. By creating this relationship it undermines their physical independence and calls into question their definition as fundamental quantities. Using his development of quantum mechanics, Heisenberg then shows a method to identify such pairs of observations ⁽³⁵⁾.

Early in his career Duchamp began to see painting as an intellectual tool and wanted to transcend painting that simply dealt with the representation and interpretation of sensorial information or "retinal painting." His first work to clearly demonstrate this transcendence, "The Bride Stripped Bare by Her Bachelors, Even" combines painting on glass and the representation of a fantastic machine composed, in part, by objects such as a chocolate grinder and a water mill. This machine, designed to allow nine masculine "molds" or "bachelors" referred by Duchamp as "the projection of the main points of a three-dimensional body" to slip off the dress of a feminine mechanical "Bride." Overall, no result is produced, serving to juxtapose an enormous display with a trivial outcome ⁽³⁶⁾. Duchamp viewed this as both "a wedding of mental and visual reactions" and "an accumulation of ideas" where some of the ideas require graphic images and others a commentary ⁽³⁷⁾.

In summary, Heisenberg develops the concept of the uncertainty principle using his construct of the matrix mechanics of quantum theory to communicate what we can comprehend of reality through the use of matrix algebra, while Duchamp creates a conceptual art, using both

35. Heisenberg W. "Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik." *Zeitschrift für Physik* 1927; 43: 172-198

36. Faerna JM. "Duchamp: Great Modern Masters." New York: Harry N. Abrams, Inc.; 1996. p. 5.

37. Sanouillet M "Dans l'Atelier de Marcel Duchamp." *Les Nouvelles Littéraires* 1954; 1424: 5.

traditional and nontraditional media as well as “found objects” to communicate his concept of how we both interact with and comprehend reality through his “Large Glass.”

An Understanding of Reality requires and Intellectual Effort: Galileo and St. Thomas Aquinas

A second key theme in the Arts Global Specialization remains the way human beings process and interpret the information obtained through the senses. An illustrative simplification of this is the perception of the half full or half empty glass. This physical object can be viewed by two individuals with different points of view, and their individual interpretations lead to very different intellectual constructs of it. Each of these constructs carries with it applied meaning as well as implications about its usefulness and history. In short, much of what is understood by simply observing the object is a function of the observer.

A more concrete example within the Arts can be seen by the efforts of St. Ignatius of Loyola. In order to change the perspective of one’s spirituality, St. Ignatius first developed the Spiritual Exercises and a mechanism for sharing them. Later, to further this change in perspective, he joined with a small group of followers and established the Jesuit Order.

Galileo believed the simplest explanation for the evidence available to him was the heliocentric universe. He described the universe as the book in which philosophy (physics) was written, and the language used was mathematics⁽³⁸⁾. Galileo rejected blind allegiance to philosophical and religious authority, and altered his views encompass the simplest interpretation of experimental results. But the most fundamental contribution Galileo made to our view of reality was recognizing the utility in formalizing the use of instruments to enhance the senses. He developed standards of time and distance so experiments could be repeated, and based some of his most important arguments on observations made possible by the use of a telescope. His observations of the moons of Jupiter demonstrated that some astronomical bodies did not directly revolve around the earth. His observations of the phases of Venus demonstrated that Venus had to orbit the sun. Finally, his observations of the moon demonstrated that the Earth was the only astronomical object with surface features⁽³⁹⁾. Galileo allowed technology to alter his view of reality, and accepted both that altered view and the explanations such a view engendered. Galileo communicated his ideas and concepts through publication. His work “Dialogue Concerning the Two Chief World Systems” could be read and understood by any educated person of his time.

St. Thomas Aquinas developed his Natural Theology based on his view that theology was a science operating on the body of knowledge contained in scripture and tradition. To obtain truth St. Thomas argued, one must operate on this body of knowledge using both faith and reason. Thus, St. Thomas argued for spontaneous generation of life, since “the generation of one thing is the corruption of another,” and that “from the corruption of the less perfect the more perfect

38. Drake S. Discoveries and Opinions of Galileo. New York: Doubleday & Company; 1957. p. 237-238.

39. Sharratt M. Galileo: Decisive Innovator. Cambridge: Cambridge University Press; 1994. p. 1-10.

should be generated.”⁽⁴⁰⁾ Clearly the first assertion is based on reason and the second on faith. Likewise, he makes a distinction between the organic and non-organic powers of a human being, arguing that the organic powers (e.g., the senses) operate on the “composite” or union of soul and body, while the non-organic (e.g., the intellect) operates only on the soul. Therefore, intellect is independent of any bodily organ. Since we receive knowledge from sensible things, which of themselves cannot be the subject of our intellect, there exists in the soul a power to extract intelligible likeness from the senses. Thus, all sensory knowledge is subject to interpretation by the intellect.

In summary, Galileo develops his view of the Heliocentric Universe using arguments derived through the augmentation of his senses via technology including the telescope and communicated these ideas in his “Dialogue.” St. Thomas Aquinas develops his Natural Theology using scripture and tradition and communicates it through the *Summa Theologica*. It is interesting to note that both figures used the publication of documents as a means of communication, but for St. Thomas Aquinas, the audience for this work had already become more restrictive, and the dissemination of these concepts was handled through a third party, the clergy. This is a trend that will overtake virtually all of the sub-specializations in the Arts in the present day, where communications to those outside the specific sub-specialty or discipline need an interpreter to understand the communications coming from that discipline.

Fundamental Rules bring Order to Reality: Plato and Newton

Once the critical breakthrough in the transition to the magic to the mythic universe occurred and man realized that rules could be placed on reality, the search for the nature and subject of those rules began. For many, the work of Albert Einstein at the beginning of the twentieth century exemplified this search. His assertion that basic rules of physics apply to all physical phenomena, including the electromagnetic, led to the creation of a new way to view components of reality, such as space and time⁽⁴¹⁾.

Isaac Newton created a system of mathematical laws to organize the emerging body of empirical evidence into a set of rules governing a “Mechanical Universe,” where mathematical equations outlined a cause and effect relationship for the motion of both terrestrial and celestial bodies. The concept espoused by Galileo, to accept the most straight forward explanation of empirical information was extended by Newton. Kepler’s laws of planetary motion were obtained empirically, by fitting data to a set of mathematical relationships in much the same way Galileo would approach the problem. By comparison, in “*Philosophiae Naturalis Principia Mathematica*” Newton developed a set of laws governing the motion of objects acted upon by an external force. He then developed the Universal Law of Gravitation to describe the magnitude of the gravitational force between two massive objects. Finally he combined these two laws and in

40. The “*Summa Theologica*” of St. Thomas Aquinas. Part I QQ L.-LXXIV. Literally translated by Fathers of the English Dominican Province. Second and revised edition [Internet]. London: Burns Oates and Washbourne; 1922. Vol. 3. Chapter: QUESTION LXXII.: ON THE WORK OF THE SIXTH DAY. Available from: <http://oll.libertyfund.org/title/1981/127194/2513438>

41. Einstein A. “Zur Elektrodynamik bewegter Körper.” *Annalen der Physik* 1905; 17:891-921.

doing so derived Kepler's Laws of Planetary Motion. This represented a key step in the formation of rules to bring an order to reality. Prior to Newton, physical phenomena could be described by mathematics, but the overarching structure relating one phenomenon to another did not exist. With Newton we have the Mechanical Universe, with mathematical laws linking all types of motion together, wherever on Earth or in the rest of the Universe it occurred, and whatever motivated that motion.

Plato developed the concept of the realm of the forms and ideas which contains the perfect instances of the components of reality. These components included concrete objects (e.g., a horse) and abstract concepts (e.g., Love). A chair existed perfect and unchanging in the Realm of the Forms. When something was perceived as a chair it was because the perfect form of chair was being expressed to some intensity in it. When something is perceived as beautiful it is because we see some of the archetype form of beauty in it. This allowed for relative beauty to exist, for example, as the expression can be of a higher or lower intensity (42). To Plato, material objects are in a constant set of flux, and all things are in the process of becoming something else. Our senses perceive the constant flux in both the Forms that are expressing themselves in an object and the intensity of that expression. As such, the senses cannot discern the true nature of the Forms. It is up to the intellect to distill these Forms from multiple instances at varying intensities. Within this world view, Forms have a real and permanent existence. Using the theory of Forms or Ideas Plato created a framework dictating how the universe operates. The idealized Forms, invisible to the senses and only detectable by intellect, governed all empirically visible objects and processes. For example, the triangle and the circle, perfect in concept, only expressed themselves in observable objects in a transient and imperfect way (43). This leads to the assertion that the motion of the stars move in circles and that all actions and motions tended toward an idealized conclusion.

We see that both Newton and Plato create a framework within which the universe is completely prescribed and ordered. We also observe that the communication of this ordered universe differs widely. Newton used the language of mathematics and geometry to communicate his construct, while Plato uses allegory, like the allegory of the cave. In the case of the latter, the construct was accessible to the average educated person of his time, while in the former, we once again see the need for an interpreter.

Communications in the Arts Revisited

In the above comparisons the development of common themes by different sub-specializations within the Arts are contrasted. When the comparisons included Natural Science, Philosophy or Theology two general trends can be identified. All three disciplines rely on languages that appear deceptively similar. Issues arise, however, because those languages have nuances that can cause a significant alteration in meaning. Compounding this language issue is a second, more insidious tendency, where each sub-specialty has a propensity to apply discipline specific

42. Tarnas R. *The Passion of the Western Mind*. New York: Ballantine Books; 1991. p. 6-7.

43. *Ibid*; 7-11.

téchnē to problems posed in another's "language." This can lead to the philosopher dismissing a scientific theory on epistemological grounds, a scientist using thermodynamics to disprove the existence of God or the theologian arguing against the heliocentric system based on the revealed Truth in scripture.

Another issue complicating communications in the arts comes from a reliance on discipline specific jargon in the communications of fundamental concepts. One sees a dramatic change when reviewing the work of Galileo and Newton. Both intended to establish a new way of looking at physics, but Galileo's work could be understood by his educated peers, while Newton's work was far less accessible. This trend is not limited to the sciences. Consider the commentary on Duchamp's work: "The Bride Stripped Bare by Her Bachelors, Even - is notorious for being enigmatic and impenetrable. In reality, it is no more so than any other great work of art." ⁽⁴⁴⁾ This quote clearly reflects a pride in the exclusivity of knowledge by practitioners in the field. The same can be said for the other disciplines within the arts global specialization.

Conclusions

In conclusion, the appearance of a schism in the arts exists for several reasons. There is a tendency in the arts to resort to impenetrable jargon. Part of the problem may be due to a general lack of literacy in each of the specific languages of the sub-specialties, but that may be an unavoidable consequence of the high degree of development (or sub-specialization) experienced in modern society. Modern disciplines not only need to rely on an interpreter to bring their message to an audience outside their sub-specialty, but seem to prefer it that way.

A second reason for the appearance of a schism is the high degree of specialization within the construction of the discipline, the ease with which the boundaries between disciplines can be crossed, and the willingness of practitioners of those disciplines to apply their tools to the body of knowledge of another discipline.

The above analysis, however, indicates that the schism is not real. The sub-specializations within the Arts global specialization all share common themes. They each investigate these themes using creativity, construction and communications derived from their sub-specialization, and seek some level of comprehension from this investigation.

When society is confronting difficult issues or social stress there is a tendency for sub-specialization to decrease. This can result in a realignment of the elements of creativity, construction and communications into new sub-specializations. In successful societies this realignment results in disciplines capable of solving the issues or sources of stress. Often this period of realignment also results in the kind of "turf" violations which give rise to the sense of a schism between the disciplines as they tend to augment their body of knowledge by plundering from other sub-specialties.

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44. Faerna JM. Op Cit: 5.