The role of productive imagination in creating artworks and discovering scientific hypotheses

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1. Introduction: Probing Kant on the Role of Productive Imagination in Artistic and Scientific Creating and Discovering New Modes of Representing Reality

In this article I elaborate on Kant's conception of artistic *Productive Imagination* in creating artworks and I generalize it to explain the scientist *intellectual intuition* in discovery new hypotheses. Kant explicates *Intuition* as presentation of the imagination and developed the conception of *Productive Imagination* to explain the genuine creation of fine art.

For the imagination (as a productive cognitive power) is very mighty when it creates, as it were, another nature out of the material that actual nature gives it (Kant, *CJ*:314).

Kant developed the conception of *Intellectual Intuition* as supersensible objects of reason as distinct from empirical ones. I turn this transcendental concept into cognitive operations and explain all cognitions experientially. Hence the role of *productive imagination* lies in the artistic creation of new exemplary artworks, and the role of *intellectual intuition*, as productive imagination, lies in scientistic discovery of new scientific points of view. Within Pragmaticist epistemology I explain that artists and scientists use their productive imaginations differently in their respective enterprises to construct their different modes of representing reality. These two kinds of imaginary productive operations are based directly and indirectly on the perceptual images of empirical objects. To understand the artistic creation of exemplary artworks, and the scientific discovery of new hypotheses, we have to elucidate the roles of their productive imaginations in these different enterprises by analyzing the different structures the artistic *aesthetic reflective judgment of taste* and scientistic *logical reflective judgment of coherence*. I criticize Kant's narrow conception of *judgment* and offer Pragmaticist epistemic logic as complete proof of truth.

2. Kant on Theoretical Judgment and Aesthetic Judgment: Difficulties in the Conception of Judgment

2.1. Kant's division between theoretical logical judgment and aesthetic reflective judgment

Kant's dichotomy of art and science is based on the epistemological division between theoretical [logical] judgment and aesthetic [reflective] judgment, when the former is an objective and true representation of reality while the latter is subjective though universal to human nature in aesthetic experience without representing reality. This is based on the metaphysical division between the determinism of scientific mechanical rules followed in the development of theories, and the freedom of the artistic-genius's productive imagination in creating exemplary fine arts. Kant explicates this division as lawfulness versus free play (Kant, CJ:##35 36). This dichotomy between art and science, between artistic free productive imagination in creating fine arts and scientistic determinated mechanical rules of formulating theories, is elaborated in our traditions of phenomenological "Artism" and analytical "scientism."

2.2. Kant's Conception of Judgment and Its Difficulties in of His Three Critiques

Kant's epistemology developed on his general Conception of Judgment:

I then find that judgment is nothing but a way of bringing given cognitions to the objective unity of apperception (Kant, *CPuR*: B141-142).

Kant has three conceptions of judgments: *theoretical logical judgment* of science, *aesthetic reflective judgment* of fine art, and the *practical judgment of moral law* commands. In these three types of judgments we reflect upon our judging operations to feel and control them by comparing the relation among the operated cognitions of our faculties of Imagination, Understanding, and Reason. Thus we detect harmony or disharmony, but always between the two of them, as the subjective conditions for adequate or inadequate judgments. However, not every cognitive operation determines objective judgment since aesthetic reflective judgments are not objective knowledge of reality but only subjective reflection on the ideas of the Imagination and Understanding faculties to compare their harmony or disharmony ensuing from the feelings of aesthetic pleasure and displeasure (Kant, *CJ*: 237'-238'). The difficulty with Kant's three types of judgments is that because of his phenomenalist epistemology there cannot be any external restriction for their objectivity so he must assume transcendental principles, concepts, or rules, based on faith only. I showed that Kant's judgment of taste of the *Third Critique* is the same as Peirce's *Abductive inference of suggesting* new concepts or hypotheses, the *moral judgment of the Second Critique* is *Deductive apodictic inference*, and of the *First Critique* is the *Inductive determinative inference* of *theoretical* judgment, being equivalent to Peirce's basic *inferences*.

2.3. Pragmaticist Overcoming Kant's Narrow Conception of Judgment by Epistemic Logic of Trio

Hence not one of Kant's different judgments is complete proof of its truth, validity, or universality. To overcome the *a priorist* epistemology I showed that only the sequence of the three inferences, the *Trio* of Abductive Logic of Discovery, Deductive Logic of Necessity, and the Inductive Logic of Evaluating hypotheses, can confront reality and comprise complete proof (Nesher, 2007). This epistemic logic of cognition comprises complete proof of any judgment without recourse to any transcendental a priori assumptions. Our basic cognition is the perceptual operation of the *trio*:

[see Appendix for Diagram 1]

Thus, => is the Abductive *plausibility connective* suggesting the concept A^{Ab}, is the Deductive *necessity connective* inferring the abstract object C^{Dd}, and is the Inductive *probability connective*

evaluating the relation of the concept A^{Ab} and new experiential object C^{In}. Since Kant does not combine the three inferences into complete proofs of the truths of theoretical,

ethical and aesthetical judgments, he has to justify their a priori assumptions separately (*CPuR*:A84ff.; *CPrR*:42; *CJ*:##30, 31). Thus by complete cognitive proof we confront reality with Abductive material logic of discovering cognitions and Inductive material logic of their evaluation which can justify them empirically without any a priori justification. Kant's frustrated attempt to unify human reason "to derive everything from one principle" is solved by Peircean epistemic logic of the *Trio*. With Pragmaticist epistemic logic we can understand better the scientist's *discovery* of hypotheses and the artist's *creation* of artworks.

3. Artistic Genuine Productive Imagination in Creating Fine Arts and Aesthetic Experience.

3.1. Can the Artist Play Free with Productive Imagination in the Creation of Exemplary Artwork?

Kant's aesthetic theory of fine arts divided into two parts: the creation of the artwork by the artist and its evaluation in reflective judgment of taste. How can genuine creation of artwork be both the free play without following rules and despite being purposely and academically trained to control his work? It can be shown that free creation is self-controlled by habitual rules, and generally, according to Spinoza, personal freedom is inner determination (Nesher, 1999). Kant cannot accept such a conception of freedom since his critical philosophy is based on the dichotomy between the determinism of nature and the freedom of the transcendental subject. Yet we cannot explain the role of artists' *productive imagination* without playing free with self-control in creating artwork.

3.2. The Conception of Aesthetic Experience and Creativity

The artist's aspiration in creating artwork is to make his abstract ideas of reality sensible by exhibiting them aesthetically in individual characters and situations of artwork. The artist has the motivation and theme to turn his *intellectual ideas* into the imaginatively created *aesthetic ideas* as artwork. Yet these intellectual ideas with their intuitive meaning-content come from the artist's experiential confrontation with reality. The artist wants to create an epitome of a lover or a cruel person, as Dostoevsky does in *The Idiot*, and *The Devils* respectively, but not to represent any personality but a type of human character, a "sensible expression" in which everyone can find something of himself, and thus represent aesthetically reality by exhibiting human mind and behavior.

My fantasy can in the highest degree differ from the reality that took place, and my Pyotr Verkhovensky may in no way resemble Nechayev, but it seems to me that in my astonished mind imagination has created that character, that type, which corresponds to this crime (Dostoevsky, on *The Devils*, October 8, 1870).

We have to explain how the artist in free play of *productive imagination*, reflecting continually on his experience and evaluating the beauty of the work in its creation, can achieve the harmony between the *rationality* of the *intellectual ideas* and the *sensuality* of the *aesthetic ideas*.

3.3. Reflective Self-Control of the Productive Imagination in Creating the Aesthetic Product

However, if the spiritual motivation is that *aesthetic ideas* are to emulate *intellectual ideas* to create beautiful artwork, it must have reflective self-control to achieve the *harmony* between them:

[see Appendix for Diagram 2]

The creation of artwork by the *Productive Imagination* is by harmonizing the artist's *intellectual ideas* and the created *aesthetic ideas* which can be achieved by free-playing them reciprocally. Intellectual Ideas include rich experiential and general meanings and the theme of the intended artwork from which the artist uses the pre-conceptual imagery meaning-components to quasi-deduce and exhibit the aesthetic epitomes by subsuming the exemplified particulars under the general ideas. This is done with the best elements that will attune to the initial Intellectual ideas. To evaluate these elements in creative operation the artist continuously has recourse to his *general knowledge of reality* and the *imagery sensual intuition*. Since this productive imagination is an unstated operation, there are no formal rules to control the exhibition of aesthetic ideas, but habitual quasi-rules are instinctively and practically self-controlling and infer adequately *aesthetic ideas* from *intellectual ideas*. Yet the criterion for achieving beauty is only a true aesthetic representation of reality.

4. Discovery of New Modes of Representing Reality: Intellectual Intuitive Productive Imagination and Genuine Creative-Discovery as Metaphor

4.1. Sensual Intuition and Intellectual Intuition in the Discovery New Concepts and Hypotheses

Epistemically the role of intellectual intuition in Abductive logic of discovery of new scientific hypotheses is analogous to our sensual intuition of perceptual discovery of new concepts (Nesher, 2001). The scientist's *intellectual intuition* operates with *productive imagination* on scientific background knowledge to solve its difficulties in explaining reality. This is done by *productive imagination* operating by instinctive and practical self-control to recombine the iconic and indexical imagery meaning-contents of background knowledge to discover a new imagery picture of reality. Then the scientists formulate them into a new abstract hypothesis, so we do not need scientists' *a priori* intuition as a miracle, à la Einstein and Popper. We can understand intuitive discovery of new aesthetic ideas and scientific hypotheses as *metaphors*. By creating and discovering new ideas, artists and scientists still use some old expressions, such as the terminology of *space and time*, but they change the imagery meaning-components to elaborate new pictures, so as to replace the classical picture's physical reality by the relativist picture. The new accepted theory has lost its metaphorical character as newly discovery, and has become merely an analogy to the old theory, e.g., the analogical pictorial imagery of Newtonian gravitational forces and Einsteinian Relativity with spacetime curvatures: we use both of them, but in different proof-conditions.

In his first paper on atomic theory in 1913, Bohr emphasized that although Newtonian mechanics is violated, its symbols permit visualization of an atom as a minuscular solar system. Bohr based all of his reasoning on the following visual metaphor: The atom behaves *as if* it were a minuscule solar system (Miller, 1996:225).

But the source of the intellectual intuition meaning-content lies in sensual intuition, otherwise it would remain an empty abstract formalism.

4.2. The Role of Intellectual Intuition of Productive Imagination in the Recombination of Scientists' Background Knowledge to Discover New Hypotheses

The role of human intellectual intuition in genuine scientific discovery of new hypotheses lies in overcoming the difficulties in interpretating scientific background knowledge into discovery of a new comprehensive imagery-picture of reality to formulate the hypothesis. This is done by the *productive imagination* of *intellectual intuition* operating on the *imagery* components of the symbols to recombine them in Abductive discovery work by detecting new iconic similarities and indexical analogies for new combinations from background knowledge components. For example, in looking for a new intellectual image of the quantum theory components, instead of the images of weave and particle separated complementarily, the scientist can imagine a dynamic continuum of particle-weave components (Bohm and Hiley, 1993). Similarly, Cervantes combines in Don Quixote two different characters: a brave fighter for justice and a ridiculous fantasist, a combination which we can find, in different portions, in every one of us. Thus, *intuitive productive imagination* can freely play with different components of our experiential knowledge to create new aesthetic characters.

[see Appendix for Diagram 3]

This Abductive discovery of a new scientific hypothesis is the first stage of the entire scientific discovery; it continues with Deductive inference of theoretical prediction and Inductive evaluation proving its truth. Here is Einstein's expression of his play with productive imagination:

In the following, I am trying to answer in brief your questions as well as I can

(A) The words or the language, as they are written or spoken, do not seem to play any role in my mechanism of thought. The psychological entities which seem to serve as elements in thought are certain signs and more or less clear images which can be "voluntarily" reproduced and combined. There is, of course, a certain connection between those elements and relevant logical concepts …

(B) The above mentioned elements are, in any case, of visual and some of muscular [kinesthetic] type. Conventional words or other signs have to be sought for laboriously only in a secondary stage, when the mentioned associative play is sufficiently established and can be produced at will.

(C) According to what has been said, the play with the mentioned elements is aimed to be analogous to certain logical connections one is searching for.

(D) Visual and motor. In a stage when words intervene at all, they are, in my case, purely auditive, but they interfere only in a secondary stage as already mentioned.

(E) It seems to me that what you call full consciousness is a limit case which can never be fully accomplished …

I am enough of an artist to draw freely on my imagination. Imagination is more important than knowledge. Knowledge is limited. Imagination circles the world. (Einstein to Hadamard, 1945) *"Intuitive thinkers have made many of the breakthroughs in science."* (Louis de Broglie)

4.3. The Self-conscious and Self-control of Intellectual Intuition in Discovery of a New Hypothesis

What Einstein expresses as *thought* without words can be understood as a distinction between *imagination* and *reasoning* (Einstein, 1949:7-9). The idea is that one's cognitive operation can be meaningful for one when its elements have felt meanings such that the entire operation is

meaningful for him to communicate to others. Yet without any verbalization of such an operation we hardly remember and articulate it, though we can elaborate upon it *habitualiterly*, albeit with some explain for it as an unconscious process, hence as the work of a god, a muse, or any supernatural (e.g., Plato, Kant). That way we explain that there is no mystery in such an ingenious scientific operation. How we can understand Einstein's *unconscious thought* in scientists' creative imagination (Einstein, 1949:7)?

Certain obvious features of the phenomena of self-control … can be expressed compactly … by saying that we have an occult nature of which and of its contents we can only judge by the conduct that it determines, … and since we are conscious of what we do deliberately, we are conscious *habitualiter* of whatever hides in the depths of our nature; and … that a sufficiently energetic effort of attention would bring it out. Consequently, to say that an operation of the mind is controlled is to say that it is, in a special sense, a conscious operation. (Peirce, *CP*: 5.440-441)

Yet all self-control of mental operation must be at some level of self-consciousness to connect the phases of intuitive creativity in order to discover, elaborate and prove rationally the hypothesis.

5. Different Roles of "Productive Imaginations" in Artistic Creation and Scientific Discovery

5.1. The Roles of "Productive Imagination" in Artistic New Exemplary Representations of Reality

The role of artistic *productive imagination* in the creation of aesthetic representation of reality lies in the artist's *Deductive* interpreting his *intellectual ideas* into *aesthetic ideas* as epitomized artwork. This is done by quasi-proof of this operation to ensure that artwork is a true aesthetic representation of reality.

[see Appendix for Diagram 4]

5.2. The Roles of "Productive Imagination" in Scientific Discovery of a New Picture of Reality

However, the role of the scientist's *productive imagination* lies in his *intellectual intuition* recombining Abductively the imagery components of scientific background knowledge to overcome its difficulties. This is discovering a new imagery picture of reality to formulate a new hypothesis to prove its truth.

[see Appendix for Diagram 5]

But taken from the psychological view-point, this combinatory play seems to be the essential feature in productive thought–before there is any connection with logical construction in words or other kinds of signs which can be communicated to others. (Einstein, 1945)

Scientists reach the coherency of the new scientific picture only by evaluating the hypothesis experimentally, but in the imaginative phase they only feel it in regard to background knowledge.

5.3. Artist and Scientist Represent Reality Through Their Cognitive Confrontation with Reality

We can explain that our aesthetic judgments of beauty are due to the artwork's true aesthetic representation of reality, and can be indicated through the harmony of intellectual ideas and aesthetic ideas in the creation and evaluation of artworks. But without confrontation with reality there is no

ground for the objective and true creation and evaluation of artworks in our judgments of taste and in scientific feeling of the coherence and beauty of their hypotheses (Nesher, 2002).

6. Conclusion: Genuine Artistic and Scientific Works are Different Modes of Representation

6.1. Fine Art and Science are Different Cognitive Procedures of Representing Reality

There is similarity in representation between scientific theories and fine arts and even myths as a kind of artistic epitomizing of characters, such as Apollo and Dionysus, to represent types of persons. In the creation of artworks by artists, and their grasp by others, one continuously compares them with their experience. The difference between artist and scientist in representing reality is that the former only instinctively quasi-proves the truth of artworks, while scientific hypotheses are proved rationally. This explains why artworks are regarded as fictions since we feel their truth only implicitly, while in science we prove it explicitly.

Every natural science will be worthless if its claims could not be tasted by observation of nature; every art would be worthless if it was no longer able to move men, no longer able to illuminate for them the meaning of existence (Heisenberg, 1948:88).

Hence, from our sensual experience and the inquiries into the nature of reality we develop our scientific theories and aesthetic artworks to represent reality truly to elevate our life within it.

6.2. Art and Science Are Different Modes of Representing Reality: "Aesthetically" and "Logically"

Aesthetic and *scientific* modes of representation differ in that the artist's representing reality is by *aesthetic epitomizing* of characters and situations, and the scientist's is by logical *abstraction formulating* general theories. Dealing with artworks, we have feelings and emotional reactions of pleasure by which we aesthetically judge them beautiful to indicate their beauty and truth in an aesthetic representation of reality. The proof and the truth of scientific logical abstraction formulations are proved true at the rational level of self-control of the discovery, elaboration, and evaluation of the hypotheses, yet are always relative to the accepted proof-conditions, the true-conditions and the proof methods of theories.

6.3. Art and Science Both Prove the Truth of Their Representation of Reality and Thus Have Truth in Beauty and Beauty in Truth

What is the beauty of scientific formulas and their proofs? The icons of aesthetic presentations in art and science have some similarity, and so does the indexical analogy between them in representing reality. Therefore, we can hypothesize that in both cases the feeling of aesthetic pleasure can be explained as true aesthetic representation of reality, though the modes of representations of art and science differ as individual epitomization and general formalization respectively.

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Appendix

Diagram 1:

The Operation of Perception is the *Trio* Quasi-Proof of Perceptual Judgment:

$$\textbf{Abduction}((C^{Ab}(A \rightarrow C) => A^{Ab}) + \textbf{Deduction}((A \rightarrow C)\ A) \rightarrow C^{Dd}) + \textbf{Induction}((A, C^{In}) \sim > (A^{Ab} \rightarrow C^{In}))$$

Diagram 2:

Genuine Creation of Artwork with Reflective Free Play of Productive Imagination:

⌐------Reflective Act of Comparison----⌐
DEDUCTION: A QUASI-INFERENCE
Free Play of *Productive Imagination* to Reach Harmony of **Intellectual** and **Aesthetic** Ideas

HARMONY or DISHARMONY

Understanding   Productive Imagination   Artwork
Creation Rule(Intellectual Ideas ==============> Aesthetic Ideas)
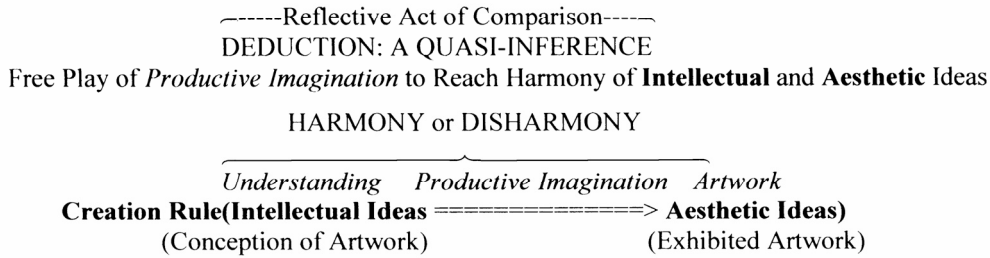(Conception of Artwork)   (Exhibited Artwork)

Diagram 3:

Intuitive Recombination of the Background Knowledge by Productive Imagination to Abductively Suggest a New Picture of Reality for Intellectual Scientific Hypothesis:
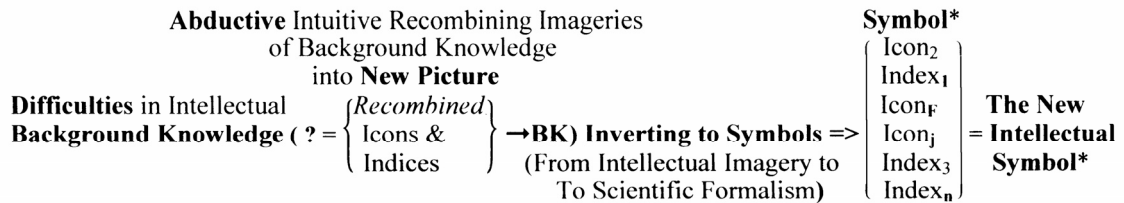
Abductive Intuitive Recombining Imageries   **Symbol***
of Background Knowledge   ⌈ $Icon_2$ ⌉
into **New Picture** | $Index_1$ |
Difficulties in Intellectual   ⌈*Recombined*⌉ | $Icon_F$ | **The New**
Background Knowledge (? = ⟨ Icons & ⟩ →**BK) Inverting to Symbols =>** | $Icon_j$ | **= Intellectual**
                                      ⌊ Indices ⌋ (From Intellectual Imagery to | $Index_3$ | **Symbol***
                                                    To Scientific Formalism**)   ⌊ $Index_n$ ⌋

Diagram 4:

The Artist's Creation of Artwork and His Reflective Free Play to Harmonize Intellectual Ideas and Aesthetic Ideas: The Role of Productive Imagination
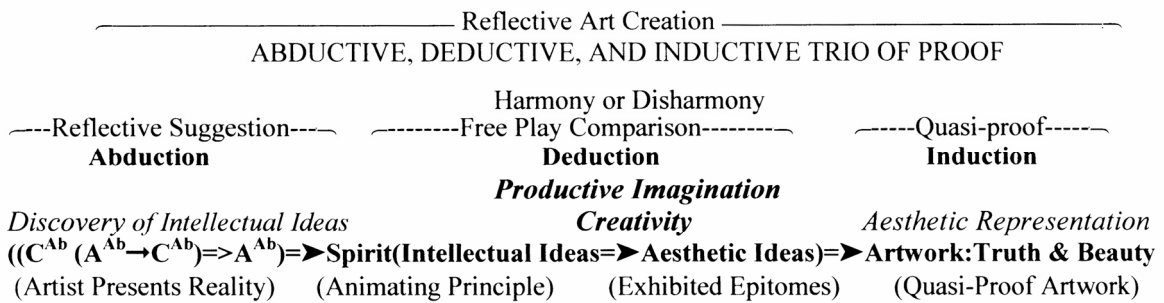
⌐————————————————— Reflective Art Creation —————————————————⌐
ABDUCTIVE, DEDUCTIVE, AND INDUCTIVE TRIO OF PROOF

Harmony or Disharmony
⌐---Reflective Suggestion---⌐   ⌐--------Free Play Comparison--------⌐   ⌐-----Quasi-proof-----⌐
Abduction   **Deduction**   **Induction**
                            Productive Imagination
Discovery of Intellectual Ideas   ***Creativity***   *Aesthetic Representation*
((C^{Ab} (A^{Ab}→C^{Ab})=>A^{Ab})=➤Spirit(Intellectual Ideas=➤Aesthetic Ideas)=➤Artwork:Truth & Beauty
(Artist Presents Reality)   (Animating Principle)   (Exhibited Epitomes)   (Quasi-Proof Artwork)

Diagram 5:

Genuine Discovery of Scientific Theory by Intellectual Intuition of Productive Imagination Solves the Difficulties of Previous Theories:

⌐----------------------Reflective Act of Discovery----------------------⌐
ABDUCTIVE, DEDUCTIVE, AND INDUCTIVE TRIO OF PROOF
Abduction

Productive Imagination
Difficulties in   ***Discovery***   *Logical Representation*
Rule(Background Knowledge ⇒Recombination Imagery Ideas) ⇒Symbolic New Hypothesis ⇒Proof
(Analysis Theoretical Difficulties)   (The New Visual Model)   (Proving New Theory)