Charles Sanders Peirce:
Play and the Logic of Discovery[1]

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Man is not a circle with a single center; he is an ellipse with two foci.   Facts are one, ideas are the other.

Argot is nothing more nor less than a wardrobe in which language, having some bad deed to do, disguises itself, It puts on word-masks and metaphoric rags.

Victor Hugo[2]

In the waning years of his peculiar, though wonderfully interesting, life, Charles Sanders Peirce wrote an essay with the curious title "A Neglected Argument for the Reality of God."   Approaching age seventy, suffering both severe poverty and painful illness, Peirce--mathematician, logician, philosopher, one of America's greatest minds--kept on writing.   Unlike the bulk of his voluminous writings which was first published only decades after his death, this essay was written for publication in *Hibbert Journal* and Peirce repeatedly expressed frustration at the length limitations the journal gave him.   Still in twenty-two pages Peirce not only summarized and updated many of the central elements of his expansive semiotic program, he introduced new and novel topics, notably "musement."   Here, as in all his works, Peirce's writing is sometimes frustratingly opaque, yet not without occasional passages of poetic eloquence.   Perhaps more than clear exposition, this essay is an invitation to musement and thought.

Peirce begins the essay with a series of definitional clarifications—"God," "idea," "real," "actual," "experience," "argument," "argumentation" (all together handled in a couple of paragraphs)—before entering into a discussion of "musement," which he alternatively terms "Pure Play."   Musement, Peirce argues, understood as a purposeless though lively communication in odd half hours between self and self leads eventually and inevitably to the idea of God's reality.   "In the Pure Play of Musement the idea of God's Reality will be sure sooner or later to be found an attractive fancy, which the Muser will develop in various ways."(6.465)[3]   Peirce understands the idea of God's reality to be an operative hypothesis which shapes conduct in accordance with a state of mind he calls "believing." Entwined with a discussion of the three-stage process of inquiry as well as the principles that distinguish "pragmaticism" Peirce refines, extends, and expounds his argument for God's reality.

Though the essay appears to center on a theological issue, it serves as a culminating discussion to Peirce's life-long endeavor to understand the various processes of inference (the core of his semiotic) and as an expansion of this discussion of musement, a kind of play.   This essay is, to my knowledge, Peirce's only discussion of play, yet his understanding of play is traceable to one of the first books of philosophy he ever read.

Appealing to common knowledge, Peirce wrote: "Play, we all know, is a lively exercise of one's powers." (6.458)   Of play, Peirce acknowledges a pure form, a Pure Play, Musement, described as "a certain agreeable occupation of mind."   "Indulged in moderately—say through some five to six percent of one's waking time, perhaps during a stroll—it is refreshing enough more than to repay the expenditure."   Musement "involves no purpose save that of casting aside all serious purpose."   "It bloweth where it listeth."   "It has no purpose, unless recreation."   If purpose enters the process it becomes science, which Peirce understands as inappropriate to concerns about "the truth of religion." (6.458)

To the determined practitioner of musement Peirce provides eloquent advice.

> The dawn and the gloaming most invite one to Musement; but I have found no watch of the nychthemeron that has not its own advantages for the pursuit.   It begins passively enough with drinking in the impression of some nook in one of the three Universes.   But impression soon passes into attentive observation, observation into musing, musing into a lively give and take of communication between self and self. . . . Adhere to the one ordinance of Play, the law of liberty.   I can testify that the last half century, at least, has never lacked tribes of Sir Oracles, colporting brocards to bar off one or another roadway of inquiry; and a Rabelais would be needed to bring out all the fun that has been packed in their airs of infallibility. . . . those problems that at first blush appear utterly insoluble receive, . . . their smoothly-fitting keys.   This particularly adapts them to the Play of Musement. (6.459-6.460).

The three universes of experience to which Peirce refers, summarized in "The Neglected Argument" (see also 4.545ff), are basic to his program.   The first universe comprises all "mere Ideas, those airy nothings to which the mind of poet, pure mathematician, or another *might* give local habitation and a name within that mind." Peirce specifies the second universe as "the Brute Actuality of things and facts."   The third universe includes everything "whose being consists in active power to establish connections between different objects, especially between objects in different Universes."   This is the universe of the sign, which has its being in its power to mediate between its object and the mind. (6.455)   In these terms, musement at least begins with a "drinking in the impression of some nook of one of the three Universes."

In musement no kind of reasoning is to be discouraged.   In particular musement should not be constrained to "a method of such moderate fertility as logical analysis." (6.461)   Peirce concludes his encouragement.   "Enter your skiff of Musement, push off into the lake of thought, and leave the breath of heaven to swell within you, and open conversation with yourself; for such is all meditation." (6.461)

Once in this lake of thought Peirce expects the skiff of musement to take a course running inevitably toward the hypothesis of God's reality.   One begins perhaps with the interest in the nature of one's feelings, with the faculties to experience pain and pleasure.   In time this course will lead to metaphysical interests, to universe-wide phenomena only partly experienced and still unformulated. These, Peirce recommends, should be pondered from every point of view, an effort sustained until some truth beneath the phenomena seems to arise.   During this course one will begin to appreciate the unspeakable variety in one or another of the three universes of Peirce's conception, but in time musement on the variety will turn to connections and homogeneities, not only within one or another of the three Universes, but among them as well.   Peirce discusses, as an example of one of these homogeneities, "growth" which occurs among the phenomena of all of the universes.   The course of this skiff of musement is that of increasing inclusiveness and generalization.   A reduction of the manifold to unity.   Such a process Peirce argues is bound eventually to raise the hypothesis of the reality of God. (6.462-465).[4]

This process leads to the composition of a nest of three arguments, which Peirce sometimes collectively calls the "Neglected Argument."   He also refers to it as the "Humble Argument" perhaps the more accurate and useful designation, for it is open, in Peirce's terms, "to every honest man, which I surmise to have made more worshippers of God than any other."(6.482)   It is a "neglected argument" only in that Peirce believed it to be known, but ignored, by theologians.   It is an argument not unknown to anyone and Peirce even holds that it is most forceful "in the form it takes in the mind

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[4]There is an interesting comparison to be made between Peirce's discussion of the hypothesis of God's reality and Jacques Derrida's discussion of the loss of center.   Derrida calls attention to an event, a rupture, in the history of the concept of structure.   This rupture is the realization that while center gives structure orientation, balance, and organization, it restricts its play.   The rupture occurs as one begins to think of center as an attribute of structure, leading one "to begin to think that there was no center, that the center could not be thought in the form of a being-present, that the center had no natural locus, that it was not a fixed locus but a function, a sort of non-locus in which an infinite number of sign-substitutions came into play." (Jacques Derrida, "Structure, Sign, and Play in the Discourse of the Human Sciences,"*Writing and Difference*, trans. Alan Bass. London: Routledge, 1966, pp 278-294), p. 294. Though Peirce's discussion here appears to posit the being-presence of God, the unity of all, the *ens necessarium*, it is essential that we see that he posits the hypothesis of God's reality and that he leaves open the possibility that the humble argument might lead to hypotheses adorned in various terms.   While I believe that Peirce's ideas are often as radically insightful as Derrida's, they are sometimes obscured by the language of the era in which he wrote.

of the clodhopper." (6.483)   From a third perspective the argument bears upon what Peirce terms "methodeutics," that is, on the principles of argumentation and inevitably on what he understood as "pragmaticism."[5]

Peirce held the argument for God's reality to be nothing other than an example of the "first stage of a scientific inquiry into the origin of the three Universes." (6.485)   He saw an identity between the maxim of his pragmaticism and what, by this point of development in his thought, he understood as the first stage in the process of inquiry (variously termed "abduction," "retroduction," and "hypothetic inference").   In identifying musement as an instance of "abduction," Peirce made a connection between play and the maxim of pragmaticism.

Play, as Peirce argued, at least in its form that he called Pure Play or Musement, leads eventually and inevitably to a grand hypothesis of unity, the *ens necessarium* to which Peirce gave the Christian/American alias "God."   In this discussion, there is a fascinating implication that play and that most creative stage of inquiry Peirce called abduction can both be more fully understood when conjoined.

Throughout his life, Peirce turned again and again to contemplate the nature of inference.   Just how is it that knowledge is gained?   From whence cometh hypotheses? What is the logic of discovery? His continuing analysis of induction and deduction convinced him that these forms of inference do not "contribute the smallest positive item to the final conclusion of inquiry." (6.475 see also 5.171)   He proposed a third mode of inference, surely one of his greatest contributions, which he called by various names: abduction, retroduction, and hypothesis (or hypothetic inference). Late in his life this mode had come to be understood as the first of three stages in the process of inquiry.[6]   It focused on the logic of discovery, on the creation and acceptance of hypotheses.   In "A Neglected Argument" Peirce described the creation of hypotheses in these terms:

> Every inquiry whatsoever takes its rise in the observation, in one or another of the three
> Universes, of some surprising phenomenon, some experience which either disappoints an

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[5]Though the philosophical movement Peirce initiated is most commonly called "pragmatism," not "pragmaticism," and that term was first used by Peirce, he later used the term pragmaticism in reaction to the interpretations given the former term by Ferdinand Schiller and William James.   In shifting to the new term he wrote:
> So then, the writer, finding his bantling "pragmatism" so promoted, feels that it is time to kiss his child good-by and relinquish it to its higher destiny; while to serve the precise purpose of expressing the original definition, he begs to announce the birth of the word "pragmaticism," which is ugly enough to be safe from kidnappers. (5.414)

Because of this statement and that Peirce used the more inelegant term in "The Neglected Argument," I have chosen to use it throughout this essay.

[6]For the sorting out of the history of Peirce's conceptions on inference, see K. T. Fann, *Peirce's Theory of Abduction* (The Hague: Maartinus Nijhoff, 1970).

expectation, or breaks in upon some habit of expectation of the *inquisiturus*; and each apparent exception to this rule only confirms it.   There are obvious distinctions between the objects of surprise in different cases; but throughout this slight sketch of inquiry such details will be unnoticed, especially since it is upon such that the logic-books descant.   The inquiry begins with pondering these phenomena in all their aspects, in the search of some point of view whence the wonder shall be resolved.   At length a conjecture arises that furnishes a possible Explanation, by which I mean a syllogism exhibiting the surprising fact as necessarily consequent upon the circumstances of its occurrence together with the truth of the credible conjecture, as premises.   On account of this Explanation, the inquirer is led to regard his conjecture, or hypothesis, with favor.   (6.469)

Elsewhere Peirce presented this first stage of inquiry in syllogistic form:

The surprising fact, C, is observed;

But if A were true, C would be a matter of course,

Hence, there is reason to suspect that A is true.   (5.189)

Only the first stage of inquiry gives rise to hypothesis.   It does not establish anything (it does not give security, as Peirce would say); this is the work of induction and deduction.

Deduction, of which Peirce held a more or less traditional understanding, collects through logical explication the consequence of a hypothesis.   It formulates the implications a hypothesis ought to have in light of experience.   Induction follows as the final stage of inquiry to ascertain how far these logical consequence accord with experience.   It examines experience, which is never exhaustive or totally representative of the domain of the hypothetic implications, in light of expectation and draws general conclusions.   Deduction explicates, induction evaluates.   Only abduction creates any real advancement in human knowledge. (see 5.171 and 6.475)

Striking at the heart of philosophical systems that rest on and proceed from first principles or ultimate goals, Peirce established a philosophy with a particularly modern character.   Peirce's pragmaticism (synonymous with abduction) founds inquiry on a process that begins with the introduction of a "may be" emerging from a background that is always to a degree tacit and promised continued improvement through criticism.   Still, there is no final truth or conclusion.

Peirce's conception of abduction can be more fully appreciated in light of his critique of Cartesianism which he advanced as four denials.   Read positively they present key elements of his pragmaticism.

1.   We have no power of Introspection, but all knowledge of the internal world is derived by hypothetical reasoning from our knowledge of external facts.
2.   We have no power of Intuition, but every cognition is determined logically by previous

cognition.

3. We have no power of thinking without signs.
4. We have no conception of the absolutely incognizable. (5.265)

Beginning with the general policy—a method of doubt—that nothing can be accepted as true that is subject to any doubt, Descartes turned to introspection. He doubted everything until he at last found that which is, for him, beyond doubt, "I think, therefore I am." It is upon this method of doubt that the Cartesian system is built. It owes much to the Scholasticism it sought to replace, most significantly the idea that the acquisition and development of knowledge must rest on some unquestioned, undoubtable *a priori*. Whereas the schoolmen proceeded on the authority of God revealed through the testimony of the church, Descartes's system proceeded on a method of doubt which, through introspection, led him to that indubitable first principle.

Peirce denied that we have the power of introspection, the ability to get at the truth independent of external conditioning. This position is a direct consequence of his maxim of pragmaticism and a declaration that the scope of the maxim extends to knowledge of the internal as well as the external world.

Peirce also objected to the foundation of inquiry, of science, being dependent upon individual self-consciousness. Individuals cannot be the sole judges of truth. His maxim of pragmaticism pushed toward inquiry proceeding in public among a community of inquirers. Only in this way is knowledge subject to criticism and refinement.

The second denial, that of intuition, is effectively a denial of the Cartesian method of skepticism. Descartes's system must rest on intuition which by definition is a rationally justified, but unconditioned, premise. While Descartes thought this could be accomplished by clearing the mind of prejudice as an act of the will, Peirce held this to be impossible. Every cognition is logically determined by previous cognition. There is for Peirce always a background. Much of that background is always tacit as has so effectively been shown by Michael Polanyi[7] and George Lakoff,[8] and for this reason among others we cannot clear our minds of prejudice; there can be no intuition, all knowledge is personal.

Descartes replaced the testimony of authority of Scholasticism with reason, but both sought to found knowledge on unquestionable first principles. Peirce's critique is that there is no absolutely first premise. All knowledge is won in the never-ending posing, criticizing, and testing of hypotheses.

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[7]Michael Polanyi, *The Tacit Dimension* (Garden City, NY: Doubleday & Company, 1966).
[8]George Lakoff and Mark Johnson, *Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought* (Chicago: University of Chicago Press, 1999).

Peirce understood hypothesis to pertain only to the domain of "intellectual concepts." (5.467)   In the terms of his three universes, this cannot take place without signs, they comprise the third universe. Hypotheses, as is all thought, are sign constructions.   The universes of brute actuality and ideas are known by the mediation of signs.   There is no unmediated access to outside reality.   This is Peirce's position on the body-mind problem bequeathed to us by Descartes.   Even all observations, what we consider facts, form themselves only in relationship to background and in terms of signs.   Peirce's semiotic is itself a critique of Cartesianism's position on the body.   By beginning with "I think, therefore I am," one identifies oneself only with thought, with mind.   The mind and the body are of separate natures, distinct and can exist separately (not that they do).

The fourth denial follows directly.   Cognition proceeds from hypothesis; hypothesis emerges from a field of inquiry.   Thus "over against any cognition there is an unknown but knowable reality; but over against all possible cognition, there is only the self-contradictory.   In short, *cognizability* (in its widest sense) and *being* are not merely metaphysically the same, but are synonymous terms." (5.257)

Cartesianism is caught in the distinction between the inventions of thought and the particular realities these thought inventions represent.   By holding that the Cartesian method only applies to the inventions of thought and that the medium of thought is separate from reality, then thought can never grasp what is real.   Yet the Cartesian claim to know particular realities immediately forces the conclusion that we conceive what is incognizable.   Peirce not only showed the nonsense of this position (to identify something as incognizable already requires its cognition in some sense), but established his semiotic as the solution.

But, by proposing a hypothesis for the reality of God, is not Peirce simply returning to the position of Scholasticism which rested, as Peirce put it, "on the testimony of the sages and of the Catholic Church" (5.264)?   The important distinction is that Peirce argues that musement leads inevitably to the *hypothesis* of God's reality.   The reality of God is not proposed to be the unquestioned premise underlying all inquiry.   Peirce held that "the function of hypothesis is to substitute for a great series of predicates forming no unity in themselves, a single one (or small number) which involves them all, together (perhaps) with an indefinite number of others.   It is, therefore, also a reduction of a manifold to unity." (5.276)

The hypothesis of God's reality is but a version of the most global possible hypothesis, that is, the hypothesis that reduces the manifold to unity.   It is simply a dressing of the idea of unity and universality in particular Western and Christian theological attire.   As hypothesis, a "may be," it serves to affect human actions, but the notable difference is that in Peirce's construction, God's reality is hypothetic, a "may be" or a "may not," and therefore remains open and vital, rather than being a statement of accepted conviction, a certainty proclaimed in the past.

Abduction is inseparable from Peirce's understanding of pragmaticism as he so often indicated. Peirce described pragmaticism in the simple terms of the concern with "the admissibility of hypotheses to the rank of hypotheses," the "explanations of phenomena held as hopeful suggestions," that is, "pragmatism . . .   is nothing else than the question of the logic of abduction." (5.196)   The maxim of pragmaticism amounts to a criterion of meaning.   A hypothesis only has meaning if it has empirical or practical consequences.   The total of these possible consequences constitutes its meaning.   But this must not be confused with some crass pragmatism of efficiency, for it simply means that a hypothesis must be subject to test by experimentation.   "Pragmatism . . . makes conception reach far beyond the practical.   It allows any flight of imagination, provided this imagination ultimately alights upon a possible practical effect." (5.196. See also 5.13n1, 5.412, 5.464)[9]

Furthermore, meaning is essentially always open to revision and development.   "Consider what effects, that might conceivably have practical bearings, we conceive the object of our conception to have.   Then, our conception of these effects is the whole of our conception of the object." (5.402)

The hypothesis that holds up through repeated testing may come to be associated with a high degree of confidence in its ability to render clarity, yet the conceivable practical effects of a conception always remain virtually open.   "This leaves the hypothesis but one way of understanding itself; namely, as vague yet as true so far as it is definite, and as continually tending to define itself more and more, and without limit." (6.466)

Without a foundation on unquestionable first principles on which to build meaning and with no hope for final closure of meaning, Peirce's pragmaticism carves out a distinctly modern position.   The hope offered in his conception of inquiry is that the process is self-critical and self-correcting.   Hypotheses that do not accord with practical effects are abandoned.   Pragmaticism (or the more or less synonymous hypothesis and abduction) is the method of methods, the guide toward meaning.

But what accounts for abduction?   What accounts for the measure of correctness of hypotheses chosen when there is a seemingly infinite possibility to choose incorrect hypotheses?   Is abduction logically based, a random consequence of chance, or an inexplicable psychological phenomenon? These are problems with which Peirce struggled throughout his life and though he argued powerfully, many still espouse contrasting views.

Peirce attributed abduction to "the spontaneous conjectures of instinctive reason" (6.475), that is, he

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[9]By practical effect Peirce does nothing more than insist on the engagement of Schiller's "sensual drive." See Elizabeth M. Wilkinson and L. A. Willoughby, translators and editors, *Friedrich Schiller, On the Aesthetic Education of Man, in a Series of Letters* (Oxford: At the Clarendon Press, 1967).

held that to construct and choose hypotheses is as instinctive to the nature of being human as nest building is to bird nature. "It must be confessed that *if we knew* that the impulse to prefer one hypothesis to another really were analogous to the instincts of birds and wasps, it would be foolish not to give it play, within the bounds of reason; especially since we must entertain some hypothesis, or else forego all by that very means." (6.476)[10]

Peirce argues that abduction is based on *il lume naturale*; that it is not only of human nature to be engaged in hypothetic inference, but that the hypotheses we choose on impulse are chosen for the reason of being the more facile and natural. (6.477)

Though it is but conjunctive to Peirce's concern, it might be argued that, though often exhilarating, surprise is unstable and threatening to human beings. Surprise, in the logical context of inquiry, motivates a reaction of dissipation that is instinctual just as is physical surprise. That is, we construct hypotheses to dissipate the surprise encountered in inquiry as instinctively as we blink or wince in self preservation at the surprise of physical threat to well being. While there is a drive to dissipate surprise, the question is whether or not that drive is effected through a logical process, that is, whether there is continuity between the inquiry that leads to the selection of hypotheses and the methods of inquiry that evaluate selected hypotheses. While many hold that there is not continuity here, that discovery is inexplicable at least in the terms of inquiry, Peirce advanced abduction as a stage of inquiry yet expanded the notion of instinct to include the logic of discovery. I will considered this more fully below. First, an abductive interlude.

In the spirit of provocation that characterizes "The Neglected Argument," I am interested primarily in creatively contemplating some of the implications of Peirce's understanding of inquiry. Others have conducted critical discussions that I need not repeat, though this area of Peirce's thought remains inappropriately unexplored. I want to approach this by way of abduction itself.

Surprising fact C:

> As to the word "play," the first book of philosophy I ever read (except Whately's Logic, which I devoured at the age of 12 or 13,) was Schiller's *Aesthetische Briefe*, where he has so much to say about the Spiel-Trieb; and it made so much impression upon me as to have thoroughly soaked my notion of "play," to this day.

In the decade or so before his death Peirce maintained an active correspondence with Victoria Lady

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[10]There are remarkable correlations between Peirce's view of hypothetic inference and the work done by neuroscientist Michael S. Gazzaniga, *Nature's Mind: The Biological Roots of Thinking, Emotions, Sexuality, Language, and Intelligence* (New York: Basic Books, 1992) and Lakoff and Johnson's work in *Philosophy in the Flesh*.

Welby.   With mutual admiration they read and commented upon each other's writings and ideas.   In December 1908 the exchange included discussion of Peirce's "A Neglected Argument."   Peirce's inclusion of play did not go unnoticed by Lady Welby who wrote: "And Play too; which we so often connect, not with the Play of cosmical forces or of controlled impetus, but with the mere random wandering, a sign of mental disease, which no true Play can be."[11]

Peirce's response to Lady Welby is abducting in suggesting that, with Schiller's Aesthetic Letters in mind we review Peirce's understanding of play and, not only play but, abduction and, not only abduction but, his pragmaticism and, not only his pragmaticism but, his whole tripartite program.[12] This retroduction (a leading backwards) to Schiller produces the general hypothesis that Schiller's Letters were influential to Peirce not only on his understanding of play but on his understanding of inference, including abduction, which is synonymous with his pragmaticism, and inseparable from his whole semiotic.

What I want to explore is that in the light shed by Peirce's late conjunction of play (drawn, I believe, from Schiller) and abduction, we can illuminate the fundamental character of his abduction and pragmaticism.   I am not primarily interested in showing that Peirce is dependent on Schiller, how Peirce advanced Schiller's ideas, or anything of this sort.   I believe that Schiller's ideas on human nature, particularly those clustering around his conception of play and the play drive, when conjoined with Peirce's ideas on abduction and pragmaticism, produce an enhanced understanding of the nature of play and consequently on the logic of discovery.   I am interested in what happens in the play back and forth from Peirce to Schiller to Peirce.

Peirce identified musement, and thereby play, as an example of the first stage of inquiry.   Whereas musement (Pure Play is Peirce's alternate term) leads eventually to the most global of hypotheses, the reality of God (the *ens necessarium*), this "`Humble Argument' is nothing but an instance of the first stage of all such work, the stage of observing the facts, or variously rearranging them, and of pondering them until . . . there is `evolved' . . . an explanatory hypothesis."   (6.488)

Schiller held that "Man plays only when he is in the full sense of the word a human being, and he is only fully a human being when he plays."

Peirce rests the inferential process, particularly abduction, on human instinctive reason, on *il lume naturale*.   "Instinctive mind" is mature mind.   "Our logically controlled thoughts compose a small

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[11]Charles S. Hardwick (ed.), *Semiotic and Significs: The Correspondence Between Charles S. Peirce and Victoria Lady Welby* (Bloomington: Indiana University Press, 1977), p. 64.
[12]Peirce does not mention Schiller in "The Neglected Argument."   Caution must be made not to be confused by his mention (6.485) of F. S. C. Schiller whose ideas on pragmaticism he criticized.

part of the mind, the mere blossom of a vast complexus, which we may call the instinctive mind."
(5.212)

Schiller accounted for the nature of being human in terms of a set of three drives or impulses: the formal, the sensual, and the play drives.13   Schiller understood the formal and sensuous drives as two contrary, yet constitutive, forces.   The one seeks absolute reality, universality, form; the other seeks existentiality, particularity, and brute physicality.   While these drives oppose one another and are mutually exclusive, they are nonetheless both necessary.   They find coherence and meaning only in a third drive, the play drive, in which a reciprocal action between the two drives both gives rise to and sets limits on the activity of the other.   In the play drive each of the other drives achieves its highest manifestation but precisely by reason of the other being active.

Peirce struggled throughout his life to make a precise distinction between abduction and induction. At times he held them to be opposites, at opposite poles of reason: abduction seeks a theory while induction seeks facts. (7.218)   By another kind of distinction he said that hypothesis produces the sensuous element of thought while induction produces the habitual element. (2.643)   Deduction seems so clearly distinct from both that it figures little in these discussions.   Deduction is logical explication, an affair largely of formal logic.   Induction and deduction seem always to form a complementary pair that Peirce contrasted with abduction.   Neither induction nor deduction, in contrast to abduction, adds to knowledge; their role is to test and explore hypotheses that issue from abduction.   The challenge Peirce faced in articulating the elements of inference was to both clearly distinguish among these three types or stages and to appreciate the interrelationships among them. While the three are held to be distinct, all are concerned in some sense both with principle (law, form, structure, unity, generality) and with case (experience, sense, facts, observations).   Deduction tips the scale toward the side of principle; induction toward the side of the case.   Abduction mediates between the two, beginning with the observation of a surprising fact–surprise itself is experiential–and ending with the embracing of likely principle, that is, hypothesis.

The parallels between Peirce and Schiller on these matters are too remarkable to ignore.   Peirce himself saw play as an example of abduction and, as shown, he attributed his understanding of play to the influence of Schiller's *Spieltrieb*.   It takes little imagination to suggest a parallel between deduction and Schiller's formal drive and between induction and Schiller's sensual drive.   The clarity gained by viewing Peirce in the light of Schiller's *Spieltrieb* is in the terms of the interdependent, yet distinct, elements of this tripartite system.   This playful comparison suggests that induction, deduction, and abduction are not wholly separate and independent from one another.   Similar to Schiller's conception of play, abduction engages, foreshadows, anticipates, and encompasses both

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13 For a fuller discussion of Schiller's concept of play see my forthcoming essay "The Powerful Play Goes On."

induction and deduction.   The inferential processes that lead to the establishment of knowledge do not, except in the most idealized sense, follow a single track of three successive stages, as Peirce's later conceptions held, running from abduction through deduction to a conclusion in induction.   These processes engage iterations and oscillations, a movement back and forth among these modes that, while analytically separable, are in process inseparable.

Reframing Peirce's understanding of inquiry in light of Schiller's *Spieltrieb* suggests that Peirce's conception of hypothetic inference was an attempt to acknowledge that the highest achievements of human inquiry are won not through inductive or deductive inference, but through that creative mode in which each finds its fulfillment in the activities of the other, in that mode where the mediation between the sensual and formal is most at play.   The whole field of inquiry is a field of play, an abductive field.   The poles that distinguish the limitations on the play within this field are induction–to the side of experience, data, and cases–and deduction–to the side of form, principle, and theory.   As the contrasting, yet interdependent, nature of these poles is appreciated, there is the rise of the conception of abduction, which, when conceived in its most ideal terms, designates that creatively playful process that gives rise to hypothesis in the conjunction of the inductive and deductive modes, the bootstrap to the advancement of knowledge.

While Peirce made repeated efforts to clearly distinguish abduction and induction, he understood the continuity between them.   In an illuminating passage Peirce says that "when we stretch an induction quite beyond the limits of our observation, the inference partakes of the nature of hypothesis.   It would be absurd to say that we have no inductive warrant for a generalization extending a little beyond the limits of experience, and there is no line to be drawn beyond which we cannot push our inference; only it becomes weaker the further it is pushed." (2.640)

But every induction goes beyond what has been directly observed.[14]   Induction occurs precisely with the inference that some whole population is probably like a sample in a certain regard.   Thus induction is always in some sense the kind of extension that Peirce called abduction.   In this passage Peirce clearly acknowledged continuity between induction and abduction.   He attempted to point to that area where induction blurs into abduction.   The same continuities and blurrings might be drawn between abduction and deduction.   Problems are resolved, clarity gained, if we interpret, or perhaps extend, Peirce as understanding that inquiry is constituted by a field at play with induction and deduction being poles within that field and abduction being at once the dynamic play of the field as well as a conception of the most creative mode in the process of inquiry.

Peirce noted that deduction is conducted primarily in terms of symbols, that is signs that represent

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[14]This is shown in the analysis of William H. Davis, "Synthetic Knowledge as 'abduction'," *Southern Journal of Philosophy* (Spring, 1970): 37-43 and in K. T. Fann, pp. 22-23.

their object as a matter of convention, although that in some respects deduction also engaged icons, signs that represent their objects by resembling them, and indexes, signs that represent their objects by being actually connected with them. (6.471)   Continuing this line of analysis in the present abductive mode suggests that abduction is conducted in terms of all types of signs, but that it tends to be dominated by icons.   Discovery is commonly described as occurring in a flash; it is a sudden insight, a moment when one sees or conceives wholly.   The linear, time elapsing, processes of explicative deductive logic are seen as a whole; the processes of sampling and the inductions from them are seen in a moment.   It is as if the processes of inference are seen from above as an image instantly graspable in total.   This is consistent with Schiller's description of the *Spieltrieb* as "directed towards annulling time within time, reconciling becoming with absolute being and change with identity." (XIV.3)15   More must be made of this in a later discussion of the logic of discovery.

The provocative conjunction of Peirce and Schiller is furthered by the most recent translators of Schiller's Letters, Elizabeth Wilkinson's and L. A. Willoughby's analysis of the form and structure of the Aesthetic Letters.   In the Letters, Schiller seems to be operating with two completely unreconciled and irreconcilable strata of thought.   One is based in a three-phase theory of cultural development in which human progress moves from the physical through the aesthetic to the moral.   The other strata is a kind of synthesis theory in which the physical and the moral are to be reconciled in the aesthetic. Schiller tends to oscillate between the two introducing by means of this play a higher tripartite structure.   In Wilkinson's and Willoughby's analysis nearly everything Schiller did must be understood in the terms of a tripartite structure.[16]   In an appendix to their translation of Schiller's Letters, Wilkinson and Willoughby present diagrams to help illustrate the structure of Schiller's thought. Notably they use triangular diagrams to illustrate three types of synthesis Schiller used as well as how these triangles might be strung hierarchically together for the fullest appreciation of Schiller's concepts.[17]   One type of synthesis is distinguished by the term at the apex being different from either term at the base, for example:
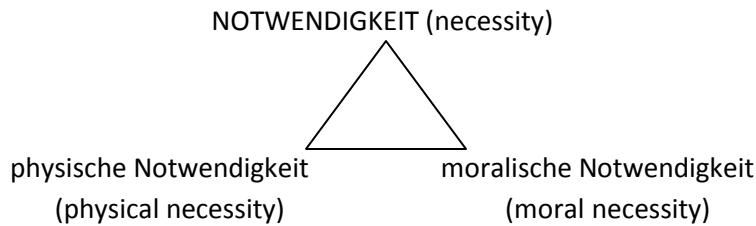
Spieltrieb (Play Drive)

(Sensuous Drive) Stofftrieb   Formtrieb (Form Drive)
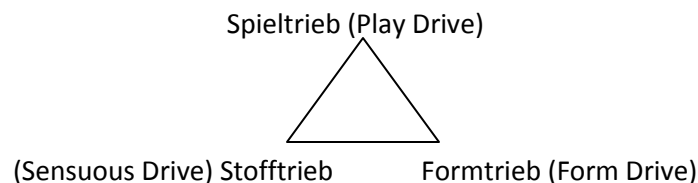
In a second type, a single concept is polarized by qualifying adjectives, as in:

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15 Schiller's Letters.
[16]See particularly the analysis, p. li.
[17]This analysis is carried out even more fully in Elizabeth M. Wilkinson, "Reflections After Translating Schiller's *Letters On the Aesthetic Education of Man*, in *Schiller Bicentenary Lectures*, edited by F. Norman (London: University of London, Institute of Germanic Languages and Literatures, 1960), pp. 46-82.

NOTWENDIGKEIT (necessity)

physische Notwendigkeit   moralische Notwendigkeit
(physical necessity)   (moral necessity)

Identified as binary synthesis, the third type is designated by the term at the apex being the same as one of those at the base, but printed in capitals to indicate that it is a higher concept, embracing both the limited concept of the same name and its opposite, as for example:

FREIHEIT (freedom)

Natur (nature or character)   Freiheit (freedom)[18]
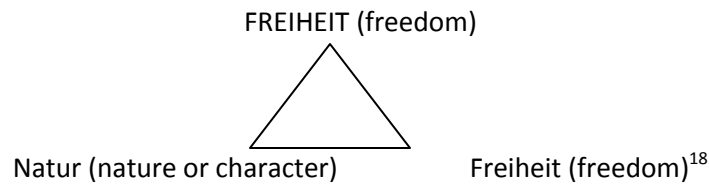
It is also important that, according to Wilkinson's and Willoughby's analysis, the structure of Schiller's letters is best comprehended in terms of a succession in threes, that Schiller repeatedly proposed some "third thing."

Since Peirce acknowledged reading Schiller's Aesthetic Letters as one of his first books on philosophy and it is known that the book was the subject of Peirce's most careful study, a fuller analysis of Peirce in light of the tripartite structures of Schiller's conceptions might prove a fruitful source of Peirce's obsession with three-part structures, but this is a subject for Peirce specialists. It is sufficient here that these parallels between Peirce and Schiller suggest further clarification of Peirce's conception of abduction.

From the perspective of inference being composed of various kinds of leadings: the relationships among retroduction (leading back) or abduction (leading away from center), induction (leading in), and deduction (leading down) are representable as the distinct points of an equilateral triangle.   These three are distinct in the terms of the direction by which their logic proceeds.
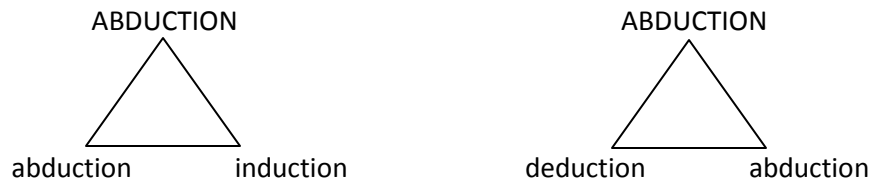
Abduction

Deduction   Induction

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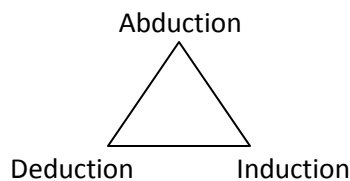
[18]Wilkinson and Willoughby, pp. 349-350.

But from the perspective of the process by which knowledge is advanced, abduction stands first in a three phase process followed by deduction and induction.   Here they are distinguished by virtue of their place in a somewhat idealized process.
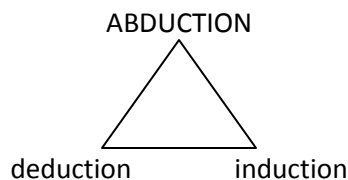
Abduction ———> Deduction ———> Induction

From the perspective of the logic of discovery, that is, the systematic and formal modes that lead to the selection of hypotheses to be tested, triangles again help illustrate the synthetic relationship. First, abduction might be understood in its relationship to induction and deduction by a two triangle representation.   In each triangle abduction occupies a place both at the apex of a triangle (where it is capitalized) and at one angle point on the base (where it is not capitalized).   The other base angle is occupied in each triangle respectively by induction and deduction.

ABDUCTION

abduction   induction

ABDUCTION

deduction   abduction

These triangles show the logical continuity between abduction and induction and deduction.   There are blurrings between them, continuities among them.

Continuing to the next aspect of this relationship, abduction, particularly when conceived in terms most parallel to Schiller's *Spieltrieb*, must be seen as encompassing and including both induction and deduction.   Here, in triangular terms, abduction is at the apex, capitalized to emphasize the encompassing nature, with induction and deduction occupying the points at the base.   This presentation incorporates and combines the above two triangles, and the analyses they represent.

ABDUCTION

deduction   induction

Abduction, when characterized as play, is a both-and-neither mode of inquiry.   It is both deductive and inductive in that it mediates experience and form.   It is not only mediative it is encompassing, that is, induction and deduction each finds its fulfillment in terms of the other–the sphere of this fulfillment is abduction. Abduction may be analytically isolated, clearly distinct from deduction and induction, as the mode of inquiry in which hypotheses are constructed and accepted (selected), but it is continuous with induction and deduction in that both are anticipated (seen as a whole) in the iconic

signs of hypothetic inference.   The "may be or may be not" vitalizing feature of hypothesis is never lost to induction or deduction.[19]

Peirce saw pragmaticism as a method of methods–that is, a second order abstraction.   Pragmaticism is not seated on first principles nor driven by the promise of a final goal.   From the perspective of pragmaticism the motivation to seek knowledge through inquiry is as much in the vitalizing nature of the process as in the value of the knowledge that is thereby gained.   Inquiry is not to gain anything so much as it is to do something vitalizing and that can, I believe, be suitably characterized as play, at least as derived from the analysis of Schiller's Letters.

Once we have won this point, there are provocative implications in terms of the ongoing discussion of the logic of discovery.

It is commonly denied that discovery is even accessible to analysis.   Karl Popper has argued, "The initial stage, the act of conceiving or inventing a theory, seems to me neither to call for logical analysis nor to be susceptible of it."[20]   John Wisdom wrote, "There is no rational machinery for passing from observational premises to an inductive generalization but that hypothesis is attained by some mental jump."[21]   Thomas Kuhn concluded, "The new paradigm . . .   emerges all at once, sometimes in the middle of the night, in the mind of a man deeply immersed in crisis.   What the nature of that final stage is—how an individual invents (or finds he has invented) . . . must here remain inscrutable and may be permanently so."[22]   There seems little to gain by holding to this position.   Based on my analysis of Peirce in light of Schiller's *Spieltrieb*, discovery is a necessary dimension of all inquiry.   It is the epitome of the playfulness of inquiry.

The confoundment over whether there is or is not a logic of discovery shares features with the present

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[19]Bateson sees "exploration" as a case exemplary of this double description, and rather remarkably, though he does not cite Peirce, he discusses the method of exploration he calls "abduction" which he defines as the "lateral extension of abstract components of description" (Bateson, *Mind and Nature*, p. 142).   It is that process by which we describe some event or thing and then look about the world finding other cases that fit the same rules that we devised for our description.   It is that process in which once I have conceived of play as connected to difference and to abduction in one place, I, seemingly remarkably and uncannily to me, find it (or something very like it) everywhere I turn.
Abduction is, according to Bateson, widespread; inseparable from metaphor, dream, parable, allegory, the whole of art, science and religion, and the whole of poetry. Bateson even illustrates abduction through a discussion of totemism. Abduction is foundational to all thought. It is the process of double or multiple description and the chiasmatic processes that create new information. It is key to all inquiry.
[20]Karl R. Popper, *The Logic of Scientific Discovery* (New York: Basic Books, 1959), p. 20.
[21]John O. Wilson, *Foundations of Inference in Natural Science* (London, 1952), p. 49.
[22]Thomas S. Kuhn, *The structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962), 2nd ed 1970), pp. 89-90.

widespread misunderstandings of play.   Play has been mistakenly approached primarily in terms of a supposed contrast or opposition to work, to the serious, to the real.   Thus even before it is considered, it is categorized as extraordinary, exceptional, abnormal, unreal.   Parallel to this, discovery has been understood as an unexplainable unanalyzable moment outside of logic, an aberrance from the perspective of the logical processes of inquiry.   However, looking back to Schiller's understanding, play characterizes the mediation between form and sense, between the particular and the universal.   Play is the drive or impulse in which human beings not only gain their fullest achievement, but also the terms that best characterize what distinguishes human nature.   And, in a similar manner, Peirce understood abduction as characterized by that mediation between observation and explanation.   While there are elements of mediation even in the most polarized phases of observation or explanation, discovery is most creative and radical at those points of greatest mediation, where the distance between observation and explanation is the greatest.   This play is progressively diminished as one approaches the polar positions.   The heuristic potency of inquiry peaks in the regions of greatest mediation.   To say this more colloquially: the most unlikely hypotheses are the most provocative, a function Peirce provides with the curious term "esperable uberty."

The logic of discovery is then none other than the logic of inquiry; inquiry is inseparable from discovery.   But the very process of logic seems to be defied in those events of greatest discovery, where there is a seeming break, the appearance of a new shaft of light, the introduction of something new.   Such moments of discovery appear to exclude the processual temporal nature of reason.   If hypotheses arise in a flash of insight, there is no process to which hypotheses are the conclusions or results.   How can there be a logic of discovery?

One clue to comprehending this logic is found in Peirce's designation that deduction, while including indexical and iconic signs dealt predominantly in those signs he designated as symbols.   To follow the clue, icons are signs that represent their objects by exemplifying or resembling them, for example, maps and diagrams.   But icons are not exclusive of indexes and symbols.   Maps are composed of figures that are designated by convention as representing some object (though these often resemble the objects represented).   The labels identifying territories are indexical in that the labels and designated territories are physically contiguous.   A feature of the iconic character of mapping is that it is taken in at a moment, a semiotic function capable of translating the temporal and spatial into the timeless and spaceless.   A journey charted on a map is iconic in the sense that it represents the journey by resembling it in one respect.   The arrowed lines drawn on the map resemble the journey across the physical territory.   Yet whereas the journey unfolds in time and space and in its actual course may significantly vary from the charted journey, the journey, when mapped, is grasped at once in its totality.

The logic of discovery is logic translated into an iconic dimension.   The occasion of discovery may be thought of as the momentous grasping in total of the course of logic that proceeds from a hypothetic position to its validation.   Obviously induction and deduction have an iconic aspect, though it is argued that these inferential processes hold in greater predominance other types of signs.   Iconic signs are especially suited to discovery in their ability to facilitate the simultaneous holding of multiple and, often conflicting, courses of reasoning.   A simple example is the children's puzzle "one of these is not like the other."   This feature is necessary to any process of choice or mediation.   As one may observe at a glance multiple routes and journeys upon a map, one can only physically travel but one of these roads at a time, along an inviolable linear sequence.   The iconic processes of logic engaged in hypothetic inference are similar to comparing and evaluating multiple and possibly conflicting courses of logic.   When, in moments of discovery, we suddenly "see" the way, "grasp" the hypothesis, we engage logic in an iconic modality.   If asked why we chose one hypothesis over another, we can provide reasons as easily as we can for providing reasons for choosing one route over another when consulting a map.[23]   But this involves a transformation away from the iconic mode.[24]

There is nothing exclusive or extraordinary about the logic of discovery.   It is merely an iconically dominated modality of logic.   What distinguishes discovery is not the presence or absence of logic, but the span of mediation, the playfulness of the inquiry, the sign types of the logic engaged, the uberty or potential fruitfulness of the inquiry.   Where the mediation between observation and explanation is greatest, where the proposed hypothesis varies most from that domain of currently operative theory, the potential significance of the discovery is greatest and likely more exclusively iconic in the logical forms employed.

What logical criteria pertain to the selection of hypotheses?   Peirce suggested a number of factors: the economic effectiveness and the logical simplicity.[25]   In light of seeing abduction as characterized

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[23]See Fann, p. 41.

24In my lecture series "Brain, Body, Movement" 2009 www.Sam-Gill.com I have considered the role of feeling and emotion in thought and reason, Lecture 11.

[25]See 6.477, Fann, pp. 45-53.   The whole hypothetic process is commonly stemmed by the presentation of a number of stock hypotheses that are selected to terminate, often short, the more complex processes of constructing hypotheses that will require testing and evaluation.   We maintain a whole inventory of these hypotheses related to the following ideas: 1) "I'm surprised by something, but that must be due to my ignorance."   This statement implies that we willingly accept our ignorance, at least in some areas.   2) "I'm surprised by something, but I can't pay attention to every quirk; this is someone else's department."   This statement reflects an atomized world of specialization where we ignore all but what is in our own purview.   3) "I'm surprised by something; 'How Surprising!'"   This statement acknowledges that the world does not always make sense and to simply acknowledge surprise dispenses with the motivation to generate explanatory hypotheses.   4) "I'm surprised by something; indeed, so surprised am I that I cannot think at all."   This statement accounts for the emotion of surprise or amazement that is so great that it trips our overload switches.   5) "No fact, A to Z, in any context can surprise me."   This statement reflects either the naive or the smug cosmopolitan.

in terms of play with abduction being distinguished as the most playful region in the play field of inquiry, I suggest that hypotheses may also be chosen on the basis of their potential play (uberty), that is the subjective relative valuation of the openness, creativity, freedom, and challenge of the hypotheses.   The higher the potential play of a hypothesis, the more deductive and inductive action it will spawn.   This is similar to selecting a journey on a map because it is most scenic or because it promises to take one into regions least traveled.   Surely hypotheses are not selected on the degree of promise that they will produce acceptable explanations to immediate problems.   Were that the case, hypotheses would tend always to be highly conservative.   It is the degree to which they open to the unknown, more than the promised immediate closure of the unknown, that makes hypotheses attractive.   In hypotheses we embrace, we see in a glimpse all sorts of things we will be taken toward not knowing precisely or with certainty how they will turn out.

The logic of abduction, the selection of hypotheses, may be conceptualized using patterns of correlation between the potential play of the hypothetic structure and the play tolerance of the one contemplating the acceptance of the hypothesis.   A play-based perspective may be especially stimulating when conjoined with the consideration of the patterns of the history of science as presented in Thomas Kuhn's highly influential book *The Structure of Scientific Revolution*.[26]

The prevailing image has held that scientific development is a matter of accumulation, that is, scientific research incrementally adds to the total body of knowledge.   Kuhn concluded that this image is fundamentally misleading.   Kuhn's reading of science failed to support this view and led him to propose a revolutionary process in which crises in current paradigms eventually reach such urgency that they precipitate the replacement of the existing paradigm by an entirely different one.   It is an image of the history of science as a series of paradigm shifts.

Revolution is not an everyday affair in science.   Kuhn uses the term "normal science" to designate the phase of science operating under an accepted paradigm not overly threatened by a crisis of failure. Normal science is the science of the received tradition, the science of textbooks, the science whose research is "a strenuous and devoted attempt to force nature into the conceptual boxes supplied by professional education." (p. 5) This is the science Kuhn describes as directed toward problem-solving, that is, attacking tasks that are known to be in the grasp of the operative paradigm.   Normal science fits the usual image of science as steady accumulation.   The grounding of a normal science is identified by Kuhn by the somewhat ambiguous term "paradigm."   "A paradigm is what the members of a scientific community share, *and*, conversely a scientific community consists of men who share a paradigm." (p. 176) Normal science seeks confirmation of the paradigm and success is measured in

These statements were developed in my *Native American Religious Action* (Columbia, S.C.: University of South Carolina Press, 1987), p. 14.
[26](Chicago: University of Chicago Press, 1962, 2nd ed, 1970), citations here are to the 1970 edition.

these terms.   Novelty or anomaly are often ignored or denied.

But what accounts for discovery, for the introduction of new paradigms?   Kuhn charts the course in normal science that leads to revolution, to the rupture in which one paradigm replaces another.   The key is the persistence of anomaly that finally leads normal science to crisis.   From this crisis a set of new theories may be generated and, though it often takes a generation to accomplish, they eventually become established as the new reigning paradigm.   "Extraordinary science" is the term Kuhn uses to designate this phase of discovery, of the invention of theory, of the creation of new paradigms.   Once a new paradigm gains acceptance, a new phase of normal science unfolds.

It is important to consider the nature of anomaly and novelty, though Kuhn does not do so directly.[27] Anomaly and novelty are concepts that have to do with fit.   In terms of theory, anomaly occurs when data or observations fail to find adequate explanation by a given theory.   Anomaly motivates either a review of data or a revision in theory.   If anomaly leads to theory revision, then one must posit that there is something inherent in the data that remains the same from one theory to another.   This suggests there is an underlying matrix, or perhaps we could say paradigm, that gives base to such decisions and processes.   In other words, there can be no anomaly if there is not some given matrix within which something does not fit.

This makes sense within what Kuhn calls "normal science," but he describes the same process as operative in scientific revolutions where there are shifts in paradigm.   Anomaly, though at first suppressed or ignored, eventually constitutes crisis at the level of paradigm motivating the revolution and paradigm shift.   But what serves more fundamentally or globally than paradigm as a place from which to choose a new paradigm to replace the present one?   Kuhn refers to this, curiously I believe, in the terms of "problem."   For example, when discussing why a new paradigm is adopted to replace an old one he says that "probably the single most prevalent claim advanced by the proponents of a new paradigm is that they can solve the problems that have lead the old one to a crisis." (p. 153).   But he also holds that problems are paradigm dependent (p. 166) as are even the data (p. 122).   What in the frame of one paradigm are problems, even acknowledged data, are not necessarily so in another. To even say that a new paradigm solves problems that led another to crisis implies not only that the normal function of paradigms is to solve problems (which is, of course, Kuhn's understanding of normal science), but also that the problems precede and exist apart from the paradigms (which Kuhn at least at one point denies).[28]

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[27]However, see his description of anomaly in *The Essential Tension: Selected Studies in Scientific Tradition and Change* (Chicago: University of Chicago Press, 1977), p. 236.
[28]Kuhn's critics have focused heavily on the circularity of his argument.   See Imre Lakotos and Alan Musgrave (editors), *Criticism and the Growth of Knowledge* (Cambridge: Cambridge University Press, 1970).

Kuhn offers other reasons for choosing paradigms, though he sees these reasons as much more limited.   A new paradigm may be said to be aesthetically more pleasing: "neater," "more simple." He also suggests that "something must make at least a few scientists feel that the new proposal is on the right track, and sometimes it is only personal and inarticulate aesthetic considerations that can do that."   The implications of these statements are shocking: that personal and aesthetic valuations are necessarily inarticulate; that such valuations are independent of paradigm; and that such phrases as "right track" are independent of paradigm.

Kuhn understands paradigm in the global terms of world view.   One sees the world in the terms of paradigm.   Problem, aesthetic and personal judgment, evaluations of "right track," "wider range," "greater precision" (p. 66) must be *of* paradigm, yet these are the foundational positions Kuhn discusses as the bases on which rest decisions for paradigm shifts.   This tension raises fundamental questions about Kuhn's whole argument.   Normal science, seen as problem-solving rooted in the accepted paradigm, is defined by its problems.   Yet it is the superior ability to solve problems, the very same problems, that is the basis for overthrowing one paradigm for another.   Somehow the problems, in Kuhn's analysis, must be at once subject to and superior to paradigm.

The same confoundment may be seen underlying Kuhn's discussion of progress.   The very concept of science is, as Kuhn notes, inseparable from progress.   Science has no difficulty whatsoever in making the claim of progress in knowledge.   "A scientific community is an immensely efficient instrument for solving the problems or puzzles that its paradigms define." (p. 166) But progress is also paradigm dependent.   When considering the sequence of paradigm shifts that constitutes the history of science, Kuhn concludes "We may, to be more precise, have to relinquish the notion, explicit or implicit, that changes of paradigm carry scientists and those who learn from them closer and closer to the truth." (170)   This reveals some confusion about what is exclusive of paradigm.   This statement suggests that while progress is paradigm dependent, truth is not.   But how then can truth have any meaning if it is virtually inaccessible?   Kuhn holds that to reject paradigm is to reject science altogether.

What then motivates scientific inquiry?   It can no longer be the achievement of truth, the end and completion of knowledge as Stephen Hawking would have it.29 Kuhn suggests a shift from a goal-oriented imagery, to the imagery of evolution in progress; that we pursue science in the "evolution-from-what-we-do-know." (p. 171) This is a "process that moved steadily *from* primitive beginnings but *toward* no goal." (p. 172).   But this is a continuous and continuing process given significance by an evolution-type paradigm.[30] This is the view of a normal science.   One wonders how

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29 For a discussion of Stephen Hawking in terms of play see my "The Glory, Jest, and Riddle: Stephen Hawking and A Brief History of Time" 1988, 2009.   www.Sam-Gill.com
[30]It is remarkable given the history of controversy surrounding evolution that Kuhn is not the only one to appeal to

it differs, other than the inclusion of a bit of jerkiness, from the image Kuhn seeks to replace.

Though it seems clear that Kuhn's attempt to correct the notion of science as accumulation is important, the manner by which he has attempted to do so raises the fundamental question "why science?"   It offers pale, if any, answers.

Kuhn himself attempts a paradigm shift, from science as accumulation to science as periodic revolution.   But, to me, there is a serious flaw in this attempt.   The acceptance of, the dwelling within, a paradigm is what defines and distinguishes normal science.   This is no qualified acceptance; it is no partial commitment to some new ideas.   It is paradigmatic: foundational, determinative of problems, world views, and everything else.   One lives and dies by paradigm, that is surely why it takes the turnover of a generation for a new paradigm to gain a foothold.   But the very substance of Kuhn's proposed paradigm, what might be called "the paradigm paradigm," is that paradigms are temporary, they do not achieve progress beyond themselves, they do not lead to truth.   This is the paradigm of modernity, for it is tacitly the rejection of paradigm.   Knowing that paradigms are temporary, that even the succession of paradigms need not achieve progress toward truth, how can anyone embrace any paradigm?   Kuhn's proposal is not simply a fundamental shift in epistemology and ontology, it proposes their end, though curiously Kuhn seems not to fathom the weight of this position.   It is a version of the rupture that Jacques Derrida describes as the challenge to the fixedness of structure that characterizes our age.   While Kuhn's discussion gives us a glimpse of a new way to see the history of science, he remains so confined to the language of one restrictive paradigm that he seems unable to see the impact of what he is suggesting.   In that glimpse we see the nakedness of science, its lack of foundation garments.   I think this contradiction finally defeats Kuhn's most basic point.   When theory, valuation, progress, problems are paradigm dependent, there comes to be no base, other than normal science, from which to choose a different paradigm.   What Kuhn describes as normal science in last analysis is all-inclusive.   All science is paradigm bound. Extraordinary science (which Kuhn discusses precious little anyway) is extraordinary in escaping the bounds of the operative paradigm, but in doing so ceases to be scientific, thus extraordinary science (whose task is discovery) is the extra-scientific.   Losing extraordinary science and discovery we are back to the original image of science as accumulation (the characterization of normal science).   The only possible recourse is to hold that new paradigms are somehow tacit to operative paradigms.

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it as the super-paradigmatic frame that links sequences of scientific paradigms, that characterizes the continuity of the scientific process.   Stephen Hawking made essentially the same appeal in his *A Brief History of Time*. Acknowledging that theory is always provisional, always beyond final proof, he raises the question of the judgment among possible theories.   His resolution is to see evolution as super-theoretical (as apparently are some scientists):   "Based on Darwin's principle of natural selection . . . some individuals are better able than others to draw the right conclusions about the world around them and to act accordingly." (p. 12).   Wonder where Hawking places himself on this scale of values?

Then it is not a matter of choosing between competing paradigms (which is itself paradigm dependent), but a matter of articulating tacit paradigms.   One wonders if this process really amounts to revolution.

There is another factor that moves me closer to suggesting an alternative.   This is Kuhn's choice of the contrasting categories "normal" and "extraordinary" which I find an interestingly odd choice.   The most direct opposite of "normal" is "abnormal;" the opposite of "extraordinary" is "ordinary."   It may first appear sensible to choose "normal" to distinguish paradigm-bound processes, but this choice raises the problem of what to do with discovery which Kuhn preconceives as being beyond what scientists "normally do."   It would not seem appropriate to call those creative geniuses who discover whole new systems by the more directly opposite, though offensive, term "abnormal."   They are truly "extraordinary."   However, if one begins with the identification of discovery as "extraordinary," it would be somewhat offensive to call the balance of the scientific community "ordinary."   This may seem but a silly semantic problem, surely due to the oddities of language, but it should have given Kuhn pause.   If discovery is not presupposed to be beyond paradigm or, to be even more inclusive, if discovery is not presupposed to be beyond the processes of inquiry, there would be no need for these terms.   These particular confusions would be eliminated, replaced by some much more interesting ones.   All I am saying here is that Kuhn's terms "normal" and "extraordinary" betray tacit operative assumptions (based on paradigm) that underlay his whole program of scientific revolution and that the usefulness and accuracy of this tacit paradigm is questionable.

The contribution of Kuhn's work is to demonstrate that scientific growth occurs not solely as a continuous process of accumulation (which Kuhn understands to be a widely held misunderstanding), but rather includes shifts, revolutionary in order.   In light of the history he reviews, this seems a laudable corrective.   However, in divorcing discovery from the daily processes of scientific inquiry, it at once tends to place it in the realm of the unanalyzable (the accidental, inexplicable, and even mysterious) and it ignores, if not denies altogether (much to many working scientists' dismay I would think), the discoveries and theoretical shifts made daily in the course of inquiry.   It also presents a perspective on the nature of being human that I do not particularly want to support: humans are "normally" not creators of hypotheses, they are "normally" drones of law to the point of filtering out anomaly and novelty.   Kuhn, in attempting to show a more accurate picture of the processes of scientific discovery, throws out the playfulness I believe is distinctive of being human.

Though he considers the process of discovery inaccessible to analysis, Kuhn describes discovery in language that seems in a measure related to Peirce.

> Novelty emerges only with difficulty, manifested by resistance, against a background provided by expectation.   Initially, only the anticipated and usual are experienced even under circumstances where anomaly is later to be observed.   Further acquaintance, however, does

result in awareness of something wrong or does relate the effect to something that has gone
wrong before.   That awareness of anomaly opens a period in which conceptual categories are
adjusted until the initially anomalous has become the anticipated.   At this point the discovery
has been completed. (p. 64)

Kuhn makes no reference to Peirce in *The Structure of Scientific Revolution* although Peirce had begun
writing about discovery more than a century earlier.   In terms of the above analysis, I believe that
Peirce had already offered a more modern and fruitful understanding of discovery than did Kuhn.[31]
Put in the terms of the above analysis of Peirce in light of Schiller the following account of the logic of
discovery can be put forth.

Discovery, as play, is continuous with the whole field of inquiry, understood generally in this frame as
the pursuit of knowledge and clarity of meaning.   Discovery, as analogous to play, as a species of play,
may be conceived as a characteristic of the nature of inquiry, an identification of that extension or
expansion to which all inquiry at every stage and in its most basic sense is bent.   As that which
characterizes the structure of inquiry, play is always present as a distinguishing feature.   To
comprehend discovery is not a matter of ferreting out the phase of inquiry to which discovery is
confined nor is it to exclude discovery from inquiry altogether.

The affinities between play and discovery are so great that the language of play may be illuminating to
the discussion of discovery.   As play, discovery can be subjectively evaluated and measured, at least
in rough comparative terms.   Indeed, this is a fundamental, though almost wholly ignored, aspect of
the scientific process.   Every laboratory finding is a discovery, if in no other than the simplest sense of
extending a theory to a new area of application.   That the play of the theory is not known with
certainty for this new area of application is the motivation and justification for the experiment.   Even
the terms "experiment" and "test" include the dimension of extension that encompasses the notion of
discovery, though it may be relatively minor.   There are examples where discovery exists in larger
proportions, yet remains short of the sorts of revolution Kuhn recounts.   Within a body of theory,
applications, areas of relevance, implications, may be discovered initiating whole new areas of inquiry.
Finally at the extreme, there are those discoveries of revolutionary stature, those transformations
synonymous with such names as Copernicus, Galileo, Newton, and Einstein.

Kuhn, like most, considers discovery to be either present or absent, and reserves the term to designate
those major events of revolutionary proportion.   Were it possible to clearly distinguish discovery, to

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[31]It is notable that, while Morton Kaplan, in his *Science, Language and the Human Condition* (New York: Paragon
House, 1984), places himself in the lineage of Peirce's "pragmaticism" and begins his book with a criticism of
Kuhn's *The structure of Scientific Revolution*, he does not even mention Peirce's many discussions of abduction.

analyze and comprehend its logic, to set it apart by reference to definite criteria from the processes of "normal" inquiry where there are extensions of knowledge in steps and leaps, perhaps there would be some importance in taking this approach.   However, as shown, confining the term "discovery" to those major revolutionary insights is usually accompanied by the predisposition that discovery is extraordinary, beyond analysis or description, an unfathomable mystery.

Discovery can be analyzed in terms of the play of the field of inquiry where the potential play of structures of inquiry and the play receptivity of the inquirer are variables.   In such a field, to increase playfulness either by enhancing the potential play of structures or by increasing the tolerance for play of the inquirer is equivalent to the play drive as described by Schiller, which in this arena might be termed the discovery drive, the force to achieve fulfillment of the human potential in the expansion of knowledge.   The evaluation of scientific paradigms, or theories, or ideas, or hypotheses is done not so much based on their ability to solve problems, as on their potential playfulness, their potential for discovery.   Problem-solving is certainly important, but it is secondary at best.   The playfulness of ideas, hypotheses, and theories is measured in terms of their latitude of application, their potential openness to growth and extension, their appeal to the wide community of players (inquirers), their flexibility and transformability, in Peirce's terms, their uberty.   In his essay "The Essential Tension," Kuhn presents a similar image, "the productive scientist must be a traditionalist who enjoys playing intricate games by pre-established rules in order to be a successful innovator who discovers new rules and new pieces with which to play them."[32]

There are theoretically, even in limited domains like science, infinite numbers of hypotheses, theories, and paradigms.   Those systems that have high potential play are likely to have long lives.   Systems such as those outlined by Copernicus and Newton offer enormous potential for play, as the history of science has shown.   Even when there are major shifts to other systems, these older ones retain their players, and that is because they continue to present a high potential play.   Over time many structures tend to exhaust their potential play, like falling objects eventually dissipate their potential energy.   When this begins to happen, some inquirers, inevitably those with the greatest play initiative and tolerance, will look to (or concoct) other structures or fields to play within.   If this is done long before the current structure has begun to decline in its playfulness, the inventor or discoverer of the new structure will likely be ignored; its inventor called a crackpot, or worse not funded.   This does not disqualify the event as a discovery.   This is not necessarily bad theory, it may only be bad timing. This also reflects the subjective, valuative, side of inquiry. We often find ourselves amazed that some theories in science thought to be new have been anticipated, sometimes by centuries.   These anticipations are often the products of individuals with enormous play initiative, who could not abide by the play structures at hand and had to invent others even knowing that they would likely not be

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[32]Kuhn, *The Essential Tension*, p. 237.

taken seriously.   It also demonstrates what overrides all else, that science (as are all traditions of inquiry) is a system of values.[33]

Graphing the potential play of frames (a generic term including paradigms and bodies of theory, hypotheses, and ideas) and the play tolerance of the inquirer(s) allows us to map various elements in the dynamics of inquiry and discovery.

The first graph (See Figure 1, below) focuses on the attention to and classification of data. Within a given frame depending on how the frame is viewed and on the play receptivity of the inquirer the data of interest will vary as well as the way it is categorized.

In the regions where the frame is considered to have a low potential play all inquirers will simply include some data as unquestionably fit, more or less unacknowledged. Still as the play receptivity of the inquirer increases, this category diminishes slightly. As the play potential of the frame increases, the concerns with fit come increasingly to be a factor. Data are divided among those that are acknowledged as fitting or relevant to the frame and those data that are expected to fit within the frame as it is explored and extended. These are the only categories acknowledged by inquirers with relatively low play tolerance. Only as play tolerance or initiative increases do other categories of data emerge in the acknowledgment of novelties and finally anomalies. Novelties tend to have a positive connotation overall, as in delightful discoveries of data that may open whole new regions to the frame, whereas anomalies tend to threaten the frame.

The modes of inquiry that are engaged within this field may also be charted on the same coordinates (See Figure 2, below). At the lowest range of play tolerance, the inquirer simply applies the entire frame to experience, unacknowledged, wholly indwelt. Here, there is scarcely any difference between frame and field of inquiry. As play tolerance increases this relationship to frame diminishes markedly.

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[33]The contemporary period of science is distinctive in several respects that may be cast in a critical light by this analysis. It is accurate to say that most scientific research is motivated and funded as a problem-solving activity. Government and industry fund scientific research to solve needs. Scientists and whole fields of science develop simply because there is a need established by an agency who can fund research.   This is science yielding to or being shaped by the valuations of the larger society. On the surface it appears that this approach to science is antagonistic to free play and innovative discovery. In Kuhn's terms it is the most entrenched form of "normal science." Scientific research is like a factory; it produces solutions to military and industrial problems. The motivation is not the play of inquiry, the drive to discovery, the achievement of human potential. Success is measured in the size of the research awards granted. Certainly some areas of science have fallen prey to these factors and have been stifled by them. However, a remarkable testimony to the power of the play factor in scientific processes of inquiry, is the extent to which, even when motivated solely by externally designated problems and values, scientists tend not to be able to keep from seeing the unexpected and playful aspects of their research that go far beyond the problem-solving needs for which they are funded. The banality of funded problem-solving often gives way to the vitalizing playfulness of inquiry, and even sometimes to the chagrin of the funders.

Above this most basic level is the conscious application of frame. There is no question of the appropriateness of the frame, it is simply a matter of applying it. This area covers all areas of applied sciences for example. Above this are the activities that extend the frame, both in terms of its domain of application and its logical and theoretical consequences. Still higher, both in terms of the necessary correlation of the potential play of the frame and the play receptivity of the inquirer, are those activities of innovative frame expansion. This area of inquiry is much more risky than the previous area of frame expansion. It's activities are far from certain as to the products of their labor. Still this area of inquiry seeks not to overthrow or replace the frame, but to transform and expand its every feature. Finally, at the highest evaluation of the potential of the frame, literally pushing beyond its limits, are those playful inquirers who gain visions of frames beyond, frames that obsolete the present one or are wholly unlike it.

There are clearly necessary correlations between the acknowledgement and categorization of data and these modes of inquiry.   The frame-shifting inquirers must center their attention on acknowledged anomalies, while applying inquirers must largely ignore anomaly altogether.

If the graphing of modes of inquiry is overlaid by the graphs of human experience some interesting observations can be made (See Figure 3, below).The innovations and expansions of the frame parallel the channels of correlation of higher and higher play potential and play initiative, the channel of increased value.   The more innovative expansion is subject to greater risk and the experience of anxiety, but also more likely to be engaged in the experience described as flow. The frame-shifters operate in the area characterized as fear and anxiety.   Still all modes of inquiry intersect with the experiences that range from the intolerable to the fun and interesting, but the higher modes of inquiry never intersect with the experiences that tend toward boredom.   The lower levels of inquiry tend to intersect all kinds of experience.   For example, the application of the frame at its higher levels of potential may produce discomfort and anxiety, while application at the other end of the spectrum be so routine as to be simply boring.

Using the same coordinates the process of a frame shift and the history of a frame can be described. First, a proposed shift in frame is not even acknowledged by most who indwell the currently held frame. When their play receptivity is not high enough to even acknowledge novelty, they cannot acknowledge frame alternatives. The mode of inquiry related to this proposed frame, but still from the perspective of the current frame, is confined to those with the highest potential play. When a frame shift has occurred, there are correlating shifts in the acknowledgement and categorization of data and the modes of inquiry set off. The movement is toward the conditions of the fully established frame. First the theory is expanded, yet there can be no application. As frame is expanded and areas of applicability confirmed, then areas of application may finally be established. The data shift occurs in the expansion of areas of acknowledged fit and the shrinking of the data categorizes as novelty and

anomaly.

From the stage of the fully established frame, its history may follow any number of courses. Broadly these might be conceived as diminishing, stabilizing, or expanding. Those frames in which potential play diminishes, may do so by becoming so commonplace and unquestioned that there is no opening to extension or application. Novelty and anomaly decrease as the frame is extended to incorporate these. At the other extreme, frames may find that they are less and less suitable. That novelty and anomaly tend to arise even where unexpected, as in the attempt to apply the frame to some area where it is known to have application. Whereas the former pattern is one of running down or playing itself out in old age, through exhaustion, this diminishment of potential play stems from an overload of misfit. One might say this history is the frame playing itself to death in a frenzied suicide. In this death, the presence of anomaly is undeniable to all inquirers, no matter what their play tolerance or initiative, motivating all inquirers to become frame-shifters. Many frames are able to uphold potential play for very long periods, even remaining viable in large domains long after other frames have taken their places along side.

The character, status, and history of frames (paradigms, to recall Kuhn's discussion) are not at all simple or singular. Though these features can be considered from a great many perspectives, the attempt here has been to place the analysis in the aesthetic frame set by Schiller who was centrally concerned with the achievement of the fullest measure of human potential. In this frame of analysis, the marvel of discovery and the history of inquiry are understood in the terms of playfulness, on the one side, and in the terms of a play-based theory of value, on the other.
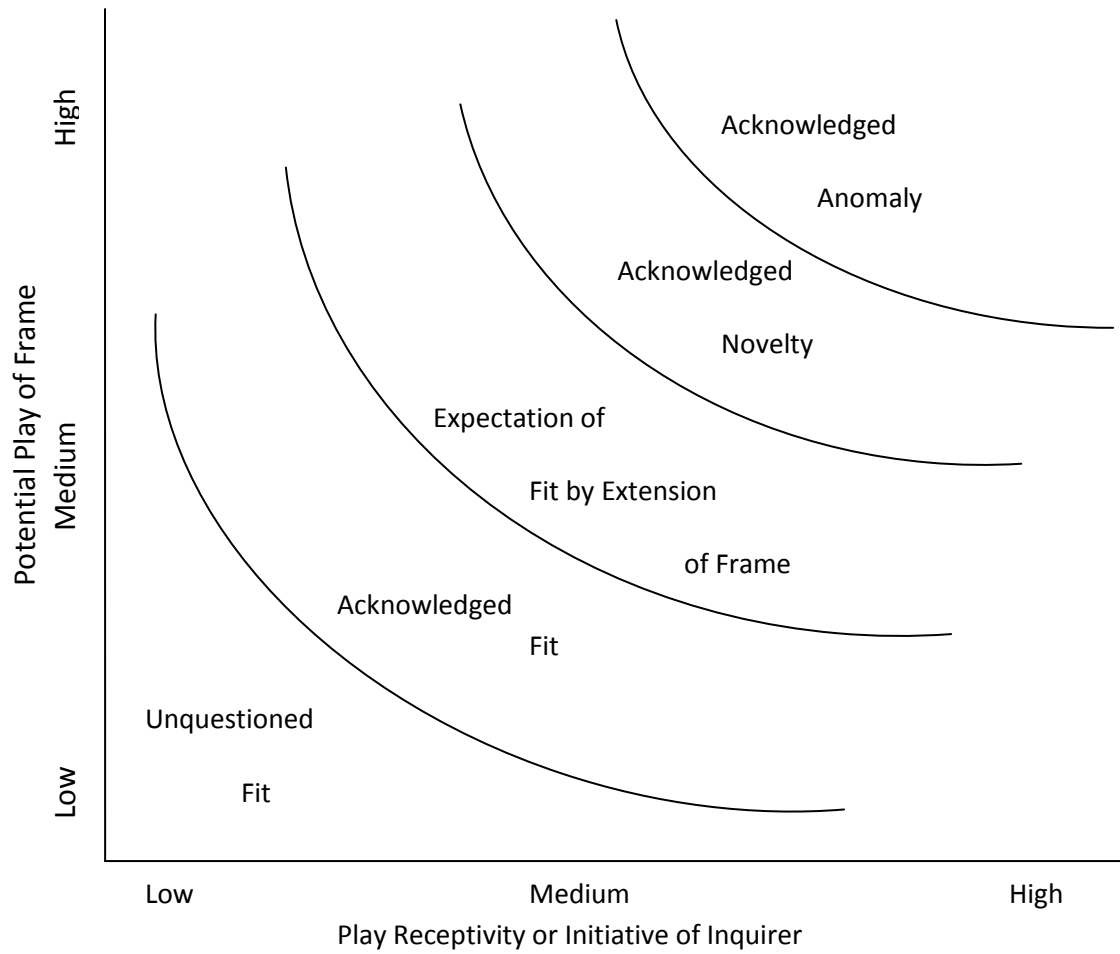
Figure 1 – Classification of Data

Motivated Development
Of New Frames

Innovative
Frame Expansion

Frame
Extension

Frame
Application

Potential Play of Frame

High

Medium

Low

Low   Medium   High
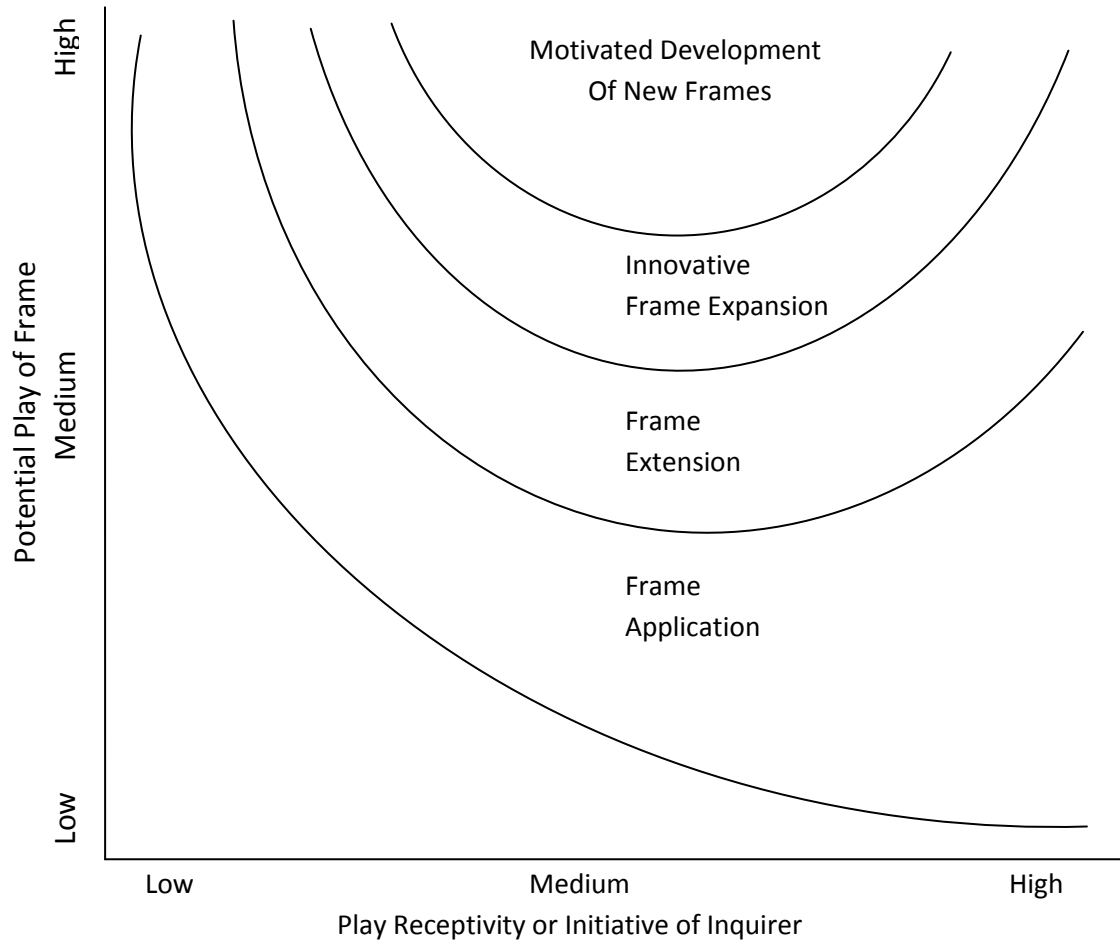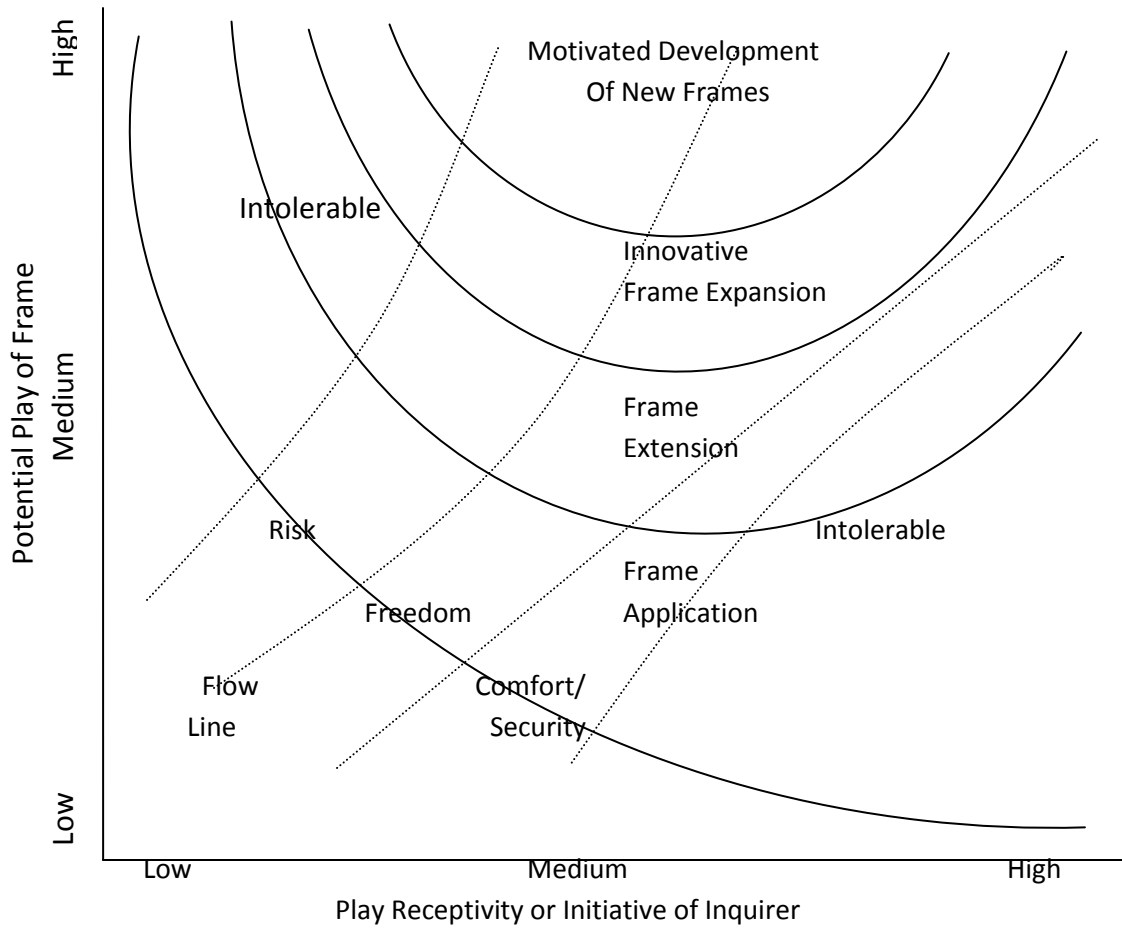
Play Receptivity or Initiative of Inquirer

Figure 2 – Modes of Inquiry

Figure 3 – Modes of Inquiry and Related Experience