Induction and Concept-Formation in Francis Bacon and William Whewell

John P. McCaskey

PhD Candidate
Department of History, Stanford University
May, 2004

In Objectivist epistemology, induction and concept-formation are closely related. In *Introduction to Objectivist Epistemology*, Ayn Rand writes, "The process of forming . . . concepts contains the essential pattern of . . . induction. . . . The process of observing the facts of reality and of integrating them into concepts is, in essence, a process of induction."[1] Unfortunately, she does not elaborate extensively on this relationship—and, in this essay, neither will I. Others, including some at this Workshop and of course Leonard Peikoff in his recent lectures on induction, have been examining this relationship more in-depth than I am qualified to do. My goal instead is simply to introduce you to a line of British philosophers from Francis Bacon (1561–1626) to William Whewell (1794–1866) who, like Rand, held induction to be closely associated with concept-formation. By exploring the thought of Bacon, Whewell and others, we may learn more about this association on which Rand left frustratingly little.

The basic connection between concept-formation and induction is easy enough to recognize. Consider the canonical story about swans. You observe an extended series of white swans and, with inductive confidence, conclude that all swans are white. Someone shows you a black swan and says, "Look! Not all swans are white. No matter how many white swans you see, you cannot be sure there is not a black one. Induction is inherently unreliable." To avoid conceding, you could simply reply, "That black thing is not a

[1] Ayn Rand, *Introduction to Objectivist Epistemology*, expanded 2nd ed. (New York: Meridian, 1990), p. 28.

swan." You and your interlocutor cannot resolve the disagreement about induction without explicitly or implicitly addressing the issue of how one decides what things are subsumed under the concept *swan*. Deciding whether attributes observed in some members of a group are attributes of all members depends on what members are in the group. That is, there is an inescapable and intimate connection between induction and the formation of concepts.

Before examining this relationship in the work of Bacon and Whewell, a preliminary remark is necessary. The meaning of the term *induction* has changed since their time, and we must be careful not to read back into the period our modern-day understanding. I will offer just one example that should put you on guard: Contrary to widespread belief, David Hume did not write anything skeptical about induction—not, that is, about what in his day was called *induction*. It was a common term and he rarely used it. When he did, he suggested was a perfectly valid form of argument. Hume's name was not associated with induction until early in the twentieth century, after the word had acquired an altered meaning. Though the nature of conceptual change is a topic of this Workshop, I will not present induction as a case study of such change. I merely want to alert the reader that carrying all the modern baggage associated with the term *induction* back into the seventeenth, eighteenth, and nineteenth centuries can make for a confusing trip. Leave that baggage behind, and carry with you only a rough idea that induction has something to do with coming to know general truths by experience with particulars, and we can then journey safely back to the early seventeenth century.

Francis Bacon (1561–1626)

During the Middle Ages and Renaissance, induction had an established identity and place in the canon of logic. In a typical scholastic logic textbook, after extensive coverage of the syllogism, its figures, conversions, rules, and so on, induction received a short treatment. Induction was defined as an argument or a progression from several particulars

to a universal. A typical example was: "Rheinish wine heateth, Maluesey [wine] heatheth, French wine heateth, neither is there any wine that doth the contrary: Ergo all wine heateth."[2] The author of this widely read example offers only the following requirement for ensuring that the induction is valid: "Necessary it is, that in such arguments all the examples which are induced be like, so that if any be found contrary, the argument is of no force."[3] In his major epistemological work, *Novum Organum* of 1620,[4] Francis Bacon called this form of induction "childish."[5]

Novum Organum is a 60,000-word treatise on induction. Bacon probably wrote more on induction than all European authors since Aristotle combined.[6] He introduces his topic with these words:

> The syllogism consists of propositions, propositions consist of words, and words are tokens for notions. Hence if the notions themselves (this is the basis of the matter) are confused and abstracted from things without care, there is nothing sound in what is built on them. The only hope is true *induction*.[7]

Bacon here claims that the validity of syllogisms rests on induction—not merely that the major premise rests on induction, but that every notion used in every proposition of a syllogism depends on induction, and if the induction is performed poorly, "everything falls to pieces."[8]

The word *notion* here is important. In modern English the term can have a sense of whim, fancy, or error. In the seventeenth century, it had no such connotation and had

---

[2] Thomas Wilson, *Rule of Reason* (London: 1551), n. p., *Early English Books, 1475–1640*, 1124:03, image 64–5. Some spelling modernized.

[3] Ibid.

[4] Francis Bacon, *Novum Organum* (London: 1620). Translations, unless otherwise noted, are from Lisa Jardine and Michael Silverthorne, eds., *The New Organon* (Cambridge: Cambridge University Press, 2000). Citations are as §book.aphorism (where applicable) followed by page number in the Jardine edition.

[5] *Novum Organum,* "Distributio Operis," 'The plan of the work,' p. 17 and §1.105, p. 83.

[6] Wilson's textbook, a typical one, included about three hundred words on induction.

[7] *Novum Organum,* §1.14, p. 35. Emphasis in Bacon's original. I have replaced "counters" in Silverthorne's translation with "tokens," as Bacon used elsewhere when writing in English.

[8] *Novum Organum,* "Distributio Operis," 'The plan of the work,' p. 16.

conception and *idea* as synonyms.[9] Though I think *concept* would be a fair modern rendering, I will continue to use *notion*, and ask the reader to keep in mind the more general sense.

For Bacon, the formation of notions is a normative process: it can be done well, or it can be done poorly.[10] Bacon calls the bad way *anticipation*,[11] which literally means 'getting hold of beforehand.'[12] Anticipation is the process of jumping too quickly from sense, particulars, and experience to generalizations. "One merely brushes experience and particulars in passing,"[13] and rushes prematurely to form notions, propositions, and syllogisms. Notions formed by anticipation may engender consensus,[14] but they have no true reference to things in reality and lead to all sorts of errors. Ill-formed notions Bacon calls *idols*. Note that these idols for which Bacon is so famous are not just any mistaken ideas men refuse to reconsider. They are specific cognitive products: notions formed using the wrong method.

The correct method Bacon calls *interpretation*. By this method man does not leap to generalizations prematurely but advances to them from sense experience cautiously, developing lower-level notions first and progressing incrementally to the highest-level axioms. Although the method is cautious, it is not skeptical. Indeed, Bacon holds that the proper application of reason will result in notions that extend beyond the instances that went into their formation. Properly formed notions are not merely the sum of their observed instances. Thus it is possible to apply well-developed notions to new and different situations. This is the foundation for Bacon's belief that knowledge, properly

[9] John Wilkins, *An Essay Towards a Real Character, and a Philosophical Language* (London: 1668).

[10] *Novum Organum*, §1.22, p. 37.

[11] *Novum Organum*, §1.26, p. 38.

[12] It had been a common term for innate ideas. Lewis and Short, *A Latin Dictionary*, s.v. 'anticipatio.' *Greek-English Lexicon*,. s.v. *prolēpsis*. See also Peter Urbach, *Francis Bacon's Philosophy of Science* (La Salle, Ill.: Open Court, 1987), p. 37–38.

[13] *Novum Organum*, §1.22, p. 37.

[14] *Novum Organum*, §1.27–30, p. 38; §1.77, p.63; §1.84, p. 68.

acquired, is power.

The proper way to form notions, Bacon claims, is by the use of a new type of induction.[15] The old, scholastic type is induction by "simple enumeration."[16] It is not a useful method because the resulting notion has no applicability beyond the observed instances. The notion refers only to the particulars that went into its construction. The problem, Bacon says, is that this method does not identify the underlying *form*.

> He who knows forms comprehends the sameness of nature in very different materials. And so he can uncover and bring forth things which have never been achieved. . . . Hence true Thought and free Operation result from the discovery of Forms.[17]

The new type of induction involves identifying forms and by that identification justifies generalizations that can be applied beyond already observed particulars.

What does Bacon mean by *form?* He uses the word in two senses.[18] One is a definitional sense. He writes that form is the "true difference," the "definition," or the limitation by which something is a species of a higher-level genus.[19] With this sense, we might identify form as 'essence' or 'essential definition.' The second sense is more like 'cause.' He calls it a law[20] and describes it as something's "causative nature or the source of its coming-to-be."[21] But Bacon does not mean us to understand form as two distinct concepts. For him, form is both essence and cause, its statement is both definition and law. The form of something is its essential attribute (or attributes). This attribute accounts for its being what it is, both in the epistemological and in the metaphysical sense.

---

[15] *Novum Organum*, "true": §1.14, §1.40, §1.105, §2.7, §2.10, §2.16, §2.19, §2.21; "proper": §2.10; "legitimate": §1.105; "perfect": §2.21. (Here is another potential anachronistic misunderstanding. Do not assume Bacon means by "perfect induction" what we mean).

[16] *Novum Organum*, "Distributio Operis," 'The plan of the work,' p. 17; §1.105, p. 83.

[17] *Novum Organum*, §2.3, p. 103, "sameness" for "unitatem," instead of Silverthorne's "unity."

[18] This paragraph draws heavily on Thomas Fowler's introduction, pp. 53–59, to his 1889 edition of the *Novum Organum*. I believe Fowler's analysis remains the best understanding of Baconian Form.

[19] *Novum Organum*, §2.1, p.102; §2.20, p.135; §2.4, p. 104, respectively.

[20] *Novum Organum*, §2.2, p. 103.

[21] *Novum Organum*, §2.1, p. 102, "sive naturam naturantem, sive fontem emanationis."

A Baconian form is a universal.[22] "He who knows the cause of a nature . . . only in certain subjects has an imperfect Knowledge of it; . . . But he who knows forms comprehends the sameness of nature in very different materials."[23] He who knows for example the form of heat, one who knows heat's essential and causative nature, knows about all things hot. Consequently, he will be able to effect heat not only in some materials, but in all. To know the form of something is to have knowledge of all instances of it and to have "certain, unrestricted"[24] knowledge of how to effect it.

Consider the following observations.[25]

> Flame from burning wood is hot.
> Flame from burning wax is hot.
> Flame from burning gunpowder is hot.

The conventional inductive question is: Are all flames hot? Bacon, however, claims this is the wrong question, or at least the wrong question to start with. The unique development in Baconian induction is the shift of attention from the particular subjects to the universal predicate. In the example, Bacon does not first ask, 'What can be said about all flames?' but 'What can be said about all heat?'[26] Bacon looks at the argument this way:

> Flame from burning wood is hot.
> Flame from burning wax is hot.
> Flame from burning gunpowder is hot.

If asked, 'Are all flames hot?' Bacon would not reply, 'It depends on the number of hot flames observed and whether any cold flames have been observed.' Instead he would reply, 'It depends what heat is.'

To determine the nature of the predicate, the nature of heat in this example, Bacon recommends collecting a large number of observations and arranging them in three

[22] *Novum Organum*, §2.1, p. 102.
[23] *Novum Organum*, §2.3, p. 103,
[24] *Novum Organum*, §2.4, p. 104, "certam" and "liberum."
[25] *Novum Organum*, §2.11, p. 110; §2.13, p. 122–3.
[26] This is the effect of *Novum Organum*, §2.5–9, pp. 105–9.

tables—a table of positive instances, a table of negative instances, and a table of varying instances.[27] For all tables, he recommends the widest possible variety. For heat he lists twenty-seven instances, from sunrays to horse dung. He lists thirty-two negative instances, each a variant of one of the positives, as for example, rays of the moon instead of rays of the sun. His table of degrees contains forty-two varying instances, such as the sun at different times of the day and fire of different materials. By an iterative process of differentiating and integrating, trial and error, comparing and contrasting, proposing and excluding, a process he calls true induction, Bacon concludes that the form—the essential and causative nature—of heat is a certain kind of motion. He does not conclude that this motion is one thing and heat a separate effect, not that "heat generates motion or that motion generates heat . . . but that actual heat itself . . . is motion and nothing else."[28]

By identifying "the true form or definition of heat,"[29] Bacon draws a universal conclusion,

> *If in any natural body you can arouse a motion . . . [of the type described] . . . you will certainly generate heat.* It is irrelevant whether the body is elementary (so-called) or imbued with heavenly substances; whether luminous or opaque; whether rare or dense; whether spatially expanded or contained within the bounds of its first size; whether tending toward dissolution or in a steady state; whether animal, vegetable or mineral, or water, oil or air, or any other substance whatsoever which is capable of the motion described.[30]

Thus, Bacon has proposed that true induction is the process by which a predicate notion is properly formed, and if that notion is properly formed, that it can be used in the structuring of an inductive argument in such a way as to yield a valid, certain, and universal conclusion.

---

[27] *Novum Organum*, §2.11, p. 110–1; §2.12, p.112–9; §2.13, p. 119–26.
[28] *Novum Organum*, §2.20, p.135.
[29] *Novum Organum*, §2.20, p.135.
[30] *Novum Organum*, §2.20, p.135. Bacon's emphasis.

William Whewell (1794–1866)

The next philosopher to write more on induction than everyone before him combined was William Whewell. His *History* and then *Philosophy of the Inductive Sciences* ran to three volumes each, and he published several other articles, essays and reviews on the topic. He believed he was working within a tradition begun by Bacon, whom he called "the Hero of the revolution in scientific method."[31] Whewell placed an excerpt from *Novum Organum* at the head of his *Philosophy*, copied Bacon's aphoristic writing style, began the *Philosophy* with words plainly recalling Bacon's, and named one of his books after Bacon's.[32]

To understand Whewell's theory of induction, we must understand the basic outline and terminology of his overall theory of knowledge. Whewell claims that his whole philosophy rests on a recognition of the difference between *thoughts* and *things*.

> Our Thoughts are something which belongs to ourselves; something which takes place within us; they are what *we* think; they are actions of our minds. Things, on the contrary, are something different from ourselves and independent of us; something which is without us; they *are*; we see them, touch them, and thus know that they exist; but we do not make them by seeing or touching them, as we make our *Thoughts* by thinking them; we are passive, and *Things* act upon our organs of perception.[33]

These "organs of perception," however, do not themselves provide us with perceptions, merely with sensations. Sensations are given a perceptual form, automatically, by means of a few *fundamental ideas*, such as space and likeness, with the result that we perceive objects: "Perception is Sensation, along with such Ideas as make Sensation into an

[31] William Whewell, *Philosophy of the Inductive Sciences* (1st ed., London: 1840; 2nd ed., London: 1847), §12.11.4, p. 230. Unless otherwise noted, citations will be as §book.chapter.article followed by volume:page number in the second edition. When included, in parentheses, a second page number will be to William Whewell, *Theory of Scientific Method*, edited with an introduction by Robert E. Butts (Indianapolis: Hackett, 1989).

[32] The third edition of the *Philosophy* was reprinted in 1858–1860 as three separate volumes and with new titles. Whewell named the second volume *Novum Organum Renovatum*.

[33] *Philosophy*, §1.2.1, 1:17. Whewell's emphases.

apprehension of Things or Objects."[34] From this apprehension of objects, knowledge is built up hierarchically, using *conceptions*.

> We gather knowledge from the external world, when we are able to apply, to the facts which we observe, some ideal conception, which gives unity and connexion to multiplied and separate perceptions. . . . Our *conceptions*, thus verified by *facts*, may themselves be united and connected by a new bond of the same nature; and . . . man may thus have to pursue his way from truth to truth through a long progression of discoveries, each resting on the preceding, and rising above it.
>
> Each of these steps, in succession, is recorded, fixed, and made available, by some peculiar form of words; and such words, thus rendered precise in their meaning, and appropriated to the service of science, we may call *Technical Terms*.[35]

Thus, conceptions bind facts together, and words (or technical terms) fix those conceptions and make then usable. Finally, to round out Whewell's terminology of items in the cognitive hierarchy: A second conception, broader than another, is called an *idea*. The difference between conception and idea, like that between species and genus, is hierarchically contextual. What is an idea at one level can be a conception at another. An idea, such as space or causality, broader than all or nearly all other conceptions is one of the above-mentioned *fundamental ideas*.

The way in which perceptions, things, facts, conceptions, terms, ideas, and fundamental ideas are structured into a body of scientific knowledge involves two complementary processes, the *explication of conceptions* and the *colligation of facts*. The two phrases run throughout Whewell's work, and the following mnemonic may be useful: the first is like analysis, the second like synthesis. Explication and colligation are not necessarily sequential, either temporally or logically. They are simply two complementary, primary processes involved in scientific knowledge.

---

[34] *Philosophy*, §1.2.10, 1:43; §8.1.2, 1:467–8.
[35] *Philosophy*, §1.3.1, 1:51. The first two emphases are mine, the latter Whewell's.

To *explicate* a conception is to clarify it by identifying what it contains, by "unfolding" it, as Whewell often says.[36] This may include, to begin, surveying and examining examples. When Whewell explicates the conception *symmetry*,[37] he lists as examples the right and left sides of animals and the three faces on the summit of some crystals. He also identifies several kinds of symmetry: simple, triangular, tetragonal, pentagonal and oblong. To explicate is also to identify implications. One implication of symmetry is that symmetrical members are affected in like ways by like circumstances. An implication of the conception of the earth as a globe[38] is that the earth casts a circular shadow, as during a lunar eclipse. Another task of explication is to determine in what way a conception is an instance or modification of a more general idea. The result of all these considerations may be a definition. "The Definition gives the last stamp of distinctness to the Conception; and enables us to express, in a compact and lucid form, the . . . propositions into which the . . . Conception enters."[39] Note that the definition is the final, not the initial, step. "The Conception must be *formed* before it can be *defined*."[40] In fact, "though Definition may be subservient to a right explication of our conceptions, it is *not essential* to that process."[41] The essential part of explication is the identification of the constituent facts included in the conception.

Colligation is the complementary process of "binding"[42] facts together. Whewell stresses that it is not just that "we find something in which the facts *resemble each other*."[43] A conception is not merely a binding of multiple instances of a common

[36] *Philosophy*, §11.1, 2:3 (p.106); §7.1.1, 1:439.
[37] *Philosophy*, §7.1, 1:439–47.
[38] *Philosophy*, "Inductive Table of Astronomy."
[39] *Of Induction, with Especial reference to Mr J. Stuart Mill's System of Logic* (London: 1849), reprinted in Butts, as "Mr. Mill's Logic," §35, p. 284. See also *Philosophy*, §11.2.6–10, 2:11–16 (pp. 110–114).
[40] *Mr. Mill's Logic* (p. 284). Whewell's emphasis.
[41] *Philosophy*, 11.2.9, 2:13–14 (p. 112). Whewell's emphasis. Fundamental Ideas cannot be defined. They are simply acknowledged in "self-evident truths" that Whewell calls "Axioms." *Philosophy*, 1:21.
[42] *Philosophy*, 11.1, 2:5 (p. 104); 11.4.1, 2:36 (p. 130); 11.4.11, 2:45 (p. 137).
[43] *Mr. Mill's Logic* (p. 284). Whewell's emphasis.

attribute. It is rather a binding of the facts themselves—not just the common attributes, not just the definition, but indeed all the attributes and even propositions associated therewith. The conception of universal gravitation, for example, *includes* the fact of heliocentric motion, *includes* the fact of the precession of the equinoxes, *includes* the conception of terrestrial weight, and so on.[44] This is why Whewell says explication is an unfolding. It is an exposing of what has already been bound together in the colligation.

The process of colligation is a normative process. It can be done properly or improperly, and Whewell calls the proper method *induction*. "*Induction* is a term applied to describe the *process* of a true Colligation of Facts by means of an exact and appropriate Conception."[45] The first step in an induction—in a successful colligation, a successful binding—is selection of the broader (possibly fundamental) idea that contains the facts under investigation. Before an induction of planetary observations can proceed, for example, it must be decided whether these observations are instances of physical motion or are instances of supernatural whim. Thus, an induction *presupposes* that all the observations are instances of one already known universal. An induction is not the creation of a new generalization per se. It is the narrowing of an already existing generalization. Every conception is, for Whewell, a modification of an existing (possibly axiomatic) idea. Ultimately, all conceptions are modifications of *space*, the inescapable, fundamental idea presupposed in the very act by which we perceive objects. Once the facts and the broader-level idea have been identified, the first step of colligation is complete.

The second step is the construction of the conception. This involves a creative act that Whewell calls *invention*. He observes that such invention is often performed by means of hypotheses—"by calling up before our minds several suppositions, and

[44] *Philosophy*, 11.6.1, 2:75 (p. 162). Whewell himself uses such italics when making this point.
[45] *Philosophy*, "Aphorisms Concerning Science," 13, 2:468 (138).

selecting that one which most agrees with what we know of the observed facts."[46] How does the discoverer select from among the invented hypotheses? Before Whewell answers this, he stresses that a colligation, the formation of a conception, can still be meritorious and useful even if erroneous. The task of the colligation is to bind the facts together so that they can be cognitively manipulated as a unit. He offers the example of *fuga vacui*, nature's abhorrence of a vacuum. Water rising in pumps, the operation of a bellows, an infant's sucking action, respiration in animals, and many other facts were usefully bound together by this conception, even though aspects of the conception were later found erroneous. With this preliminary made and stressed, Whewell proceeds to offer criteria for the testing of hypotheses.

His tests for hypotheses include the following. First, an induction must be consistent with the facts. This consistency must be overwhelming, but not necessarily absolute. Whewell cites the orbit of Uranus. "If we find that Uranus . . . deviates from Kepler's and Newton's laws, we do not infer that these laws must be false; we say that there must be some disturbing cause."[47] As mentioned above, a valid hypothesis must also be a modified instance of a broader idea. A valid hypothesis must also be consistent with whatever facts follow deductively from it.[48] Whewell furthermore claims that "our hypotheses ought to *foretel* phenomena which have not yet been observed; at least all phenomena of the same kind as those which the hypothesis was invented to explain."[49] For example, "the *Epicyclical Theory* of the heavens was confirmed by its *predicting* truly eclipses of the sun and moon, configurations of the planets, and other celestial

[46] *Philosophy*, 11.5.6, 2:54 (p. 145).

[47] *Criticism of Aristotle's Account of Induction* (Cambridge: 1850), reprinted in Butts, p. 315–6. John H. W. Herschel made the same point. *A Preliminary Discourse on the Study of Natural Philosophy* (London: 1830), p. 165.

[48] *Philosophy*, 11.6.18, 2:93 (p. 175–6).

[49] *Philosophy*, 11.5.10, 2:62–3 (p. 151). Whewell's emphasis.

phenomena."[50] But Whewell then, famously, goes further:

> The evidence in favour of our induction is of a much higher and more forcible character when it enables us to explain and determine cases of a *kind different* from those which were contemplated in the formation of our hypothesis. The instances in which this has occurred, indeed, impress us with a conviction that the truth of our hypothesis is certain. No accident could give rise to such an extraordinary coincidence.[51]

Whewell gives a special name to this kind of evidence. He calls it *Consilience of Inductions*. He gives as an example the fact that Newton's inverse-square law of universal gravitation, developed to explain orbits, turned out to explain something seemingly unrelated, the precession of the equinoxes.[52] Whewell believes consilience to be one of the most powerful confirmations that an hypothesis can have. He says consilience has never supported an hypothesis later found to be false.[53] Consilience gives rise to Whewell's final criteria, simplicity. One hypothesis that encompasses multiple, seemingly unrelated, phenomena is simpler and better than multiple independent hypotheses.

All these criteria—agreement with facts, prediction, consilience, simplicity—are not arbitrarily chosen. They are direct results of Whewell's theory that an induction is the successful construction of a conception. A conception, by the nature of its universality, must include all facts of the class, not just those already observed; therefore a valid induction must be able to make predictions about the unobserved. Because a conception includes all attributes of a fact, including its relations, the conception must be consistent with deduced implications. The discovery of a consilience demonstrates that facts earlier included in two or more conceptions are in fact instances of a single conception, strengthening and broadening the conception and increasing simplicity and the unity that

[50] *Philosophy*, 11.5.10, 2:63 (p. 151). Whewell's emphasis.
[51] *Philosophy*, 11.5.11, 2:65 (p. 153). Whewell's emphasis.
[52] *Philosophy*, 11.5.11, 2:66 (p. 153).
[53] *Philosophy*, 11.5.11, 2:67 (pp. 154–5); *Mr. Mill's Logic* (p. 295).

is the goal of the binding. Since an induction is a successful construction of a conception, Whewell's criteria for a valid induction follow from the nature of a conception.

Whewell frequently says that every valid induction is accompanied by a new properly formed conception. The "Inductive Step" *is* "the Invention of the Conception."[54] "In *every* inference by Induction, there is some Conception *superinduced* upon the Facts."[55] This conception includes the facts, but it is not merely the facts. Something is added, a bond that holds the facts together.[56] The group of facts is then "seen *in a new light*"[57] and takes on "a new shape."[58] The penultimate step (a definition may be the ultimate) is creation or new application of a word, phrase,[59] or technical term. Whewell offered ninety pages[60] on how such terms have been and should be formed. He himself is credited with coining several (including *scientist* and *physicist*). It is by the creation of such conceptions—completed by creation or application of a word or phrase—that inductions, for Whewell, are performed.

Conclusion

I said that I would introduce you to a line of thinkers for whom concept-formation and induction were intimately related. Space limitation requires that I fulfill my obligation by simply identifying the line's two end-points—and claiming there are other points (including Thomas Reid and John Herschel) on the line.

I suspect that further investigation of all thinkers on the line would offer valuable insight into questions about those relationships between induction and concept-formation currently at the forefront of Objectivist research.

---

[54] *Philosophy*, 11.6.17, 2:91 (p. 174).
[55] *Philosophy*, 11.5.11, 2:65 (p. 142). First emphasis mine, second Whewell's.
[56] *Philosophy*, 11.6.3, 2:77 (p. 163).
[57] *Philosophy*, 11.6.12, 2:85 (p. 170). Whewell's emphasis.
[58] *Philosophy*, 11.6.3, 2:77 (p. 163).
[59] *Mr. Mill's Logic* (p. 271).
[60] Philosophy, "Aphorisms respecting the Language of Science."