

EXPERIENCE AND EXPERIMENTATION:
THE MEANING OF *EXPERIMENTUM* IN AQUINAS

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WHEN SEEKING TO UNDERSTAND a philosopher's use of a given term, one must both engage in precise textual analysis and consider the broader historical setting. Failing to distinguish technical from ordinary language meanings effectively underspecifies the term one is attempting to define. Diachronic changes in a term's nontechnical meaning and the tendency to retroject contemporary ideas into the past add to the interpretive challenge. Skewed translations misrepresent a philosopher's thought, especially to scholars not conversant with the source language.

A case in point is *experimentum*, which prominent classical and medieval dictionaries define as 'experiment'. This definition has been adopted in recent translations of Thomas Aquinas.¹ Given the controversial relationship between ordinary experience and experimentation, it is difficult properly to understand

¹ E.g., *STh* II-II, q. 95, a. 5, obj. 2: "Human knowledge begins by experimentation, according to Aristotle. But after a great deal of experimentation involving astronomical readings, men have discovered that certain future events can be predicted from the stars" (*Summa Theologiae*, vol. 40, trans. T. O'Meara [New York: Cambridge University Press, 1968], 51). Cf. "Human science originates from experiments [*ex experimentis*], according to the Philosopher (*Metaphysics* 1.1). Now it has been discovered through many experiments [*per multa experimenta*] that the observation of the stars is a means whereby some future events may be known beforehand" (*Summa Theologica*, trans. English Dominican Fathers, 3 vols. [New York: Benziger Bros., 1947], 2:1603). Section I, below, addresses these translations' inadequacies.

experimentum and *experientia*.² This study aims to surmount the hermeneutical difficulties inherent in Aquinas's use of these terms by linguistic, historical, and substantive analysis.

Section I first distinguishes between experience, tests, and experiments by establishing defining characteristics of each in light of a Thomistic philosophy of science. The section then argues that defining *experimentum* in Aquinas as 'experiment' is anachronistic. To prove this point requires apposite reference to medieval science, since Aquinas's terminology did not exist in a vacuum. Section II provides accurate and exhaustive definitions of *experimentum* and *experientia* as they occur in Aquinas, together with representative textual citations for each meaning.

Yet there is more at stake with *experimentum* than the adequacy of dictionary definitions; the semantic confusion regarding the term has contributed to the oversight of a crucial process in Thomistic epistemology. Aquinas most fully explains *experimentum*'s role in the acquisition of knowledge in his commentary on book 1, section 1 of Aristotle's *Metaphysics* (nn. 15-25). By a close analysis of this key text, section III shows that *experimentum* properly refers to a preabstractive function of the cognitive power.³ Section IV indicates the cognitive imperfection

² "The subject of [medieval] experimentation and its corollary, experimental science, is fraught with semantic difficulties" (David C. Lindberg, "Experiment and Experimental Science," in *Oxford Dictionary of the Middle Ages*, ed. Robert E. Bjork [Oxford: Oxford University Press, 2010], 2:604). "Some clarification can be gained regarding [the problem of the origins of experimental methodology] through a careful analysis of just how important notions such as 'experience' and 'experiment' have functioned in various contexts, among different schools, within various historical periods, and in different disciplines. . . . A major desideratum in this regard would be to have a comprehensive study of the changing roles which 'experience' and 'experiment' have played in the development of Western thought, what meanings the terms have taken on under various circumstances, and what relation 'experience' and 'experiment' have had to other sources of knowledge" (Charles B. Schmitt, "Experience and Experiment: A Comparison of Zabarella's View With Galileo's in *De Motu*," *Studies in the Renaissance* 16 [1969]: 81).

³ There has been almost no investigation of *experimentum* as such to date. James Stromberg's protracted "Essay on *Experimentum*," *Laval théologique et philosophique* 22 (1967): 76-115 and 23 (1968): 99-138, is little more than a collection of Scholastic quotations. Cornelio Fabro focuses exclusively on the role of *experimentum* in the induction of speculative first principles in *Percezione e pensiero* (2d ed.; Brescia: Morcelliana, 1962), chap. 5, sect. 3. Fabro studies a text from Cajetan, alleging (wrongly, as I will argue) that

of experiential propositions by defining their quantitative and modal status in terms of Aristotelian and contemporary logic.

I. SEMANTIC AND HISTORICAL ANALYSIS OF ‘EXPERIMENT’, ‘EXPERIENCE’, AND *EXPERIMENTUM*

In classical Latin, *experimentum* and *experientia* were approximate synonyms meaning ‘experience’ or ‘test’; these two notions were contained indistinctly in the root *experior* (“test, experience, endure”).⁴ The fundamental meaning of *experimentum* as ‘experience’ or ‘test’ remained unchanged in the medieval period. William of Moerbeke followed his predecessors’ use of both *experimentum* and *experientia* to render the Greek *empeiria* when translating book 1, chapter 1 of the *Metaphysics*.⁵ Aquinas favors *experimentum*, employing it forty percent more

Aquinas’s treatment of *experimentum* “does not contribute substantially new elements to [Aristotle’s] theory.” Robert Brennan holds that *experimentum* is a technical term and describes it as “the perfect form of sensitive cognition and the highest achievement of our sensitive powers,” but does not say whether it is formal (i.e., imaginary) or intentional (i.e., cogitative) (*Thomistic Psychology* [New York: MacMillan, 1941], 145). Both Fabro and Brennan overlook the technical use of *experimentum* regarding the cogitative. In contrast, Joseph Lennon, “The Notion of Experience,” *The Thomist* 13 (1960): 315-44, emphasizes the cogitative power’s role in experience.

⁴ The reference to trying experiences in book 1 of the *Aeneid* may be familiar: “Vos et Scyllaeam rabiem penitusque sonantis accestis scopulos, vos et Cyclopea saxa experti” (lines 200-01). In a philosophical context, Seneca used the terms to contrast experiential and instinctive animal cognition: “They appear to have knowledge of the harmful that is not gathered from experience; for they fear certain things before they are able to experience them” (“Apparet illis inesse scientiam nocituri, non experimento collectam. Nam antequam possint experiri, cavent”) (*Epistula* 121, 19-23); cf. Richard Sorabji, *Animal Minds and Human Morals* (Ithaca, N.Y.: Cornell University Press, 1993), 35. All translations are mine unless otherwise indicated.

⁵ See nos. 5-7 of the Moerbeke translation in Aquinas’s *I Metaphys.*, lect. 1 (Marietti ed., p. 5). Cf. the translations of *Metaphys.* 1.1.980b25-981a29 in the *vetustissima*, *vetus* and *media latina*. *Metaphysica, libri I-IV.4: Translatio Iacobi sive ‘Vetustissima’ cum Scholiis*, in *Aristoteles Latinus*, vol. 25, part 1, ed. G. Vuillemin-Diem (Paris: Desclée de Brouwer, 1970), p. 5, line 16 to p. 6, line 19. *Metaphysica, libri I-IV.4: Translatio Composita siue ‘Vetus’*, in *Aristoteles Latinus*, vol. 25, part 1a, ed. G. Vuillemin-Diem (Paris: Desclée de Brouwer, 1970), p. 89, line 14 to p. 90, line 14. *Metaphysica, libri I-X; XII-XIV: Translatio Anonyma sive ‘Media’*, in *Aristoteles Latinus*, vol. 25, part 2, ed. G. Vuillemin-Diem (Leiden: Brill, 1976), p. 7, line 14 to p. 8, line 15. James of Venice authored the first translation before 1150; the authorship of the second and third is unknown.

often than *experientia* in his extant writings (327 as opposed to 232 uses).⁶ The semantic difference between these cognate terms in Aquinas is unclear and has never been the object of a detailed study.

In order to determine the meaning and thus the proper translation of *experimentum*, one must first establish the meaning, scope, and use of ‘experiment’ and ‘experience’ in English. ‘Experiment’ was originally used in a broad sense to refer to any kind of test; given that the first references to this usage are from the late fourteenth century, it undoubtedly derives from the corresponding meaning of *experimentum*.⁷ In current English, ‘experiment’ properly refers to tests undertaken to verify a hypothesis or to illustrate a known truth by means of the scientific method.⁸ I submit that the more precise contemporary meaning of ‘experiment’ is a subset of the former generic meaning subsequent to semantic specialization. Since the generic sense is considered antiquated or metaphorical, I use ‘test’ to refer to tests in general.⁹

Tests can be divided into two subsets. Experimental tests employ the scientific method, experiential tests rely on unaided external sensation. Experiential tests are a subset of ordinary experience, which is distinct from experimentation, properly speaking.¹⁰ Scientific experimentation is characterized by the

⁶ Omitting uses in scriptural quotations, patristic texts, and spurious works. Claims regarding the frequency of terms in Aquinas’s works are based on, or verified in, the *Index Thomisticus*, ed. Roberto Busa et al. (online edition, ed. Eduardo Bernot and Enrique Alarcón, <<http://www.corpusthomicum.org/it/index>>). All searches include the declined forms and, in multiword expressions such as *experimentalis scientia*, noncontiguous usage of the terms.

⁷ *Oxford English Dictionary*, online edition (henceforth, *OED*), “Experiment,” def. 1a.

⁸ Cf. *ibid.*, def. 2-4.

⁹ An antiquated use: “To make another experiment of his suspicion.” Shakespeare, *Merry Wives of Windsor* IV. ii. 30 (cited in *OED*, def. 1a). A metaphorical use: “She’s performing an experiment to see which flavor she likes best.”

¹⁰ One could illustrate these genus-species relationships by two intersecting circles, the larger one representing “ordinary experience,” the smaller, “tests,” with the intersection containing experiential tests, and the nonoverlapping area of “tests” containing experiments. Other subsets of the circle representing experience are suggested by the definitions of *experientia* and *experimentum* below, excluding metaphorical usage (as in angelic “experience”).

conscious effort to prove or disprove a hypothesis by means of mathematical analysis, instruments, and the systematic manipulation of material reality. The proper subject of modern science extends to truths or theories about things' physical properties and behavioral characteristics. In contrast, ordinary experience is broader in extension, insofar as it relies on the external senses independently of artificial techniques; more immediate, insofar as it deals with macroscopic objects; and more reliable, insofar as external sensory error is negative rather than positive.¹¹ Unlike complex scientific experimentation, learning based on ordinary experience requires neither quantitative analysis nor intricate instruments, and is thus fully accessible to the nonspecialist. (Sections III and IV present a fuller, principled explanation of ordinary experience.)

Ordinary experience (including experiential tests) is distinct from but not necessarily inferior to scientific experimentation as a basis for the investigation of nature and human behavior. Thomistic natural philosophers such as Wallace and Ashley grant the importance of experiments in reaching properly scientific certitude as well as probable conclusions.¹² On the other hand, reasoning based on ordinary experience can yield apodictic conclusions regarding real principles operative in the natural world. Such principles attained by philosophy of nature are of

¹¹ "Such examples [as the earth's apparent immobility in relation to the sun] do not prove that our senses are in positive error. All that they show is that while our senses correctly inform us about the broader aspects of reality, they cannot directly fill in all the details. The 'errors' of normal sense knowledge (if they can even be called that) are purely *negative*; they are *insufficiently* sensitive to show reality in all its details. But what they do show us is really there. Relative to us on the surface of the earth, the earth is stationary and the sun moves" (Benedict Ashley, *The Way toward Wisdom: An Interdisciplinary and Intercultural Introduction to Metaphysics* [Notre Dame, Ind.: University of Notre Dame Press, 2006], 86; cf. 85-91). This presupposes Aristotle's view that the proper sensibles are more reliable than the common, and that errors in incidental sensation are not attributable to external sensation but to one's interpretation thereof by means of the cogitative power and intellect.

¹² Cf. William Wallace, *The Modeling of Nature: Philosophy of Science and Philosophy of Nature in Synthesis* (Washington, D.C.: The Catholic University of America Press, 1996); and Ashley, *Way toward Wisdom*, for further explanation of the relationship presented herein between philosophy of nature or "natural science" (in the Aristotelian sense) and experimental science.

assistance in interpreting experimental data. For example, behavioral psychologists can benefit from applying foundational Aristotelian principles to their findings, since excessive reliance on mathematical analysis leads to investigations that risk statisticizing the obvious.¹³ Although experimentation provides detailed knowledge inaccessible to the unaided senses, it only contributes indirectly to the ethical, metaphysical, or natural theological sciences, which are architectonic with respect to the specific modern sciences in important respects.

The neglect of a realist philosophy of nature under the influence of Cartesian methodic doubt and mechanism has led modern science to reject experiential inferences in favor of a purely experimental method. The complementarity in methodology between animal psychologists and ethologists provides one illustration of the need to harmonize rather than oppose experience and experimentation. Laboratory experiments cannot replace observation of animal activity in the wild.¹⁴ While less accurate in revealing discrete physical properties, field observation may better reveal individual and group behavioral characteristics and dispel illusions generated by the lab setting. In reply to scientific reductionists, natural philosophers grant the perennial value of the strictly mathematical and instrumental method, but hold that both the experimental and the observational approaches can provide the basis for further dialectical and demonstrative inquiry.

¹³ The conclusions of such studies range from the superficially descriptive to the misleading, as when Daniel Gilbert concludes that children cause unhappiness, based on a majority of parents interviewed (*Stumbling on Happiness* [New York: Vintage Books, 2005], 243-44). This apparent appeal to objectivity reflects an emotivist reduction of happiness to the absence of stress; it thus commits the fact/value fallacy. If one understands happiness as an activity of the soul in accord with perfect virtue (Aristotle, *Nic. Ethic.* 1.7.1098a7), happiness need not be attained independently of stressful situations (such as child-rearing), but may be found in the midst of them.

¹⁴ "The complexity of animal behavior study does not depend on elaborate mathematical treatments, on delicate instruments or giant computers—the paraphernalia that people usually associate with science. Although these devices have their place, they are after all only a means of wringing facts from nature. . . . The challenge is mainly to the intellect, to the judgment and patience of the observer rather than to his technical ingenuity" (Kenneth D. Roeder, "Introduction," in Nikolaas Tinbergen, *Animal Behavior* [New York: Time Books, 1965], 7).

Having outlined the distinction between experiments, tests, and experience from both an ordinary language and a philosophical perspective, we may now turn to the proper definition of *experimentum* and its cognates in the classical Latin that is at the root of medieval Latin usage. The *Oxford Latin Dictionary* defines *experimentum* as “a method or means of testing, trial, experiment” and *experientia* as “the testing of possibilities, trial, experiment.”¹⁵ Given that the ancients had not codified controlled experimentation into an established practice, this makes the exception into the norm. While these Latin terms may mean “test or trial,” neither was consciously used to signify an ‘experiment’ in the specific sense. The definition of the cognate *peira* as ‘experiment’ in Liddell and Scott’s *Greek-English Lexicon* is equivalently eisegetical.¹⁶ The proper translation is the generic ‘test’, rather than the specific ‘experiment’. One can only substitute ‘experiment’ for ‘test’ at the price of anachronism.

The textual citations provided by these dictionaries tend to disregard the terms’ fundamental semantic value as ‘experience’. In none of the examples listed under the *Oxford Latin Dictionary*’s first definitions of *experimentum* and *experientia* do the terms mean ‘experiment’ in the specific sense, but ‘test’ or ‘trial’, and in some cases ‘experience’. Pliny the Elder wrote: “When wells are dug, if sulphurous fumes occur . . . they kill the well-diggers. The *experimentum* for this danger is to send down a lit lamp.”¹⁷ This refers to a practical test whose purpose is to avoid harm, not to an experiment aimed at knowledge for its own sake. According to Liddell and Scott, Aristotle states that the Greeks learned by ‘experiment’ (*peira*) that listening to certain types of music affects one’s character. This portrays the Greeks as

¹⁵ S.v., ed. P. G. Glare (Oxford: Clarendon Press, 1968-82). Cf. “experimental knowledge,” s.v. “Experientia,” *Latin-English Dictionary*, William Smith and John Lockwood (Edinburgh: Chambers-Murray, 1933); “the knowledge gained by repeated trials, experimental knowledge,” s.v. “Experientia,” *A Latin Dictionary*, Charlton Lewis and Charles Short (Oxford: Clarendon Press, 1879).

¹⁶ Henry Liddell and Robert Scott, *A Greek-English Lexicon* (9th ed.; Oxford: Clarendon Press, 1996), s.v. “Peira,” def. 2.

¹⁷ Pliny the Elder, *Natural History* 31.49 (cited in *Oxford Latin Dictionary*, s.v. “Experimentum”).

performing methodical tests to determine music's psychological effect. With Jowett, I read Aristotle as asserting that attentiveness to experience over time reveals the effect of music on the inclination to virtue.¹⁸

Although the ancients' and medievals' ignorance of experimental methodology inhibited their understanding of the natural world, the same cannot be said of their nescience of Humean methodic skepticism. To define *experientia* as "the testing of possibilities" retrojects a modern understanding of tests as the search for possibilities as such into the premodern mindset. The insertion of "possibilities" seems to invoke Hume's view that any causation one experiences is merely one possibility among others, and thus there can be no observation of causality, only of contingently related facts. Such a definition runs counter to the common-sense understanding of 'test' in ancient and medieval ordinary language.¹⁹ For Aristotle and Aquinas, as well as for the ordinary person, the mind has reality as its proper object. The intellect and reality are not in an adversarial relationship unless the intellect is confused by sophistic arguments or the will suppresses the understanding of first principles (*nous archōn*).

Privileging the sense of 'test' over that of 'experience' suggests that only hypothetical-deductive tests can yield certain knowledge. Yet learning from common experience need involve neither conscious testing nor method. One does not claim to know by "methodic experience," experimentation, or testing that spending hours on the beach causes sunburn.²⁰ One learns this by

¹⁸ "Later experience [*peira*] enabled men to judge what was or was not really conducive to virtue, and they rejected both the flute and several other old-fashioned instruments" (Aristotle, *Politics* 8.6.1341a37 [Benjamin Jowett trans., *The Basic Works of Aristotle*, ed. Richard McKeon (New York: Random House, 1941), 1314]).

¹⁹ Whether it is accurate regarding ancient or medieval skeptics would require a separate study; regardless, the exception does not establish the rule.

²⁰ Although I cannot analyze Alfarabi and Avicenna on experience here, one finds a similar anachronism in the rendition of *tajriba* in these philosophers by "methodic experience" in *Classical Arabic Philosophy: An Anthology of Sources*, trans. Jon McGinnis and David Reisman (Indianapolis: Hackett, 2007), rather than by "experience," as in Deborah Black, "Knowledge (*ilm*) and Certitude (*yaqīn*) in Al-Fārābī's Epistemology," *Arabic Sciences and Philosophy* 16.1 (2006): 40-42; and Avicenna, *Remarks and Admonitions, Part One: Logic*, Sixth Method, ch. 1 (trans. Shams C. Inati; Toronto: PIMS, 1984), 120. Still, "methodic experience" is an

experience, though one could perform experiments to find out more about the phenomenon. Similarly, experiencing that children behave less rationally than adults requires neither tests or experiments. Following in Hume's footsteps, contemporary thinkers habitually reject experiential inferences based on non-enumerative induction, granting credence instead to experimental enumerative induction.²¹ In contrast, Aristotle and Aquinas characterize experience as a non-enumerative, abstractive induction.²² 'Experience' for them refers to the mind's receptivity to reality by means of sensation, memory, and reflection. Overlooking this leads to the translation of ancient and medieval texts as if they had been authored by protomoderns.

To render *experimentum*, *experimentalis*, and *experimentaliter* in Aquinas as 'experiment', 'experimental', and 'experimentally' is to transliterate rather than translate.²³ The first meaning for

improvement on "experimentation" (McGinnis, "Scientific Methodologies in Medieval Islam," *Journal of the History of Philosophy* 41.3 [2003]: 307-27), which evinces a lack of distinction between experiments as confusedly conceived by the medievals and the experimental method explicitly espoused in the modern era. For a similar critique of "experimentation," cf. Jules Janssens, "'Experience' (*tajriba*) in Classical Arabic Philosophy (al-Fārābī-Avicenna)," *Quaestio* 4 (2004): 46 n. 4; 54 n. 24.

²¹ In 1748, David Hume wrote: "As to past *Experience*, it can be allowed to give *direct* and *certain* information of those precise objects only, and that precise period of time, which fell under its cognizance . . ." (*An Enquiry Concerning Human Understanding*, sect. 4, part 2, par. 29, ed. L. Selby-Bigge, revised by P. Nidditch [Oxford: Clarendon Press, 1975], 33). "Experimental" refers to a subset of enumerative induction that corrects for such induction's inherent fallibility by experimental method.

²² For an in-depth study of the different kinds of inductive reasoning in Aristotle that replies to modern and contemporary critiques, see Louis Groarke, *An Aristotelian Account of Induction: Creating Something from Nothing* (Montreal: McGill-Queen's University Press, 2009).

²³ Roy Deferrari and M. Barry, *Lexicon of St. Thomas Aquinas: Based on the Summa theologiae and Selected Passages of His Other Works* (Washington, D.C.: The Catholic University of America Press, 1948); Roy Deferrari, *Latin-English Dictionary of St. Thomas Aquinas* (Boston: St. Paul Editions, 1960). Cf. G. Klubertanz, *The Discursive Power: Sources and Doctrine of the vis cogitativa according to St. Thomas Aquinas* (St. Louis: Modern Schoolman, 1952), 207-10; V. Rodríguez, "La cogitativa en los procesos de conocimiento y afectación," *Estudios filosóficos* 6 (1957): 254. The medieval Latin dictionaries consulted were not more helpful, e.g., the truncated definition of *experimentum* as "information" in *Medieval Latin Dictionary*, ed. J. Niermeyer and C. van de Kieft, revised by J. Burgers (Leiden: Brill, 2002), s.v. The definitions suggested below might provide a helpful starting point for the corresponding entries in a medieval Latin dictionary.

experimentum in Deferrari's *Lexicon of St. Thomas Aquinas* ("trial, test, experiment") echoes that in the *Oxford Latin Dictionary* and duplicates that in Schütz's *Thomas-Lexikon* ("Versuch, Probe").²⁴ Neither Deferrari nor Schütz clarify how to understand 'experiment' or *Versuch* nonanachronistically. In all but one of the texts cited under the first definition of *experimentum* in both Deferrari and Schütz, the term means 'experience'. Aquinas never consciously uses *experimentum* to refer to the specific 'experiment' as opposed to the generic 'test' or 'trial'.

Translating *experimentum* as 'experiment' is equivocal insofar as it overlooks the limitations of medieval scientific methodology. A representative example may be found in the *Secunda Secundae*, question 95, article 5. Contrary to both English translations, Aquinas refers therein not to experiments, but to experience: "Human knowledge arises from experience [*ex experimentis*], as is clear from the Philosopher, in the beginning of his *Metaphysics*. Yet by repeated observations [*per multa experimenta*], some discovered that certain future things can be foreknown by observing the stars."²⁵ Aquinas here considers ordinary experience as the basis for subsequent mathematical or demonstrative reasoning, as in the discovery of the cause of a lunar eclipse in book 2, chapter 2 of the *Posterior Analytics*.²⁶ The insufficient medieval distinction between astronomy and astrology indicates the inappropriateness of 'experiment' or 'experimentation' in this context. Aquinas lacked the natural science inerrantly to distinguish legitimate inferences regarding the celestial bodies'

²⁴ Ludwig Schütz, *Thomas-Lexikon* (Stuttgart: Frommanns Verlag-Günther Holzboog, 1958; reprint of 1895 edition), s.v. Deferrari acknowledges his dependence on Schütz (*Lexikon*, vii).

²⁵ Cf. n. 1. "Scientia humana ex experimentis originem sumit, ut patet per Philosophum, in principio *Metaphysicorum*. Sed per multa experimenta aliqui compererunt ex consideratione siderum aliqua futura posse praenosci" (*STh* II-II, q. 95, a. 5, obj. 2).

²⁶ Schmitt reaches a similar conclusion on the observational rather than properly experimental character of medieval astronomy ("Experience and Experiment," 88).

influence (as in predicting tides) from idle speculation.²⁷ Although he stressed that both reasoning and experience are crucial to natural science, he realized that the medieval study of nature often yielded belief rather than certain knowledge.²⁸ In those cases where he uses *experimentum* in its classical sense, translating it as ‘test’ avoids all risk of confusion, while ‘experiment’ invites anachronism.²⁹

A discussion of *experimentum* as used in the medieval sciences may help delineate the extent of this anachronism, and thus help explain the rationale for the translations suggested below. Experience conceived in Aristotelian terms entailed little use of methodical tests until after Aquinas’s death, barring rare exceptions such as Robert Grosseteste and Roger Bacon.³⁰ Albert the Great, while a pioneer in the observation of the natural world, still relied heavily on tradition, as evidenced in his biological works.³¹ Medieval thinkers rarely or never made use of controlled

²⁷ E.g., *STh* I, q. 115, a. 3, ad 2; q. 115, a. 4; *De Pot.*, q. 5, a. 8; etc. For bibliography, see Thomas Aquinas, *The Division and Methods of the Sciences: Questions V and VI of His Commentary on the “De Trinitate” of Boethius*, trans. A. Maurer (Toronto: Pontifical Institute of Mediaeval Studies, 1986), 44 n. 24.

²⁸ E.g., “The Philosopher shows this . . . both by reason, and by sensory experience, which are the more accurate sources of belief in natural matters” (“et per rationem, et per experimenta sensibilia, quae magis in rebus naturalibus faciunt fidem”) (*III Sent.*, d. 3, q. 5, a. 1).

²⁹ See textual citations under *experimentum*, def. 5, below.

³⁰ Grosseteste and Bacon argued for the importance of empirically testing one’s claims, but *experimentum* seems to be best rendered as “test” or “experience” in their case as well. Although Bacon is sometimes credited with inventing “experimental science” (*scientia experimentalis*), he includes both magic and divine revelation within the scope of this generically experiential knowledge. Nor is *scientia experimentalis* a Baconian neologism, as it was simultaneously employed at least by Aquinas. For an overview of the debate, see Jeremiah Hackett, “Roger Bacon on *scientia experimentalis*,” in *Roger Bacon and the Sciences*, ed. Jeremiah Hackett (Leiden: Brill, 1997), 277–316.

³¹ Albert did not consciously use *experimentum* to refer to properly experimental as opposed to experiential tests. For example, Albert concludes from his test (*experimentum*) of snuffing out a candle with a spider that spiders have a “cold complexion.” Such a test is only inchoatively and remotely related to the specific use of “experiment” that requires the systematic isolation of the different factors at work, as later suggested by Francis Bacon. Other scholars have reached the same conclusion: “The line between ‘to experience’ and ‘to learn through experience’ (that is, to ‘experiment’) is not always clear. . . . The term ‘experiment’ has generally been avoided as being too specific and carrying too many modern overtones” (glossary entry for *experimentum* in *Albertus Magnus, On Animals: A Medieval Summa*

experimentation. Even when reality was manipulated, no attempt was made to mathematize the result, with the exception of the four intermediate sciences (*scientiae mediae*) situated between natural philosophy and mathematics. Yet one cannot extrapolate from the use of mathematics in astronomy, optics, harmonics, and mechanics to its use in other fields of inquiry.

Subordinate sciences such as medicine or alchemy might seem to be an exception insofar as they occasionally employed empirical tests. Yet, in both the intermediate and the subordinate sciences, the medievals did not consciously use *experimentum* to refer to methodic experimentation as distinct from experiential tests or mere observations. Despite the use of experience and occasional tests (*experimenta*), medieval science often failed to distinguish medicine from superstition, alchemy from chemistry, or natural causality from divine influences or magic. *Experimentum* came to mean ‘remedy’ in medical texts.³² Yet it was not always clear whether natural or magical causes were at work.³³ *Experimentum* even occurs in explicit references to magical healings and curses; in such cases, I suggest it is best rendered as ‘spell’.³⁴ Proper experimental method (as opposed to

Zoologica, 2 vols., trans. Kenneth Kitchell and Irven Resnick [Baltimore: Johns Hopkins University Press, 1999], 2:1770).

³² E.g., “For curing jaundice, know that the proper remedy [*experimentum*] is ivory rubbings and liver extract” (“Ad curandam icititeiam proprium experimentum recipe rasure eboris, succi epatice”) (Peter of Spain, *Liber experimentorum vel Thesaurus pauperum* [Antwerp, 1497, f. d2r]; cited in Schmitt, “Experience and Experiment,” 87 n. 18; my translation). Lynn Thorndike notes “the common medieval use of the word ‘experimentum’ for almost any medicinal recipe or remedy” (*A History of Magic and Experimental Science*, 8 vols. [New York: Columbia University Press, 1923-58], 2:495). Thorndike consistently renders *experimentum* as “experiment.” I submit that *Liber experimentorum* is a “book of remedies,” not a “book of experiments,” especially in light of the folkloric cures prescribed therein.

³³ Cf. Schmitt’s characterization of *experimentum* as “a recipe or formula of some sort used to bring about a non-natural change in the course of natural events” (“Experience and Experiment,” 87).

³⁴ E.g., the acts of a provincial Dominican chapter in 1311 commanded the remission of all “libros nigromanticos, experimenta, conjurationes et quecumque scripta superstitiosa” (cited in *ibid.*, 87 n. 18). The inadequacy of “remedy” seems clear in the Hermetic books, which refer to spells (*experimenta*) of invisibility or of destruction; contrast Thorndike’s “experiments” (*History of Magic and Experimental Science*, 2:227).

random observation or magic) remained almost entirely uncodified during Aquinas's era.

Schmitt's extensive textual evidence for the lack of distinction between *experientia* and *experimentum* in the medieval and renaissance periods confirms my research.³⁵ Buonamici (Galileo's teacher) used *experientia* and *experimentum* interchangeably to refer to experience or observations.³⁶ As late as the seventeenth century, both Zabarella and Galileo called their experiments on motion *pericula* (not *experimenta*).³⁷ There appears to be no clear definition of *experimentum* (as opposed to *experientia*) referring exclusively to the scientific manipulation of nature until Christian Wolff in 1732: "An experiment is an experience, which deals with those facts of nature that do not happen except by human intervention."³⁸ There is thus concrete evidence supporting the thesis that *experimentum* was not explicitly conceived of as intrinsically manipulative as opposed to observational during the medieval period.

However, contrary to the belief that the Scientific Revolution constituted a complete break with what preceded, there were successful (albeit rare) experiments among medieval Aristotelians seeking the causes of natural phenomena. Aristotle had engaged in careful and methodic observation, including dissection. Yet his empirical approach to natural sciences such as zoology was eclipsed by Platonic indifference to the study of nature for its own sake, and thus fell into desuetude for a millennium and a half.³⁹ With the Aristotelian renaissance of the thirteenth century, there was a renewed interest in proper empirical and scientific method; for example, Theodoric of Freiberg perfected Grosseteste's and

³⁵ Even in strictly medical contexts, *experimentum* and *experientia* were not clearly distinguished as late as a sixteenth-century medical lexicon (Schmitt, "Experience and Experiment," 87 n. 18).

³⁶ *Ibid.*, 90ff.

³⁷ Cf. Wallace, *The Modeling of Nature*, 305, 343.

³⁸ "Experimentum est experientia, quae versatur circa facta naturae, quae nonnisi interveniente opera nostra contingunt" (Christian Wolff, *Psychologia empirica*; cited in Schmitt, "Experience and Experiment," 80; my translation).

³⁹ Cf. Michael W. Tkacz, "Albert the Great and the Revival of Aristotle's Zoological Research Program," *Vivarium* 45 (2007): 30-68.

Bacon's research to achieve an accurate definition of the rainbow using experimental optics.⁴⁰ Beginning around 1400, the Paduan Aristotelians developed the methodology of scientific investigation until the time of Galileo, who conceived his research on the model of the *Posterior Analytics*.⁴¹ Indeed, the elderly Galileo considered himself a truer Aristotelian than many of his Scholastic contemporaries.⁴² The scientific method is a natural continuation of Aristotelian method, with the addition of novel elements such as Descartes's Platonic use of mathematics in areas not traditionally considered intermediate sciences.⁴³ One must not allow the semantic imprecision of *experimentum* to obscure the reality of methodic experiments in the medieval and renaissance periods.⁴⁴

II. DEFINITIONS OF *EXPERIMENTUM* AND RELATED TERMS

The following proposed definitions and textual references for *experientia*, *experimentalis*, *experimentaliter*, and *experimentum* are intended to supersede those in the current *lexica* of Thomistic Latin. The meanings are listed in the order of their frequency of use. This order does not indicate the meanings' relative philosophical import; I will argue that cogitative *experimentum* is the term's most significant meaning, despite the paucity of references.

⁴⁰ William A. Wallace, *The Scientific Methodology of Theodoric of Freiberg* (Fribourg: The University Press, 1959); cf. Wallace, *The Modeling of Nature*, 324-34.

⁴¹ John H. Randall. "The Development of Scientific Method in the School of Padua," *Journal of the History of Ideas* 1 (1940): 177-206. William A. Wallace, *Galileo's Logic of Discovery and Proof: The Background, Content, and Use of His Appropriated Treatises on Aristotle's "Posterior Analytics"* (Dordrecht: Kluwer Academic, 1992); cf. Wallace, *The Modeling of Nature*, 334-40.

⁴² "Against all reason I am impugned as an impugner of the Peripatetic doctrine, whereas I claim (and surely believe) that I observe more religiously the Peripatetic or, I should say, Aristotelian teaching than do many who wrongfully situate me as averse to good Peripatetic philosophy" ("Letter to Fortunio Liceti" [1640], in *Le opere di Galileo Galilei*, ed. A. Favaro et al. [Florence: Barbèra, 1968], 18:248; cited and translated in William Carroll, "Galileo Galilei and the Myth of Heterodoxy," in *Heterodoxy in Early Modern Science and Religion*, ed. John Brooke and Ian Maclean [Oxford: Oxford University Press, 2005], 143).

⁴³ In this I concur with Randall, Wallace, and Ashley; e.g., Randall, "Development of Scientific Method," 203-5.

⁴⁴ Cf. Lindberg, "Experiment and Experimental Science," 604-5.

The definitions account for every use of the terms, excluding direct or indirect citations from other sources (scriptural quotations, patristic authors, etc.) whose usage sometimes differs from that of Aquinas.⁴⁵

experientia, -ae, *f.*

1. Experience, broadly speaking, i.e., external and internal sensory knowledge of things vs. purely intellectual knowledge. *Experientia proprie ad sensum pertinet* (experience is properly placed under sense knowledge) (*De Malo*, q. 16, a. 1, ad 2).
 - a. in view of practical, i.e., prudential or ethical, knowledge. *In singularibus [actibus hominum] perfectam cognitionem adipisci non possumus nisi per experientiam* (we can only acquire perfect knowledge about singular human actions by experience) (*STh* I-II, q. 97, a. 2, obj. 3); *prudentia magis est in senibus . . . propter experientiam longi temporis* (prudence is found more in older people due to long experience) (*STh* II-II, q. 47, a. 15, ad 2).
 - b. in view of practical, i.e., artistic or productive, knowledge. *Per experientiam homo acquirit facultatem aliquid de facili faciendi* (by experience one acquires the ability to do something with ease) (*STh* I-II, q. 40, a. 5); cf. I *Metaphys.*, lect. 1 (Busa ed., 18-20).
 - c. in view of speculative knowledge. *Cognitio per experientiam longi temporis est accipientis scientiam a rebus* (by long experience one acquires knowledge from things) (*II Sent.*, d. 7, q. 2, a. 1, obj. 4); *in rebus sensibilibus . . . per experientiam*

⁴⁵ For ease of reference, references to several of Aquinas's commentaries use the numbering found in *Sancti Thomae Aquinatis Opera Omnia: Ut sunt in Indice Thomistico additis 61 scriptis ex aliis Medii Aevi auctoribus*, 7 vol., ed. Roberto Busa (Stuttgart-Bad Cannstadt: Frommann-Holzborg, 1980); electronic edition, ed. Enrique Alarcón (Pamplona: Universidad de Navarra, 2006, accessible at <<http://www.corpusthomicum.org/iopera>>).

. . . *accipimus universalem notitiam* (we acquire universal knowledge of sensory things by experience) (I *Post. Anal.*, lect. 30 [Busa ed., n. 4]); *Plato . . . circa intelligibilia intentus, sensibilibus non intendebat, circa quae est experientia* (Plato . . . was so intent on intelligible things that he ignored sensory things, which are the object of experience) (I *De Gen. et corrup.*, lect. 3 [Busa ed., n. 8]).

- d. of divine things. *Experientiam in dono* (the experience of a gift [of the Holy Spirit]) (I *Sent.*, d. 15, q. 5, a. 3, expos.); *concepta est ex experientia divinae bonitatis* (it is conceived based on the experience of the divine goodness) (In *Ps.* 39 [Busa ed., n. 6]; cf. In *Ps.* 33 [Busa ed., n. 9]).
2. Experience, in a metaphorical sense, i.e., being consciously the subject of a state or condition not restricted to sensory knowledge, over some period of time.⁴⁶ *Transfertur enim experientiae nomen etiam ad intellectualem cognitionem* (the term ‘experience’ is said metaphorically even of intellectual knowing) (*De Malo*, q. 16, a. 1, ad 2); *Deus et beatitudo . . . non sunt ita nobis per experientiam nota sicut virtutes* (God and beatitude are not as well known to us by experience as the virtues are) (*STh* II-II, q. 145, a. 1, ad 2).
 - a. of evil. *Post peccatum factus est cautior per experientiam mali* (after the fall he grew more cautious due to the experience of evil) (II *Sent.*, d. 21, q. 2, a. 1, ad 4); cf. III *Sent.*, d. 19, q. 1, a. 3, qcla. 1 (experience of eternal punishment); In *Lam.* 3, lect. 6.
 - b. of knowledge. *Per experientiam scientiae* (by the experience of knowing) (II *Sent.*, d. 22, q. 1, a. 2, ad 3); cf. *STh* III, q. 12, a. 1, ad 1.

⁴⁶ Cf. OED, “Experience,” definition 4a: “The fact of being consciously the subject of a state or condition, or of being consciously affected by an event.”

- c. in angels. *Experientia in angelis et daemonibus dicitur secundum quandam similitudinem prout scilicet cognoscunt sensibilia praesentia* (experience is said of angels and demons by way of a certain similitude, that is, inasmuch as they know present sensible things) (*STh* I, q. 58, a. 3, ad 3); cf. *STh* I, q. 64, a. 1, ad 5.

experimentalis, -e, adj., experiential. Usually used with *scientia* regarding Christ's experiential knowledge (*STh* III, q. 12, *passim*).

experimentaliter, adv., experientially, from experience.

experimentum, -i, n.

1. Experience, broadly speaking, as either repeated or discrete observations or sensations, vs. purely intellectual knowledge; cf. *experientia*, def. 1.⁴⁷
 - a. external sensory. *Multa experimenta sensitiva demonstrant . . . quod natura non patitur vacuum* (many sensory observations show that nature does not admit of a vacuum) (*II Sent.*, d. 1, q. 1, a. 5, obj. 4); *fluidum non potest consistere super corpus rotundum, ut experimento patet* (a fluid cannot rest on a sphere, as experience shows) (*STh* I, q. 68, a. 2, obj. 2); *mare esse altius terra experimento compertum est in mari rubro* (it has been discovered by experience that the sea is higher than the earth in the case of the Red Sea) (*STh* I, q. 69, a. 1, ad 2).
 - b. internal sensory. *Ad vaporationem cujusdam fumi trabes domus videntur serpentes, et multa experimenta hujusmodi* (upon the emission of certain fumes, the beams seem to be snakes, and many similar experiences) (*II Sent.*, d. 8, q. 1, a. 5, ad 4); *dormiens, ut experimento scitur, interdum argumentatur* (one sometimes reasons in one's

⁴⁷ For independent confirmation of the translation by "observation," see Schmitt, "Experience and Experiment," 88.

- sleep, as is known from experience) (IV *Sent.*, d. 9, q. 1, a. 4, qcla. 1, obj. 3).
- c. of divine things. *Adam . . . per experimentum cognovit ea quae nos credimus* (Adam knew by experience those things that we believe) (*De Verit.*, q. 18, a. 3, obj. 3); *In Ps.* 41 (Busa ed., n. 6).
2. Experience, properly speaking, as a technical term from Aristotle, i.e., intermediary between sensory memory and universal knowledge. *Experimentum nihil aliud esse videtur quam accipere aliquid ex multis in memoria retentis* (experience seems to be nothing other than to receive something from many things stored in memory) (II *Post. Anal.*, lect. 20 [Busa ed., n. 11]); cf. I *Metaphys.*, lect. 1 (Busa ed., n. 18); II *Sent.*, d. 7, q. 2, a. 1, obj. 4; III *Sent.*, d. 34, q. 1, a. 2; *ScG* II, c. 76.
- a. in view of speculative knowledge. *Experimento indiget et tempore intellectualis virtus* (intellectual virtue requires experience and time) (II *Sent.*, d. 20, q. 2, a. 2, s.c. 2 [citing Aristotle, *Nicomachean Ethics* 2.1.1103a16]); *principia universalia posteriora, sive sint rationis speculativae sive practicae . . . habentur . . . secundum viam experimenti* (secondary universal principles, whether they belong to speculative or practical reason, are acquired by way of experience) (*STh* II-II, q. 47, a. 15); *ostendit virtutem experimenti tam in speculativis quam in operativis* (he shows the importance of experience in both speculative and practical matters) (*In Job* 12 [Leonine ed., vol. 26, part 2, p. 81, ll. 181-85 (henceforth, 26/2:81.181-85)]).
- b. in view of practical, i.e., prudential or ethical, knowledge. *Prudentia . . . indiget . . . experimento et tempore* (prudence requires experience and time) (*STh* II-II, q. 47, a. 14, ad 3).

- c. in view of practical, i.e., artistic or productive, knowledge. *Quia potentiam recte et faciliter operandi praebebat experimentum, videtur fere esse simile arti* (because experience gives the ability to work rightly and with ease, it seems almost the same as art) (I *Metaphys.*, lect. 1 [Busa ed., n. 17; n. 20]).
- 3. Experience, in a metaphorical sense; cf. *experientia*, def. 2. *Experimento discere possumus quod circa incarnationem Dei plurimi errores sunt exorti* (by experience we can learn that many errors arose regarding the Incarnation) (ScG IV, c. 53).
 - a. of evil. *Hoc consecutum est ex peccato suo quod malum per experimentum cognosceret* (it resulted from his sin that he knew evil by experience) (II *Sent.*, d. 22, q. 1, a. 2, ad 3).
 - b. of knowledge. *Hoc experimento cognoscimus dum percipimus nos abstrahere formas universales* (we know this by experience, when we perceive that we abstract universal forms) (*STh* I, q. 79, a. 4); cf. *STh* I, q. 89, a. 1; ScG II, c. 66.⁴⁸
- 4. Proof.
 - a. proof or indication based on experience. *Aliud signum experientiae, sive aliud experimentum* (another sign from experience, that is, another experiential proof) (*In Ps.* 36 [Busa ed., n. 18]); *ut sumatis experimentum divinitatis meae* (that you may receive a proof of my divinity) (*In Jn.* 11, lect. 3); *ut ei humana ratio experimentum [Eucharistiae] non praebeat* (so that human reason be unable to provide an experiential proof [of the Eucharist]) (*In 1 Cor.* 11, verse 23 [reportatio Reginaldi de Piperno]); *nullus scit se esse in Christo certitudinaliter, nisi per quaedam*

⁴⁸ Aquinas only speaks of *experimentum* in spirits once, when he writes that demons can predict future events due to their “long experience” (*In Is.* 3.3 [Leonine ed., 28:32.552-54]).

experimenta et signa (no one is certain that he is in Christ, except by certain proofs from experience and signs) (*In 2 Cor.* 12, lect. 1).

- b. rational proof. *Ratio praebens sufficienter experimentum fidei facit visionem* (when reason offers sufficient proof of faith it makes vision) (*III Sent.*, d. 24, q. 1, a. 3, qcla. 3, ad 1); [*fides*] *experimentum rationis effugiat* (faith puts rational proof to flight) (*IV Sent.*, d. 11, q. 1, a. 1, qcla. 2, obj. 2).⁴⁹

5. Test, trial. *Cum enim experimentum non sit nisi de dubiis* (a test is only of that which is doubted) (*II Sent.*, d. 22, q. 2, a. 2); *experimentum sumitur de aliquo, ut sciatur aliquid circa ipsum* (someone is put to the test so that something may be learned about him) (*STh I*, q. 114, a. 2); *tentare proprie est experimentum sumere de eo qui tentatur* (to tempt is properly to put to the test he who is tempted) (*STh II-II*, q. 97, a. 1); *cum aliquis equum currere facit ut evadat hostes, hoc non est experimentum de equo sumere, sed si equum currere faciat absque aliqua utilitate, hoc nihil aliud esse videtur quam experimentum sumere de equi velocitate* (when one makes one's horse run to escape the enemy, this is not testing the horse; but if one were to make it run without any useful end, this is seen to be nothing other than to test the horse's speed) (*ibid.*); cf. *STh II-II*, q. 97, a. 2.
6. Remedy, cure (in a medical context). *Accipiens doctrinam alicuius experimenti* (one who is given knowledge of a cure) (*Quodl.* XII, q. 14, a. 2, *tit.*); *uti illo experimento in salutem corporalem aliorum* (to use that remedy for others' bodily health) (*ibid.*, *corp.*) Unique occurrences in Aquinas.⁵⁰

⁴⁹ *Experientia* is used in this sense in the patristic Latin found in the *Catena aurea* (e.g., Remigius, *Catena in Matt.* 10, lect. 6), but never by Aquinas.

⁵⁰ For independent confirmation of this definition, see n. 32.

These definitions show the extent to which *experimentum* and *experientia* are, and are not, synonymous. Aquinas never uses *experientia* to mean “test,” “proof,” or “remedy”; nor does he ever refer to cogitative *experientia*. *Experientia* is more frequently used in an abstract or broad sense, while *experimentum* can refer to one instantiation of *experientia*: Aquinas never uses *experientia* in the plural, but he often uses *experimenta* (as in the frequent *ex multis experimentis*). When used in the precise sense described in the following discussion, *experimentum* can refer to an inference or conclusion from the larger phenomenon of *experientia*. While the second meaning of *experimentum* presupposes the first, *experimentum* as mere repeated observation does not necessarily engender *experimentum* properly speaking.

III. *EXPERIMENTUM* AS COGITATIVE COLLATIO

Aquinas’s fullest explanation of “experiential knowledge” (*experimentalis scientia*) follows Aristotle’s account in *Metaphysics* 1.1. This text and its parallel in *Posterior Analytics* 2.19 are the two key Aristotelian texts, and Aquinas’s respective commentaries are the key Thomistic texts. In the remainder of this article I read Aquinas’s account of experience as an organic development of Aristotle’s and thus refer to the latter’s texts when Aquinas does little more than paraphrase them.

Metaphysics 1.1 asserts that “experience is knowledge of singulars.”⁵¹ In speaking of “experiential notions,” Aristotle indicates that experience constitutes an inchoative kind of knowledge.⁵² The technical usage of “experience” (*empeiria*) refers to the highest stage of sensory cognition. *Posterior Analytics* 2.19 states that experience results from many memories of similar external sensory impressions.⁵³ *Metaphysics* 1.1 adds a crucial

⁵¹ I *Metaphys.*, lect. 1 (Marietti ed., n. 18); Aristotle, *Metaphys.* 1.1.981a17.

⁵² Aristotle, *Metaphys.* 1.1.981a6. Moerbeke translates “tes empeirias ennoematon” as “experimentales conceptiones” (I *Metaphys.*, lect. 1, n. 6 [Marietti ed., p. 5]), though Aquinas nowhere adopts this expression.

⁵³ “So from sensation comes what we call memory, and from memory, when it is generated repeatedly of the same thing, there comes experience. For memories that are many in number constitute a single experience” (Aristotle, *Post. Anal.* 2.19.100a4-6).

detail: “many memories of the same thing produce finally the potency for a single experience.”⁵⁴ “The potency for” experience implies that one must make a comparison of one’s memories of the characteristics of similar things in order for the memories to engender experience, properly speaking.⁵⁵ Mere repeated observations of a fact (cf. *experimentum*, def. 1) are insufficient to constitute experience (in the sense of *experimentum*, def. 2). The same principle applies to the acquisition of practical knowledge. One must actualize one’s memorative capacity by reflection in order to attain experience.

One way such reflection takes place is when one notices similar cause-effect relationships, culminating in an experiential judgment. That a given remedy can heal many instances of a given symptom is a matter of experience. In contrast, “to judge that it has done good to all persons of a certain constitution, marked off in one class, when they were ill of this disease, e.g., to phlegmatic or bilious people when burning with fever—this is a matter of art.”⁵⁶ Subsequent to this initial stage of experiential comparison and judgment, the intellect may use deductive reasoning to conclude to universal, necessary judgments, whether they be productive (*techne*), prudential (*phronesis*), or speculative (*episteme*). Alternatively, the intellect can form universals by abstraction as described in *Posterior Analytics* 2.19.

Although the account of experience in the two key Thomistic texts coincides with Aristotle’s on most points, Aquinas makes two historically significant additions:

In humans, the next thing above memory is experience [*experimentum*], which certain animals participate in to a slight degree. For experience [*experimentum*] comes from the comparison [*ex collatione*] of many singulars that have been received in memory. But this kind of comparison [*collatio*] is proper to man, and it pertains to the cogitative power, which is called particular reason, and which is able to compare [*collativa*] particular intentions, just as universal reason does

⁵⁴ Aristotle, *Metaphys.* 1.1.981a1.

⁵⁵ Pavel Gregoric and F. Grgic reach a similar conclusion in “Aristotle’s Notion of Experience,” *Archiv für Geschichte der Philosophie* 88 (2006): 9–11.

⁵⁶ Aristotle, *Metaphys.* 1.1.981a10–12. Note that “of one class” renders “kat’eidōs hen,” “according to one form.”

with universal intentions. . . . Beyond experience [*experimentum*], which belongs to particular reason, humans have universal reason, by which they live, as by that which is principal in them.⁵⁷

First, where Aristotle does not say which faculty is involved, Aquinas repeatedly asserts that the cogitative power is responsible for *experimentum*. (The common sense, imaginative, cogitative, and memorative powers are the four internal senses for Aquinas, with the cogitative operating in direct continuity with intellect to enable humans to know singulars.)⁵⁸ Since Aquinas never affirms that the cogitative yields *experientia*, it is clear that *experimentum* in the proper sense refers to one or more acts of the cogitative or the cognitional product thereof (i.e. some kind of sensory intention).⁵⁹

Second, Aquinas introduces the term *collatio* to describe how experience is acquired, and attributes *collatio* to the cogitative. *Collatio* is a polyvalent term that stems from *conferre*, and thus has three meanings: “comparison,” “gathering,” and “inference.” Each meaning manifests some aspect of this cogitative act. The

⁵⁷ “Supra memoriam autem in hominibus, ut infra dicitur [n. 18], proximum est experimentum, quod quaedam animalia non participant nisi parum. Experimentum enim est ex collatione plurium singularium in memoria receptorum. Huiusmodi autem collatio est homini propria, et pertinet ad vim cogitativam, quae ratio particularis dicitur: quae est collativa intentionum individualium, sicut ratio universalis intentionum universalium. . . . Homines autem supra experimentum, quod pertinet ad rationem particularem, habent rationem universalem, per quam vivunt, sicut per id quod est principale in eis” (I *Metaphys.*, lect. 1, [Marietti ed., n. 15]).

⁵⁸ See *STh* I, q. 78, a. 4 for Aquinas’s only *ex professo* treatment of the internal senses; see also my forthcoming book on the cogitative power. Following Aquinas’s own usage, I often refer to the cogitative power (*vis cogitativa*) as “the cogitative” (*cogitativa*) for the sake of brevity (e.g., II *Sent.*, d. 24, q. 3, a. 4, ad 5; *STh* I, q. 78, a. 4; *ScG* II, c. 76; *De Verit.*, q. 10, a. 5).

⁵⁹ Schütz and Deferrari do not bring this out in their definitions of *experimentum*. In light of Deferrari’s dependence on Schütz, the following is significant: “A critical and negative point of view [regarding the cogitative] was assumed by Dr. Schuetz. In what was intended to be a very carefully documented study, he concluded that the *vis cogitativa* is superfluous and self-contradictory” (Klubertanz, *Discursive Power*, 8; referring to “Die *vis aestimativa seu cogitativa* des hl. Thomas von Aquin,” *Görres-Gesellschaft zur Pflege der Wissenschaft*, Jahresbericht der Section für Philosophie für das Jahr 1883 [Cologne: J. P. Bachem, 1884]: 38-62). While the incomplete Thomistic dictionary entries have contributed to the oversight of cogitative *experimentum*, this very incompleteness seems to stem from the dismissal of the cogitative power as “self-contradictory.”

process by which one “gathers together” (*confert*) different shared characteristics of a given natural or artificial kind is termed a “gathering of one thing from many” (*collatio unius ex multis*). The cogitative acquires experience by a comparison (*collatio*) of one thing to another to see what they have in common. One then infers (*confert*) that certain individuals belong to a given class, as Aquinas explains in the parallel text in his commentary on the *Posterior Analytics* (II *Post. Anal.*, lect. 20). (Neither *conferre* nor *collatio* is used with this meaning in Moerbeke’s translation of the two key Aristotelian texts.)

The analysis of *experimentum* is of great significance for a proper understanding of the cogitative power. In the only *ex professo* book on the cogitative power in English, George Klubertanz holds that *experimentum* is purely practical and plays no role in speculative knowledge.⁶⁰ The textual references under *experimentum*, definition 2a (as well as 1c and 3) falsify this claim. *Metaphysics* 1.1 states that “science [*episteme*] and art come to men through experience,” and Aquinas reiterates this assertion of experience’s role in the acquisition of speculative knowledge.⁶¹ Aquinas employs *experimentum* more often regarding speculative knowledge than regarding practical. Klubertanz’s reading of Aquinas as reverently quoting Aristotle causes him to misrepresent Aquinas on *experimentum*.

Klubertanz’s claim that both *experimentum* and *collatio* are strictly practical stems from a misreading of Aquinas’s commentary on *Posterior Analytics* 2.19.⁶² Having excluded the cogitative from the acquisition of theoretical knowledge, Klubertanz sees no place for the cogitative in this key text. Yet Aquinas states in his commentary on *Metaphysics* 1.1 that the cogitative performs *experimentum*, that is, it notices similarities among different individuals by a comparison (*collatio*). He clearly refers to *experimentum* and *collatio* as closely related phenomena in both key texts. Although Klubertanz rightly observes that Aquinas does not develop experience’s role in speculative

⁶⁰ Klubertanz, *Discursive Power*, 206-12.

⁶¹ Aristotle, *Metaphys.* 1.1.981a2. Cf. I *Metaphys.*, lect. 1 (Marietti ed., n. 18).

⁶² Klubertanz, *Discursive Power*, 210-12.

knowledge in his commentary on *Metaphysics* 1.1, this is because Aquinas follows Aristotle's treatment closely. *Metaphysics* 1.1 argues that the wise, in contrast to the experienced, have knowledge of causes and principles: "we suppose that artists are wiser than men of experience."⁶³ Aristotle uses "wise" in a broad sense that includes practical architectonic knowledge, as distinguished from the proper use that refers to knowledge of the absolutely (*haplos*) highest causes. This analogical use of "wisdom" is contrasted with the inferior practical cognition of one who has the experience of a cure's effectiveness without knowing the cause thereof. Aristotle focuses on practical experience since one can more readily grasp the nature of wisdom in a concrete analogate ordered to producing physical effects. Yet *Posterior Analytics* 2.19 and Aquinas's commentary on it focus on the precise sense of experience (*empeiria/experimentum*) as it is operative in the speculative realm. Noticing common traits, such as that some humans are white, is preparatory to the acquisition of speculative as opposed to practical knowledge.⁶⁴

Aquinas defines both abstract knowledge and experience in general terms as "one notion [*acceptio*] of something taken from many," then specifies that, while *scientia* grasps universals, "singulars are grasped by experience."⁶⁵ This statement does not specify whether "singulars" refers to individuals taken one by one, or as a group. A. Suárez opts for the first view and portrays *experimentum* as "the perception of a singular of a determinate nature by the cogitative in imagination's phantasm."⁶⁶ This accurately describes the cogitative's role in the intellectual reflexive judgment on a singular subsequent to having apprehended

⁶³ Aristotle, *Metaphys.* 1.1.981a25.

⁶⁴ Aristotle, *Post. Anal.* 2.19.100b1; II *Post. Anal.*, lect. 20 (Marietti ed., n. 596).

⁶⁵ "experimentum videtur fere esse simile arti et scientiae. Est enim similitudo eo quod utrobique ex multis una acceptio alicuius rei sumitur. Dissimilitudo autem, quia per artem accipiuntur universalialia, per experimentum singularia" (I *Metaphys.*, lect. 1 [Marietti ed., n. 17]; cf. II *Post. Anal.*, lect. 20 [Marietti ed., n. 592]). For "experience is of singulars," cf. "cum ars sit universalium, experientia singularium" (I *Metaphys.*, lect. 1 [Marietti ed., nn. 22 and 18]).

⁶⁶ A. Suárez, "Los sentidos internos en los textos y en la sistemática tomista," *Salamancaensis* 6 (1959): 468.

its nature. It is also a valid interpretation of “singulars” as used in the context of the cogitative’s formation of the minor premise for a practical syllogism, as in Aquinas’s commentary on book 6, chapter 12 of Aristotle’s *Nicomachean Ethics*: “singulars are properly known by an interior sense . . . namely, the cogitative power.”⁶⁷

However, insofar as the two key texts characterize cogitative *experimentum* as pre-abstractive collative knowledge, they invalidate Suárez’s interpretation. If “singulars” referred to individuals viewed exclusively insofar as they are individuals, and thus independently of gathering (*collatio*) their commonalities, experience could not help form “one notion from many.” In the context of *Metaphysics* 1.1, knowing singulars by experience essentially refers to the recognition of a commonality as shared by several individuals, and to the resulting experiential notion or judgment. Many singular phantasms are related to an experiential notion as matter to form, or as potency to act. I suggest that experience in the potential sense of repeated memories be termed “material,” and that properly cogitative experience be called “formal.”

The “singulars” in question need not be unique individuals under the aspect of their being perceived as such, even though formal experience presupposes such cogitative perception by means of individual intentions. Neither the cogitative’s judgment on incidental sensibles nor its instrumental role in intellectual judgments on a primary substance as such are the focus of the discussion. Nor can the “one experiential knowledge generated from many memories” correspond to a common name understood in a scientific, comprehensive way.⁶⁸ Rather, in the process of experience, the cogitative’s object consists of the notion, limited in extension, which refers to *several* individuals insofar as they share one or more characteristics. As evidenced by the statement “experience is *only* concerned with singulars,” the plural is meant

⁶⁷ “Singularia proprie cognoscuntur per sensum . . . interiorem . . . scilicet vim cogitativam” (VI *Nic. Ethic.*, lect. 9 [Marietti ed., n. 1249]).

⁶⁸ “ex multis memoriis fit una experimentalis scientia” (I *Metaphys.*, lect. 1 [Marietti ed., n. 18]).

to refer to more than one, but less than all.⁶⁹ Aquinas follows Aristotle's view that experience refers to *some*, while science and art refer to *all*, using the Latin *alii* to express the quantity "some":

When one has learned [*accepit in sua cognitione*] that this medicine has helped Socrates and Plato and many other [*multis aliis*] individuals suffering from a given sickness, whatever it may be, this pertains to experience. On the other hand, when one learns that this helps all [*omnibus*] those with a determined type of illness and with a given constitution . . . this now pertains to art.⁷⁰

Aquinas uses *accepit in sua cognitione* rather than *intelligit* or some other expression that would indicate fully intellectual knowledge. For Aquinas, individual intentions such as "Socrates" or "Plato" must be involved in the judgments from which formal experience can arise. In light of the foregoing, it appears that not only individual intentions but also experiential notions are stored in the memorative power, since, being nonintellectual, such notions cannot be retained in the potential intellect.

IV. LINGUISTIC AND LOGICAL ANALYSIS OF EXPERIENTIAL PROPOSITIONS

The logical status and linguistic equivalent of cogitative experiential judgments require further clarification. One must first recall Aristotle's distinction between experiential and scientific knowledge. In explaining the difference between experience as cognition of singulars, and science and art as cognition of universals, *Metaphysics* 1.1 relies on the distinction from *Posterior Analytics* 2.1 between knowing that (*hoti*) something is the case and knowing why (*dioti*) it is so. The "why" is provided by the cause or explanation, ordinarily expressed as the middle term of a syllogism. *Metaphysics* 1.1 states that science and art are

⁶⁹ "experimentum *tantum* circa singularia versatur" (ibid.; emphasis added).

⁷⁰ "cum homo accepit in sua cognitione quod haec medicina contulit Socrati et Platoni tali infirmitate laborantibus, et multis aliis singularibus, quidquid sit illud, hoc ad experientiam pertinet: sed, cum aliquis accipit, quod hoc omnibus conferat in tali specie aegritudinis determinata, et secundum talem complexionem . . . id iam ad artem pertinet" (I *Metaphys.*, lect. 1 [Marietti ed., n. 19]).

superior to experience because they both know that (*to hoti*) and can provide the explanation for why (*to dioti*), whereas experience alone cannot explain why.⁷¹ In the parallel text in *Nicomachean Ethics* 6.7, Aristotle notes that the experienced person knows simply that eating fowl is healthy, while the one with scientific knowledge (*episteme*) possesses the explanation for why this is so, namely, because light meat is healthy.⁷² In practical matters, a case where inexperienced scientific knowledge would be worse than experience alone would be knowing that light meat is healthy but not which animals have light meat.

One can provide a fuller account of the contrast between universal and experiential knowledge by elucidating the syllogistic basis for explanatory as opposed to merely factual cognition. The juxtaposition of explanatory science and art with nonexplanatory experience helps explain why experience does not extend to all possible cases. Formally speaking, experiential knowledge means knowing a demonstrative syllogism's conclusion without knowing its premises. Take the following:

- (1) Meat that is low in saturated fat is healthy.
- (2) Ostrich has low-fat meat.
- (3) Therefore, ostrich is healthy.

Exclusively scientific knowledge of nutrition would only grasp the major premise, thus leaving one unaware of what kinds of animal have low-fat meat. To construct a practical version of the syllogism, the major premise and conclusion would change to "Low-fat meat should be eaten" and "Ostrich should be eaten," while the minor premise would remain the same. Independently of this syllogism, one could notice that one gains less weight on a diet of ostrich, and thus discover proposition (3) from experience

⁷¹ Cf. I *Metaphys.*, lect. 1 (Marietti ed., n. 24): "Those who know the cause and the reason why [*propter quid*] are more knowledgeable and more wise than those who are ignorant of the cause, but only know that [*quia*] something is so. Now the experienced know that [*quia*], but not the reason why; while the artist knows the cause and the reason why, and not just that something is the case."

⁷² Aristotle, *Nic. Ethic.* 6.7.1141b14-21.

alone, yet without knowing proposition (3) *as* a conclusion. In practical decisions, experience alone is more helpful than knowledge of universals alone: the experienced person does not need to know the underlying syllogism in order to judge correctly. One could conceivably learn proposition (1) through scientific knowledge and proposition (3) through experience, and not realize that they are logically connected.

While experiential judgments stem from the cogitative's activity of *collatio*, they also rely on the intellect if they are expressed propositionally using universal terms, given that only the intellect can cognize universals as such. However, insofar as the explanatory premises are unknown, such experiential judgments only qualify as imperfect or vague knowledge. Thus, particular reason's practical application of universal reason's concept is of limited extent in an experiential judgment. On this interpretation, Aristotle's example of knowing that fowl is healthy without knowing why refers to experiential *quia* knowledge in one who lacks an explanation, and whose knowledge is therefore not necessary as being "said of all" as described in *Posterior Analytics* 1.4.

Properly experiential knowledge of singulars refers to a classification that is particular (i.e., it extends to more than one but less than all) or that is universal but not known to be such with certainty. Since those who possess scientific knowledge can explain why something is the case, the propositions they formulate are reliably universal in extension, even regarding cases not previously encountered. Thus, "all fowl have lean meat" entails that ostriches have lean meat. In contrast, the experienced person might believe that only one kind of fowl is lean. His cognition is inferior to that of one who grasps the middle term of the relevant syllogism, and thus his experiential judgment has limited extension. The proposition's less-than-universal extension reflects the possible mode of experiential judgments prior to clarification by philosophical reflection or scientific investigation.

One can infer from Aquinas's explanation of prudential experience that experiential judgments are not just possible, but

probable: “The infinite number of singular things cannot be comprehended by human reason. . . . Yet *through experience the infinite singulars are reduced to the finite number of things which happen for the most part*, the knowledge of which suffices for human prudence.”⁷³ Elsewhere, Aquinas makes a similar observation regarding experience in the theoretical domain: “For experience in particular matters is most efficacious in proving, the more so, the more often something has been observed and the more infallibly discovered.”⁷⁴ Experience is knowledge of “what happens for the most part” as distinguished from knowledge of “what is necessarily and simply true.”⁷⁵ Examples of necessarily true knowledge are the law of gravity, or the judgment “humans cannot survive without air.”

Knowing what usually happens allows one to assess probabilities or, practically speaking, risks. Although the law of gravity does not necessarily entail that one who falls fifty feet perishes, survival is improbable; rationalizations aside, extreme sports such as free climbing (climbing without safety gear) or free diving (diving great depths without air tanks) evidence imprudence and rashness. Yet humans commonly ignore both universal laws and the lessons of sensory judgments. Even after years of experience (nontechnically understood), the cogitative power may remain unactualized with regard to the reflection required for *experimentum* (in the technical sense). Consequently, the memorative power remains in potency to practical experience, and, *a fortiori*, the practical intellect is not actualized by the habit

⁷³ “Infinitas singularium non potest ratione humana comprehendi. . . . Tamen *per experientiam singularia infinita reducuntur ad aliqua finita quae ut in pluribus accidunt*, quorum cognitio sufficit ad prudentiam humanam” (*STh* II-II, q. 47, a. 3, ad 2; emphasis added).

⁷⁴ “Experimentum enim in rebus particularibus maxime efficax est ad probandum, et tanto magis quanto diuturnius est observatum et infallibile inventum” (*In Job* 8, verse 8 [Leonine ed., 26:54.127-30]).

⁷⁵ “Prudence is about contingent matters of action. In such matters man cannot be directed by what is necessarily and simply true, but by what happens for the most part. . . . And one must consider what is true for the most part by experience” (“Prudentia est circa contingentia operabilia, sicut dictum est. In his autem non potest homo dirigi per ea quae sunt simpliciter et ex necessitate vera, sed ex his quae ut in pluribus accidunt. . . . Quid autem in pluribus sit verum oportet per experimentum considerare” (*STh* II-II, q. 49, a. 1).

of prudence. Thomistic psychology can explain risk-indifferent or self-destructive human behavior by pointing out the tension between the limpid universal intellectual judgment and the cogitative power's erroneous judgment on a singular action, particularly when swayed by the sensory appetite.

In terms of ordinary-language Aristotelian logic, experiential knowledge would ordinarily be formulated as a particular proposition, that is, one whose extension is less than universal, but greater than individual or singular, as in: "Most kinds of fowl are healthy." The experience of singulars could also be expressed as an indefinite proposition that leaves the quantity undetermined. "Fowl is lean meat" refers indeterminately to one, some, or all kinds of fowl; since it is not known to be universal, it too is an experiential judgment. Experiential propositions can be expressed modally, as in: "It is probable that this kind of fowl is healthy."⁷⁶ In contrast, a universal proposition holds for all singulars of a given class. If the predicate is essentially related to the subject, it can be expressed as a modally necessary proposition.

In symbolic logic, universal propositions are symbolized using the universal quantifier. Thus, "All swans are feathered" would be written as "All A are C" and symbolized as: $\forall x[Ax \rightarrow Cx]$. An experiential proposition such as "Some swans are white" is of limited quantity and thus not distributed to all individuals. Such a proposition would be written as "Some A are B" and symbolized as: $\exists x[Ax \& Bx]$. Since the existential quantifier refers to "at least one," it does not distinguish between singular and particular propositions; nor do these formulations express whether such propositions are stated scientifically or experientially, since contemporary logical symbolization is concerned with the formal rather than the material aspects of logic. Still, one could stipulate a singular's uniqueness by further symbolization.

⁷⁶ Although logic traditionally only admits of necessary and possible as modal categories, the statistical rationale for the use of "probable" is sound. My reasoning is supported by Avicenna's statement that "experience may necessitate a certain judgment, or it may necessitate a probable one" (Avicenna, *Remarks and Admonitions, Part One: Logic*, Sixth Method, ch. 1 [trans. Inati, 120]).

In order to establish whether one can use the existential quantifier to symbolize an experiential proposition, one must determine whether a singular affirmative proposition can be experiential, that is, whether a single case suffices for experience. Since experience requires many memories of many sensations, such a proposition seems formally insufficient, as in: "This free diver passed out at -50 meters and survived." Since the most likely outcome of such an event is death, treating this single event as a sound basis for a theoretical or prudential experiential generalization commits the fallacy of the exception proving the rule. Yet a unique occurrence shows that an event is not impossible, and thus justifies a factual universal negative judgment, in other words, one infers by way of contradictory opposition that "Every free diver who passes out at -50 meters drowns" is false. Such a judgment could be expressed modally ("It is not necessary that all apnea divers who pass out at -50 meters perish") and symbolized by negating the modal operator for necessity. (Practically speaking, it might be helpful to establish a modal operator symbolizing probability.)

Determining whether a singular proposition functions experientially requires examining its content and use. One must establish whether the judgment bears upon a singular as such and thus functions independently, or whether it is in the context of *collatio* and functions experientially. If the proposition's subject is considered insofar as it is uniquely singular, as in "Socrates is human," the subject stands independently of *collatio*; one already possesses the universal "human" and is applying it to an individual. Forming such a proposition requires the joint activity of both particular and universal reason. The cogitative supplies an individual intention for "Socrates" in subordination to the intellect's reflexive knowledge of singulars, and the intellect provides the note of universality in "human." In terms of Aquinas's presentation of *experimentum* as collative, a judgment on a singular as singular is not experiential, properly speaking; judgments on singulars as such provide the remote matter of experience, while the apprehension of their similarities by *collatio*

provides its proximate matter. The formal aspect that is applied to the matter would be best termed a sortal, that is, a less-than-universal sensory generalization.⁷⁷

Nonetheless, a judgment on one instance may suffice to form an experiential proposition in the proper context. Such a judgment qualifies as experiential when one inductively compares and contrasts a novel object to one's memories of other similar objects. The process may be more or less conscious depending on its ease and rapidity. In contrast to small children, adults habitually classify things with relatively little need for deliberate comparison. Thus, one's cogitative forms an experiential notion of a novel species upon viewing a specimen in a zoo exhibit by comparing it with one's recollections of similar animals. This serves as the basis for the abstraction of a universal by the active intellect.⁷⁸

A judgment on a singular object can be rendered experiential when one compares and collates the object's different essential sensibles (i.e., proper and common). The subsequent singular proposition can qualify as experiential (as in: "This specimen looks like a new kind of beetle"). One's judgment is vague insofar as one does not yet know the insect's properties with certainty, but experiential insofar as one believes that it is a new kind of insect by comparing its characteristics with each other, recalling other beetles that one has seen, remembering one is in an unexplored stretch of jungle, etc. For the more experienced, such a judgment takes place connaturally and requires less reflection than it does for the inexperienced. The novice may need actually

⁷⁷ I argue in my forthcoming book that this is the most likely interpretation of the "first universal" in II *Post. Anal.*, lect. 20.

⁷⁸ The standard account of Thomistic epistemology omits the intermediary experiential notion, presenting instead a direct passage from a singular phantasm to a universal concept. While this would require further discussion, Aquinas explicitly teaches the contrary in at least one text: "It is impossible to discover universals independently of induction. And this is more manifest in sensory [as opposed to mathematical] things, because we receive universal knowledge from them by our experience of sensory individuals, as is made clear in *Metaphysics* 1" ("Impossibile est universalia speculari absque inductione. Et hoc quidem in rebus sensibilibus est magis manifestum, quia in eis per experientiam, quam habemus circa singularia sensibilia, accipimus universalem notitiam, sicut manifestatur in principio *Metaphysicae*") (I *Post. Anal.*, lect. 30 [Busa ed., n. 4; cf. n. 5]).

(i.e., consciously) to form a series of judgments which are only potentially present in the veteran's connatural judgment. As long as one is uncertain what the specimen is, one lacks explanatory knowledge.

Aristotle and Aquinas only mention experientially recognizing similarities, but one must also notice differences, such as that this object is not like any previously encountered. One could call such negative judgments contrastive as opposed to comparative. They rely on previous generic or specific comparisons. An experiential cogitative judgment on only one specimen may prepare the way for abstraction or insight into the thing's essential nature, thus yielding a scientific judgment that depends on universal reason.⁷⁹ If certainty is achieved, one can state: "This specimen is a new kind of beetle." If one determines that it is not a new species, this raises no problems for the present account insofar as the experiential proposition only expressed a probable cogitative judgment. Given that a single case can suffice for experience, the existential quantifier's lack of distinction between singular and particular propositions need not be an obstacle to the symbolization of experiential propositions.

Language can be of great assistance in the experiential process, since it allows one to benefit from others' knowledge. Aquinas seems to link *experimentum* to learning by language when he notes that *experimentum* by means of hearing "is of the greatest importance for the contemplative sciences."⁸⁰ "Hearing" (*auditus*)

⁷⁹ Cf. Ashley, *Way toward Wisdom*, 283-84: "A zoologist meeting a single animal can sometimes come to the intuitive judgment that this animal has some different properties that distinguish it from other species in the category of substances. . . . In seeking assurance that the special traits of a specimen indicate a truly essential difference in the substance, [one may] be puzzled, but it is not beyond possibility that the close relationship among these traits may make it entirely certain that they reveal the unique character of a new species. Thus, such difficulties common to all research are not proof that genuine insight into the essential character of an object cannot at least sometimes be gathered from a single specimen. Many examples in the history of science show that in fact many discoveries of this sort have been made, such as the identification of extinct species of animals from single fossils."

⁸⁰ "Because experience is from sensation, he fittingly shows the importance of experience by sensory judgment, and especially by hearing . . . because, among all the senses, hearing is more capable of learning, whence it is of the greatest value for the contemplative sciences . . . he shows the importance of experience in both speculative and practical matters, when he

refers primarily to spoken language (*sermo*).⁸¹ One relies more on language-based experience in natural science, mathematics, or metaphysics than in the fine or useful arts, where nonlinguistic external sensory experience is ordinarily more important. By hearing (or otherwise sensing) examples expressed in language, the cogitative gradually prepares notions for intellectual abstraction. The mental terminus of a neither entirely obscure nor fully understood externally sensed or imagined word is thus a formally experiential notion. One can conclude that nonlinguistic and language-based learning are two species of cogitative experience (*experimentum*).

While the broad sense of *experimentum* includes any act of external or internal sensation, the proper sense refers to an inductive gathering of commonalities by the cogitative power prior to abstraction proper. This collative process actualizes many memories, whether by deliberate reflection or by an immediate intuitive judgment. Granting the imperfection of cogitative experiential notions allows one to admit the validity of empiricist claims regarding the fallibility of human cognition, while still maintaining the accuracy of properly intellectual abstraction. Experiential propositions can be integrated into the life of universal reason by philosophical analysis and scientific investigation, thus allowing the natural scientist to determine whether a material substance's characteristics are properties or mere accidents.

adds that 'wisdom' that pertains to contemplation 'is in the elderly,' because the elderly have heard much" ("Quia experimentum a sensu est, convenienter per iudicium sensuum virtutem experimenti manifestat, et praecipue per auditum . . . quia auditus inter omnes sensus est disciplinabilior, unde plurimum ad scientias contemplativas valet . . . ostendit virtutem experimenti tam in speculativis quam in operativis, cum subdit 'in antiquis est sapientia,' quae ad contemplationem pertinet, quia scilicet antiqui multa audierunt" (*In Job* 12 [Leonine ed., 26/2:81.172-77 and 181-85])).

⁸¹ See Aristotle, *De sensu et sensato* 1.1.437a4-15; I *De sensu*, lect. 2 (Marietti ed., n. 31).