

Mathematical Foundation of Baumgarten's Concept of the "Extensive Clarity"^(*)

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Introduction

Alexander Gottlieb Baumgarten (1714–62) is widely considered the founder of aesthetics. He defines it as the “science of sensible cognition (*scientia cognitionis sensitivae*)” (Baumgarten 2007, §1)⁽²⁾. According to him, “sensible cognition” is “a complex of the representations remaining beneath distinctness (*complexus repraesentationum infra distinctionem subsistentium*)” (§17). This definition is based on the Leibniz–Wolffian epistemology, according to which cognition is “either obscure or clear,” the latter of which is “either confused or distinct” (Leibniz 1956, 33). Therefore, aesthetics is the science of “confused” cognition first of all. However, unlike Leibniz and Wolff, Baumgarten saw such “confused” cognition not negatively but as another way of recognizing things than “distinct” cognition. This is reflected in his distinction between “extensively clear” and “intensively clear” recognition, which he introduces in his dissertation *Reflections on Poetry* (*Meditationes philosophicae de nonnullis ad poema pertinentibus*, 1735): “When in representation A more is represented than in B, C, D, and so on, but all are confused, A will be said to be EXTENSIVELY CLEARER than the rest (*Si in repraesentatione A plura repraesententur quam in B C D etc., sint tamen omnes confusae, A erit reliquis EXTENSIVE CLARIOR*)” (Baumgarten 1954, §16). In *Metaphysics*, (*Metaphysica*, 1739), he provides a more detailed explanation:

“Suppose that there are two clear thoughts of three notes each, but such that the notes that are clear in the one thought are obscure in the other:

the first will be clearer. Therefore, clarity of perception is increased by the clarity of the notes due to distinction, adequation, etc. Suppose that there are two clear thoughts of equally clear notes, where one thought contains three notes and the other contains six: the later will be clearer. Therefore, clarity is increased by a multitude of notes. Greater clarity due to the clarity of notes can be called INTENSIVELY GREATER CLARITY, while greater clarity due to the multitude of notes can be called EXTENSIVELY GREATER CLARITY. An extensively clearer PERCEPTION is LIVELY. The liveliness of THOUGHTS and of SPEECH is BRILLIANCE (splendor), and its opposite is called DRYNESS (a difficult type of thinking and speaking)."

"Pone duas cogitationes claras trium notarum, sed sint in una clarae, quae in altera obscurae sunt, prior erit clarior. Ergo claritas perceptionis augetur claritate notarum per distinctionem, adaequationem e.c. Pone duas cogitationes claras notarum aequaliter clararum, quarum tres sint in una, sex sint in altera: posterior erit clarior. Ergo multitudine notarum augetur claritas. CLARITAS claritate notarum maior INTENSIVE, multitudine notarum EXTENSIVE MAIOR dici potest. Extensive clarior PERCEPTIO est VIVIDA. Vividitas COGITATIONUM et ORATIONIS NITOR (splendor) est, cuius oppositum est SICCITAS (spinosum cogitandi dicendique genus)." (Baumgarten 2013, §531)

Following this distinction, Baumgarten defines aesthetics as "the science of knowing and presenting sensibly (*scientia sensitive cognoscendi et proponendi*)" (§533)⁽³⁾. Consequently, aesthetics is the science of "extensively clear" cognition.

It is in the section of "Aesthetic Light"⁽⁴⁾ that "extensive clarity" is discussed in *Aesthetics* (*Aesthetica*, 1750/58). There, Baumgarten connects the above-mentioned distinction between intensive and extensive clarity to the concept of light. He asserts that "intension of clarity through distinctness, adequateness, depth, and, as it were, pureness of intelligence is not at all aesthetic light, and hence neither absolute nor relative, but logical one (*Claritatis intensio per distinctionem, adaequationem, profunditatem intelligentiaeque veluti puritatem prorsus non est lux aesthetica, hinc nec absoluta nec comparativa, sed logica*)" (§617) and that "therefore, any aesthetic light that

you may seek directly will be the extension of clarity through a multitude of notes (*Omnis itaque lux aesthetica, quam in rebus intendas directo, perspicuitas rerum erit sensitiva, claritatis per multitudinem notarum extensio*)” (§618). And he continued as follows:

“Hence it seems to me right that I may call those thoughts vivid, in which a certain special variety and, as it were, an unexpected rapid celerity of the mutually pressing notes is perceived, from whose eminent diffusion that brightness and splendor of reflection would arise in part, the whole of which must nevertheless be transparent and absolutely clear”.

“Hinc iure mihi meo videor eas demum cogitationes dicere posse vividas, in quibus peculiaris quaedam varietas, et subita veluti notarum se mutuo prementium celeritas deprehenditur, ex quarum eminenti diffusionem nitor et splendor ille meditationis exsurgat in parte, cuius totum esse tamen debet perspicuum et absolute clarum”. (§619)⁽⁵⁾

Hiroshi Matsuo, who translated this classic as a whole into the modern language (Japanese) for the first time, comments that this sentence “contains a remarkable insight:” here “Baumgarten attempts to explain this mechanism [of changing quantity into quality] through the concepts of compression and diffusion: the notes are compressed once, then they spread out” (Matsuo 1985, 56).

Though this is one of the few studies on the concept of “extensive clarity,” which is crucial for Baumgarten’s aesthetics, Matsuo offers no further consideration. This paper aims to fill this gap. What led Baumgarten to develop the concept of “extensive clarity” based on the transformation of quantity into quality? I will answer this question in a word by “mathematics” (in a broader sense). For him, following Wolff (Wolff 1963, §14), “recognition of quantities in things is mathematical, and its science is mathematics” (Baumgarten 1773, §36). In the following we will see what mathematical aspects makes Baumgarten’s concept of “extensive clarity” possible and how⁽⁶⁾.

1 Mathematical Understanding of the Relationship Between Quality and Quantity: *Metaphysics* §§246-248

It may be commonly assumed that one of the differences between the first

generation (Wolff and, as his predecessor, Leibniz) and the second generation (Baumgarten and Meier) of the Wolffian school lies in their aptitude for mathematics. However, this is not the case, although the latter did not publish any works dedicated to mathematics. Baumgarten's *Reflections* are originally described in a highly mathematical manner. For instance, in the opening paragraphs, he defines "discourse" as "a series of words which designate connected representations" (Baumgarten 1954, §1), "sensible representations" as "representations received through the lower part of the cognitive faculty" (§3), and then combines these definitions to define "sensible discourse" as "discourse involving sensible representations" (§4)⁷. It is also mathematical that most of §s include "scholia." *Reflections* are, in Frederick Beiser's word, "[Horace's] De arte poetica rendered more geometrico" (Beiser 2009, 124).

In *Metaphysics*, we encounter the mathematical not only in its form of demonstration but also in its content, particularly in Section Eleven (The Infinite and the Finite) of Chapter Two (the Internal Disjunctive Predicates) in Part One (Ontology). It begins with the statement that "[t]he quantity of a quality is DEGREE (the quantity of strength) (*Quantitas qualitatis est GRADUS [quantitas virtutis]*)" (Baumgarten 2013, §246)⁸. Although this discussion on "the quantity of a quality" is the opposite of what is explored in §619 of *Aesthetics*, it is succeeded by the following:

"The lowest or smallest degree is that than which less is impossible. The greater degrees are wholes of many of the smallest degrees. In any greater degree whatsoever, there is a multitude of degrees, which is called INTENSITY. If this is enlarged, the QUALITY, to which the degree belongs, is INCREASED; if it is diminished, the quality, to which the degree belongs, is DECREASED."

"Gradus infimus seu minimus est, quo minor impossibilis. Gradus maiores sunt plurium minimorum tota. In quovis gradu maiore est multitudo graduum, quae INTENSIO dicitur. Haec si augetur, QUALITAS, cuius gradus est, INTENDITUR, si minuitur, qualitas, cuius gradus est, REMITTITUR." (§247)

The points in this quotation are (1) the expression "quality to which the degree belongs" and (2) that it is increased or decreased. According to §246, the former

denotes the “quality of the quantity of a quality.” The latter may appear peculiar as it is supposed to be not quality but quantity that is increased or decreased. That is said to be caused by enlargement or diminishment of intensity or a multitude of degrees, which is found in any greater degree or wholes of many of the smallest. Taken together, enlargement or diminishment of intensity within the wholes of the smallest causes the increase or decrease in quality, which is the mechanism discussed later in §619 of *Aesthetics*.

While I will further explore the mathematical implications of “the wholes of the smallest” later, I will now address the subsequent §:

“To be a real being is a quality belonging to every being. And since there is a certain number of realities in every being, every being has a certain degree of reality. Hence, this will either be the greatest, or not. And since that degree of reality in comparison with which a greater is possible, or that which is not the greatest, is called a LIMIT (a boundary, end), that which has a limit will be FINITE (limited), while that which does not have a limit will be INFINITE (real, unlimited). Therefore, a being having the maximum degree of reality, or that which is the most real being, is infinite, whereas every other being is finite. A finite being whose limits we either cannot determine, or do not wish to determine, is INDEFINITE (the imaginary infinite, mathematically infinite)”.

“Ens reale esse est qualitas, omni enti conveniens. Cumque in omni ente sit certus realitatum numerus, omne ens habet certum realitatis gradum. Hinc vel erit maximus, vel non maximus. Cumque gradus realitatis, quo maior possibilis est, seu non maximus, LIMES (terminus, finis) dicatur, limitem autem habens FINITUM (limitatum), non habens limitem INFINITUM (reale, illimitatum) erit. Ens ergo gradum realitatis maximum habens s. realissimum, est infinitum, finita reliqua omnia. Finitum, cuius limites determinare vel non possumus, vel non placet, est INDEFINITUM (infinitum imaginarium, mathematice tale).” (§248)

By the concept of “degree” he here defines the finite and the infinite, which is the subject matter in this section. Notably, he also distinguishes between the “infinite” and the “indefinite.” The latter is, as it were, “half-infinite,” “quasi-infinite,” or “human-infinite” in that “we either cannot determine, or do not

wish to determine” its limit⁽⁹⁾. And since he calls it also “mathematically infinite,” he regards it to be treated mathematically. In the following I will delve deeper into this point by referring to the *Sketch of Philosophical Encyclopedia*. (*Sciagraphia encyclopaedia philosophicae*, published posthumously in 1769).

2 Baumgarten’s Reception of Leibniz’s Differentials

Sketch is supposed to be the manuscript of the lectures delivered in 1739/40 (cf. Schwaiger 2011, 18f.). Its §128 of Section One, “Ontology,” within Chapter Two, “Metaphysics with Closer Connections,” includes an extraordinarily long scholium (spanning 6 pages) that classifies mathematics as the “science of quantity”⁽¹⁰⁾. He first divides it into pure and mixed one, then the former into interior and superior one, the latter of which contains analysis and the one “in uniting use.” Analysis is further classified into that of the finite and of the infinite, the latter of which is “of imaginary quantities, which lack a boundary beyond which they cannot be enlarged, the DIFFERENTIAL CALCULUS OF Leibniz IN A BROADER SENSE (*quantitatam imaginariarum, quibus desunt termini, ultra quos augeri minuiue nequeant, CALCULUS DIFFERENTIALIS Leibnitti LATIUS SUMTUS*).”

Here we can find a connection with what was discussed in the previous section. First, “imaginary quantities, which lack boundary beyond which they cannot be enlarged” is “indefinity” in §248 of *Metaphysics*. Second, Baumgarten identifies it as “the differential calculus of Leibniz in a broader sense.” This indicates that it is the differential calculus that he has in mind in “the wholes of the smallest” in §247 of *Metaphysics*. Consequently, the Leibnizian differential calculus serves as the background for the mechanism of transforming quantity into quality discussed in §619 of *Aesthetics*.

Further support for this can be found in another passage from the very *Aesthetics*: “Just as Leibniz called music an arithmetic exercise of the unconsciously counting soul, so also by the expectation of similar cases, and thence, as it were, by the innate, first faculty of imitation, a child who is not yet conscious that he thinks, much less that he thinks beautifully, is already exercised (*Sicuti musicam Leibnitius dixit exercitium arithmeticum numerare se nescientis animae: sic etiam per expectationem casuum similium et inde veluti connotam imitationem primam nescius adhuc paene se cogitare, multo magis se pulchre cogitare iam exercetur infans*)” (Baumgarten 2007, §54). The Leibnizian

idea mentioned here is directly derived from his letter to Goldbach on 17.04.1712 (Leibniz 1734, I 240f.)⁽¹¹⁾, but we can find similar ideas elsewhere; “[m]usic charms us, although its beauty consists only in the agreement of numbers and in the counting, which we do not perceive but which the soul nevertheless continues to carry out, of the beats or vibrations of sounding bodies which coincide at certain intervals” (Leibniz 1956, 1042). As “the unconsciously counting soul” in the former or “the counting, which we do not perceive but which the soul nevertheless continues to carry out” in the latter show, what is here developed is the theory of the so-called “minute perceptions.” And if this presupposes, as some have pointed out (cf. e.g. Otabe 2010; Morejón 2022), the theory of differentials, we can conclude it as the foundation of Baumgarten’s description of the transformation of the quantity of notes into the quality of brilliance.

3 Mixed Mathematics or Physics as a Background to Compression and Diffusion

It is not only the “pure” mathematics that is noteworthy in §128 of *Sketch*. There, Baumgarten counts as “mixed” one a wide variety of applied sciences, ranging from hydrodynamics, hydraulics, cosmography, astronomy, chorography, mathematical topography, hydrography, pyrometry, acoustics, and optics to calendariography, music, pyrotechnics, and architecture. He not only enumerated these disciplines but was also sufficiently well-versed in them to deliver lectures. According to Alessandro Nannini, Baumgarten taught courses on these subjects a total of nine times at the University of Frankfurt on the Oder, employing G. E. Hamburger’s *Elements of Physics* (*Elementa Physices* 1727) and Daniel Bernoulli’s *Hydrodynamics* (*Hydrodynamica* 1738) as textbooks (Nannini 2024). It shows how important physics was for Baumgarten, compared with the courses on aesthetics held only twice.

Consequently, it is no surprise that in *Philosophical Letters of Aletheophilus* (*Philosophische Briefe von Aletheophilus*), published anonymously in 1741, Baumgarten defends (in the second letter) aesthetics established by himself with the help of experimental physics, with reference to the figures such as Nicolas de Malebranche, Robert Boyle, Francis Bacon etc. Reading their books, he argues, makes it possible “to establish many common laws of solely sensible experience,” to “indicate the means by which the senses could be heightened

and expanded and [to] warn against those which might prematurely dull and clumsy them” (Baumgarten 1741, 8). For experimental physics and aesthetics have reliance on the senses and experiences in common. The sisterhood between logic and aesthetics (Baumgarten 2007, §13) also applies to pure and mixed mathematics.

From these backgrounds, it is supposed that in §619 of *Aesthetics* Baumgarten elucidates the mechanism of extensive clarity through the physical phenomena of compression and diffusion. Of course, he employs “diffusion” not in its literal sense, as it in the modern sense was established in the early 19th century by Thomas Graham. Nonetheless, it will be allowed to conclude that in order to elaborate extensive clarity he had a physical model in mind if we consider (1) the extent of his intellectual indebtedness to Leibniz, as partially showed in the previous section, and (2) the fact that he argues that the more awakened spirits weigh the proportion between cause and effect aesthetically by means of “natural dynamometry” (Baumgarten 2007, § 457)⁽¹²⁾

Conclusion

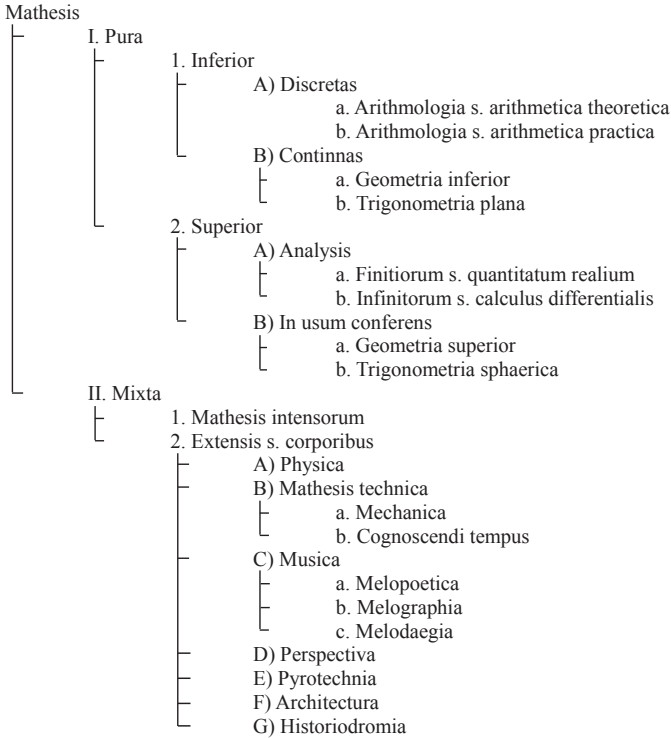
The analysis conducted thus far demonstrates the significant role that mathematics plays in the establishment of aesthetics by Baumgarten. This becomes particularly noteworthy when considering the subsequent history of aesthetics, as similar mathematical motifs can be found, for example, in Immanuel Kant’s explanation of the sublime as “that which is absolutely great” (cf. Sugiyama forthcoming) or Georg Simmel’s aesthetics based upon the phenomenon of threshold developed in his *Philosophy of Money* (*Philosophie des Geldes*, 1900) (cf. Sugiyama 2024). We can say even more generally that aesthetics is, to some extent, grounded in mathematics.

Notes

- (1) This paper is based upon the oral presentation held at the 16th Congress of the International Society for Eighteenth-Century Studies, 4th July 2023, Rome, and supported by JSPS KAKENHI Grant Number JP22K00141.
- (2) All translations of quotations from *Aesthetics* are mine, with reference to the German translation.
- (3) Translation slightly modified.
- (4) §§614–828. This is one of the six elements constituting perfection of sensible cognition (§22), i. e. beauty (§14).
- (5) As an opposite case, Baumgarten claims that an ugly obscureness in what is thought beautifully is produced by demanding 1) an excessive intension, 2) an excessive extension, or 3) an excessive retention of attention, the last of which further occurs either through 3–1) being surrounded with a still further new brilliance and an eye-dazzling vividness and the outward change of a multitude of notes, or 3–2) being illuminated with a luxurious diffusion and so long with new and ever new commentaries (§636).
- (6) For the relationship between aesthetics and the natural sciences in Baumgarten, Jäger 1984 has long been the sole scholarly work, which focuses on astronomy. Recently, however, Alessandro Nannini has conducted an in-depth investigation of this subject, among which Nannini 2024 is relevant to this paper and examined in detail later. Additionally, Ioku 2021 explores proper names and their poetic effects in Baumgarten and Meier by paying attention to (not Baumgarten’s but) Meier’s concept of “mathematical infinity,” whereas this paper focuses on Baumgarten’s mathematics.
- (7) Translation slightly modified.
- (8) This is also followed by the Wolffian one (Wolff 1730, §747): “We can either CONCEIVE of and understand (i.e. know distinctly) given things without assuming or relating them to anything else (without the presence of anything else), or we cannot. The former are QUALITIES and the latter are QUANTITIES (*Discrimina interna possunt repraesentari in ente in se spectato, hinc quomodocumque cognosci, seu DARI. Data vel possumus etiam [sine compraesentia] sine assumpto alio, sine relatione ad aliud, CONCIPERE et intelligere, i. e. distincte cognoscere, vel non possumus. Illa sunt QUALITATES, haec QUANTITATES*)” (§69); “quantity is the internal distinguishing mark of what is merely similar [= things that are the same according to quality] (*Mere similia non sunt congruentia, hinc quantitate differunt, hinc quantitas est discrimen internum mere similitum*)” (§71; cf. §70).
- (9) Later the Kant in the Herder-Notes on Metaphysics interprets this § as follows: “In the real sense, that should be infinite in which maximal reality exists. But the concept of the infinite only implies that something cannot be measured. For this a suitable word would have to be invented. That would be the greatest possible degree, but not the infinite. The word infinite is actually mathematical. That is aesthetically infinite which is to be measured but not measured” (Kant 1902–2020, XXVIII 31f.). Here Kant (and/or Herder) takes the pair “infinite – indefinite” in Baumgarten as “mathematically – aesthetically.” Though they differ in which is to be “mathematical,” it is important for (history of) aesthetics that the former

regarded the “human” infinity (“which is to be measured but not measured”) as “aesthetic.”
For details, see Sugiyama forthcoming.

(10) The classification as a whole is as follows:



(11) This book (*Epistolae ad diversos*) is found in the catalogue of books Baumgarten possessed ([Anonymous] 1762, 121).

(12) See also §§459; 462f.; 493; 495; 678; 818; 866. “Dynamometry” is mathematics of forces, belonging to the sciences of powers alongside philosophical dynamics (Baumgarten 2013, §204).

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バウムガルテンの「外延的明晰性」概念の数学的基礎

杉山 卓史

バウムガルテンは美学を「感性的認識の学」として創設した。「感性的認識」とは、彼によれば「判明性の下に位置する表象の複合体」である。これは、彼の属するライプニッツ＝ヴォルフ学派の認識論に即せば、「判明な認識」に対する「混雑した認識」である。この〈判明－混雑〉という垂直関係を、バウムガルテンは〈内包的（＝徴の明晰性による）明晰性－外延的（＝徴の多さによる）明晰性〉という水平関係に組み換えた。それゆえ、「感性的認識」とは「外延的に明晰な認識」と換言できる。この「外延的明晰性」という概念が『美学』において重要な役割を演じるのは、第二巻「美的光」節である。そこで彼は、多くの徴が圧縮された後に一気に拡散することによって生動性という美的質が生じると主張している。換言すれば、彼は（徴の）量が（生動性という美的）質へと転化する事態を語っているのである。しかし、このような興味深い記述について、これまで踏み込んだ考察はなされてこなかった。本稿では、この記述の基礎づけを、「量の学」と定義される（広義の）数学に求める。第一節では、『形而上学』における量と質の関係についての記述を検討する。第二節では、『哲学的百科事典の素描』における数学論と、そこに見られるライプニッツの微分論の受容を検討する。第三節では、『素描』においては「混合数学」とされる物理学に対するバウムガルテンの態度を検討する。