

Châtelet's Enlarging Intelligence

Abstract

We present a short global appraisal of Châtelet's program to enlarge intelligence, and we study in detail a previously unpublished worksheet where Châtelet mentions splitting, inverting, and augmenting, as essential features in the appearance of new knowledge. We compare those local findings with similar ideas in Novalis and Florensky, and we build on them to offer a methodological understanding of analogical thinking and creativity.

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Index terms

Keywords:

[Châtelet](#), [Novalis](#), [Florensky](#), [Intelligence](#), [Splitting](#), [Inverting](#), [Augmenting](#)[Top of page](#)

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Author's notes

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Full text

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1Intelligence is deployed around complex weavings, where symbols live in a multitude of levels, reflections, refractions. Foldings and unfoldings permeate many partial understandings, and it is only thanks to a deep Pascalian resonance between heart and reason that we are able to cope with the diversity of knowledge. Gilles Châtelet's profound mixtures in mathematics-physics-philosophy offer invaluable guides to capture sound orientations for such an enlarged intelligence, never reducible to fragmentary dogmas. In Section 1, we present a brief global summary of Châtelet's main revolutionary epistemological contributions. In Section 2, we provide a local study of a previous unpublished worksheet, where Châtelet points out the importance of splitting, inverting, and augmenting, for the development of creativity. In Section 3, we compare the situation with some fragments of Novalis, and in Section 4, we do so with some writings of Florensky. Finally, in Section 5, we bring together the three perspectives and offer some methodological considerations around analogical thinking and creativity.

1. Châtelet's Global System

2Gilles Châtelet's main works in the philosophy of mathematics (*Les Enjeux du mobile*, 1993; *L'Enchantement du virtuel*, posthumous, 2010) confront the fundamental problems of mathematical thought's mobility, and of its *natural osmoses* with physics and philosophy. Châtelet's texts offer several sui generis perspectives to work on the spectrum of mathematical philosophy: an *openness* onto a sort of *primacy of the visual* in mathematical practice (thereby bringing to bear part of Merleau-Ponty's general phenomenological program in the context of mathematics); a special sensitivity to the *mobile emergence* of mathematical concepts and "things," owing to a study of the *gestures* and *processes* on the border of the virtual and the actual; careful attention to and subtle analysis of the *metaphorical webs* that accompany the doing of mathematics, and govern its interlacing with physics and philosophy; meticulous study, with detailed concrete cases, of the modes of *articulation* of mathematical knowledge and of its *dialectical balances*.

3The five chapters' titles in *Les Enjeux du mobile* are indicative of Châtelet's originality: "The Enchantment of the Virtual"; "The Screen, the Spectrum and the Pendulum: Horizons of Acceleration and Deceleration"; "The Force of Ambiguity: Dialectical Balances"; "Grassmann's Capture of the Extension: Geometry and Dialectic"; and "Electromagnetic Space." Châtelet's array of examples is concentrated in the modern period (Argand, Cauchy, Poisson, Grassmann, Faraday, Maxwell, and Hamilton, among others), but timeless interlacing recurs as well (Oresme, De Broglie). In the introduction, Châtelet quotes André Weil's lengthy explanation of the primordial role that "obscure analogies" play in mathematical investigation - the *threshold of creative penumbra* that Châtelet explores in approaching the "gestures that *inaugurate* dynasties of problems," the articulations and torsions between reason and intuition, the "rational capture of allusions," and the structural and hierarchical deployment of the diagrams of thought.

4The fourth chapter is something of a gem in the philosophy of mathematics. Châtelet patiently reviews how Grassmann constructs the "synchronous emergence of the intuitive and the discursive" in a living unity that is neither *a priori* nor *a posteriori*, how the dialectic engenders new forms by way of a careful hierarchy of scales in Grassmann's exterior products, how Grassmann's very style leads to a natural approach to the processes that enable the capture of self-reference ("comprehension of comprehension"), and how the apparent oppositions of continuous/discrete and equal/different make up *fluxes of mathematical inventiveness* that serve to articulate its

various, partial modes of knowing (numbers, combinatorics, functions, extension theory). Going further still, a magisterial thirty-page section on Grassmann products explains, in vivid detail and with the constant presence of diagrams, the great lines of tension of Grassmann's system, which Châtelet explicates in the first part of the chapter. The entire work constitutes a major contribution to the philosophy of mathematics, which, to our mind, is the most original work on the subject since Lautman.

• 1 Beyond the main forces of Romanticism in Châtelet, Carlos Lobo has investigated a complementary *phe* [\(...\)](#)

5In the following table (Figure 1), we synthesize some of the main *global forces* of Châtelet's Romantic system. [1](#)

• 2 One can synthesize Châtelet's manifold and complex system through a basic idea: *virtualities, modal* [\(...\)](#)

Figure 1. Weavings, slidings, derivations, in the work of Gilles Châtelet[2](#)

	influences	nuclear problems	boundary derivations	sliding
panorama (EXT) Math	Cauchy Grassmann	diagrammatic imagination	<i>diagrammatology as dimensionality enlarging</i>	openness: spatial negativities
Phil	Aristotle Leibniz	modalities and possible worlds	<i>virtuality as alternation of possibilities</i>	openness: creative negativities
environment (INT) Math	Grothendieck	analogies and translations	<i>dynamic and virtual liberation of geometry</i>	openness: conceptual dislocations
Phil	Deleuze Foucault	cultural articulations	<i>passages processes</i>	polar ruptures <i>a priori / a posteriori</i>
cultural correlations		activism homosexuality		openness: social pulse

[Zoom Original \(jpeg, 173k\)](#)

• 3 " Le plus haut point de la raison est-il de constater ce glissement du sol sous nos pas..." (Merleau-P [\(...\)](#)

• 4 Cf. Alunni 2017.

6A back-and-forth between nuclear problems and boundary derivations (" slidings" following Merleau-Ponty)³ around diagrams, modalities, and analogies, is characteristic of Châtelet's approach. Situating himself at the borders of creativity (" avant-postes de l'obscur"),⁴ Châtelet explores with great detail the ramified, nonlinear emergence of mathematical imagination. Openness in every aspect (conceptual, spatial, numerical, social, human) pervades his thought. Attentive to passages and processes, virtuality explodes, liberating our understanding.

2. An Unpublished Worksheet: Splitting, Inverting, Augmenting

- 5 Cauchy's theorem states that for a function f of complex variables defined on a domain (open, connexe) ([...](#))

7In a brilliant analysis of Cauchy's Residue Theorem (Châtelet 1993: 63-8),⁵ Châtelet shows how residues *split, invert, and augment* our knowledge. Through the *inversion* $f(z)/(z-a)$ the point a in the complex plane *splits* and blows out: " en épaississant un point je le fais donc retentir dans tout le plan; c'est le miracle de l'holomorphie" (*ibid.*: 68). Then, the residue *turns* around, and offers an *augmented* understanding of the whole: " le résidu fait bien peu de cas de l'extension et, en s'appropriant un 'avoir tourné,' saisit un tour de main, une modalité de mouvement capable d'éveiller les voisinages d'un point" (*ibid.*).

- 6 We are indebted to Charles Alunni and Catherine Paoletti for allowing us to access Châtelet's unpub ([...](#))

8Châtelet's tactics - splitting, inverting, augmenting -, in order to provide a faithful comprehension of complexity, are nicely synthesized in a previously unknown Châtelet's worksheet (see Figure 2 below).⁶ Combining musical modulations, geometrical drawings, short annotations, and methodological paths, Châtelet shows how the augmentation of knowledge (" agrandir un domaine, augmenter le nombre de dimensions") is related to Pascal's synthetic thinking (" géométrie synthétique, 60 droites de Pascal"), Novalis religious wanderings (" Novalis: religions, la question du compte"), Lobachevsky's hyperbolic geometry (" esthétique, Lobachevsky"), and Kummer's invention of ideals (" nombres idéaux de Kummer"). In order to handle one of the main problems of creativity (" la question des analogies, *dédoublement*"), Châtelet offers then a natural path for discovery/invention:

1.
splitting (" dédoublement");
2.
totality through parts (" *totalité en parties*");
3.
dimensional growth (" augmentation des dimensions");
4.
analogy creation (" création d'analogie").

Je présente si nouveau
si moderne
 $O \approx S$
Art (réel)
Phil (Bible)
rapport à l'homme
au son
école? simple?
le monde réel "familial"
(et celui qui qu'
(un monde un autre)

- la question des analogies
si doublement

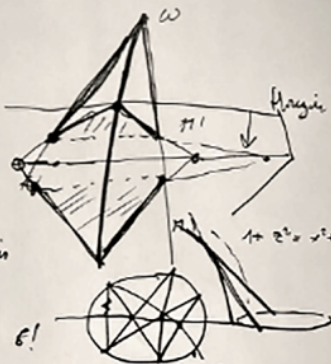
Problèmes : religion
la question du compte

Mathématiques
Lobachevsky
toute grande géométrie
tout est fait
la géométrie fait l'architecture
multiplication simple d'addition
- apparaît un domaine
- apparaît le monde de
- dimension
nombre (dixit de Hume)

sciences naturelles
a) développement
b) développement
c) développement
d) question d'analyse

généralisation synthétique
 A_1, A_2, A_3
 F_1, F_2, F_3
 B_1, B_2, B_3
 g_1, g_2, g_3

60 chets de Pascal
3 à 3 en continu
1600
A Goughen
1800
CUP



Fonds Châtelet, Legs Alunni, CAPHES, ENS, Paris.

9In the tetrahedron imagery visible on the worksheet, one can imagine Châtelet's perspective, situated at the infinity point (ω) and projected onto a "horizon" where all names (Pascal, Novalis, Lobachevsky, Kummer) converge. Each of those figures is in fact related to a strong *openness* of mind, each one extending its cognitive context. In the worksheet, one can read that "artist is the one who centers in herself" ("est artiste celui qui se *centre* en lui-même"), but, through a slight misreading, one can also imagine the artist *countering* herself ("est artiste celui qui se *contre* en lui-même"). In fact, centering and countering go hand-in-hand, as it happens with Cauchy's Residue Theorem (center in a , counter in $1/(z-a)$) or, as we shall see in Section 4 below, with Florensky's *inverted perspective*.

- 7 " Une philosophie offensive ne saurait se contenter de ratiociner indéfiniment sur le 'statut' des o (...)

10Châtelet's *philosophical offensive*,⁷ looking to understand the hidden contours of creativity, acquires new strength in his concrete, technical studies. The articulation of new dimensions enlarges intelligence. Often, those augmented dimensions occur when an idea is split and inverted. The worksheet we presented offers those clues in a nutshell, thanks to a free drawing hand, something very dear to Châtelet's philosophy of *gesture*. In a *modal back-and-forth* between actuality and potentiality, it is in the actual handling of the paper, in its stains, cuts, and diagrams, that virtuality emerges.

3. Inside the *Brouillon*: Novalis and the Poetic Theory of Fluids

- 8 Numbers between square brackets [xyz] refer to numbered paragraphs in the *Brouillon*.

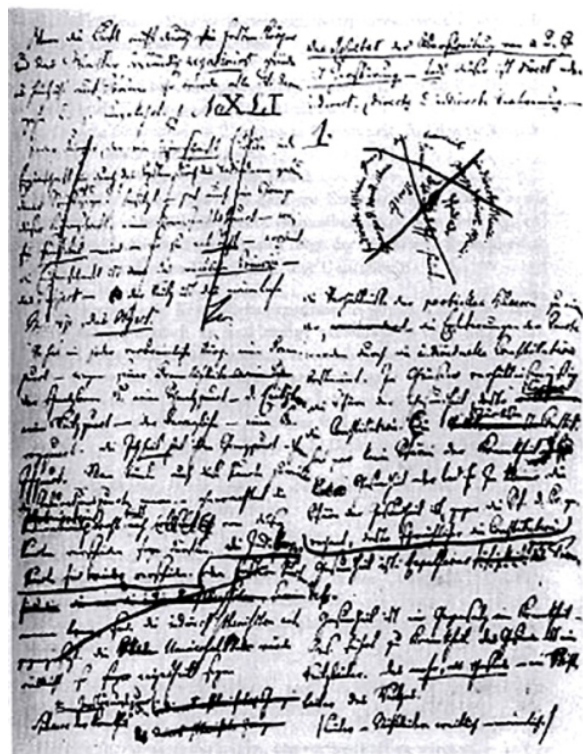
11In *Das Allgemeine Brouillon* (1798-1799/2007), Novalis offers an extraordinary array of aphorisms and short notes to capture the wide complexity of the World. A sort of *conceptual mineralogy*, or *poetic theory of fluids*, the *Brouillon* explores with particular acumen very diverse forms of splitting, inverting, and augmenting knowledge. For Novalis, a "theory of contact - of transition" [634]⁸ becomes a central poetic task; sculptors and musicians "both require an obstacle - a contact. The one to form - the other to move" [634]; contact, which is "both separation and connection" [295], supports a "philosophy of fermentation, of negative combustion - a theory of secretion" [130]. Knowledge is then *split* through "simultaneous thinking and nonthinking" [769], through "antinomies of concepts and processes" [603], while "the imagination becomes simultaneously an (outward) direct sense, and an (inward) indirect sense" [327]. After splitting, a permanent *inversion*, offering new perspectives, is canalized through "bridging" [737], "transfusing" [802], "translating the movement into the shape and vice versa" [653]. Finally, an *augmentation* of intelligence is obtained through "unity" [479], beyond "polarities" [479], thanks to a "theory of transposition, or composition" [592], which allows to escape from "a chasm of thought [...]" that only the imagination, like the shadow of a giant intelligence, is able to bridge" [737].

12Walter Benjamin's *The Concept of Criticism in German Romanticism* (1919) studies in detail Novalis's "infinity of connectedness" and his "infinitely many stages of reflection" (Benjamin 1996: 126). Philosophy appears there as a "mystical [...] penetrating idea that drives us incessantly in every direction," (*ibid.*: 139) resonating with Châtelet's conceptual and material blow-up from the "avant-postes de l'obscur." Novalis's observation that the simultaneous appearance of "thought and observation is a critical germ," propels Benjamin to underline how our mind is "awakened" (*ibid.*: 151) by the splitting. Member of an "*infinitorium*," of "a continuum of ideas" (*ibid.*: 166) the Romantic poet enters a higher level of reality, where all types of inversions and augmentations occur. *Germs become gems* in an ever-shifting, "omniplastic structure" (*ibid.*). For Novalis, the pendulum between the Many and the One becomes inscribed in an ever-balancing *back-and-forth* between the positive and the negative, where poetic (and mathematical) *secretion* configures the shapes of the world mineralogically.

- 9 Novalis, "Physical Fragment" (Ms XLI, *Freiberger naturwissenschaftlichen Studien*), Archive, Frankfurt ([...](#))
- 10 This is something similar to what happens with the intuitionistic double negation similar to what h ([...](#))
- 11 This is better expressed in Spanish (only language where it happens), where reason ("razón") and he ([...](#))

13A diagram by Novalis in a 1798 manuscript (Figure 3) shows a *spherical scale* where infinite layers are intertwined, in order to show "how the extremes coincide and become welded."⁹ The fragment evokes different possible degrees between the "limits of illness" and the "limits of well-being," through "movement points," "saturation points," and "± destruction points" (Novalis 1993: 71-2). The desire to reconstruct the *flux* of life ("movement") through singular *breaks* ("saturation," "destruction") can also be read as a *resonance* of Châtelet's *programme*, to understand the continuum through its singularities. In that endeavor, our three basic gestures - splitting, inverting, and augmenting - pave the way to *enlarge intelligence*. The *split* offers the possibility to explore negativity, the *inversion* turns negativity into an extended positivity,¹⁰ and the *augmentation* constructs forms of extended thought, where reason and imagination become fully dual.¹¹

Figure 3



[Zoom Original \(jpeg, 264k\)](#)

Novalis, Physical Fragment (1798).

4. Inverting Florensky: At the Borders of the Visible

In some annotations written at the dawn of the 20th century, the soon-to-be mathematician/theologian/art critic/scientist, Pavel Florensky, experiences the forces of *splitting* the soul, and *enlarging* its vision. Looking at his dreams, Florensky observes how his "Self becomes duplicated" (1901), and how that "clear example of splitting" forces a "sense of discovering and revealing something new" (1904) (Florenskij 2023: 5, 9). An enlarged consciousness offers the possibility to explore *phenomena* usually forbidden to our "Blind Eyes" (Tarkovsky). Florensky is able then to probe a complex "geology of the soul," open to hidden "undergrounds," and to live an "indecipherable impulse to remoteness" (1905) (Florenskij 2023: 11). *Inverting* the forces of knowledge, reminiscent of Novalis's conceptual mineralogy, Florensky discovers "cristallographically" the truth in deeply engulfed antinomies (1914) (Florenskij 2004). Beyond positivity, linearity, or supposedly analytical clearness, Florensky studies inversions that offer *integral spectral* views of *phenomena*. In *Inverted Perspective* (1919) (Florenskij 1992), and in *Imaginaires in Geometry* (1922) (Florenskij 2021), Florensky breaks our usual standpoints, and multiplies our visual dimensions. Châtelet's methodology (a) - (d) (see Section 2), to arrive at creativity through splitting and growth dimensionality, has here a precise resonance.

• 12 Cf. Gray 1997.

- 13 Cf. " L'espace électrogéométrique," in Châtelet (1993: 219-70).

15In *Iconostasis* (1922) (Florenskij 1992), Florensky studies the borders of knowing through a detailed analysis of the construction of Orthodox icons. Between the " light of Spiritual day" and the " shadows of the sensitive World" (*ibid.*: 130), the " ecstatic soul passes from the terrestrial world to the celestial world" (*ibid.*: 128), and an ascend-descent *back-and-forth* provides the basic scale to be able to transit the wanderings between the Many and the One. The complex materiality of the icons, where perspectives at times converge, and at times diverge, where all kinds of *strata* are superposed, where colors and ointments reject each other before becoming welded in unexpected gluings, offer a sort of magnetic field in which " the form of the visible is constituted by its invisible lines" (*ibid.*: 185). Florensky's metaphor recalls Riemann's manuscript drawings of his Riemann Surfaces,¹² and Châtelet's considerations on Faraday and Maxwell as well.¹³

- 14 A full dynamism of images leads to a " movement of second order, a *movement of the movement*" (Floren (...))

16A sketch (see Figure 4) in Florensky's manuscript *Analysis of Time and Spatiality* (c. 1924) (Florenskij 1995: figure XIV) evokes the movements of intelligence: deformations, rotations, orientations, almost of " second order." ¹⁴ One can easily sense the *splitting* of the blades, their *inverse* movements (short arrows in the opposite direction of the main arrow), and the resulting *enlargement* of the static figure at left. Through the (re)composition of dynamic perspectives, knowledge can hope to capture the complexities of the world. In the same vein as Châtelet looks for ramified virtualities which may help to understand the " blind points" of creativity, and in the same mood in which Novalis throws himself in a differential *infinitorium* only saved by poetry, Florensky allows himself to be flooded in a Melvillean Deep Ocean where the innocuous Self becomes blended into universal empathy. All three visionaries acquire a glimpse of eternity.

Figure 4. " Analysis of Time and Spatiality," Figure XIV



[Zoom Original \(png, 284k\)](#)

Florensky, Analysis of Time and Spatiality, manuscript, VChUTEMAS Lessons, 1924-1925.

5. From Germ to Gem: On Analogies and Creativity

- 15 For a good view of Novalis's understanding and use of mathematics, cf. Dyck 1960.
- 16 Cf. Zalamea 2026.
- 17 Following a comment by Paola Cantù (*MathPhiLab*, November 10th 2025), we have to mention that the tr (...)

17Châtelet and Florensky graduated as mathematicians, and knew the discipline in-depth. Novalis, by contrast, was not a working mathematician, yet his mathematical insights,¹⁵ always original, permeate in depth his *Allgemeine Brouillon*. Mathematical creativity, with all its complex zigzags - between possibility, necessity, actuality, between abduction, deduction, induction, between hypotheses, proofs, examples -, cannot be reduced to a given philosophical standpoint, and needs a wide variety of critical approaches to capture faithfully its inexhaustible spectrum.¹⁶ In that endeavor, *splitting*, *inverting*, and *augmenting* become three key gestures to understand the mathematical fabric. As Châtelet admonishes us, after the movements of a) splitting, b) reaching totality through parts, and c) growing dimensionally, we attain the threshold of d) analogy creation. For instance, we can observe this situation in Galois - a) algebraic extensions, b) algebraic closure, c) vector spaces, d) ambiguity theory -, in Riemann - a) Riemann surfaces, b) Riemann-Roch, c) moduli spaces, d) Uniformization

Theorem -, in Poincaré - a) homology and homotopy, b) fundamental groups, c) Betti numbers, d) Poincaré's conjecture -, in Grothendieck - a) fine theory of Banach spaces, b) nuclear spaces, c) Grothendieck's inequality, d) naturality -, etc.[17](#)

- 18 Cf. Zalamea 2013, Zalamea 2014.

- 19 In a wonderful Melvillean image, Frédéric Jaëck compares the analytical and proof-oriented approach [\(...\)](#)

- 20 Cf. Alunni 2004.

18A sound approach to creativity, in general,[18](#) and to mathematical creativity, in particular, needs then enough (Brouwerian) plasticity and (Peircean) vagueness, to overcome the usual, unhealthy, analytical illusions of clearness.[19](#) We need to be able to navigate the richness of imagination, *penumbra*, and diagrammatic thinking, [20](#) in an often disoriented World. In that direction, the synthetic sketches of Châtelet's worksheet (Figure 2) condense a *germ*, turned into a very *gem*, of enlarged intelligence.

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Notes

[1](#) Beyond the main forces of Romanticism in Châtelet, Carlos Lobo has investigated a complementary *phenomenological* approach, which enlarges our view of the system. Cf. Lobo 2017, 2024a, 2024b.

[2](#) One can synthesize Châtelet's manifold and complex system through a basic idea: *virtualities, modalities, and negativities open up our imagination, and diagrams and analogies help us to wander through the paths of*

invention. This is what Figure 1 above tries to capture in a nutshell. The prefix (EXT) refers to some central forces appearing in Châtelet's texts, while (INT) refers to other central forces at stake in Châtelet's environment, which finally become incarnated in his very figure.

[3](#) " Le plus haut point de la raison est-il de constater ce glissement du sol sous nos pas..." (Merleau-Ponty 1964: 92).

[4](#) Cf. Alunni 2017.

[5](#) Cauchy's theorem states that for a function f of complex variables defined on a domain (open, connected) of the complex plane, if the function is well behaved (*i.e.* holomorphic) on the domain and a point a is given in that domain, the value $f(a)$ is entirely determined by its values on any loop around a in the domain. The proof goes on by *splitting* and *inverting* a (through $1/(z-a)$), *enlarging* the holomorphic $f(z)$ through the meromorphic $f(z)/(z-a)$, and integrating its values around the loop.

[6](#) We are indebted to Charles Alunni and Catherine Paoletti for allowing us to access Châtelet's unpublished archive, now available (2024) at the Legs Alunni, CAPES, ENS, Paris.

[7](#) " Une philosophie offensive ne saurait se contenter de raisonner indéfiniment sur le 'statut' des objets scientifiques. Elle doit se situer résolument aux avant-postes de l'obscur, en ne considérant pas l'irrationnel comme 'diabolique' et réfractaire à l'articulation, mais comme ce par quoi des dimensions neuves peuvent advenir" (Châtelet 1993: 22). See also Alunni 2017. Compare with Lautman's admonition 60 years earlier: " Les philosophes sont alors en droit de se demander si la philosophie des sciences ne manque pas à la mission essentielle de toute philosophie lorsqu'elle cesse de chercher des méthodes qui donnent à l'homme l'accès au réel" (Lautman 2006: 64).

[8](#) Numbers between square brackets [xyz] refer to numbered paragraphs in the *Brouillon*.

[9](#) Novalis, " Physical Fragment" (Ms XLI, *Freiberger naturwissenschaftlichen Studien*), Archive, Frankfurt: *Freies Deutsches Hochstift*. Translation of the text and analysis in Novalis (1993: 71-2).

[10](#) This is something similar to what happens with the intuitionistic double negation similar to what happens with the intuitionistic double ($\neg\neg$) in Kripke models, which, far to be reduced to simple positive identity, becomes *extended* to complex positive density.

[11](#) This is better expressed in Spanish (only language where it happens), where reason (" razón") and heart (" corazón") are fully connected by duality (co): *corazón* = *co-razón*.

[12](#) Cf. Gray 1997.

[13](#) Cf. " L'espace électrogéométrique," in Châtelet (1993: 219-70).

[14](#) A full dynamism of images leads to a " movement of second order, a *movement of the movement*" (Florenskij 1995: 176).

[15](#) For a good view of Novalis's understanding and use of mathematics, cf. Dyck 1960.

[16](#) Cf. Zalamea 2026.

[17](#) Following a comment by Paola Cantù (*MathPhiLab*, November 10th 2025), we have to mention that the triadic gesture "splitting, inverting, augmenting" is a *local* method hidden in Châtelet's manuscript, based essentially on an analysis of the *local* Cauchy Theorem. It should not be considered as a universal or *global* method, which would then illuminate any mathematical creation. The extrapolation of the method to partially understand Galois, Riemann, Poincaré, or Grothendieck, is ours, with all its limitations.

[18](#) Cf. Zalamea 2013, Zalamea 2014.

[19](#) In a wonderful Melvillean image, Frédéric Jaëck compares the analytical and proof-oriented approaches to some sort of "écume" (foam) on a surface which hides the deep currents of the Ocean (*MathPhiLab*, November 10th 2025).

[20](#) Cf. Alunni 2004.

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Figure 2. Gilles Châtelet. Unpublished Worksheet

Fonds Châtelet, Legs Alunni, CAPHES, ENS, Paris.

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Figure 3

Novalis, Physical Fragment (1798).

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Figure 4. "Analysis of Time and Spatiality," Figure XIV

Florensky, Analysis of Time and Spatiality, manuscript, VChUTEMAS Lessons, 1924-1925.

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