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Intensio: Leibniz in Creating a New Term for the Modal Logic

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Abstract:
It is still difficult to say what the main source of Leibniz's modal thinking was; at least, his acquaintance with the ideas of Spanish Jesuits about the "moral necessity" is to be dated to the epoch when the modal ideas already took shape in his mind. There was, however, one name normally referred to by Leibniz himself as his main predecessor in modal thinking, Richard Swineshead. In fact, Leibniz created his personal myth about Swineshead even before having read his works, and so, he attributed to Swineshead some of his own ideas, including the modal reinterpretation of the term *intensio* borrowed from the mediaeval physics.

Leibniz's achievements and intuitions in the field of intensional logics were evaluated, for the first time, by no other than the creator of the modern modal logic Clarence I. Lewis, whose seminal 1918 monograph contains a very important historical essay on Leibniz with addition of two translations of his pertinent works (published for the first time in 1903, but not acknowledged as important even then). [1, pp. 5-18, 373-387] Then, Leibniz's ideas about intensionality were studied in a more systematic way by Nicholas Rescher, [2] another key figure in the twentieth-century modal logic.

It is still a disputable matter, whether Leibniz had direct predecessors in his modal thinking. It is often thought that, in the matters of theodicy, he had ones – Spanish Jesuit thinkers of the seventeenth century who were teaching about the "moral necessity" for God and even the "possible worlds." [3] It is certain that Leibniz did have access to their publications, although was not referring to them explicitly. However, Bartholomew Des Bosses, another Jesuit and a correspondent of Leibniz, who was the first to notice the parallels between these Jesuits' and Leibniz's thought, did not attribute to them any direct influence on Leibniz. [4, pp. 228/229 (lat./Eng. tr.) and 438, n. 5.][1]

The German mystical thought of Weigel, F. M. van Helmont, and Böhme could also be a source of inspiration for Leibniz's modal thinking, but this possibility remains unexplored, and, anyway, Leibniz did not recall any of them in explicitly modal contexts.[2]

Normally, Leibniz presented his ideas concerning the modal logic as his original ones. There is, however, a unique name which is often referred to in Leibniz's works as his predecessor in modal thinking, Richard Swineshead. Moreover, Leibniz's modal term *intensio*, so popular in the modern logic, goes back to Leibniz's understanding of Swineshead. Probably, however, the modern historians of the modal logic had reason to pay little attention, if any, to Swineshead. Leibniz's admiration toward Swineshead is a phenomenon whose value is somewhat independent from the historical personality of Swineshead as a scholar.

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Mary Spencer in her 1971 notice showed how the modern use of the term "intension" and its derivates goes back to Leibniz. [5] Since then, some previously unpublished Leibniz's papers became available, [3] and their contents allow us to grasp Leibniz's intuition in a more adequate way. The scholastic background of Leibniz's usage of *intensio* has been noticed but never traced, and this is the main reason to readdress the issue after Mary Spencer.

In his earlier period, Leibniz knew the word *intensio* only in the sense of the late Scholasticism, where it was a physical term (roughly with the same meaning as the modern "intensity")[4] forming a pair with its antonym *remissio*. The fourteenth-century scholastic debate concerning "intensions" and "remissions" of forms was about physics. Leibniz, however, was thinking about physics in terms of semantics. Moreover, his way of thinking was influenced by the logic of Port Royal (1662) with its distinction between "extension" and "comprehension"[5]; it is rather obviously that the term "extension" in Leibniz's usage goes back to Arnauld and Nicole.

Somewhere before 1681, Leibniz started to develop a very high idea, if not a myth, about his alleged predecessor in Scholastics, Richard Swineshead (*fl. ca.* 1340–1355) nicknamed Calculator,[6] then known to Leibniz only indirectly from the references by other authors (only one of them is called by name: Scaliger[7]). In one instance, Leibniz said that, judging from the works of Swineshead's followers ("ejus sectatorum scripta"), their merits in applying mathematics "in media metaphysicorum" ("in the field of metaphysics") must be praised, and, probably, they would anticipate "our works," were they reached by "the presently achieved light of mathematics" ("lumen Mathematicorum quod nunc accensum est"). [6, p. 720] Leibniz's attitude toward both Swineshead and Scholasticism is clear from the following passage: "Parmy les Scholastiques il y eut un certain Jean Suisset appellé le Calculateur, dont je n'ay encor pû trouver les ouvrages, n'ayant vue que ceux de quelques sectateurs qu'il avoit. Ce Suisset a commencé de faire le Mathematicien dans le Scholastique, mais peu de gens l'ont imité, parce qu'il auroit fallu quitter la methode [des] disputes pour celle des comptes et raisonnemens, et un trait de plume auroit epargné beaucoup de clameurs."[8]

According to Leibniz's impression which was already formed as early as in 1682, Swineshead must be placed alongside with Aristotle![9] In other instances, Leibniz enumerates Swineshead's studies among the most important achievements in philosophy.[10] It is obvious that Leibniz, long before reading Swineshead, already considered him as the inventor of logical "calculus," the main goal of Leibniz's own studies. When, in December 1689, Leibniz eventually found Swineshead's incunabula in Florence, he was very glad and, of course, did not change his opinion.[11] It was certainly a forcible interpretation of Swineshead's legacy, but in our present situation of lacking detailed studies in Swineshead and even critical edition of his works[12] it would be hasty to judge in what extent Leibniz was indulging in wishful thinking.

The real Swineshead participated in the circle of British schoolmen which considered the qualities ("forms") as able to change in intensity without being changed themselves (that is, remaining the same individual forms but differing in intensity).[13] His main innovation in the field consisted in introducing a specific way of counting the quantity of a given form. He proposed to start from the zero grade (not from the maximum grade), and so, *de facto* to count only the "intension" (intensity), because the "remission" becomes an equivalent magnitude whose counting from the zero grade is inconvenient.[14] This is basically the modern approach to measurement of physical magnitudes. Apparently, however, there is no sign that Swineshead himself applied his theory outside physics and considered it as a universal logical computus[15]—as his admirer Leibniz certainly did.

In one of the earliest notices mentioning *intensio*, Leibniz gives the following definitions: "*Intension* is the quantity of the form itself, such as if the form is motion, intension would be speed. *Extension* of a form is the quantity of matter which is within the form of the same measure, such as the quantity of the moving body is the extension of the motion."[16] These definitions are still in Swineshead's vein. But even before reading Swineshead Leibniz started to use the notion intension for the logic of natural language, for the phenomenon which we now call indexicality. Thus, he

wrote: “In the pronouns, we have some intension, such as *ego, egomet; tu, tute; ille, illemet* or *ille ipse, ipsemet.*” [7, p. 888][17] This is not an intensional in the modern sense (such as in the Montague semantics), but simply a dimension of meaning. The indexicals, such as the pronouns, do not have a function which ascribes to them denotations in each of the possible worlds (as does the intensional in Montague’s sense).

Such was the background of the now famous Leibniz’s passage in the *Nouveaux Essais sur l’entendement humain*, IV, xvii, 8: “La maniere d’enoncer vulgaire regarde plustost les individus, mais celle d’Aristote a plus d’egard aux idées ou universaux.[18] Car disant ‘tout homme est animal’, je veux dire que tous les hommes sont compris dans tous les animaux; mais j’entends en même temps que l’idée de l’animal est comprise dans l’idée de l’homme. L’animal comprend plus d’individus que l’homme, mais l’homme comprend plus d’idées ou plus de formalités; l’un a plus d’exemples, l’autre plus de degrés de realité; l’un a plus d’extension, l’autre plus d’intension.”[9, p. 486][19]

Now Leibniz’s approach—which Leibniz himself considered as being Swineshead’s one—became called-for in the Quantum logics, where the physical phenomena are treated with the logical methods developed for the philosophy of language. Leibniz applied to the language the logical ideas inspired by Swineshead’s physics, but now the logicians of physics use logical ideas of the philosophy of language and, in general, of the modal logic, which go back to Leibniz.[20] In both cases, both physics and language are treated within some general semantic approach. The circle is closed.

Moreover, the modern Quantum logics are continuing Leibniz’s ideas of the last year of his life (1716), when he reconsidered, in the IV and V letters to Clarke, his own (now called Leibniz’s) principle of the identity of indiscernibles.[10] The violation of this principle in the world of Quantum phenomena is the main reason of the irreducible intensionality in the corresponding Quantum logics.[21]

Leibniz, as it seems, did not explain the reasons of his own predilection toward the intensional semantics; on the contrary, he always explained his intensional calculi in the extensional terms as well (calling such an extensional approach the “Scholastic” one [11, p. 200][23]. Were Leibniz continue his work after 1716, he would enfaced the serious asymmetry between the intensional and extensional semantics of the world, which would justify his (after Aristotle) choice of the intensional approach as the basic one.

References

1. Lewis 1918. Cf. Couturat 1903, and, before this, Couturat 1901.
2. Rescher 1954/2006. Cf. Swoyer 1995; Bradley 1998.
3. Cf. Knebel 2000; Schmutz 2006.
4. Leibniz 2007
5. Spencer 1971.
6. *Elementa Rationis* (1686); Leibniz 1999, p. 720.
7. Leibniz 1999
8. Cf. Matthews 1992
9. Leibniz 1990
10. Chernoff 1981
11. Leibniz 1999

Notes

1. Des Bosses 1719. One can see, from Leibniz's letter to Des Bosses dated to 15 February 1712, that it was Des Bosses himself who introduced Leibniz to this Jesuit doctrine of divine "moral necessity": Leibniz 2007. Such a late date precludes any possibility that this Jesuit doctrine was among the *sources* of Leibniz's modal thought.
2. As an introduction to this topics, s., most recently, Coudert 2011, and, among earlier publications, especially Coudert, Popkin, Weiner 1998.
3. Published for the first time in Leibniz 1999.
4. Cf. Leibniz's often quoted long philosophical letter to his disciple and friend Arnold Eckhard (1677), where he gives the following definitions: "...*perfectionem* esse gradum seu quantitatem realitatis seu essentiae, ut *intensio* gradus qualitatis, et *vis* gradus actionis" (Leibniz 2006, p. 543. Nr 148) — "...*perfection* is degree or quantity of reality or essence, as *intensity* is degree of quality, and *force* is degree of action" (Leibniz 1989, p. 177).
5. Cf. definition in Port Royal's *Logique, ou L'art de penser*, II, xvii: "…il faut distinguer dans les idées la comprehension de l'extension, & que la comprehension marque les attributs contenus dans l'idée, & l'extension, les sujets que* contiennent cette idée <* *variant reading*: …sujets qui participent et contiennent cette idée selon sa comprehension>" (Arnauld, Nicole 1981, p. 169). Translation: "…in the ideas, one has to discern between the comprehension and the extension, in the way that the comprehension designs the attributes contained in an idea, and the extension the subjects which contain this idea <*variat reading*: …subjects which participate and contain this idea according to the comprehension>."
6. There is no detailed study of him; cf. the most comprehensive article: Mudroch, Sylla 2008.
7. *Sc.*, Julius Caesar Scaliger (1484–1508); his "Eloge" to Swineshead is mentioned by Leibniz in his letter to Antonio Alberti (20 January 1690): Leibniz 2009, p. 306. The editors provide (*ibid.*) the exact quote from Scaliger, which, probably, contributed to formation of some "cult" of Swineshead in Leibniz: "Joanni Suisset calculatori, qui pene modum excessit ingenii humani," that is, who "almost surpassed human abilities." Cf. also Leibniz's letter to Justel quoted in n. 16 below. There were three Swinesheads in the 14th-century Oxford, Richard, John, and Roger, and Leibniz during the whole his life attributed to "Calculator" Richard the name of the lawyer John, who left no works.
8. *Projet et essais pour avancer l'art d'inventer* (dated from August 1688 to October 1690, but the citation obviously predates December 1689, when Leibniz read Swineshead in Florence); Leibniz 1999, p. 965, cf. p. 945 for datation. Tr.: "Among the Schoolmen, there was a certain John Suisset named Calculator, whose works I was unable to find out so far, having seen only those of followers which he had. This Suisset started to do mathematics in scholastics, but few people imitated him, because (otherwise) one would have to abandon the method of disputes and (to take) instead the method of computations and reasoning, in the way that one stroke of pen would eliminate much screams."
9. *Ad Praefationem Elementorum veritatis aeternae* (1682): "Dicam nunc de illis qui Methodum demonstrativam ad Metaphysica et Moralia transtulere. Primus aliquid in hoc genere praestitit Aristoteles, cujus libri *Primorum Analyticorum* utique sunt demonstrativi, et scientiam condunt circa materiam ab imaginatione remotam. Inter Scholasticos quidam Joh. Suisset, vulgo dictus calculator, Mathematicum aliquid affectavit, et de intensione ac remissione qualitatum solito subtilius ratiocinatus est"; Leibniz 1999, p. 446. Tr.: "Now I say about those who applied the method of [logical] demonstration to metaphysics and moral matters. Aristotle was the first who showed something in this genre, whose books *Prior Analytics* are certainly demonstrative and led scholarship in the matters remote from imagination. Among the Scholastics, certain John Suisset, nicknamed Calculator, explained something mathematically, and reasoned about intension and remission of qualities in more details than usually."
10. *Catalogus inventionum in logicis* (early 1681?); Leibniz 1999, p. 427 — this seems to be the earliest piece of the whole Swinshead's dossier in Leibniz; cf. *De arte characteristica ad perficiendas scientias ratione nitentes* (1688); Leibniz 1999, p. 910.
11. Letter to Antonio Alberti, 20 January 1690 (s. note 11), p. 306: "J'y ay vû aussi un livre imprimé vers la fin du 15[.] siècle [= either Padua, *ca* 1477 or Pavia, *ca* 1498] que j'avois desiré de voir il y a long temps, sçavoir Johannis Suisset *Calculationes de Motu, et intensionibus ac remissionibus formarum seu qualitatum*. Il estoit fameux sous le nom de Calculator. <...> C'estoit quelque chose de singulier, qu'un scholastique raisonnât Mathematiquement [tr.: I have seen, moreover, a book published in the late 15th century, which I was wishing to see since long time, namely, John Suisset's *Computations concerning Movement and Intensions and Remissions of Forms, that is, Qualities*. He was famous under the name Calculator]"; letter to Henri Justel (29 July/8 August 1692): "J'avois cherché long temps les oeuvres du celebre Suisset, scholastique Anglois, dont Jules Cesar Scaliger et autres parlent avec grandissime eloge; il avoit introduit les Mathematiques dans la Scholastique; et on l'appelloit pour cela le Calculateur. Mais ses ouvrages sont devenus si rares, à cause de l'oubli sans doute, et du mépris qu'on a eu depuis pour ces études, que je ne les ay vûs qu'à Florence. <…> Cependant je remarquay qu'il y avoit des pensées profondes [tr.: I was looking since long time for the works of the famous Suisset, an English schoolman, about whom Julius Caesar Scaliger and others say with much praise; he introduced mathematics in scholastics, and was named, because of this, the Calculator. But his

works became so rare—because of oblivion, I am sure, and outcast which he undergone after this because of these studies—that I had not seen them before Florence. <...> Nevertheless, I noticed that there were, here, some deep thoughts]" (Leibniz 2009, p. 555).

12. Critical edition of Swineshead's *Calculator* was a long-life task of Marshall Clagett, which he left unfulfilled. Cf. Murdoch 2006, p. 17.
13. The alternative viewpoint, elaborated by some British scholars, consisted in considering the changes of the "forms" as destruction of the previous "forms" and their substitution with the next ones. Thus, any degree of temperature, for example, was considered as a specific form which is to be destroyed when the temperature changes. Cf. Shapiro 1959.
14. Cf. the only detailed study in the field, where all the relevant citations are quoted with the variant readings: Clagett 1950/1979; neither subsequent parts of this study nor critical edition of Swineshead were produced by the author.
15. I consulted Swineshead in the most accessible edition, slightly different by contents from that which consulted Leibniz: Suiseth 1520.
16. *Specimena de motus causa et de corporum qualitatibus* (between 1678 and 1681): *Intensio* est quantitas formae in se, ut si forma sit motus, intensio erit celeritas. *Extensio* formae est quantitas materiae cui inest forma homoeomerica, ut quantitas corporis moti est ipsius motus extensio; Leibniz 1999, p. 2016 (*ed. princeps*). This notice is roughly contemporary to the earliest mentions of Swineshead in Leibniz's papers.
17. *De lingua philosophica* (1687–1688): In pronominibus habemus quandam intensionem, ut *ego, egomet; tu, tute; ille, illemet* seu *ille ipse, ipsemet*;
18. Leibniz was basically right in this understanding of Aristotle. [8, pp. 17-23]
19. Tr.: "The common mode of statement regards rather individuals, but that of Aristotle ideas or universals. For in saying, every man is an animal, I mean to say that all men are included in all animals; but I mean at the same time that the idea of animal is included in the idea of man. Animal includes more individuals than man, but man includes more ideas or more formalities; the one has more examples, the other more degrees of reality; the one more extension, the other more intension" (Leibniz 1896, p. 569).
20. Among the pioneering works one should name Goldblatt 1974 and Toraldo di Francia 1985. As Vasjukov noticed, Goldblatt uses, in his Kripkean frames, a function analogue to the intensionals of Montague: Vasjukov 2005, pp. 105-106. For a detailed discussion of designation and description problems, s. Dalla Chiara, Toraldo di Francia 1992. S., moreover, other most important works: Dalla Chiara 1987; Dalla Chiara, Krause 1998; Dalla Chiara, Giuntini, Greechie 2004, esp. pp. 199-200.
21. Cf., beside the bibliography in n. 25, French, Krause 2006.
22. *Elementa calculi* (1679): In scholis aliter loquuntur, non notiones spectando, sed exempla notionibus universalibus subjecta [tr.: In scholastics, it is said differently, not in the aspect of notions but the individuals put under universal notions]

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