

MANNOURY AND BROUWER: ASPECTS OF THEIR RELATIONSHIP AND COOPERATION

by

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'<... whom I not only reckon among my best and oldest friends but also among my nearest and most congenial collaborators in the philosophical field of thought.' (Mannoury on Brouwer, 1947a: p. 514)

'<... > and may we remain landmarks for each other among the earthquakes and subsidences.' (Brouwer to Mannoury, New Year greeting, December 31st, 1953)

1. Introduction

In for a penny, in for a pound: whoever takes up with the first Dutch contributions to the discussion of the foundations of mathematics and mentions Brouwer must inevitably also mention Mannoury. For both in the history and the sociology of science Brouwer (27.2.1881-2.12.1966) and Mannoury (17.5.1867-30.1.1956) must be studied together, just as they must be named in one breath with Heyting and his 1928 prize-essay. Moreover looking at the history of significs in the Netherlands, whoever mentions Mannoury must also mention Brouwer. For much as F. van Eeden and V. Lady Welby, and Van Eeden and Brouwer have to be considered together regarding the beginnings of significs, so must Brouwer and Mannoury.

Pupils and adepts of one or the other especially for a long time have hindered an unbiased appraisal of the relationship and cooperation between Mannoury and Brouwer with their anecdotes, their stories at second hand, their confusion of before and after, and their respective esteem for

one or the other. The non-mathematicians among the later significians were inclined to draw a dividing line between Brouwer, the 'mathematical genius' and Mannoury, the 'original thinker' and 'founder of significs'. The mathematicians however, including Heyting (cf. especially Heyting 1968: pp. 308), were often looking for or imputing various unilateral influences by Mannoury on Brouwer. In this context a remark by Brouwer from later years often went the round "that he thought he owed a good 80% of his ideas to van Eeden and Mannoury".¹

Since the interpretation of this pronouncement raises more problems than it can resolve I prefer to follow here an observation by Mannoury who regarded the effort towards the "intensification of understanding through judicious communication" as the new mark of the changed attitude by the thinkers of his age (Mannoury 1935, p. 91). In this emphasis on interaction and reciprocity of influences I also find myself in accord with recent studies of Brouwer by Van Dalen, Van Stigt, and Heijerman, with those of Mannoury or the signific movement respectively by Willink, Van Nieuwstadt, and Heijerman, and with Troelstra's on Heyting.

In the following pages I shall distinguish first of all four interrelated dimensions of the Mannoury-Brouwer relationship: a) the field of mathematics; b) the development and institutionalization of significs; c) the personal dimension; and d) the political. In the process I shall present some historical data and sketch out a number of little-known or unknown occurrences in order to correct some common misrepresentations especially of the first two dimensions. Against this background we shall then look in more detail at three partially contested examples of reciprocal influencing or cooperation respectively, viz. 1. Brouwer's rejection of the principle of the excluded third; 2. the cooperation in the field of significs; 3. the events around Heyting's 1928 prize-essay.

2. Four dimensions of the Mannoury-Brouwer relationship

a) Mathematics

Even before Gerrit Mannoury began teaching at Amsterdam University in 1903 as a university lecturer without having received a formal academic

1. Personal communication, Prof. J.Ch. Boland (Gorssel), 9.2.1982; cf. also Boland (1979, p. 34).

education he conveyed to the young student L.E.J. Brouwer the often missed fascination which can emanate from a mathematics allowing room for unencumbered experimentation, for imagination, harmony, and beauty. Mannoury's contributions to the discussions at the meetings of the Wiskundig Genootschap (Mathematical Society) and his early mathematical publications imparted such an attraction according to Brouwer's own testimony (Brouwer, 1947, pp. 192f.). Thus from 1903 on Brouwer was to be found among Mannoury's first students and he was also one of the few who followed for nearly three years the philosophical lecture on 'Hegelen of Cijferen' (Hegeling or doing arithmetics)² which Mannoury held in his private rooms. Mannoury's essay published under the same title in 1905 contains in wording reminiscent of Multatuli (i.e. Eduard Douwes Dekker) first fundamentals of his negation theory (cf. Van Nieuwstadt, 1978, p. 343) and of his philosophy of mathematics.

Also in 1905 Brouwer's 'Leven, kunst en mystiek' (Life, art, and mysticism) was published, an important key to the philosophical background of his doctoral thesis (cf. Van Dalen, 1978, 1981a, b; Heijerman, 1981); the ideas concerning the philosophy of language contained therein are apparently independent of Mannoury's analysis and critique of language. Twenty years later Mannoury wrote Van Eeden about this slim volume:

"Yes, Brouwer's brew is indeed revolutionary, and this in more than one sense, you are completely right there, but for the present the majority of people will not even take note of it."³

How far-sighted this remark was! Only more than 75 years later did this short book produce in some the bewilderment and indignation (cf. Kousbroek, 1982), but also the appropriate contemplation (cf. Heijerman, 1981; Van Dalen, 1981a) it had failed to incite on its publication.

During these years there grew the lifelong friendship between Mannoury and Brouwer which remained unaffected by personal and philosophical controversies and untouched by the different approaches to the discussion of mathematical foundations; even rigorous reviews, public critique, could not cloud this relationship.

In 1906 a publisher offered Mannoury the editorship of the first Dutch philosophical journal which he eventually undertook together with Brouwer only to be deprived of it after vehement opposition from the philosophical associations.

Brouwer's famous doctoral thesis appeared in 1907. The partly ironical and partly caustic review which Mannoury (Mannoury, 1907b) published from the point of view of the philosophy of mathematics in 'De Beweging' and his sober and completely technical-mathematical review in 'Nieuw Archief voor Wiskunde' (1907a) were well able to create the impression that an antagonism existed between the two. They themselves, however, looked upon the exchange as moves in an argument ad rem from which the personal aspect was excluded. Mannoury's main critique attacked the absolute nature of Brouwer's claim to have provided mathematics with a basis both ultimate and securing certainty in the form of the continuity intuition. But even references to some formalizations (in Mannoury's sense) made by Brouwer himself could not dissuade the latter from claiming that his treatise was generally true (cf. Brouwer, 1908a, p. 328). For in accordance with his conception of mathematics Brouwer was neither able to accept the role which Mannoury assigned in mathematics to language nor Mannoury's ultimate grounding of this language and the formalizations signified by it in psychical phenomena. For to Brouwer psychology as an empirical science was one form of the mathematical interpretation of the world, and therefore

"< . . . > psychology assumes mathematics at least inclusive of the first infinite power, is based hence on principle on the intuition of complete induction." (Brouwer, 1910a, 200).

This argument which Brouwer adduces in his review of Mannoury's 'Methodologisches und Philosophisches zur Elementar-Mathematik' (Methodological and philosophical contributions to elementary mathematics, 1909), a book which receives too little attention today, amounts to an immunization of his intuitionism against Mannoury's critique. And in a further short and largely unknown review of this book he pays Mannoury back in his own coin for the latter's review in 'De Beweging':

"A many-faceted treatise on the foundations of mathematics and cognitive theory the perusal of which may cure the reader both of Hegelian inclinations and of reason itself."

And later on he writes:

"The author defends formalism against intuitionism, in all a thankless task; he hence gives

2. Cf. file 'Kolleges, De logiese grondslagen der Wiskunde', Significis Archive.

3. Letter dated 28.12.1925, Van Eeden Archive, no. 710.

the impression of more or less having become converted to intuitionism while writing his treatise." (Brouwer, 1910b).

Between the two works of Brouwer and Mannoury just mentioned there appeared in 1908 Brouwer's article 'De onbetrouwbaarheid der logische principes' (The unreliability of the logical principles, 1908) to which we shall return below.

In 1909 Brouwer became university lecturer and in 1912 professor in ordinary while Mannoury had to discontinue his lectures in Amsterdam in 1910 as he had accepted a position as teacher in Vlissingen whence he was unable to travel to Amsterdam on a regular basis. By this circumstance his close personal contact with Brouwer was interrupted and was only reestablished in 1916. In 1917 Mannoury was appointed senior lecturer in Amsterdam and in 1918 professor in ordinary for analytical and descriptive geometry, mechanics, and the philosophy of mathematics, both with the lively support of Brouwer. Thus both were colleagues and equals until Mannoury's pensioning in 1937. The emphasis of their cooperation however shifted between 1917 and 1926 more and more from mathematics to signics.

In 1927 Mannoury formulated the annual prize-question of the Wiskundig Genootschap, and I shall return to the relevant circumstances below.

After 1937 personal contacts and correspondence between the two appear to have taken place sporadically only. Five occurrences from these later years however are worth mentioning: In 1943 Mannoury published 'La question vitale: 'A ou B'' (The vital question: 'A or B'), a kind of late hommage to Brouwer's break with Aristotelian logic. On the 16th of September, 1946, it was Brouwer's turn to confer on Mannoury the honorary degree of Doctor of Science on behalf of the rector of Amsterdam University and he used the opportunity to speak in very personal terms about his relationship with Mannoury (cf. Brouwer, 1947). Shortly thereafter, on the 19th of February, 1947, Mannoury gave the official address on the occasion of the celebration of the 40th anniversary of Brouwer's graduation, and referring to 'La question vitale' he again praised Brouwer's break with the Aristotelian mode of thought (Mannoury, 1947b) as an important step away from a static science of objects towards a dynamic human one. That same year Brouwer together with Beth, Clay, Van Dantzig, and

Révész belonged to a 'private committee' which raised the contributions that allowed the publication of the two volumes of the 'Handboek der analytische signifika' (Handbook of analytical signifika) (Mannoury, 1947c, 1948) on the occasion of Mannoury's 80th birthday (cf. Van Dantzig, 1947). Finally in 1949 Mannoury declared his readiness to collaborate with the complete edition of Brouwer's works for the first time planned by Heyting. When Brouwer turned down this project on account of his own pressure of work, Mannoury encouraged Heyting to edit a Festschrift in honor of Brouwer's 70th birthday which however was realized just as little.⁴

b) Signics

Here I am not concerned with a history of the beginnings of the signic movement in the Netherlands: this I have sought to reconstruct elsewhere (cf. Schmits, 1983, 1984; Ms. 1985). I shall restrict myself to a number of particulars only.

From the autumn of 1915 on Brouwer together with F. van Eeden was one of the driving forces on the way to an institutionalization of signic research in the Netherlands. The conception of the 'International Institute for Philosophy at Amsterdam' and the 'International Academy for Practical Philosophy and Sociology' to be founded and promoted by the Institute can be attributed nearly completely to him. The aims set for these institutions were on the one hand derived from his philosophy of language and from his mysticism, on the other from the ethically motivated plan of an intellectual reform of society by means of the analysis of language, language reform and the creative use of language. Moreover an essay of importance to communication theory Brouwer wrote as a review of the doctoral thesis of the poet, lawyer and signician J.I. de Haan (Brouwer, 1916) was influential on subsequent discussions.

In search of further collaborators besides Van Eeden, the sinologist and author Henri Borel, and the social worker and later mayor H.P.J. Bloemers, Brouwer remembered his friend Mannoury and his studies on the philosophy of language. On the 17th of April, 1916, Mannoury promised his cooperation, and likewise soon thereafter the Utrecht physicist L.S. Ornstein. Despite some disagreements about the programme of the Academy Mannoury, recently returned to Amsterdam, joined the group of signicians in June, 1917, without however signing the internationally circulated manifesto. Eventually De Haan also took part in the foundation of the Institute on the 12th of September, 1917. On this occasion Mannoury was elected chairman of the administrative council.

4. Cf. Mannoury's correspondence with A. Heyting, Signics Archive.

While the planned Academy never materialized the signicians yet convened between January, 1918, and May, 1922, for more than 40 working sessions in which the linguist and theologian Jacques van Ginneken, S.J. occasionally took part as a guest from 1919 on. Besides his administrative duties the formulation of the contents of the Institute's work also gradually passed to Mannoury from Brouwer from 1920 on at the latest.

The recurring programmatic differences between Brouwer and Van Eeden on the one hand and Mannoury on the other was among the causes which led to the suspension of the Institute's work and to the drafting of a joint declaration of principles on the part of the remaining collaborators Brouwer, Van Eeden, Van Ginneken, and Mannoury. This declaration served as the basis of the 'Signific Circle' founded on the 21st of June, 1922. While it was the intended aim of this Circle to arrive at socially effective joint actions, the theoretical work could not be continued in spite of several working programmes formulated by Mannoury, which were aiming more and more into an epistemological direction. Thus from May, 1924, onwards the collaborators addressed themselves to earlier results of their work and to discussions within the Institute in order to revise the minutes of those meetings for later publication. These 'Significiese dialogen' (Signific dialogues) (Brouwer/Van Eeden et al., 1937) published in 1937 made the 'Signific Circle' known while for most the 'International Institute', the truly vigorous and productive organization of signicians, fell into oblivion.

When in the autumn of 1924 Van Ginneken declared his resignation, Mannoury proposed the winding-up of the Circle. This notion was opposed by Brouwer and Van Eeden. Finally on the 2nd of December, 1926, the final meeting of the Circle took place which resolved to publish the 'Significiese dialogen' with Van Ginneken's consent. In the following years Mannoury followed his own course in the field of significs while Brouwer, disappointed as he was by the hopes he had pegged on the cooperation of like-minded intellects took no further part in the subsequent research activities of a new generation of signicians.

c The personal dimension

Brouwer was an emotional individualist, a loner. Both from the point of view of his philosophy with its solipsistic tendencies and also in practical everyday life which all too often was not in accord with his philosophy, he experienced a deep dominating and often inimical opposition between the subjective and the social world.

"But Brouwer is a dyed-in-the-wool heretic and his attitude towards the totality of human intellectual life with which he is conversant is heretical." (Van Eeden, 1925, p. 78).

Thus wrote Van Eeden about 'Leven, kunst en mystiek' when he had known Brouwer for quite a while, and Brouwer felt that Van Eeden

understood him. Throughout his career as a mathematician the majority of his colleagues bore out the enmity he perceived between the individual and the social world – the label of a 'rioter' attached to him. Brouwer's insensitivity to social and political constellations, his firm conviction of his own greatness and superiority and his sometimes fanatical pursuit of justice promoted his own behavior and in turn this had to result in the corroboration of his own view of his environment and moreover his environment's view of him. Even friends such as Van Eeden or Borel sometimes found it difficult to keep company with him and endure his tempers. The only choice he offered those who associated with him was one between enmity or admiration for him.

His personal relations with Mannoury formed a rare exception to his general social relationships characterized as they were by antagonisms and vicissitudes. In his address of 16th September, 1946, Brouwer expresses this state of affairs in signific terms, and at the same time he puts forward an essential reason for it:

"Differences, in the atmosphere of utility-language we never had; your sense of relativity, strongly interfering elsewhere, left you a paladin of integrity and a complete accountant of daily professional life." (Brouwer, 1947, p. 193).⁵

We see then that Mannoury upheld relativism not only in theory but largely in his everyday life also. To him differences of opinion therefore never could appear as absolute and unbridgeable; for him there was always the possibility of a gradual reconciliation.

His coevals all agree in describing Mannoury, the enthusiastic teacher, as a harmonious personality, friendly, always easy to get along with, true to his principles and extremely modest, which is why he scarcely advertized his ideas and why their authorship was not important to him, the more so as formal honors mattered little to him; he rather believed that his ideas would pave the way for themselves (cf. Schmitz Ms. 1985, p. 278).

This disposition however did not stand in the way of professional differences in opinion with Brouwer in the fields of mathematics or significs. But their unusually good personal relationship allowed Mannoury not only to settle many a dispute between Brouwer and others but it also furthered the mutual recognition of each other's achievements, assisted

5. After her father's death Brouwer told Mannoury's daughter: 'Yes, your father is one of the few people with whom I never had any quarrels. He rather brought out the good in people and I the bad.' (Personal communication, Mrs. Vuysje-Mannoury, 11.8.1982)

with their practical and professional cooperation and afforded them opportunities for mutual interaction. It seems to me that emotional, personal, and sociology of science factors play a much greater role in the history of science than most historians of science would have us believe.

d) The political dimension

When Mannoury in 1917 declined to sign Brouwer's manifesto for the 'International Academy' on account of the 'outrageous' heresies he found in them,⁶ this refusal had its sole origins in the opposite nature of their respective political convictions. In accordance with his philosophy Brouwer's political way of thinking was dominated by the defense of the primacy of the subjective world of psychic conditions over the objective external one conceived as having a 'reality' independent of the individual mind, and precisely to this latter the other individuals also belonged. In his texts may be found passages demonstrating hostility against society and fellow man, condemnation of science, progress, socialism, and the emancipation of women. From about 1915 on however he regarded it as his moral task and duty to fight by philosophical reflection, analysis of language, and the creative use of language for the deliverance of the individual from exploitation, oppression, suggestive control of the masses, and mental drill, by which means he thought the state and the ruling groups prevented or destroyed the intellectual and moral development of the individual. The ideal he had in mind was a universal state with purely administrative tasks held together solely by the social conscience of the members of society springing from their free individual will (cf. Brouwer, 1916, pp. 333f.). Mannoury however, as a socialist quite in line with his era, did not believe in the creation of a new social order or of a new language through individuals or small groups.

"The belief," writes the Dutch sociologist Ernest Zahn (1984, p. 147) 'shared by the old socialists was a belief in an idealized *future*, the expectation of this future an expectation of salvation. The promulgation of the future as a promulgation of salvation met with a special response among the Dutch socialists. < . . . > Among no other people did the image of the 'glowing dawn' have such an element of promise, had the words and verses of socialist poetry been experienced as psalms, was there such a pronounced psychological disposition to eschatology, and especially to consistent behaviour: one simply *had* to be ready 'when the time was ripe' and at the same time to bring about this great moment by such preparedness. The class struggle became a responsible, holy cause, more proselytizing than agitating.'

6. Cf. Mannoury's letter to Brouwer of 11.6.1917, Significs Archive.

All these characteristics can also be encountered in Mannoury and his writings (cf., e.g., Mannoury 1925). It is however important that Mannoury regarded this future as a state of a more perfect sociobiological balance. Relativity theory, psychoanalysis, intuitionist mathematics, and relativist philosophy he considered much as the Russian revolution as symptoms of a development away from an overstrict concentration (as in formalism or nationalism) towards a greater excentration (cf. Mannoury, 1947c; Van Dantzig, 1958, p. 430).⁷

Two examples from scientific and academic policy may illustrate both the common ground but also the contradictions which could result from the opposing political views of Brouwer and Mannoury.

It is well known that Brouwer vehemently opposed the systematic isolation of German scientists after World War I (cf. Van Dalen, 1981b). It may be less known that on the 3rd of May, 1924, the Amsterdam mathematicians Brouwer, Mannoury, De Vries and Weitzenböck jointly submitted a motion to the General Assembly of the Wiskundig Genootschap (Mathematical Society) in which they demanded the breaking off of relations between the Wiskundig Genootschap and the Union Internationale des Mathématiciens. They argued that the Conseil International des Recherches and all its members associations, including the U.I. d. M., had been founded with the express and exclusive aim of boycotting German scientists internationally; this circumstance previously had not been known to the Wiskundig Genootschap, however scientific boycott movements should not be supported by the Wiskundig Genootschap – irrespective of the value of the political aims pursued.⁸

The opposition between Brouwer and Mannoury is illustrated by an earlier incidence. On November 29th, 1918, Brouwer addressed the 'Faculteit van Wis- en Natuurkunde' (Faculty of Science). In his letter he complains of a further increase both in volume and in differentiation of the duties of the professors unbalanced by the hiring of additional faculty. He adds that moreover a reasonable distribution of duties among the lecturers were made impossible since there did not exist a corresponding salary structure

7. For a detailed discussion how Mannoury saw the relationship between politics and science, cf. Heijerman, 1986.

8. Cf. file 'Korr. Wiskundig Genootschap', Significs Archive.

and hierarchy. As a solution Brouwer recommends an increase in faculty through the hiring of additional ‘associate professors’ or lecturers respectively accompanied by a clear hierarchical structuring of the academic body which should find expression in differential titles and jurisdictions, in a distribution of duties according to the scientific importance and quality of the individual, and of course in differences in salary.

Mannoury, by then professor in ordinary just as Brouwer, commented as follows:

1. An increase in faculty is desirable, it is however opposed by financial considerations and a lack of qualified persons.
2. Intellectual activities can only be organized by intellectual cooperation and not by bureaucratic missives.

On the 12th of February, 1919 he proceeded to formulate four suggestions of his own to resolve the problems described by Brouwer:

1. Faculty to define the division of labor between professors and lecturers.
2. Faculty to consist of the representatives of professors, lecturers, and students respectively.
3. Levelling of the salaries of professors in ordinary and of lecturers accompanied by grants of ‘study subsidies’.
4. Use of officious titles and predicates (such as ‘professor’, ‘Z.H.G.’ and the like) to be opposed.⁹ To German ears this struggle between conservative and progressive professors sounds highly topical.

3. Mannoury and Brouwer’s rejection of the principle of the excluded third

The opinion common among some authors (cf., e.g., Parsons, 1967a, p. 400) that while in his doctoral thesis Brouwer had subscribed to the logical principles including the *principium tertii exclusi*, whereas a year after Mannoury’s critique in ‘De Beweging’ (Mannoury, 1907b) he had rejected the *principium tertii* precisely on account of this critique, this opinion probably has its origin in Van Dantzig, 1957, p. 15. Van Dantzig, Mannoury’s pupil, however only establishes the striking historical sequence and suggests rather between the lines a conclusion *post hoc ergo propter hoc*. The formulation he uses: Mannoury’s “advice to abandon the conventional

truths” (Van Dantzig, 1957, p. 15) appears to relate to the following, partly italicized passage in Mannoury’s review (1907b, p. 248):

“< . . . > but because he is always eager to endeavour to uphold the old conventional mathematical certainties, even where he himself proves the inadequateness of the claims of these certainties which are just as old as they are conventional.”
A clearly perceptible reference to the logical principles however can be found neither in this sentence nor in its immediate context. Indeed it could be understood as a reproach that Brouwer continued to uphold the old conviction that it was possible to provide mathematics with a secure basis and with absolute certainty whereas as a human creation it really always remained relative to language, to purpose, and to social life.

Indisputably though, Mannoury *in later years* deplored that in his critique of the logical foundations of mathematical argumentation Brouwer did not proceed to ‘the extremest conceivable radicalism’, that while he did reject the Aristotelian *principium tertii exclusi*, he failed to reject the *principium contradictionis* (principle of the excluded contradiction) also. Van Dantzig possibly came by his thesis by understanding and then using this later comment by Mannoury as an interpretative guideline to his review of 1907. Without further corroboration however this is not admissible.

Insufficient justification in this sense, but a very tempting piece of our jigsaw is the evidence uncovered some years ago that while working on his doctoral thesis Brouwer was indeed very close to this ‘extremest conceivable radicalism’. Between the deleted and unpublished passages of his thesis a piece of scribbling-paper was found, part of which read:

“Is logic a reliable means to uncover natural truths? No, for nature is not a mathematical system. Are the *principia contradictionis* and *tertii exclusi* true? (It will become apparent that they themselves are *not* true: Question of the unresolvable mathematical problems.)” (quoted after Van Dalen, 1981a, p. 13).

Given this background, could at least Brouwer have understood Mannoury’s critique as an implicit appeal to such an ‘extremest conceivable radicalism’?

Now the thesis implied by Van Dantzig has been contradicted. According to Van Dalen, 1982, p. 3 Brouwer in his doctoral thesis, 1907, p. 160, 1975, p. 88 considered the application of the principle of the excluded third still as certain. This is also claimed by Van Dantzig. But Van Dalen goes on to argue that Brouwer, 1907, p. 131; 1975, p. 75, interpreted this principle also in a completely divergent manner:

⁹ ‘A or not A’ expresses the same as ‘if not A, then not A’. In other words, Brouwer read A v

9. Cf. file ‘Korr. Universiteit’, Significs Archive.

$\neg B$ as $\neg A \rightarrow \neg B$, and in the latter reading the principle is of course certain.' (Van Dalen, 1982, p. 3)¹⁰

Finally Van Dalen, 1982, p. 4 is of the opinion that Mannoury's review, 1907b, contains suggestions too unspecific and too radical to be understood as a clearly recognizable appeal to reject the principle of the excluded third. A closer reading of the passages in Brouwer's doctoral thesis on which Van Dalen bases his argument however appears to me to bear out neither the first claim nor the second.

1. Where Brouwer, 1907, p. 160; 1975, p. 88, writes that the principles of identity, syllogism, distribution, contradiction, and of *tertium non datur* can be safely applied ('and we safely apply'), this part of the sentence just as its first part ('Thus here we safely introduce') refers back to the case described in the preceding sentence. And this case presupposes 'arbitrary mathematically constructed systems', 1907, p. 159; 1975, p. 88. Furthermore we read: "from the fact that we *see* these mathematical systems we may conclude that *here* the sentences succeeding one another according to classical logic, will never show contradictions, because they correspond to acts of mathematical construction." (1907, pp. 159f; 1975, p. 88). All this thus means nothing else than: Where a mathematical construction is successfully accomplished the logical principles including the *tertium non datur* may be safely applied to *those* sentences which accompany this process of mathematical construction. Brouwer's rejection of the unlimited applicability of the *principium tertii exclusi* however concerns the more special case in which the conception of the constructed system is neglected for a time while one continues with the accompanying linguistic constructions according to the logical principles, precisely in the confidence that each part of the further linguistic construction (of the proof) is confirmed when these conceptions are again called up (cf. Brouwer 1908b, p. 155). Comparable instances of this methodological approach are rejected by Brouwer as unacceptable in his doctoral thesis already (cf. 1907, p. 132, pp. 141f; 1975, pp. 75, 79), however he does not draw the further-reaching

conclusions such as he indeed did draw a year later.¹¹ It is not in his discussion of logic that Brouwer accepts the principle of the excluded third, as Van Dalen thinks, but there are in the first part of his thesis some minor passages where he himself applies this principle, respectively assumes its applicability (cf. Brouwer 1907, pp. 6, 11; 1975, pp. 16, 18f.). This has however already been pointed out by Heyting in his notes on Brouwer's doctoral thesis (cf. Brouwer, 1975, pp. 565f.).

2. Brouwer's misinterpretation of the *principium tertii exclusi* also does not appear to me to be demonstrable conclusively. For on p. 131 (1975, p. 75) to which Van Dalen refers, Brouwer only claims of a sentence of the form $A \vee \neg A$ that it 'says nothing' and that in this sense of 'saying nothing' this sentence expresses the same as a sentence of the form $\neg A \rightarrow \neg A$. The next sentence in his text, 1907, pp. 131f; 1975, p. 75 however, makes it clear that Brouwer sees an application of the principle of the excluded third only in his first exemplary sentence, namely: "A function is either differentiable or not differentiable". Hence the misinterpretation of the principle of the excluded third imputed by Van Dalen is not at issue here. As Brouwer himself writes later (cf. Brouwer, 1975, p. 147), in 1907 his mistake lay rather in still regarding the applications of this principle in mathematics as 'tautologies giving no information at all' and not as 'often unjustified petitiones principii'.
3. Concerning his final point we have to agree with Van Dalen in the sense that Mannoury's review contains suggestions too unspecific and too radical to be at all understood *by us also* as recognizable appeals to reject the principle of the excluded third or even the *principium contradictionis*.

Should the suggestion indeed have come from Mannoury however, which is certainly not impossible, then probably rather, or at least also, from his critical treatment of logic in his lectures (cf. Mannoury, 1909, pp. 57, 125) and especially from his then somewhat rudimentary reflections on negation theory.¹² For while for a choice negation a positive formulation can always be stated ('he is not tall' – 'He is small') so that the *principium tertii* is applicable, this is not possible in the case of an exclusion negation ('I shall not hit you'). Brouwer the

11. The same applies to Brouwer's reaction to Hilbert's assertion that every mathematical problem could be resolved either positively or negatively (cf. Brouwer 1907: 142 and Stelling No. XXI; 1908b, p. 156).
12. This possibility has already been suggested by J. van Nieuwstadt some time ago (ms., p. 7) and one could also read Mannoury (1943) in this manner – if one so chooses! – On the relationship between the intuitionistic interpretation of negation and the circumstance that the *principium tertii exclusi* cannot be applied generally, cf. Heyting 1968, p. 313; 1978, p. 8 and Parsons, 1967b, pp. 204f.

10. For a similar argument cf. Van Dalen, 1978, p. 300; 1981a, p. 13; some of its inconsistencies were first pointed out to me by J. van Nieuwstadt (Groningen).

student was well familiar with Mannoury's ideas about this matter. For they had been formulated by Mannoury in 1905 in 'Hegelen of cijferen', and as we know Mannoury held a private lecture on the topic of this article for nearly three years which Brouwer attended right until the end. In 'Hegelen of cijferen' (Mannoury, 1905, p. 72) we read for example:

"What is this: 'Oblique'? – Not straight.

What is this: 'not'? – 'Not' is a word that is no longer word but a desire for a word and for the other of this word < . . . > but degenerated to a symptom of human thoughtlessness and delight in determination < . . . > it has been ruler and legislator of the language of stammering mankind: *always* propagator of the realm, – having become a constitutional monarch, with 'not – not = yet' as a constitution. The other way round: it is the origin and change of logic, i.e. of mathematics, < . . . >"

Whatever the case may have been, a clear proof for an influence from Mannoury cannot be furnished – Brouwer and Mannoury were much to close personally and intellectually to allow this.

4. *The origin of the signific theory of language levels – an example of the cooperation between Mannoury and Brouwer*

The signific theory of language levels is both bibliographically and partly also through the secondary literature connected with the names of those who signed it on the 21st of January, 1919 and published it in the 'Mededeelingen van het Internationaal Instituut voor Wijsbegeerte te Amsterdam', no. 2, March 1919, pp. 5-13, viz. Mannoury, Brouwer, Borel and Van Eeden. Elsewhere it is connected with Mannoury's name alone. Heyting even appears to impute that the developmental stages of human intellect sketched out by Brouwer (1905) were formulated on the basis of Mannoury's theory of language levels; this however is a sheer inversion of the actual historic sequence. In reality the theory of language levels is solely the result of the cooperation between Mannoury and Brouwer while Borel, Van Eeden and De Haan only took part in its discussions.

The point of departure of the considerations which led to this theory was the reformulation of Brouwer's working programme for the planned Academy as far as this concerned the so-called dictionary project:

"the determination of basic words for the language of the relationships of rights and interests within society and the edition of (multilanguage) dictionaries of this language in which all words should be defined by such basic words." (Mannoury/Brouwer et al., 1919a, p. 6)¹³

In 1918 Mannoury proceeded to present a first independent draft of a theory of language levels with the aim of preparing the subsequent activities

13. This determination of tasks has its origins in earlier deliberations of De Haan, Brouwer and Mannoury.

of the Academy theoretically as well as methodically. In his paper he distinguishes: a) *Basic language*, i.e. the level of a child's initial language, the language of strong emotions, and of the hypothetical ur-language; b) *Emotive language*, i.e. the level and form of popular language, poetic language, of Oriental languages with pictorial scripts and – an information which Brouwer in his 1946, p. 203, presentation of this theory intentionally withholds – of the language of non-pasigraphic, non-applied mathematics; c) *Utility language*, i.e. the level of trade and colloquial language and of the Western literary languages in which groups of opposites such as blackwhite, freedom-coercion have become firmly established, which finally suggest a general applicability of the principle of the excluded third; d) *Scientific language*, i.e. the level of the languages of laws and ordinances, of financial relations, of technology and science in the stricter sense; e) *Language of symbols*, i.e. the level of logical systems and of that part of mathematics which can be rendered in a pasigraphic form.

On the one hand these five levels of language are characterized respectively by their communicative purpose, by their field of application which is one of contents and social relationships, and by their degrees and means of formalization differentiating and stabilizing meaning. On the other hand the emotional element of the meaning of words decreases when passing from a lower to a higher level while the indicative element of meaning and hence the stability of meaning and general intelligibility of words and utterances increases. At the level of the 'language of symbols' finally it is no longer possible to speak of meaning in the stricter sense. 'Basic language' and 'language of symbols' hence represent for Mannoury the extremes designated as 'generality' and 'determination', as 'excentration' and 'concentration', between which human thinking and speaking oscillate.

§ 6, the final paragraph of the text 'Signifisch taalonderzoek' (Signific language research), was also written by Mannoury, however, on the insistence and according to suggestions from Brouwer. Here Mannoury attempts to take into account Brouwer's supplements as he formulated them in his own manner in the subsequently written text 'Onderscheid der taaltrappen ten aanzien van de sociale verstandhouding' (Of the difference between language levels with regard to social communication) (Mannoury/Brouwer et al., 1919b) while at the same time emphasizing the relative nature of the system of levels. Only in this way was the parallelism between

the language levels determined by Mannoury, and the phylo- and ontogenetic developmental stages of intellect and forms of communication sketched by Brouwer between 1905 and 1916, made explicit.

For to Brouwer the transition from ‘basic language’ to ‘language of symbols’ presents itself chiefly as an increasingly strict exclusion of emotions, primary sensations, and needs from the respective communicability (cf. Mannoury/Brouwer et al., 1919b). This goes hand in hand with an increasing objectification and formalization of social relationships. From the point of view of language this way out of the isolation of the individual into social communication and various forms of sociability is characterized first by a restraint and then a progressive displacement of emotions. This process is accompanied by an increasingly strict forming of the social relationships, by a progressive safety of the communicative effort, but also by a distinct narrowing of the domain about which communications can be made and about which communication through language is possible.

The theory of language levels stands among the most important achievements of the early signific movement. At the same time it is much as the declaration of principles of the ‘Signific Circle’ one of the few published testimonies of genuine scientific collaboration between the early signifi- cians in general and between Brouwer and Mannoury in particular.

5. Mannoury, Brouwer and Heyting’s formalization of intuitionistic mathematics

Troelstra, 1981, p. 16, states:

“It has been thought that Brouwer did not appreciate Heyting’s work on the formalization of his ideas, since he himself was averse to formalization as detracting from the intuitive content of mathematics.”

Even though Troelstra advances a number of important arguments against this opinion, we still find three years later in a paper by E.M. Barth (Ms. 1984, 1f.) the following statement of a putative historical fact:

“A. Heyting, Brouwer’s sometime student and his successor to the chair, had formalized the implicit logic of Brouwer’s philosophy of mathematics in 1930, to the latter’s annoyance.”

But what did really happen between 1927 and 1930?

On the 26th of January, 1927, Mannoury wrote a letter to Brouwer in Berlin where he was giving some lectures:

“Dear Bertus. Enclosed please find a copy of a draft of the prize-question which I have sent Schuh and which relates to your theories. Have I presented your views correctly in the first sentence?¹⁴ Or would you like any changes there (or in any other part)? These can still be made.”¹⁵

A response to this letter by Brouwer was either never written or it has not been preserved. However, had Brouwer disapproved of the wording or the publication of the prizequestion he certainly would have opposed it in his very own manner. In any case the prize-question was published as that of the Mathematical Society for the year 1927.

In 1928 A. Heyting submitted his reply to the first of the two parts of the prize-question under the motto ‘Stenen voor brood’ (Stones for bread), cf. Van Dantzig, 1957, p. 15, and was awarded the prize. Troelstra who obviously had access to the Brouwer-Heyting correspondence but failed to mention Mannoury’s part in these events adduces the following arguments against the described misconception of Brouwer’s alleged negative reaction to the prize-essay: 1. Heyting himself warns in the preface to his treatise, cf. Heyting, 1930, p. 42, against an identification of intuitionistic mathematics with the formal system presented, something that – it should be added – had moreover already been taken into account in Mannoury’s wording of the question. 2. Brouwer himself had already examined the intuitionistic reliability of certain logical principles, though on a non-formal basis. In this sense Heyting’s treatise was a continuation of Brouwer’s work and a good advertisement of Brouwer’s views. On the 17th of July, 1928 Brouwer moreover wrote Heyting:

“Your manuscript interested me extraordinarily, and I regret that now I have to return it in a hurry. . . . I have learned to appreciate your work so much that I would like to ask you to rework and rewrite it in German (preferably with more details, instead of less)”, quoted after Troelstra, 1981, p. 17.

4. Brouwer suggested a publication in the ‘Mathematische Annalen’ but this was unsuccessful since at that time Brouwer was excluded from the editorial board. Through Brouwer’s intervention Heyting’s revised text was then offered to L. Bieberbach for publication in the ‘Sitzungsberichte der

- 14. ‘Though Brouwer’s set theory on principle may *not* be equated with the consequences which formally result from a certain pasigraphy, in the language with which Brouwer accompanies his mathematical intuitions certain regularities yet stand out which can be combined in a formalistic-mathematical system.’ (Brouwer Archive, Utrecht)
- 15. Brouwer Archive, Utrecht.

Preußischen Akademie der Wissenschaften' and published there, cf. Troelstra, 1981, p. 4.

All this then speaks against the never substantiated opinion that Brouwer was annoyed with Heyting's treatise. That Brouwer in his own writings never was disposed to formalization, also in contrast to the later Heyting, is quite another problem which would deserve a special investigation especially in so far as it bears on the fundamentally different situation of the first and the second generation of intuitionists.

With that we come to Mannoury's part in these events. Already in 1909 Mannoury took the view that an intuitive knowledge which really could dispense with formalizations (in his sense) and therefore with language was unthinkable, 1909a, pp. 33f. Distinctive communicable knowledge is *always* symbolic knowledge and as such refers to the human dimension, is therefore relative. Accordingly formal rules of language use must also be recognizable and formally expressible in that language which serves as an aid to memory during the process of mathematical construction or which accompanies this process of construction. To demonstrate this may even have suggested itself after Brouwer's important publications of 1918/1919 and 1925-1927.

Furthermore it is quite conceivable, if not even probable, that Mannoury posed the prize-question also with the (additional) intention of providing Heyting with an opportunity to demonstrate his special knowledge and skills. At that time Mannoury has known Heyting for a number of years already, for Heyting had attended several of his lectures at least between 1917 and 1921.¹⁶ Mannoury was probably also acquainted with Heyting's 1925 doctoral thesis and thus with his accomplishments in the field of symbolic logic and also in that of intuitionistic mathematics. And who else from the at that time small enough circle of Dutch mathematicians would have been a candidate for the treatment of the prize-question? Perhaps M.J. Belinfante?

One further circumstance in these events points at Mannoury: the motto 'Stenen voor brood' which Heyting obviously had taken from Mannoury's 'Mathesis en mystiek' (Mathematics and mysticism), 1925, p. 40, and this from a context which is materially relevant to the prize-question as a whole. For the issue at hand there is the exclusion and choice negation with the statement that the exclusion negation much as the contradiction are emotions, therefore without any indicative substance. The subsequent text reads:

"< . . . > but then what about the weather or good manners? What B-weather and what B-manners are not good? The formalist answers: well, those that one *names* 'not good', but that is stones for bread, for who this 'one' is and how loud he has to shout to be allowed to name this 'naming', that is something he does not tell us."

One final comment: Looking at Heyting's further career the content of his

16. Cf. file 'Universiteit (lijsten van hoorders)', Significs Archive.

17. Unfortunately I was unable to consult Heyting's correspondence with Brouwer.

writings after 1930, and furthermore at his correspondence with Mannoury,¹⁷ one gets the distinct impression that the relationship and cooperation between Brouwer and Mannoury which continued over decades found focus and future in their joint pupil Heyting. The evaluation and integration of the ideas coming from both his teachers, much as their further elaboration, is however part of the individual character and personal achievement of Heyting.

6. Conclusion

The relationship and cooperation between Brouwer and Mannoury has had great importance both for the history of mathematics and for the history of the signific movement in the Netherlands. That only by the setting up and accessibility of important archives (Brouwer Archive, Utrecht; Significs Archive, Amsterdam) the necessary documentation for a reconstruction of this strand of the history of science has become available is not the least reason why their relationship has only recently been taken into account in the literature. For especially Brouwer's publications with the exception of two (Brouwer, 1946 and 1947) furnish no evidence how much he owes to Mannoury and their cooperation. Thus we can only assume that Brouwer also accepted Mannoury's conception of a significantly founded philosophy of mathematics, cf. Brouwer, 1921, p. 1.

In the opposite case nearly all of Mannoury's books and some of his articles contain much clearer and manifold references to Brouwer's ideas and concepts, which he rejected, considered fruitful, or embraced. The most comprehensive references which however could not all be followed up in detail here, are contained in the articles 'Die signifischen Grundlagen der Mathematik' (The signific foundations of mathematics): 1934, pp. 291f., pp. 324f., p. 330, pp. 338f., and in 'La question vitale: 'A ou B'' (1943), as well as in the first place of the 'Handboek der analytische signifika' (Handbook of analytical significs), 1947c, pp. 129ff. These articles however provide us with no clue when it is allowed to invert our initial statement that whoever mentions Mannoury also has to mention Brouwer.

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