Evert Beth vs. Anton Reichling

Contrary forces in the rise of Dutch generativism

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1. Introduction

In this article, I discuss a remarkable element in the introduction of generative grammar in the Netherlands, namely the prominent role of the philosopher Evert Beth (1908–1964), professor of Logic at the University of Amsterdam. His *Constanten van het wiskundige denken* (Constants of mathematical thought), which was both presented as a paper and published in 1963, was a major pro-Chomskyan contribution in the struggle to establish generative grammar at the University of Amsterdam. The plea for an algorithmic approach to grammar by a renowned mathematical logician and his rather devastating criticism of his anti-Chomskyan colleague Anton Reichling (1898–1986), professor of General Linguistics, became impressive weapons in the hands of a young and pro-Chomskyan generation of Dutch linguists, especially those in Amsterdam.

In Section 2, I explain how Beth became involved in linguistics and developed into a major defender of generative grammar. In Section 3, I discuss Beth's arguments in favour of generative grammar and against Reichling's criticism of Chomsky. In this section, I discuss an exchange of letters between Beth and Reichling prior to Beth's *Constanten* lecture, which provide revealing information about the inception and development of *Constanten*. The letters also give rise to some questions about Beth's view of Reichling's general scientific position. In his last letter to Reichling, Beth identifies his opponent's arguments as identical to those presented in earlier, fruitless discussions about the foundations of physics, and concludes that a further discussion with Reichling is therefore pointless. In Section 4, I first take a brief excursion into the philosophy of physics, and then evaluate this final move of Beth in the debate.[1]

2.   Beth and linguistics

This section discusses Beth's development as a philosopher and argues that his eventual "linguistic turn" is not very surprising in the light of his earlier activities and interests. His involvement in linguistics was inspired particularly by his participation in a *Euratom* project for machine translation and his contacts with some young Amsterdam linguists, which resulted in fruitful cooperation for some years. I conclude the section with a summary of Beth's evaluation of Chomsky as presented in *Constanten*.

2.1 Beth: The philosopher

Beth studied science and mathematics as well as philosophy. He was appointed professor of "Logic and its history and philosophy of the exact sciences" at the University of Amsterdam in 1946.

   In addition to being a brilliant mathematical logician, Beth also practised philosophy in a broader sense, as is evident from his interest in the idealistic "significs" movement, which aimed at the optimization of human understanding and communication, mainly by rendering language more "logical" and less ambiguous.[2] Although Beth's "significs" involvement did not last very long, it was a first signal of his interest in natural language.

   He was particularly interested in the linguistic aspects of his core activities. Beth explored and discussed the relation between formal languages of mathematics and logic, and natural languages. He observed a continuum, rather than a deep divide, between formal and natural languages, but without denying the defects of natural language and the need to develop formal languages.

   A final factor that facilitated Beth's linguistic involvement was his interest in the contribution of philosophy, and especially of logic, to other disciplines. He was sympathetic to the *Wiener Kreis* views, of which he preferred Carnap's logicism to Neurath's empiricism. Thus, he conceived of the central, foundational role of philosophy mainly as the analysis in terms of logical-mathematical concepts, although he knew that these were not relevant to the problems of any discipline. Against this background, it is understandable that the rise of a mathematical type of linguistics was welcomed as a promising example of the type of cooperation that Beth had in mind.

2.2 Beth "going linguistic"

In this light, we need not be surprised about the remark Beth made to Hans Smits, an Amsterdam student of general linguistics, as the latter entered his office: "Oh, how nice: a linguist. I've never had one."[3]

This occurred in 1958. Smits had come for methodological advice and ended up being invited to attend lectures and seminars at Beth's institute. Gradually, more linguists, such as Remmert Kraak (1928–2005), Pieter Seuren and others followed Smits's example. In those days, Beth was developing a growing interest in "thinking machines" (artificial intelligence *avant la lettre*) and in machine translation. The linguistic component of both areas was evident to him, and he stimulated an interdisciplinary approach. In turn, the participating linguists enjoyed the exciting and "really scientific" prospects of these projects, which contrasted strongly with the barren climate at the philology departments and the general linguistics department of the University of Amsterdam.

In 1960, Beth welcomed the chance, offered by *Euratom*, to start a language-and-machine project, including job facilities. Like Beth's earlier seminars, the Euratom project became more and more linguistic in character. This was due to intrinsic developments in mathematical linguistics (e.g., the work of Bar-Hillel, who was invited by Beth to read at his institute) as well as to the fact that many Amsterdam students of linguistics were looking for a more stimulating environment. They found their way to Beth's institute, where quite a few of them got a job on the *Euratom* project. In this context, the publication of Chomsky's first book *Syntactic Structures* (1957) could only accelerate this process.

2.3 Beth and Chomsky

Beth learned about Chomsky from his linguistics students, who had themselves become acquainted with Chomsky's work through Reichling's lectures, which were very critical of Chomsky to the point of ridicule. Beth and his linguistics students, in contrast, were enthusiastic. This was the type of linguistics that fitted Beth's general scientific approach and the requirements of the language-and-machine project perfectly.

For his linguistics students, Chomsky's work offered a real alternative to the philologically oriented approaches in their departments, an alternative, moreover, that resembled the logical-mathematical approach that they had become familiar with through the teaching of Beth and his assistants.

The rise of generative grammar reinforced trends that were already present, and the focus of the Euratom group gradually shifted from logical and mathematical to linguistic topics. Beth welcomed increasing numbers of linguistics students who were interested in the new approach and disliked the hostile attitude of older linguists, especially Reichling. An added incentive for joining Beth's department was the fact that Chomsky's *Syntactic Structures* was not accessible without some knowledge of mathematics and logic, which was supplied by Beth's staff.

Beth never became a Chomskyan linguist himself, although he enjoyed disseminating the Chomskyan approach among his students. The importance he attached to Chomsky's work is very evident from his decision to discuss it in his lecture *Constants of mathematical thought*, to be presented at the meeting of the Dutch Academy of Sciences in June 1963.

2.4 Chomsky and Reichling in "Constanten": Content and context

Most sections of Beth's *Constanten* text are purely mathematical in character. Beth defends the thesis that there are three constants of mathematical thought: *the algorithm, the deductive method*, and *the infinite*. Section (8) of the article explains the theory of algorithms and their role in set theory. In section (9), Beth deals with the distinction between *decidable sets* and *canonical sets.* In the case of a *decidable* set, the question whether an item belongs to the set can always be settled by applying a *decision procedure*. In the case of a *non-decidable* set, such a procedure cannot be formulated. If a non-decidable set is *canonical,* however, there is a weaker requirement that can be met: An *algorithm* can be constructed that enumerates all members of the set.

In section (10), this distinction between types of sets is applied to language. According to Beth, the task of a grammarian is to characterize the set of sentences, that is, the set of grammatical strings of the words of a language (e.g., English) which is a subset of the set of all finite English word strings. He goes on to remark that grammarians, despite frequent attempts over the years, have never succeeded in accomplishing this task. Beth explains this by saying that earlier grammarians assumed that it is possible to formulate a decision procedure for the set of English sentences, an assumption that is probably unjustified, given their lack of success. It might well be the case that the set is undecidable, though possibly canonical. According to Beth, Chomsky's work can be characterized as an attempt to explore this idea by trying to construct an algorithm that generates all English sentences, an attempt which so far seems to have been successful.

In the penultimate section (11), Beth discusses Reichling's criticism of Chomsky "as a supplement and further adstruction."

In a letter to Reichling dated March 11, 1963, Beth motivates his choice to deal with Chomsky and with Reichling's criticism of Chomsky as follows:

> You will understand that for this lecture I chose a subject that has been close to my heart for years. It also goes without saying that I illustrate my exposition by discussing the relation between Post's[4] theory of algorithms and Chomsky's mathematical linguistics. In the literature, this relation has been too much neglected, and it is, moreover, very important for the Amsterdam EURATOM

work. Finally it will be clear to you that I cannot discuss these issues without going into your expositions and criticisms of Chomsky's work.

The last sentence explains why this letter is accompanied by Beth's draft manuscript of *Constanten*. Beth invites Reichling to provide comments. He emphasizes that he "of course" does not cherish any hope of convincing Reichling, but that he wants to avoid a widening of the gap between them and also wants to be sure that Reichling's views are rendered correctly.

I discuss the details of Beth's criticism of Reichling in the next section.

3.   Beth and Reichling

In this section, I first discuss Reichling's main objections against Chomsky's approach and relate them to his general position in linguistics. I then pay attention to Beth's first letter to Reichling, dated January 15, 1963. Finally, I discuss Beth's criticism of Reichling in *Constanten*, Reichling's comment to the *Constanten* text and Beth's final reaction.

3.1 Reichling's anti-Chomskyanism

Reichling's usual courses in general linguistics consisted of detailed discussions of texts written by some prominent linguist. He discovered *Syntactic Structures* relatively early, and from that moment on was fiercely critical of Chomsky's work in his teaching.

Reichling's small booklet *Verzamelde Studies* (Collected Studies) appeared in 1961. Two of its chapters contain his objections against Chomsky. Four main types of objection can be distinguished, which I have labelled below for ease of reference, with a brief description:

1. *A-semantism*   Chomsky's statement that "grammar is autonomous and independent of meaning" is wrong. Grammar is autonomous with respect to lexical meaning, but not entirely independent of meaning: Syntax cannot even get started without taking meaning into account.
2. *Incorporation*   Chomsky's syntactic analyses uncritically incorporate traditional grammar in its totality. This grammar depends on logic and should be replaced by a grammar based upon purely linguistic criteria.
3. *Psychologism*   Chomsky appeals to his linguistic analyses in explaining processes of language production and understanding. He thus assumes the psychological reality of his analyses, which is unjustified.

4. *Heteronomy*   Chomsky's foundations, methods and aims are non-lin-
    guistic. They belong, for example, to engineers' logic, and depend heavily
    upon logical positivism. We can learn from the past that linguistics can
    flourish only upon a purely linguistic soil.

Reichling's objections can easily be related to his roots in phenomenological
philosophy and psychology, as well as in the European variety of structuralism.
The ideas that linguistics should be autonomous and that a new syntax should
be built on this autonomous basis are general structuralistic principles. Rejec-
tion of a-semantism, so prominently defended in American structuralism, was
also a general feature of European structuralism.

Fear of psychologism was also a prominent feature of European structur-
alism. In Reichling's case, this was reinforced by his phenomenological back-
ground. Reichling's approach required a "purified" type of observation of what
occurs during language use, undistorted by theoretical considerations. One of
Reichling's recurrent principles was that categories resulting from *reflection
about language* may never be automatically thought relevant in *language use*.

3.2 Beth's first letter

On January 15, 1963, Beth wrote to Reichling asking for some clarification of
passages in Reichling (1961) that appeared "problematical" to Beth. Nine pas-
sages, all about Reichling's criticism of Chomsky, are mentioned, accompanied
by the reasons why Beth considers the criticism unjustified. He does not men-
tion any plan for a lecture, but, given subsequent developments, it is likely that
Beth was already pondering his *Constanten* lecture when writing this letter.

Although Beth stresses that his aim is not to defend Chomsky but to re-
quest further clarification, the letter is evidently pro-Chomskyan.

Which of Reichling's anti-Chomskyan passages were problematical to
Beth? Following Reichling's objections summarized above, we observe that (1)
and (3) (a-semantism and psychologism) are not mentioned at all. Beth focuses
on objections (2) (incorporation) and (4) (heteronomy) as his main issues.

Beth replies to Reichling's statements that Chomsky presupposes tradi-
tional grammar in its totality by referring to a passage in *Syntactic Structures* in
which Chomsky speaks about "a partial knowledge". This is Chomsky's sentence
in its entirety: "Notice that in order to set the aims of grammar significantly it
is sufficient to assume a partial knowledge of sentences and non-sentences."
(Chomsky 1957: 13–14).

The heteronomy issue led to two reactions. One was about the question
of how much Chomsky was influenced by logical positivism and the *Wiener*

Kreis. Beth is inclined to play down this influence. More important is his second reaction: Even if Chomsky were 100% inspired by the *Wiener Kreis,* this would not count against his *results.*

3.3 Beth's second letter: "Constanten" in statu nascendi

Reichling was pressed for time when he received Beth's first letter. In a short reply (January 23, 1963), he explains that he is unable to give an immediate reaction, due to a visit abroad.

On March 11, Beth, who had not yet received Reichling's reaction, wrote to Reichling again. In the meantime, he finished his draft of *Constanten*, and sent it with the letter quoted in the previous section. What were Beth's main objections against Reichling in this preliminary version of *Constanten*?

The content of section (11) largely echoes Beth's first letter. Reichling's objection (2) (incorporation) is discussed in almost literally the same terms. But there are also some new elements. The issue of heteronomy is not new in itself, but it is discussed more extensively. Beth repeats his earlier view that Chomsky was only slightly inspired by the *Wiener Kreis*. In addition, Reichling is accused of "a methodological purism that I always have found extremely infertile, and that should belong to the past nowadays" (Beth 1967: 166). Beth returns to heteronomy in the final section of *Constanten* (Section 12, *Conclusion*) where he tries to explain Reichling's fierce anti-Chomskyan stance. He regards it as "essentially a protest against the broad expansion of mathematical thought during the last decades." Such protests are generally rooted in a fear of "denaturing" the discipline. This fear, however, is groundless, according to Beth.

A new issue is psychologism. Reichling's criticism of Chomsky's psychologism is attacked in a similar way as that of the incorporation issue: Reichling is accused of misinterpreting Chomsky's text. Beth admits that some passages in *Syntactic Structures* describe understanding a sentence as a process of reconstructing an analysis at various levels (which would imply the speaker's "knowledge of transformational history" that is so severely criticized by Reichling), but he claims that Chomsky *generally* uses the term "understanding" in a different way, and that transformational history only "makes visible" the phenomena (Beth 1967: 167).

3.4 Reichling's reply

This time, Reichling does react, but not immediately, not until May 26. In his letter, he expresses his gladness about the opportunity, offered by Beth, to repair misunderstandings. He includes an extensive 11-page commentary on the

Constanten text. A recurrent theme in this commentary is the contrast between "traditional grammar" and "modern linguistics" (20th-century structuralism), the existence of which he suggests Beth may not have noticed.[5]

Following the sequence of subjects as they are presented in *Constanten,* Reichling begins by problematizing Beth's description of the grammarian's task in set-theoretic terms. It is not these terms themselves that are questioned, but Beth's unqualified talk about English "words" and "sentences." According to Reichling, we should first have a professional linguistic discussion about these concepts. Without it, one can only appeal to pre-scientific notions, which renders the mathematical characterization of the set of word strings that are grammatical sentences premature and pointless.

The idea that Chomsky's approach makes possible what cannot be achieved by other approaches is unjustified, according to Reichling. Beth's — in itself correct — claim about the failure of traditional grammar is not an argument in favour of Chomsky, because there now exists a much more promising branch of modern linguistics.

Beth's playing down of Chomsky's incorporation of traditional grammar by making an appeal to Chomsky's statement about "partial knowledge" is misdirected, in Reichling's view. Chomsky's "partial knowledge" concerns English sentences, whereas Reichling's objection concerns the traditional grammatical notions (like "subject," "object," etc.) applied in Chomsky (1957).

In the heteronomy issue, Reichling reacts vehemently to the accusation of methodological purism. He states that his claim that linguistics should be autonomous does not imply that linguistics alone can answer *all* questions about language, nor that it is the sole supplier of the methods to present linguistic results. What Reichling maintains is that the establishment of linguistic categories cannot occur on a non-linguistic basis, and that Chomsky neglects this principle.

The psychologism issue is the one most extensively dealt with by Reichling. Chomsky's attribution of his linguistic analyses to the language user is substantiated by no fewer than five lengthy quotations, two of which are from publications that appeared after *Syntactic Structures.* After quoting the last passage, which contains the sentence "In performing as a speaker or hearer, he [someone who has acquired the language] puts this device [the grammar] to use," Reichling asks: "May I stop now?".

Finally, Reichling denies that his criticism is directed against the broad expansion of mathematical thought. On the contrary, he thinks positively about formalization of the linguist's results. He does fear "denaturing," however — not by the application of mathematics itself, but by its premature or incorrect application.

3.5 Beth's final reaction

Beth must have written his reaction to Reichling's comment at once. On May 28, he wrote to Reichling thanking him for his letter and for the pains he had taken. But almost immediately, Beth's reaction takes a very negative turn: He mentions the strong feelings of despondency that Reichling's letter has induced in him. The reason is that Reichling's arguments echo earlier discussions about the foundations of other sciences:

> In those days, it was similarly argued that mathematical physics was unable to explain the phenomena of nature, because it did not start by reflecting about concepts like 'phenomenon' and 'nature.' And if, in reaction, reference was made to modern philosophies of nature, it was argued that these systems unjustifiably did not appeal to traditional concepts as 'form,' 'substance,' 'potentia,' 'actus,' etc. What separates us is, therefore, in my opinion, a different conception of science in general. Our different interpretation and evaluation of Chomsky's writings is only a symptom — be it a very significant one — of this difference. Accordingly, I think that I can leave my explanation unchanged, also when I take your recent quotations[6] into account.

Beth finally turns his attention to the psychologism issue once more, again defending a weaker sense of Chomsky's use of the verb "understand," and concludes by saying that he wants to leave it at that.

Reichling reacts with a brief note, written on June 4, in which he says that lack of time prevents him from going into Beth's letter, but he hopes for a later opportunity to do so. This marks the end of the exchange between the two scholars.[7]

What is most striking is Beth's rather sudden change of heart. He must have been already aware of their different conceptions of science before their correspondence, if only by reading Reichling's articles, conceptions which reflected a divide — one that was quite widespread in those days — between the humanities and the exact sciences. Beth had not thought this a hindrance for engaging in a scholarly discussion with Reichling. Which cue in Reichling's most recent letter caused Beth's conclusion that the divide is, after all, unbridgeable, and that discussion is therefore pointless? And what exactly were those earlier discussions that Reichling's arguments reminded Beth of?

To begin with the latter question: A continuous thread running through Beth's oeuvre is his debate with the Aristotelian natural philosophers. For example, in his book *Natuurphilosophie* (*Natural philosophy,* 1948), Beth extensively argues that the Aristotelian view of nature, founded in the type of categories quoted in his last letter ("form," "substance," etc.), has been definitively superseded by modern science. This change caused a foundational crisis. The ideal of explanation in terms of basic categories, which were considered intuitively evident and continu-

ous with pre-scientific views of nature, had to be given up. Now those philosophers who accepted the results of modern science but were unwilling to give up this ideal claimed a separate area for "natural philosophy," next to natural science, which continued to answer foundational questions in the Aristotelian way. Among the Dutch contemporaries of Beth who defended this conception of natural philosophy were P. Hoenen (1880–1961) and A. van Melsen (1912–1994).

Beth was vehemently opposed to this conception: this natural philosophy is nothing but natural science in its earlier and refuted shape, and therefore no longer relevant. For Beth, natural philosophy could only continue as the logical analysis of algorithmic scientific theories (Beth 1948: 60).

Why did Reichling's last letter cause Beth to compare him with these natural philosophers? The only element in his last letter that was absent in his earlier texts and that can be responsible for this turn in Beth's thought is the initial paragraph in which Reichling problematizes Beth's set-theoretical approach, the passage in which he claims that this approach can be valuable only if it is preceded by a thorough attempt to answer the questions "What is a word?" and "What is a sentence?". This way of phrasing must have reminded Beth of his opponents, the natural philosophers, who regarded the answering of similar "foundational" questions as the necessary basis upon which "positive" science should build. To illustrate the similar phrasing (and also van Melsen's opposition to Beth's view of natural philosophy), I quote the following passage from van Melsen's review of Beth (1948): "Its task [i.e., of natural philosophy] is: answering philosophical questions (…), that are necessarily left open by natural science, given its methods; such a question is, for example: what is a material thing?" (van Melsen 1949: 215).

Reichling's claim that similar "basic" questions for linguistics should be answered first — in combination with the fact that this requirement is claimed as a criticism of a new, revolutionary and mathematically oriented approach of the discipline — probably caused Beth's negative "Aha-Erlebnis."

4.   Assessment and conclusion

The parallel drawn by Beth between Reichling's reaction to Chomsky and the natural philosophers' reaction to the foundational crisis in science is challenging and deserves a more thorough analysis than I can present here. I shall therefore confine myself to some brief remarks.

In spite of the above-mentioned elements that clearly support the parallelism, there is also much that weakens it, if only because of huge differences between the history of science and the history of linguistics. In the latter, there

is nothing comparable to the stable and long-lasting Aristotelian basis of natural sciences. Moreover, as far as there *is* something more or less comparable, it is "traditional grammar," with its categories "subject," "predicate," "object," etc., which was so vehemently attacked by Reichling. In general, 20th-century modern linguistics was very critical of these categories, whereas generative grammarians largely adopted them. In addition, Reichling's questions of the "What is a sentence?" type were not at all to be answered in a traditional and intuitively evident way. On the contrary, he warns against such an appeal to pre-scientific intuition. It is generative grammar that favours such an appeal.

The comparison that Beth rather implicitly appeals to in his last letter turns out to be more complicated than Beth suggests. At the same time, the comparison constitutes a motive for another simplification: Beth's decision not to change his original text. We observed that in his commentary, Reichling presented arguments and quotations of Chomsky that shed doubt upon Beth's straightforward denial of Chomsky's incorporation of traditional grammar and of his psychologism. Having read Reichling's comments, Beth could have presented a more differentiated picture. In the letter quoted above, he motivates his vindication of his original text in terms of their diverging conceptions of science, which would explain their diverging interpretations of Chomsky's words. But it is unclear why diverging conceptions of science should prevent agreement at the basic level of what Chomsky writes.

We can, of course, only speculate about motives, but it seems likely that, at a date so near to his lecture, Beth could not find time to do something more serious with Reichling's very late reaction. Maybe he did not want to do so, or he feared a weakening of his arguments. Looking back, we can refute the latter: The effect of *Constanten* would certainly have been the same, if Beth had taken into account Reichling's comment about incorporation and psychologism. This text had a great impact, mainly through its forceful statements about the value of Chomsky's approach (cf. Koster & Verkuyl 1983–1988). Later comments strongly suggest that the fact that Reichling was criticized was more important in itself than the exact way in which this proceeded. Moreover, Beth's arguments about heteronomy were by far the most forceful and most impressive. Later developments justify this: Linguistics has ever since benefited from being a non-autonomous discipline.

Notes

1. The correspondence between Beth and Reichling is deposited with the Evert Willem Beth Foundation (location: Rijksarchief in Noord-Holland, Kleine Houtweg 18, Haarlem).

I thank its president, Henk Visser, for his help. I also thank Paul van Ulsen for his useful information about Beth, and Theo Kuipers and two anonymous reviewers for their comments on a previous version of this paper. Relevant data about the episode discussed can be found in Verkuyl (1990), van der Beek (2001), and in two unpublished texts: Doeve (1987) and Koster & Verkuyl (1983–1988). For more information about Beth and Reichling, see Van Ulsen (2000) and Elffers (2005), respectively.

2. "Significs" was an interdisciplinary Dutch movement, existing during the first decades of the 20th century, and mainly based upon the ideas of Lady Victoria Welby (1837–1912).

3. See Koster & Verkuyl (1983–1988). My English translation, just as all those that follow.

4. E.L. Post (1897–1954), American mathematical logician.

5. This suggestion of Reichling is probably correct.

6. Beth refers here to Reichling's quotations, mentioned above, from post-*Syntactic Structures* sources.

7. Reichling (1961) was reprinted several times (1962, 1965, 1966, 1969, 2000). Two times, the Chomsky-criticism was changed and slightly mitigated. However, this was not due to Beth's influence, but to changes in the generative paradigm.

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