

Wolf Barth  
Remembering a friend and Colleague

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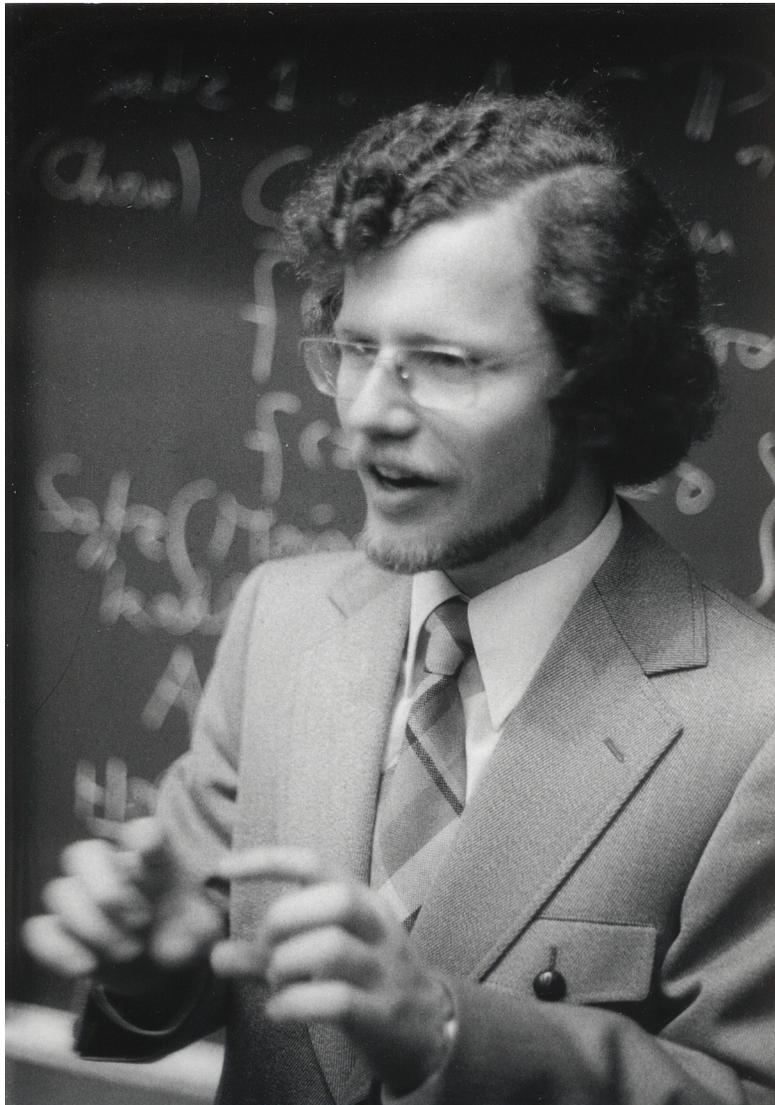


Figure 1: Picture *Konrad Jacobs*. Source: *Archives of the Mathematisches Forschungsinstitut Oberwolfach*

If you have lately visited the exposition *Imaginary*<sup>1</sup>, you have come across a nice picture of an algebraic surface with many nodes, the so-called *Barth sextic* (Fig. 2) about which I'll say more below. You may have wondered: "who is this Barth?" In this article written on the occasion of his death last December I'll sketch my relationship with him and I'll elaborate on his significance for Dutch mathematics.

Wolf Barth was born on October 20, 1942, in Wernigerode and died on December 30, 2016, in Nürnberg. He studied mathematics and physics at the university of Erlangen and had followed R. Remmert (1930–2016) to Göttingen. Under Remmert's auspices as well as that of K. Siegel's successor H. Grauert (1930–2011) he got his doctorate in 1967. When Remmert in 1967 succeeded H. Behnke (1898–1979) in Münster, Barth followed him again and stayed there for two years. He came back in 1971 for his "Habilitation", after having spent the academic year 1969/1970 at MIT, Cambridge, Massachusetts as a visiting lecturer. He subsequently came as a professor to Leiden where he remained until 1976 when, at the age of 33, he accepted an offer from the university of Erlangen-Nürnberg, and stayed there until his retirement. Brought up in the Münster school of complex analysis of several complex variables, his first interests went into that direction. The mathematics he encountered at Leiden made him shift towards complex geometry, which would become his true love. At first this meant vector bundles; later his interest also turned to surfaces and their interplay with groups.

## In Leiden

Between the years of 1970 and 1974 I was a graduate student of A. van de Ven (1931–2014). He had become professor of topology at Leiden in 1962. Wolf Barth came to Leiden to succeed W.T. van Est (1921-2002), a very amiable professor of geometry, whose inspiring lectures on algebraic topology I attended as a master student.<sup>2</sup>

Somehow van de Ven had been able to allure Barth, the most brilliant student of his friend and colleague R. Remmert, to come to Leiden as the successor of W. T. van Est. Maybe because here at the young age of 30 he was given a full professorship, a position that certainly trumped the one he had in Münster.<sup>3</sup> Barth followed in the footsteps of van Est, teaching the course on mathematical physics the latter used to do. Barth was sensitive to his duties, real or imaginary, and as usual he took his assignment very seriously and produced immaculate lectures, in particular I recall his lectures on the representations of the Lorentz group, which I attended out of curiosity. It is a subject that runs the risk of becoming rather dry, but due to the presence of the mathematical physicist Peter Bongaarts, who posed a lot of questions, the lectures became quite animated. All in all it was a great success. However, maybe due to Barth's usual high demands on himself, such an exchange with mathematical physics was never repeated in subsequent years.

Nowadays, one can hardly believe that one of the demands that came with a chair in the Netherlands consisted in delivering all lectures in Dutch. Barth took this very seriously and within a short time he spoke a perfect Dutch without any accent; he spoke it so well

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<sup>1</sup>An international exposition; the Dutch edition started last year in Eindhoven, then went to (the University of) Twente, Amsterdam, Utrecht, and will end this year in Leiden.

<sup>2</sup>Together with Alexander Rinnooy Kan we wrote a collection of exercises for van Est's course. In 1972 the latter accepted a chair at the University of Amsterdam where he remained until his retirement.

<sup>3</sup>He was "Wissenschaftliche Rat und Professor", a position that does not exist anymore. In the Netherlands it would probably be equivalent to "UD" .

that some of my contemporaries originally thought of him as Dutch. It was the language we spoke between ourselves, even in later years when Wolf had long been residing in Germany, although in later years he complained that his Dutch had become so rusty he could no longer speak it.

Thanks to Barth I was introduced to modern techniques and encouraged to use them rather than being intimidated by them. One such was spectral sequences which had never appeared inside the walls of the Leiden mathematics department before, and which Barth had used to great success in his paper [1] on vanishing among coherent sheaves on projective spaces.

Even more importantly, he gave me a lot of support. When I was struggling with Jurriaan Simonis on the double point formula, being puzzled by a suggestion of my advisor, he very much urged me to keep on trying and not just give up and ask van de Ven for assistance. It paid off, Simonis and I finally figured it out and the paper [14] was well received and played a crucial rôle in the initial stages of my career. I also owe it to Wolf's direct support that I got hired back at Leiden after my post-doc at Harvard in 1974–1975 funded by a ZWO-stipend.<sup>4</sup>

As to be expected, Barth was influenced by his senior colleague and became involved with vector bundles and wrote several joint papers with him, the most influential being [12]. Also, the topic he gave to his first and only student<sup>5</sup> in Leiden - Wilfred Hulsbergen - led to a new kind of bundles on projective spaces, subsequently named after the latter.

After his departure in 1976, Barth came back several times to Leiden. Barth's return to Leiden for the spring semester of 1990 stands out since he then took up an invitation for the prestigious Kloosterman Chair, a special chair for guest professorships named after the world-renowned number theorist.<sup>6</sup> At that time he confided to me about the time when he was a professor in Leiden: "they were the best years of my life". He especially recalled with nostalgia how van de Ven and he worked in the former's cigar smoke filled office on the article [12], nicknamed the "Babylonian vector bundles paper".

Apart from these visits, Barth also stimulated exchanges between the Dutch and German geometry school.

## Compact Complex Surfaces

Van de Ven had been thinking for some time to write a book on one of his favorite topics, complex surfaces, and suggested, it must have been around 1975, that Wolf and I would join him. After some thought we agreed, but it would take until 1984 before the resulting monograph [8] would come out. It is fair to consider Barth's participation to this project as his greatest contribution to Dutch related mathematics.

At the time of writing, technology was limited to electric typewriters with minimalist frills like the little round balls with special characters such as the Greek fonts. You really had to plan such an enormous project carefully and discuss it at every stage for its coherence, since one did not want to bother the secretary with too many new versions.

First, there was the division of labour. Wolf wrote the sections on tools of complex analysis, which Van de Ven then could use as black boxes in giving his specific proofs on

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<sup>4</sup>The "Stichting voor Zuiver Wetenschappelijk Onderzoek" was the predecessor of NWO.

<sup>5</sup>Barth was also involved in my thesis and, even more so, in that of Hans Vogelaar, where he acted as a "referent". Vogelaar was officially a student of van de Ven.

<sup>6</sup>See <http://www.math.leidenuniv.nl/nl/kloosterman/> for details on Kloosterman (1900–1968).

surfaces, while my input was Hodge theory.

I should also add that I needed to act as a mediator, van de Ven and Barth did not always get along, both having strong opinions, and it came to my lot to present compromises. Wolf, for instance, did not approve of fancy notation, as that would only suggest difficulties where there were none. This was an important point in view of the poor technology we had at that time!

Much of the discussions took place in van de Ven's office, which – as noted before – was always filled with bluish smoke, as he was an inadvertent smoker of cigars. Although upon my entrance a window was quickly opened, it did not help much. The book was such a success (yes, we did make some money out of it) that a second edition [9] was commissioned. Below I occasionally return to this joint enterprise.

## Back to Germany

Just after Wolf and Regina, his wife, left Leiden, my wife and I visited them in their flat in Erlangen. Some years later – the Barths had, like us, two children by then – our families met in Bubenreuth near Erlangen where they had built a house. On this occasion I got to know the people in the Erlangen mathematics department who just happened to have their annual outing. I was to see the Barths again in the spring of 1982. They graciously offered me to stay in their attic while Wolf and I were writing the sections on Enriques surfaces in the above mentioned book. It meant hard work at the department in the day, but in the evening beer and dinner at their place. We discussed mathematics and gossiped about our colleagues of course, but invariably other topics were touched upon such as the psychology of people, illustrated in his case by Westerns he loved to watch.

In the fall of 1982 I spent a couple of weeks in Warwick, during the festival of Algebraic Geometry arranged by Miles Reid. Then I started to delve deeper into the mysteries of Enriques surfaces and, together with Wolf, I was able to conclude this research which resulted in our paper [7]. By that time his work had become more concrete and geometrical than when he started as a student of Remmert. Several constructions for new vector bundles on projective spaces had been found by him, sometimes in connection with unexpected properties of special surfaces such as in [2] or, as in [6], written in collaboration with his first German student Klaus Hulek. For a timely report on this I refer to [3].

## Oberwolfach

As most of my contemporary colleagues, I regularly went to one of the annual or bi-annual weeklong seminars at the MFO (*Mathematisches Forschungsinstitut Oberwolfach*). Its themes ranged over all of mathematics.

Every other year in September the seminar *Komplexe Analysis* took place. It was run from 1962 until 1980 by the trio Grauert-Remmert-Stein and, as the German title suggests, its theme had been complex analysis in the tradition of the Münster school. Although in the course of the years more and more complex geometry had entered, one could still be subjected to  $\bar{\partial}$ 's in the talks. But in 1982 a division took place into a more geometrically oriented seminar and one which continued in the old tradition. In the fall of 1982 Wolf Barth replaced K. Stein (1913–2000) and he would lead the geometry faction. He also saw to it that to a greater extent than before young upcoming people should be given opportunities

to speak. He would be in charge until 1994 when J.-P. Demailly, T. Peternell and K. Hulek took over.

## Later years

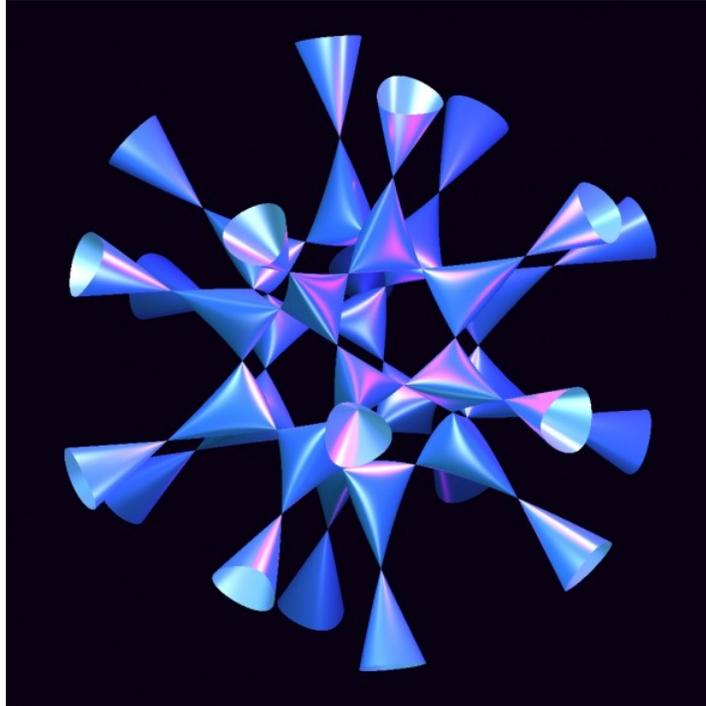


Figure 2: The Barth sextic

After the conclusion of the first edition of the book, inevitably our contacts became less frequent and also our mathematical interests diverged somewhat. I took on to Hodge theory while Wolf continued to work on concrete algebro-geometric objects; he has become especially known for the construction [4] of a projective surface of degree 6 having 65 nodes, 1 more than the maximum as asserted by Severi.<sup>7</sup>See Fig. 2. Apart from this I would also like to mention his articles with his students Th. Bauer [5], A. Sarti [11], and with S. Rams [10]. As the titles reveal, all these works are on very concrete geometric objects and their symmetries.

During the years 2000–2003 I met Wolf again regularly when preparing the second edition [9] of the book. He was still very much interested, but he wanted to be relieved of the responsibility of contributing new technical material, and instead van de Ven relegated it to the canonical choice, Klaus Hulek. We met mostly in the tower of the famous *Welfenschloß*, the mathematical institute of the home university of Hulek, Leibniz Universität Hannover. After that I did not see much of Wolf except a few times in Leiden during the meetings aptly named *Geometry in Autumn*, not only because they took place in the fall, but also hinting at the demise of geometry in Leiden after most geometers either had retired or left the country.

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<sup>7</sup>The “true” maximum is indeed 65 as shown by Jaffe and Ruberman [13].



Figure 3: Students of the last course taught by W. Barth, Erlangen 2012

Wolf would eventually divorce his wife Regina, and his life would take a new direction, although of course he always remained Wolf, maybe even more so – as illustrated by his conduct during his retirement party. Not only did he not bother to attend all the talks, but he did not even show up for the dinner that had been organized in his honor. Nobody, including the organizers, could come up with an explanation; I knew of course that in recent years his hesitation to show up at social events had only grown, but this I found to be carrying it to the extremes.

That something serious was amiss, I started to suspect when he declined an invitation to attend a memorial meeting for van de Ven in Leiden in December 2015. He excused himself that he could not travel for an extended period in a train, but only after his death did I in retrospect realize the full implication.

People who did not know him well often were put off by his briskness in delivery and directness in his opinions. But if you learned to know him, you would discover his underlying kindness and loyalty behind his somewhat forbidding and undiplomatic exterior. He cared deeply for his students; they loved him in return as demonstrated in the picture (cf. Fig. 3) I took during his retirement talk.

### Disclaimer and Acknowledgements

This short obituary does not do full justice to the mathematical work of Wolf Barth that consists of more than 50 articles, many in collaboration. For this I refer to the obituary for the "Jahresbericht der Deutschen Mathematiker Verein" that Thomas Bauer, Klaus Hulek, Sławomir Rams, Alessandra Sarti and Thomas Szemberg are writing.

I want to thank Ulf Persson and Hans Sterk for help with the redaction of this obituary; Klaus Hulek as well as Fabrizio Catanese corrected some faulty recollections. Finally, I want to express

my thanks to Wilfred Hulsbergen and Alessandra Sarti for sharing their memories of Barth and the support and interest they showed.

## References

- [1] Barth, W.: Transplanting cohomology classes in complex-projective space. *Amer. J. Math.* **92**, 951–967 (1970).
- [2] Barth, W.: Kummer surfaces associated with the Horrocks-Mumford bundle. *Journées de Géométrie Algébrique d'Angers, 1979/Algebraic Geometry, Angers, 1979*, 29–48, Sijthoff & Noordhoff, Alphen aan den Rijn — Germantown, Md., 1980.
- [3] Barth, W.: Report on vector bundles. *Proceedings of the International Congress of Mathematicians*, Vol. **1, 2** (Warsaw, 1983), 783–789, PWN, Warsaw, 1984.
- [4] Barth, W.: Two projective surfaces with many nodes, admitting the symmetries of the icosahedron. *J. Algebraic Geom.* **5**, 173–186 (1996).
- [5] Barth, W. and Th. Bauer: Smooth quartic surfaces with 352 conics. *Manuscripta Math.* **85**, no. 3-4, 409–417 (1994).
- [6] Barth, W. and K. Hulek: Projective models of Shioda modular surfaces. *Manuscripta Math.* **50**, 73–132 (1985).
- [7] Barth, W. and C. Peters: Automorphisms of Enriques surfaces. *Invent. Math.* **73**, 383–411 (1983).
- [8] Barth, W., C. Peters and A. van de Ven: *Compact complex surfaces*, *Ergebnisse der Math.* **4**, Springer Verlag, Berlin, (1984).
- [9] Barth, W., K. Hulek, C. Peters and A. van de Ven: *Compact complex surfaces*, Second edition. *Ergebnisse der Math.* **4**, Springer-Verlag, Berlin, (2004).
- [10] Barth, W. and S. Rams: Equations of low-degree projective surfaces with three-divisible sets of cusps. *Math. Z.* **249**, no. 2, 283–295 (2005).
- [11] Barth, W. and A. Sarti: Polyhedral groups and pencils of K3-surfaces with maximal Picard number. *Asian J. Math.* **7**, no. 4, 519–538 (2003).
- [12] Barth, W. and A. van de Ven: A decomposability criterion for algebraic 2-bundles on projective spaces. *Invent. Math.* **25** 91–106 (1974).
- [13] Jaffe, D. B. and Ruberman, D. : A sextic surface cannot have 66 nodes. *J. Algebraic Geom.*, **6**, 151–168 (1997).
- [14] Peters, C. A. M., J. Simonis: A secant formula. *Quart. J. Math. Oxford Ser. (2)* **27**, no. 106, 181–189 (1976).