Historical Notes 1966-1976

Garret Sobczyk
Universidad de las Américas-Puebla
Departamento de Físico-Matemáticas
72820 Puebla, Pue., México

May 4, 2020

In David Hestenes' "The Genesis of Geometric Algebra: Section 8", he writes: "Near the end of my 2-year postdoc in 1968 I began to look for a permanent academic position" [1]. The year 1968 cannot be correct, because in 1966 I had already begun work in GA at ASU with David as my thesis advisor. A couple of paragraphs further he writes, "... I had recently published two papers on Geometric Calculus in a mathematics journal, so I had many ideas on how to follow that up". Indeed, I remember going over the proofs of those papers and suggesting improvements. He then goes on to write, "For a year we had regular meetings when I gave him one good idea after another, and he came up empty each time. Then he seemed to undergo some kind of conceptual phase transformation, suddenly extracting interesting results from most of my suggestions. He quickly produced an elegant thesis, which I still regard as the best I have seen at ASU". For those readers interested in my own recollections of those years, see [2].

In the following paragraph, Hestenes writes, "After Sobczyk had finished his dissertation, in fall 1971 I arranged to teach a graduate mathematics seminar on geometric calculus with extensive problem sets graded by Sobczyk". Really, this is news to me! In 1971-1972, ASU hired me as a Visiting Assistant Professor with teaching and grading duties for my own courses. The only papers I ever graded for David was 'regrading' my own papers when he failed to understand my innovative proofs.

He then writes, "This gave me time to integrate Sobczyk's thesis with my own ideas and write it all up in three long papers, which I submitted for joint publication in a math journal. In the meantime, Sobczyk left for adventures as a postdoc in Poland behind the Iron Curtain, and I did not see him again for more than a decade".

Yes, I accepted a year's Post-Doc position with the Polish Academy of Science during the Academic year 1973-1974. In 1974 after my return from my "adventures" behind the Iron Curtain, David invited me to spend a couple of weeks with him at ASU, during which time I shared with him my new manuscript *Geometric Structures in A Certain Banach Algebra* which I had completed at

the Mathematics Institute of the University of Wroclaw, Poland [3]. My idea of a "geometric structure" allowed me to study the local properties of a differentiable manifold in the framework of linear algebra - basically continuing the work I had begun in my dissertation "Mappings of Surfaces in Euclidean Space Using Geometric Algebra" (ASU 1971) [4].

Several more paragraphs down, Hestenes writes

> "Most of the book [5] was written between 1973 and the end of 1976. Among other things, I introduced the concept vector manifold as a new foundation for geometric calculus and coordinate-free differential geometry, integrated differential forms into a more comprehensive theory of directed integrals, and developed a new approach to differentials and codifferentials for mappings and fields."

Because all of my ASU thesis [4], and many of my ideas from my Polish manuscript "Geometric Structures" [3], have been refined and usurped by Hestenes (making me into a "sounding board" and "paper grader"), I feel it necessary to call attention to my recollections of this time period [2]. My manuscript "Geometric Structures" was never published, or acknowledged by Hestenes. It is for this reason that I have scanned it and am making it available on my website for the first time. Hestenes did not even want to reference my thesis in our monograph "Clifford Algebra to Geometric Calculus: A Unified Language for Mathematics and Physics", which was only accepted for publication in 1983 although largely completed by 1976.

Since 1976, I have spent my lifetime developing many different aspects of Clifford's "geometric algebra" at the Institute of Theoretical Physics of the University of Wroclaw (1977-1983), at Spring Hill College, Mobile, AL (1983-1987), Lander College Greenwood, SC (1987-1990), UNAM-Mexico (1990-1992), and Universidad de Las Americas - Puebla, Mexico (1993-2008). Since retirement in 2008, in addition to many papers, I have written two books *New Foundations in Mathematics: The Geomtric Concept of Number* (2012) [6] and *Matrix Gateway to Geometric Algebra, Spacetime and Spinors* (2019) [7]. Also, I actively manage my publications on Research Gate.

References

[1] D. Hestenes, *The Genesis of Geometric Algebra: A Personal Retrospective*, Open Source, Advances in Applied Clifford Algebras (2016).

[2] A. Hosny Eid, **Founders of Geometric Calculus:** *An interview with Dr. Garret Sobczyk*, Published January 17, 2017, Updated Feb. 1, 2020.

https://ga-explorer.netlify.app/index.php/2017/01/17/founding-geometric-calculus/

[3] G. Sobczyk, *Geometric Structures in a Certain Banach Algebra* (125 pages), Mathematics Institute, University of Wroclaw, Poland (1974).

[4] G. Sobczyk, *Mappings of Surfaces in Euclieean Space Using Geometric Algebra*, Dissertation ASU (1971).

[5] D. Hestenes and G. Sobczyk. *Clifford Algebra to Geometric Calculus: A Unified Language for Mathematics and Physics*, 2nd edition, Kluwer 1992.

[6] G. Sobczyk, *New Foundations in Mathematics: The Geometric Concept of Number*, Birkhäuser, New York 2013.

[7] G. Sobczyk, *Matrix Gateway to Geometric Algebra, Spacetime and Spinors*, Independet publisher (Nov. 2019). Many preprints of my papers can be found on my website and ArXiv.

`https://www.garretstar.com/`