A Mathematician out of his Time: Ventura Reyes Prosper

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1. INTRODUCTION

Hormigón [1991] says that "The introduction of modern mathematical ideas in Spain was carried off mainly by three authors: Garcia de Galdeano, Torres Quevedo, and Rey Pastor." Being true the affirmation about those authors, one name at least is missing. The efforts of Ventura Reyes Prosper to introduce the new mathematical ideas in Spain were at least simultaneous in time, although maybe far fruitless.

Reyes Prosper is also worth of mention by his research work. He was the first spanish mathematician able to publish in foreign leading mathematical journals. His work was pioneering in non-euclidean geometry and, with some reservations, in mathematical logic. Besides this, the core of our interest is in that Reyes Prosper was natural from Extremadura. The first, maybe the only, outstanding scientist of this land.

2. ABOUT THE LIFE AND DEEDS OF VENTURA REYES PROSPER

Ventura Reyes Prosper was born in Castuera, Badajoz, Spain, the 31 of May of 1863. He studied Natural Sciences at the University of Madrid. The scholastic curriculum reads [cf. Gaceta de Madrid 229, August 16, 1880; pp. 499 – 503]:

The Faculty of Sciences is divided into three sections: Physics-mathematics, Physics-chemistry and Natural Science. (Art 32) Common to the three sections are: Mathematical Analysis, Geometry, Analytic Geometry, Chemistry, Physics, Natural History, Cosmology and Physics of the world, Linear and topographic design ...

and then it follows a description of the curriculum for the three sections and doctoral studies. Reyes Prosper obtained two titles: Graduate (which could be obtained at any University) and Doctor (which should be obtained at Madrid) with the highest qualification: Extraordinary Prize. His thesis, entitled *Catalog of birds of Spain and Baleares Islands*, was considered so important that was incorporated to the library of the British Museum. According to Rey Pastor, Reyes Prosper was expert in many fields: naturalist and archeologist, author of important investigations about molluscous, birds and fossils, for which he obtained prestige in Europe; he formed part of the Permanent International Ornithological Committee during the International Congress of Budapest; in 1898 he was nominee as member of the Physical Society of the Imperial University of Kasan (Russia). He also was member of the Astronomical Society of France. Besides this, and especially important to understand the development of his mathematical life, he knew many languages: he mastered french, german, english, russian, swedish, greek and latin. His mathematical works, a discipline where he was self-educated, earned him recognition as an outstanding scientist of the 19th century and one of the best spanish mathematicians of his time.

Reyes Prosper discovering of mathematics took place during a leisure travel through Germany in 1887 with his brother. There, he met Felix Klein, with whom he made friendship, Ferdinand Lindemann and some other geometers. Not strange at all is that Reyes Prosper's further studies stand out in mathematical logic and non-euclidean geometry. He also wrote some biographies of mathematicians.

After some pilgrimage through several institutes, he won his first position as full professor of natural history at the Instituto of Teruel (22 January of 1891). The second position as full professor of mathematics was won at the Instituto of Albacete (28 June 1892). He further obtained a full-professorship on Physics and Chemistry at the Instituto of Jaen; then moved to the Instituto of Cuenca until he won in 1907 a position as full professor of mathematics at the Instituto of Toledo. The same year he promoted to director of the Instituto, a position he hold until his death. He tried to obtain a position as full professor of mathematics at the Instituto de Badajoz, but he never succeeded.

Reyes Prosper died at Toledo, the 27 of November of 1922.

Official recognition in Spain only arrived to him in the following forms: he was elected member of the Real Academia de Ciencias Exactas, Físicas y Naturales de Madrid and of the Real Academy of Sciences of S. Fernando. In 1903 he was appointed as Comendador de la Orden de Alfonso XIII, and in

1913 promoted to Vocal of the Real Sociedad Matemática Española.

To reasonably ponder what a person has reached one must take into account what he did, when and where he did what he did, and how he did it. Putting all into balance, Reyes Prosper did what only a genius can do. It is true that, regarding mathematics, he just published ingenious notes, but he was the first one to do that. This attitude of "modern publishing," perhaps his most valuable legacy, was transmitted to R. San Juan (who, not many years after, published some notes in Acta Mathematica) and Rey Pastor.

It is difficult to give a slight idea of what intellectual life was (was not, should be said) for what mathematics is concerned in Spain about that time. Creation and thinking were out of place: it was believed that the duty of a Professor was to study mathematics, not to do mathematics. In this context, very few persons had original mathematical ideas in Spain and, if so, they preferred to disguise them in their texts: like E. Torroja or M. Vegas. Reyes Prosper, however, "was proud to have correspondence with colleagues in Germany or Russia, and courage to travel to talk with them," citing the warm words of Rey Pastor. The different attitude towards research is the reason for such an admiration; in words of L.A. Santaló [1975]: "At the end of 19th siecle and beginnings of 20th there were three mathematicians in Spain who influenced the formation of Rey Pastor: Zoel García de Galdeano, Ventura Reyes and Eduardo Torroja." And then adds: "He [Reyes Prosper] was possibly the first spanish mathematician who published papers in an international journal of high quality. There is no doubt that this way of "publishing outside" strongly influenced the future of Rey Pastor."

The main reason for the slow, but steady, vanishing of his research work (and in general, of his creative activity) can be identified without doubt as the lack of "mathematical feedback" from his (spanish) colleagues and of social "echo" from his community. It is true that the international mathematical community gave him a place, as can be proved by his correspondence, mathematical publications and belonging to foreign Societies. Nevertheless, all this could not overcome the sense of isolation he increasingly felt his last 30 years.

In conclusion, if Reyes Prosper should be ranked, in absolute, as an average mathematician, he must be qualified as a genius precisely because he was an average mathematician living in the Spain of the XIX siecle.

Introducing New Mathematics?

Rey Pastor defines the spanish mathematician of that time as one "who is, given two mathematical books, able to write a third." Besides the good sarcasm enclosed in this assertion, he was right. And one should even add that almost all of those books were "translated" (i.e., plagiarized) from french books. Indeed, in that moment mathematics were made in France, Germany and Russia.

Reyes Prosper steps aside of this way of doing basically because of his knowledge of languages in combination with a keen intuition. For instance, during his "habilitation" in 1888, the committee should startlingly hear the following (cf. Val [1973]):

In this program I try to introduce those modifications that in France, Italy, Great Britain, Russia and, especially, Germany are standard. Mathematicians do not work to increase the science for nothing: it is necessary to explain their new discoveries. I tried, moreover, to be extremely concise is simple matters, because it is well known that the can be learnt in very few time.

The proposed program started with "the ideas of Carmichel, Staudt, Gauss, Lobachefski, Riemann, Bolyai, etc." It included substitution theory (determinants), following Cauchy and Galois. The geometry part was devoted to the theories of Lobachefski and Bolyai, and based on works of Staudt, Klein and Pasch: euclidean geometry was explained as a particular case of "pangeometry", a term that included non-euclidean geometry. His commitment with "modern" logic was not only divulgation through his mathematical papers as we shall see, he taught Boolean logic in classroom. Consequently, the program devoted three lessons to *"the algorithms of logic, after Boole, Grassmann, Peirce and Schroder."* And all this dressed up with a plethora of historical and bibliographical references so that the student could place theories into their context.

Obviously, he did not get the position. In fact, he never obtained a position at University.

Logic Works

It is well known that research in mathematical logic in Spain has been very scarce; this should be taken with some reservation regarding some works of Pedro Hispano and Raimundo Llulio, in the 13th century, and the work, still not completely understood, of the scholastic school in 17th century.

So, we can properly say that Reyes Prosper introduces modern logic in

Spain. It has been told that Cortazar had some lecture notes about mathematical logic "that maybe some day can see the light," but the true fact is that Reyes Prosper publishes seven papers on the topic between 1891 and 1894 in El Progreso Matemático (the mathematical journal founded and published in Zaragoza by Zoel García de Galdeano). Four of these (are mainly biographical or historical: about Cristina Ladd-Franklin [14], Ernest Schroeder [15], C.S. Peirce and O. Mitchell [16] and about the symbolic logic in Italy [19]. These notes show that Reyes Prosper, a scholar in every field he got interest, was also perfectly aware and update of what happened in logic. The final outcome of this activity should have been his History of Symbolic Logic, a project that Reyes Prosper mentions in [17]. Indeed, this curious paper, intended to be the previous work for that book, proposes a classification of writings on symbolic logic. The classification, or better the project of classification, is: Pre-Boolean, Boolean, "Peircean," IV, Relatives, Of linking between absolutes and relatives, Applied. A final suggestion is to open two more groups for papers about machines and logical diagrams; and another one for History of logic. The other two notes, which to some extent qualify as pre-research papers, are:

A new way to think about Arithmetic [18], where Reyes Prosper recovers Kronecker's point of view as follows: "The only thing that the Analysis needs ... is the concept of integer; all the rest can be built on this. "Besides, he lays the foundations of arithmetic, with Peano, in that "the laws that govern numbers are direct derivations of those governing the human thinking." The paper ends with a nice argumentation for those asking for practical benefits that Hardy should have been glad to know: *Worshipers of goddess should not look for the woman inside* (Schiller).

Machine reasoning [13] describes the working of what will become Turing machines. In fact, what he describes is more a pocket calculator, but ... Many historical comments show, as always, to what extent Reyes Prosper was willing to know about the topics he got involved.

3. NON-EUCLIDEAN GEOMETRY

When we pass to describe the work of Reyes Prosper in Geometry, we stand on a higher ground; his contributions have a remarkable standard, his papers are truly mathematical papers published in serious mathematical journals, and his work of ripping new mathematical ideas in Spain deserves recognition.

Hormigón [1984] says that it was García de Galdeano who introduced non-euclidean geometry in Spain. We rather think, following San Juan, that Reyes

Prosper deserves an exaequo qualification. This opinion is supported by some facts: Galdeano's pioneering work is, according Hormigón, his 1896 paper "Las modernas generalizaciones expresadas en el Algebra simbólica, las geometrías no-euclídeas y el concepto de hiperespacio" published in *El Basilisco*, while Reyes Prosper published in 1894 an article in *El Progreso Matemático* entitled "Breve reseña histórica de la geometría no-Euclídea especialmente en dos y tres dimensiones," where he concise but masterly surveyed the origins of non-euclidean geometry.

From 1887 to 1910, Reyes Prosper publishes ten papers, two of them in the Mathematische Annalen, on non euclidean geometry. Accordingly with Val [1966] and San Juan [1950], they were read and cited by many authors: Gino Loria, Schur, Burkhardt, Bonola, Pasch, Simon, Schroder ... Let us excerpt a letter from M. Pasch to Ventura Reyes, quite defining of what the work of Reyes Prosper was:

On improper lines and planes

You show in the simplest way the:

THEOREM. *When the rays $\alpha\beta\gamma\alpha'\beta'\gamma'$ pass through one proper point and the planes $\alpha\alpha'$, $\beta\beta'$, $\gamma\gamma'$ intersect in a line then the intersecting lines from the planes $\beta\gamma$ and $\beta'\gamma'$, $\gamma\alpha$ and $\gamma'\alpha'$, $\alpha\beta$ and $\alpha\beta'$ are contained in one plane.*

The considerations by which I have introduced the improper lines and planes in my "Vorlesungen uber neue geometrie" can be greatly simplified when they are preceded by your proofs.

A fairly detailed account of Reyes Proper's papers on geometry can be seen in Cobos [1994].

4. The Works of Ventura Reyes Prosper

GEOMETRY

1. Sur la geómetrie non-Euclidienne, *Mathematische Annalen*, **29** (1887), 154 – 156.

2. Sur les propiétés graphiques des figures centriques (Extrait d'une lettre adressé a Mr. Pasch), *Mathematische Annalen*, **32** (1888), 157 – 158.

3. Nota acerca de la geometría proyectiva sobre la superficie esférica, *El Progreso Matemático*, **13** (1892), 7 – 10.

4. Resolución de un problema propuesto por Jacobo Steiner, *El Progreso Matemático*, **17** (1892), 147 – 148.

5. Recensión de Dodgson [Lewis Carroll] "Curiosa mathematica, A new Theory of Parallels, London, 1890, 3rd edition" , *El Progreso Matemático,* **21** (1892), 265 – 266.

6. Breve reseña histórica de la Geometría no-Euclídea, especialmente de dos y tres dimensiones, *El Progreso Matemático,* **37** (1894), 13–16.

7. Algunas propiedades referentes a los sistemas de círculos, demostradas sin el auxilio de relaciones métricas ni del postulado euclídeo, *El Progreso Matemático,* **39** (1895), 205 – 208.

8. Nueva demostración de las fórmulas trigométricas de un ángulo a la suma o diferencia de dos dados, *Archivos de Matemáticas Puras y Aplicadas,* **5** (1896), 89 – 91.

9. Nota sobre un punto de geometría no euclídea, *Archivos de Matemáticas Puras y Aplicadas,* **3** 1897, 44 – 47.

10. Note sur le théoréme de Pythagore et la géométrie non-Euclidienne, *Bulletin de la Societé physico-mathematique de Kasan,* Deuxiéme Série **1** (1897), 67 – 68.

11. Nota de dos demostraciones nuevas de proposiciones trigonométricas, *The Educational Times,* **1** 1910.

12. Restitución de una de las obras perdidas de Euclides, *Revista Matemática Hispano-Americana,* **10** (1919), 323 – 325.

Logic

13. El raciocinio a máquina, *El Progreso Matemático,* **9** (1891), 217 – 220.

14. Cristina Ladd-Franklin, matemática americana y su influencia en la lógica simbólica, *El Progreso Matemático,* **12** (1891), 297 – 300.

15. Ernerto Schröeder. Sus merecemientos ante la lógica, su propaganda lógico-matemática, sus obras, *El Progreso Matemático,* **14** (1892), 33 – 36.

16. Charles Santiago Peirce y Oscar Howard Mitchell, *El Progreso Matemático,* **18** (1892), 170 – 173.

17. Proyecto de clasificación de los escritos lógico-simbólicos, especialmente de los post-booleanos, *El Progreso Matemático,* **20** (1892), 229 – 232.

18. Nuevo modo de considerar la aritmética, *El Progreso Matemático,* **25** (1893), 23 – 26.

19. La lógica simbólica en Italia, *El Progreso Matemático,* **26** (1893), 41 – 43.

Biographical

20. Wolfgang y Juan Bolyai. Reseña bio-bibliográfica, *El Progreso Matemático,* **38** (1894), 37 – 40.

21. Nicolas Ivanovich Lobacheski. Reseña biográfico-bibliográfica, *El Progreso Matemático*, **36** (1893), 321–324.

22. La obra científica de Seki y sus discípulos, *Revista de la Real Academia de Ciencias Exactas, Físicas y Naturales*, **1** (1904), 251–254.

23. Juan Martínez Silíceo, *Revista de la Sociedad Matemática Española*, **5** (1911), 153–156.

OTHER

Catálogo de las aves de España, Portugal e Islas Baleares, *Anales de la Sociedad Española de Historia Natural*, tomo XV, Madrid 1886, pp. 5–109. Also reprinted with the footnote: Madrid, Imprenta de Fortanet, calle de la Libertad, n. 29, 1886. Lista de los moluscos recogidos por el doctor Osorio en Fernándo Poo y en el Golfo de Guinea, *Anales de la Sociedad Española de Historia Natural*, 15 (1886) 340. Dos toledanos ilustres en la luna, *Boletín de la Sociedad Arqueológica de Toledo*, 1 (1900) 4–5. Nuevas noticias acerca del astrónomo toledano Arzaquel, *Boletin de la Sociedad Arqueológica de Toledo*, 6 81900) 124– . El pavo real en la ornamentación mudéjar, *Revista semanal de arte de Toledo*, 27 (1916) 213. Los viejos árboles de la vetusta Toledo, *Revista semanal de arte de Toledo*, 32 (1916) 253–. El laurel de la casa de Becquer en Toledo, *Revista semanal de arte de Toledo*, 182 (1922) 329–.

5. EPILOGUE

Following San Juan, who was his disciple in Toledo, Reyes Prosper was a good man who loved the poor; he points out a sentence of Reyes Prosper: "If a powerful calls me, I attend but I do not knock at powerful's doors since I do not need them." It should be added to complete the picture that Reyes Prosper gave lessons several times on different topics to recluses in the jail of Toledo. Maybe these words show the great love that Prof. S. Juan felt by his master.

Paraphrasing the poet Antonio Machado (cf. Poesías Completas, Espasa Calpe, 9ª ed, Madrid 1970; Campos de Castilla (Portrait) p.132), Prof. Reyes Prosper would surely have said about himself

There are in my veins drops of jacobin blood [mathematics]
but my verse [science] *blossoms from quiet spring*
and, more than a accommodated man [scientist] *who knows his doctrine*
I am, in the good sense of the word, good.

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