Forschungsprojekt [DFG Projekt: 530000455]

Research interests

My research, broadly construed, addresses the history and philosophy of mathematics in the pre- and early modern periods. My current work explores the interactions between practical and theoretical geometry within the early modern Euclidean tradition. Among my earlier and more recent topics of research is the status and development of practical geometry in the Middle Ages and early modern era; the relationship between mathematics and natural philosophy within the Florentine Accademia del Cimento (1657-1667); the role and status of motion in Euclidean geometry from Antiquity to the early modern period; the epistemological status of mathematics in sixteenth-century France and Italy; as well as the epistemological status of astronomy in medieval and Renaissance commentaries and adaptations of Johannes Sacrobosco's *De sphaera*.

Research project

My current research project is part of the Franco-German collaborative project *EUCLIDES, Euclid in the Modern Age: A History of Cross-Cultural Transmissions, Translations and Transformations of the Elements*, divided between Paris (CNRS-SPHère, with Dr. Vincenzo De Risi as PI) Wuppertal (IZWT) and funded by the ANR and the DFG. Members of the Wuppertal team count Prof. Dr. Volker Remmert and Prof. Dr. Thomas Morel.

Project EUCLIDES (2024-2027)

The project *EUCLIDES. Euclid in the Modern Age* is a scientific project funded by the ANR (Project number ANR-23-FRAL-0012) and the DFG (Project number 530000455) in the framework of the Franco-German international research program and based in Paris (CNRS-SPHère) and Wuppertal (BUW-IZWT).

This project aims at providing a wide-ranging investigation of the cultural, social, scientific and epistemological impact of the diffusion of Euclid's *Elements*, the most important and widely circulated work of classical mathematics, in Europe from the 16th to the 19th century. By studying its transformations throughout its editions, translations and commentaries and its pedagogical and practical uses, the international research team involved in the project seeks to establish an overarching and interdisciplinary narrative regarding the modern tradition of the *Elements* and its unparalleled impact on the history of science, knowledge and culture.

The main objectives of the project are: (1) the analysis of the transformations of the text and diagrams of the *Elements* throughout its printed tradition and the way these reflected changes in the history of mathematics and of epistemology in the modern era; (2) the study of the diffusion and uses of the Elements in pedagogical and professional contexts in early modern Europe and their impact on the transformation of Euclid's text; (3) the establishment of an open-access database to navigate the printed editions of Euclid's *Elements*.

The analysis in (1) will show how the logical and epistemological constraints that governed the mathematical discourse (i.e. its principles, the structure of its demonstrations and its diagrams) evolved over time and transformed Euclid's text and its role in the definition of the ideal of scientific knowledge.

The analysis in (2) will show how the interaction between the *Elements* and practical mathematical knowledge, as well as the diffusion of Euclid's work in vernacular languages throughout Europe (which was crucial to its transmission within lay and professional contexts), impacted the content and uses of the *Elements* as well as the image of Euclidean mathematics in different social, institutional and cultural contexts. The study of the adaptation and

promotion of Euclid's Elements according to new pedagogical standards will provide a better insight on the changes operated in early modern Europe in mathematics and theories of education, as on the changing place held by mathematics among the sciences.
The last objective (3) will be constituted according to the principles of "green open access" and will allow scholars as well as non-experts to gain a both detailed and large overview of how Euclid's Elements evolved over time and to obtain quick answers to specific questions on the printed European Euclidean tradition.

Detailed description of the project developed in Wuppertal

The part of the project conducted in Wuppertal aims to investigate the interactions between practical mathematics, professional mathematical knowledge, and Euclid's *Elements*, both within the Euclidean corpus and in practical geometry treatises and artisans' handbooks, during the early modern era.

In the 16th century, numerous editions of Euclid's *Elements* (both Latin and vernacular) integrated features typical of practical mathematics, particularly practical geometry. This tradition provided a hands-on, empirical form of geometrical knowledge, allowing for a numerical and more concrete consideration of magnitudes. These characteristics contrasted with the more theoretical methods canonically associated with Euclid's *Elements*, regarded since the Middle Ages as the epitome of theoretical geometry. The incorporation of practical approaches in these editions reflects a growing interest among early modern authors and their readers in more applied forms of Euclidean geometry. This interest persisted beyond the 16th century, as evidenced by 17th-century editions and commentaries of the *Elements*—notably in the vernacular tradition—that explicitly aimed to adapt Euclid for practical use. Examples include Pietro-Antonio Cataldi's *I primi sei libri de gl'Elementi d'Euclide ridotti alla Prattica* (1620) and Lucas Brunn's *Euclidis elementa practica* (1625).

One of the primary objectives of this project is to assess the extent and evolution of the practical treatment of Euclid's *Elements* in the early modern era. This includes examining the motivations behind this practical adaptation and its effects on the visual and textual content of the *Elements*, its logical structure, epistemological status, and relationship to practical knowledge.

Given that Euclid's *Elements* had been a part of elementary education since Antiquity, and considering that the rapid development of numeracy and literacy in the early modern period expanded the scope and ambitions of educational institutions, this project also aims to explore how mathematics professors—editors, translators, and commentators of Euclid—adapted their teaching of the *Elements* to meet the needs of these new institutions and audiences, notably by offering a more practical and reader-friendly reading of the *Elements*.

Simultaneously, there was a rise in early modern textbooks on practical or professional mathematics, in both printed and manuscript form, predominantly written in the vernacular. These works often incorporated selected principles and propositions from the *Elements*, adapting them to suit the style, purpose, and audience of these texts. This contributed to a convergence between Euclidean geometry and practical geometry that reflected changes in the role and representation of Euclidean geometry in lay and artisanal contexts. Therefore, the project also examines the dissemination of Euclidean content within practical and professional mathematical contexts, the motivations behind this integration, and the way Euclidean principles were transformed to accommodate the needs of these audiences.

Moreover, as vernacular languages increasingly replaced Latin in 17th-century editions and commentaries of Euclid's *Elements*, this project seeks to establish the relationship between the use of vernacular languages and the pedagogical and professional applications of the *Elements*.

This includes analysing the impact of vernacular diffusion on the logical structure, terminology, and readership of Euclid's work.

Additionally, the project aims to address the evolution of the visual language used to convey Euclidean geometrical concepts in pedagogical contexts. This includes the use of geometrical diagrams, models employing folded paper to represent three-dimensional solids (as in Billingsley's 1570 edition of the *Elements*), and illustrations of geometrical instruments. The visual strategies used to represent and promote Euclid's *Elements* and geometry in various social and institutional contexts—such as the frontispieces of Euclidean editions and other mathematical treatises—are also essential to investigate within this framework.

Workshops organized within the project in Wuppertal:

22-23 May, 2025: *Euclid's Elements and Practical Mathematics in Early Modern Europe*, BUW/IZWT, Kasinostr. 19-21, 42103 Wuppertal & online