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RESEARCH ARTICLE

Examining Mehrtens' (Counter)modernism in captivity: On Bernard d'Orgeval's mathematical research in the Oflags

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Argument
What kind of mathematical research activities took place in prisoner of war camps in Germany during the Second World War? And can one inspect such activities in order to re-examine, on the one hand, Herbert Mehrtens' analysis of the modernism/counter-modernism divide of early twentieth-century mathematics, and on the other, his research on the instrumentalization of mathematics during the war? Closely examining the work carried out in the field of algebraic geometry by the French mathematician Bernard d'Orgeval, who was held in three of such camps between 1940 and 1945, the paper aims not only to unfold this unique episode in the history of mathematics, presenting it as an ephemeral configuration, but also to show the limitations of Mehrtens' approach and the narrative of modern and counter-modern mathematics.

Keywords: Herbert Mehrtens; Bernard d'Orgeval; Mathematics in the Oflags; ephemeral configurations; History of Algebraic Geometry

Herbert Mehrtens is well known for his research on the positions taken by scientists and the ways in which scientific (and more specifically mathematical) competence was mobilized or self-mobilized in the run up to and during the Second World War, both in and outside the National Socialist state.[1] In one of his papers on this subject, "Irresponsible Purity," published in 1994, Mehrtens notes an episode of a forced integration of mathematical competence in National Socialist Germany, one he elaborates on in a later paper when he describes two cases of such "mobilization . . . , related but opposite to 'self-mobilization': the exploitation of scientific slave labor" (Mehrtens 1996a, 118). One of these cases takes place in a concentration camp set up in Sachsenhausen, Oranienburg. Here Mehrtens notes that the prisoners there "were not 'really' employed as scientists," but that, "in order to give the impression that the individuals concerned are really working as scientists," it was concluded that the scientists should be given privileges, such as wearing civilian clothes for work (ibid., 120). Mehrtens, however, asks: "are suitable privileges sufficient to allow the scientist to feel 'like a scientist' and to carry out his work satisfactorily? Is the concentration camp here like a microcosm of the world . . . ?" In answer, he concludes that "this story is at least characteristic in so far as the power relationships here are crassly asymmetric, but not completely one-sided" (Mehrtens 1994, 334).

When considering how mathematics was both instrumentalized and researched within the camps, one may ask whether there were other examples of "privileged" mathematicians who had

[1]To name only a few, see the papers Mehrtens 1989; 1994; 1996a, and Mehrtens and Richter 1980. On the inverse situation—mathematicians emigrating from Germany and Europe during the Nazi era—see Siegmund-Schultze 2009.

to accommodate their mathematical work or research due to the war, working, for example, in captivity. Alongside cases of the exploitation of scientific slave labor, in other camps in Germany there was, as we will see in this paper, another type of mathematical activity carried out by "privileged" mathematicians in German captivity, namely mathematical research led by foreign officers, an activity which is neither noted nor discussed by Mehrtens. These mathematical research activities occurred in several of the numerous camps erected in Germany known as *Oflags*, from the German *Offizierslager*. These camps were prisoner of war (POW) camps for officers, separated according to the nationality of the prisoners.[2]

According to the Geneva Convention, POWs were not required to work. Consequently, in numerous Oflags, "universities" or "study centers"—later also termed "barbed-wire universities"—were opened. These "universities" organized courses, lectures, and exams, and even granted degrees that were partially recognized after the end of the war. Due also to the cooperation of the Vichy regime with Nazi Germany, the French Oflags constitute a unique case study. This paper will concentrate on these Oflags and their universities, asking, to rephrase Mehrtens's question: to what extent, with regard to the mathematical research taking place at these "universities," were such "universities" "a microcosm of the world"? And, furthermore, if they were such a microcosm, can the mathematical research done there be classified in any way under Mehrtens' scheme of modern and counter-modern mathematics, a scheme presented in his book *Moderne—Sprache—Mathematik*?

While in the following it will become clear that these universities are a reflection of certain privileges given to scholars and researchers who were POWs, and of the power relations between France and Germany, the mathematical research activities in these French Oflags necessitate a reexamination of Mehrtens's narrative of modern and counter-modern mathematics.[3] In the following, I will therefore focus mainly on the work carried out in the field of algebraic geometry by the mathematician Bernard d'Orgeval,[4] who was held in three Oflags between 1940 and 1945.

D'Orgeval was doing his PhD in algebraic geometry in Paris and in Rome before the Second World War. After being taken captive, he managed between 1942 and 1943 to publish several mathematical articles, as well as his PhD thesis in mathematics, while working in various Oflags. His mathematical work demonstrates, on the one hand, how the Oflags were a scene in which the power relations between Nazi Germany and the Vichy regime manifested themselves. On the other hand, d'Orgeval's mathematical research exemplifies that Mehrtens' differentiation between modern and counter-modern mathematics must be revised when examining concretely ephemeral, local mathematical configurations. This is also the reason why this paper focuses on d'Orgeval and not on other French mathematicians in the Oflags. As we will see, these two strands (mathematicians in the Oflags and the reexamination of the modern/counter-modern thesis) are interlaced and cannot be separated easily, which is also the reason I chose to present them together.

In the first section of this paper, I briefly review Mehrtens' modern/counter-modern dichotomy and the critiques expressed concerning it, underlining Mehrtens' ignorance of ephemeral configurations, a term which I explicate below. One such configurations is the research of d'Orgeval in the Oflags, which is discussed later in the fourth section. The second section moves on to describe the general social and political background. My focus in this section is on the universities at the Oflags, especially the French Oflags. It includes a brief presentation of the work

[2]The Oflags were designated by a roman numeral representing their region and by a letter to differentiate them when there were several in the same region.

[3]For other accounts that address the limitations of Mehrtens' approach, see also the contributions by David E. Rowe, Lukas M. Verburgt and Laurent Mazliak, and Moritz Epple in this volume.

[4]Bernard d'Orgeval is also known as Bernard d'Orgeval Dubouchet. However, in all the publications cited, his name is given as Bernard d'Orgeval.

of Jean Leray in Oflag XVII A, while also showing—in a broader context—how the Vichy regime used the Oflags and their universities for purposes of propaganda. The third section turns to d'Orgeval's activities and research during the interwar period and at the Oflags. Already in this section one can see how Mehrtens' narrative on modern and counter-modern mathematics may need a reexamination, especially if one considers French mathematicians during the interwar period and their connections with the Italian school of algebraic geometry. The fourth section turns to d'Orgeval's mathematical work itself—d'Orgeval at the time was specializing in algebraic geometry—in order to see whether and how it may be considered as either modern or counter-modern. This section begins with an overview of the history of the developments of algebraic geometry in the first decades of the twentieth century, stressing the various modern and counter-modern currents. I then turn to unfold d'Orgeval's unique ephemeral configuration, a configuration that he developed at the Oflags. As we will see, this configuration not only consisted of a combination of modern and counter-modern elements, it also calls into question the extent to which these positions were necessarily linked to (his) political positions.

1. Modern, counter-modern and ephemeral configurations

In his book *Moderne—Sprache—Mathematik*, Mehrtens reconstructs the changes and developments undergone by mathematics at the end of the nineteenth and the first half of the twentieth century on the basis of two polarizing terms: "modernity" and "counter-modernity." "Modernity" here is understood to mean pure mathematics, that is, a purely formal symbolic language of mathematics. According to Mehrtens, the mathematicians termed "modern"—such as Cantor, Hilbert, or Hausdorff—emphasized the autonomy of mathematics, an autonomy which calls for an internal ontology, one that grounds the existence of mathematics' objects in the procedures of an internal mathematical work. Mathematics consists of a symbolic language, and Mehrtens introduces Dedekind's conception of numbers as a paradigmatic example (Mehrtens 1990, 36–37) according to which the concept of a number (as well as all the mathematical concepts based on it) is a human creation. With this definition, the identity of things is made equivalent to the identity of written language signs.

"Counter-modernity," on the other hand, is understood to refer to the approach advocated by Felix Klein of bringing mathematics closer to applications and, for this purpose, of instrumentalizing its representational-visual side. Poincaré and Brouwer are also counted amongst the "counter-modern" mathematicians. Klein insisted on how mathematics may be used in science, and he underlined the importance of intuition and *Anschauung*: "On the counter-modern side *Anschauung* and intuition (in a non-visual sense) stand for recourse to a 'higher' authority granting objectivity and truth, while modernism claims creative freedom independent of any outward source: mathematics is [according to Dedekind] 'the free creation of the human mind'" (Mehrtens 2004, 293). Mehrtens illustrates his new interpretation of mathematics in this period with an examination of the language employed, showing that the way of speaking, the form of expression and of the declarations provide clues as to which side the mathematician was on.

As Mehrtens claims clearly in his book, behind the adoption and adaptation of counter-modernism by German mathematicians lies a political position, that of National Socialism, though obviously this position cannot be applied to all counter-modern mathematicians. This interpretation was new and pioneering, as it highlighted the various social, ideological, and political influences and constraints on mathematical research configurations and institutions, which were certainly Mehrtens' focus when researching mathematics in Germany during the Second World War. Nevertheless, Mehrtens' account was criticized from several points of view. First, as Jeremy Gray notes, the "explanations of major social movements [modernism and counter-modernism as presented in *Moderne—Sprache—Mathematik*] do not sit comfortably with individuals and their actions, and while Mehrtens does well to give his central figures the

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autonomy they have, ultimately they are small parts of a machine that seems to have a logic of its own" (Gray 2008, 11). After discussing several instances of influence, relations, and cooperation between modern and counter-modern mathematicians, Gray stresses that it "ceases to be obvious that the dance of modern and counter-modern lines up very well with the grander cultural clash of modern and traditional" (ibid., 12). Second, Gray argues that "the book's tight focus on Germany is unfortunate," since it immediately begs the question: "What, for example, was the contemporary situation outside Germany?" (ibid.). This question, which Gray attempts to answer in his book (Gray 2008), is also addressed in the present paper, since this paper deals not only with d'Orgeval, one of the French mathematicians held in the Oflags in Germany, but also, though more implicitly, with French mathematics during the interwar period.

A third critique was expressed by Moritz Epple, who asks: "Was the struggle between moderns and counter-moderns only a meta-mathematical drama, staged for reasons of self-interpretation and disciplinary politics? Or does the conflict also manifest itself … in the research activities and programs, in the mathematical writings of the period under consideration?" (Epple 1997, 191). While "Mehrtens is silent on this point" (ibid., 192), Epple calls for a thorough examination of the mathematical research practices themselves, focusing on Emil Artin's research on the braid group in the 1920s, and concluding that in Artin's configuration—and probably in many other mathematical configurations from this period—one finds a combination of counter-modern and modern elements. The present paper sets out to unfold d'Orgeval's research—or, more precisely, d'Orgeval's epistemic configuration—which was carried out in relative isolation, asking whether this can be classified as exclusively either modern or counter-modern.

What is meant by an "epistemic configuration"? Epple introduces this notion in his paper on knot Invariants in Vienna and Princeton during the 1920s (Epple 2004), and I follow his definition: an epistemic configuration can be defined as an array of epistemic mathematical objects and of techniques developed to study these objects. Such a configuration constitutes a space of research, being dependent on time and place, which stresses the dynamic character of the research done, a dynamism very much inherent to epistemic objects themselves. As the paper will claim, d'Orgeval's research activity in the Oflags constitutes such a configuration, one that was shaped and influenced by physical, social, and political factors (the Oflag, the creation of the universities, the Vichy regime) and by mathematical developments (the Italian school of algebraic geometry, French mathematics during the interwar period). Nevertheless, d'Orgeval's configuration, which formed at the Oflags, was short-lived, or, more precisely, ephemeral. Here I employ Catherine Goldstein's notion of an "ephemeral configuration." According to Goldstein, ephemeral configurations are configurations which arise at a "smaller scale, [when] specific opportunities at specific times, putting mathematicians in close contact with certain milieux, have hosted particular, sometimes unexpected, mathematical work." "This," Goldstein notes, "is, by definition, ephemeral in the sense that it implies links with social situations which have their own time scale and are most certainly not 'eternal truths'" (Goldstein 2018, 489–490). Along with Mehrtens' almost complete omission of French and Italian mathematicians in *Moderne—Sprache—Mathematik*,[5] here one may detect another "blind spot" in his book: the omission of such ephemeral configurations and their unique time scale.

This paper therefore aims to focus on d'Orgeval's work before and during his captivity in the Oflags as an example of such (ephemeral) configurations, a case study which necessitates not only a reexamination of Mehrtens's opposition between modernity and counter-modernity, but also a further elaboration of Mehrtens's thesis on mathematics in captivity and on the imprisoned mathematicians' cooperation with and mobilization by the National Socialist state during the Second World War. Hence, I pose the more general question—one that reaches beyond the scope of the current discussion—of the general characteristics of the mathematical research carried out

[5]Among the few French and Italian mathematicians discussed, *Moderne—Sprache—Mathematik* deals mainly with Poincaré, Bourbaki, and Peano.

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by POWs in the various Oflags. By inspecting d'Orgeval's configuration in detail, I aim to offer a way to examine the mathematical practices themselves in the Oflags, and how these practices may be considered as modern/counter-modern. But in order to do this, I must first present the social and political background of d'Orgeval's research, which is the topic of the next section.

2. Mathematicians at the French Oflags

Before describing d'Orgeval's mathematical career and research up to and during his captivity, I would like first briefly to review the "universities" operating in the various Oflags during the Second World War, and especially the (French) mathematicians working there. This will provide the background necessary to understand d'Orgeval's research activity. Hence, I will start with an examination of the French Oflags and the mathematicians who were held there, taking into closer consideration Jean Leray, one of the best known French mathematicians to have been held in the Oflags, who was held in Oflag XVII A. I question to what extent Leray's working conditions and research at the Oflags can be seen as representative. To situate the founding of these universities in the broader political context, I will then take a brief look at the influence of the Vichy regime, which exemplifies, as we will see, the uneven power relations existing at these camps.

As was noted above, in most of the camps "university centers," also called *Lageruniversitäten*, were set up. In these, prisoners gave and attended courses and lectures, and groups of academically interested people came together to form study circles and an organized teaching system. In quite a few cases, these informal groupings developed into veritable camp universities offering a wide range of subjects, with their own study regulations and examinations. When it became clear that the a quick liberation the prisoners had hoped for was not to be, the universities organized themselves in a more or less official and permanent manner, and often had their own premises and libraries.[6] To concentrate on the French Oflags, the official recognition of these universities was facilitated by *mission Scapini*,[7] which opened the Bureau d'études universitaires for such universities (Durand 1994, 178). Indeed, many of these initiatives could not have taken place or been approved without the support of the French government (i.e. the Vichy regime) and without the official approval and cooperation of German authorities and the German commanding officers at the Oflags. Moreover, the Vichy regime, which had been a collaborationist government under Pétain since the occupation of northern France, did not want to lose the "quantité considerable d'énergie intellectuelle française"[8] in the Oflags (Hannemann 2006, 99).

Around 29,000 French officers were held captive in the Oflags (Gayme 2015, 125).[9] As Évelyne Gayme notes, on September 11, 1941, "the Secretary of State for Youth and National Education, Jérôme Carcopino, wanted to see the organization of a 'centre d'études' in all the POW camps . . . , extending from primary to higher education" (ibid., 126). While these study centers were informally described as universities, and assigned rectors (e.g. for science, literature, or law), they were not officially designated as such, as the status of the teaching compared to that in France remained unclear (ibid., 127). Moreover, the teachers and students were not only academic; some

[6]The literature on these universities is vast. See, for example, Gillies 2011. On the "universities" in the French Oflags see Durand 1994; Hannemann 2006; Gayme 2015.

[7]The goal of "mission Scapini," led by Georges Scapini (1893–1976), was to improve the condition of soldiers imprisoned in Germany. Scapini was sent to Berlin in the fall of 1940, and on November 16, 1940, he signed the agreement declaring France the protecting power of its own POWs. For this purpose, the "Service diplomatique des Prisonniers de Guerre" was established, which received the duties previously assigned to the United States as protecting power.

[8]The quotation is taken from a report on the organization of education in prison camps from March 18, 1941, cited in Hannemann 2006, 99.

[9]The focus on French Oflags also stresses the unique power relations between the Vichy and Nazi regimes, which did not exist for other countries. I expand on this below.

teachers were also secondary school teachers or engineers. The audience that attended these courses was larger than in "normal" universities; it even sometimes included German officers, as d'Orgeval (1950, 665–666) underlines.[10]

One of the most famous rectors in the Oflags was the historian Fernand Braudel. Braudel was first taken to Neuf-Brisach, then to Mainz, to Oflag XII B, where he remained for almost two years before being transferred to the *Sonderlager* (Oflag X C) in Lübeck (see: Schöttler 2013). In Oflag X C he was the rector of the "university", and also wrote his famous book *La Méditerranée et le monde méditerranéen à l'époque de Philippe II*. As Schöttler (2013, 13–14) notes, Mainz at that time had one of the best municipal libraries in Germany, and Braudel was able to borrow books and journals from it, which explains the massive presence of German references in the footnotes of the *Méditerranée*. About this work, Braudel states: "without my captivity I would surely have written a completely different book"[11] (Braudel [1972] 2001, 17), a statement whose implications for the mathematical research done at the Oflags I will discuss below.

Besides the "universities," libraries were created. Some books came from the private collections of officers and some from organized loans. Others were provided by the German authorities, by families of the prisoners, or by the Red Cross. In addition, exchanges were organized with municipal or university libraries. Thus, for example, the library at Oflag II B had 35,000 books and the library at Oflag VI D had 16,000 (Gayme 2015, 128). The Academy of Sciences sent numerous books so that a scientific library could be created in Oflag XVII A (cf.: Eckes 2022). From Lübeck, Braudel once wrote that the camp library had just been enriched by thousands of volumes (Durand 1994, 187; Schöttler 2013, 14).[12]

* * *

Who were the French mathematicians at the Oflags?[13] From the summer of 1940 there were about ten French mathematicians held in captivity in the Oflags. They were Roger Apéry, Jean Favard, Jean Kuntzmann, Jean Leray, Robert Mazet, Bernard d'Orgeval, Henri Pailloux, Christian Pauc, Frédéric Roger, Jean Ville, and René Valiron. As Eckes (2022, 160) notes, all of them took part in the activities of the universities, and three of them even became university rectors (Mazet, Favard, and Leray).

Among these mathematicians, the work of Jean Leray at Oflag XVII A (where he developed sheaf theory) has already been extensively researched (Eckes 2020; Sigmund et al. 2005). Leray's experience of captivity may be understood as a "reorganisation or reassemblage of resource ensembles" (Ash 1999, 330). While I will not attempt to rehearse the history of Leray's research, two aspects in this history are worth emphasizing, as they are able to complement and nuance Mehrtens' account of mathematicians in the Second World War.

First, as Eckes stresses in his series of articles (2018; 2020; 2021; 2022), Oflag XVII A was unique in that four university-level mathematicians were captive there: Leray, Roger, Ville, and Pauc. It was therefore of particular interest to the Académie des sciences, which advocated that these mathematicians be allowed to continue their scientific work. The Académie des sciences participated, for example, in the constitution of a library there. Already in the fall of 1940, a

[10]In this regard, it should be noted that the universities in the Oflags prepared students not only for degrees in science, literature, or law, but also for other exams such as the *baccalauréat*.

[11]"Sans ma captivité j'aurais sûrement écrit un tout autre livre."

[12]See also Gillies 2011, 260: "The best stocked libraries usually indicated an active educational system within a camp. Stalag Luft VI at Heydekrug, in what is now Lithuania, … had a library with around 6,000 books, partly to support the educational demands of its inmates where study was so intense that the camp became known as the Barbed-Wire University. By the end of the war, Oflag VIIB at Eichstatt, south of Nuremberg, had an incredible collection of 15,000 books, as well as 60,000 that belonged to individual POWs."

[13]This is not to imply that mathematicians of British, American, or Polish, etc. nationality were not actively doing research at other Oflags. Universities at these Oflags and in other Stalags also existed. To give an example of a university in a British Oflag:"[In] Stalag Luft VI in Heydekrug … the educational facilities continued to expand and in 1944 it had 3,000 registered students and one hundred men took their London Matriculation exam" (Gillies 2011, 275).

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scientific collaboration with French mathematicians was set up under the impetus of the Nazi mathematician Harald Geppert (Eckes 2022, 163–5), who from the beginning of 1940 was the director of the *Jahrbuch über die Fortschritte der Mathematik* and the *Zentralblatt*. Geppert worked to improve the material conditions of certain French mathematicians who were prisoners of war. Through the direct and repeated intervention of Geppert and Gaston Julia, Leray, for example, gained access to contemporary international scientific literature. Here it should be stressed, however, that while Geppert and Julia also knew d'Orgeval's work—Geppert summarized one of his articles from 1938 in the *Jahrbuch*,[14] and Julia, as we will see below, invited d'Orgeval to his 1938–1939 seminar, where d'Orgeval gave a talk—it is not clear whether Geppert also attempted to intervene concerning d'Orgeval's material conditions.[15]

Yet this question should not be considered as a comparison between d'Orgeval and Leray, as, first, d'Orgeval was only defending his PhD thesis in 1943 (in absentia) whereas Leray was already a professor before the war. Eckes' research, in fact, questions Leray's own narrative, according to which he "feared that if his competence as a 'mechanic' ('mécanicien,' his word) were known to the German authorities in the camp, he might be compelled to work for the German war machine . . . , so he . . . presented himself as a pure mathematician, and devoted himself mainly to algebraic topology"[16] (Borel 2001, 597). Eckes (2022, 162) calls for a modification of this narrative: rather than a "silent combat," Eckes sees Leray as conducting a silent cooperation.

Second, not only, as was noted above, did Oflag XVII A have an extensive scientific library, but Leray and the other mathematicians in this camp had access, thanks to their contributions to the *Zentralblatt*, to scientific literature that no longer circulated in occupied France (Eckes 2020, 36–37).[17] Nevertheless, as we will see below, this was not the case in all Oflags and for all mathematicians researching there:[18] in the *avant-propos* to his PhD thesis, d'Orgeval clearly writes that not all of the necessary literature was available to him.

Taking these points into account (the unique grouping of university-level mathematicians, the libraries, and the access to literature), the abovementioned power relations between French POW mathematicians and their captors may be considered to reflect how the Oflags acted as a "microcosm of the world," as Mehrtens notes (Mehrtens 1994, 334). To follow Hannemann (2006, 100), one should note here that efforts to improve the coordination of the various aid organizations, which became important due to the shortage of books and paper, or the question of the future recognition of the courses and examinations taking place in the camps, could not be decided or coordinated by the Vichy regime alone, and hence the regime had to enter into negotiations with Germany, however weak its negotiating position was. Unlike Great Britain and the United States, which were able to negotiate concessions in the treatment of prisoners on the basis of reciprocity, the Pétain government always had to argue cautiously concerning the POW students. It was to its advantage, however, that Germany recognized an opportunity for propaganda influence (that might be connected with the universities) and was also prepared to make certain concessions so as not to impair good relations with the Vichy regime.

The abovementioned collaboration shows that these universities in their official, mature form could not have existed without the activity of the Vichy regime, and in fact a propaganda campaign in favor of the National Revolution was directly addressed to POW officers. As d'Hoop (1981, 11–13) stresses, a wave of Pétainism emerged in the Oflags between the fall of 1940 and the

[14] See here: https://zbmath.org/64.0691.01 (last accessed 7.2.2023).

[15] As we will see below, d'Orgeval himself notes that he was able to obtain mathematical articles and books during his captivity.

[16] Or, as Leray himself points out: "I therefore chose algebraic topology, a subject without immediate military application" ("J'ai donc choisi la topologie algébrique, sujet sans application militaire immediate") (Schmidt 1990, 165).

[17] On the recruitment of French mathematicians as reviewers for the *Jahrbuch* and the *Zentralblatt* during the German occupation of France, see Eckes 2021 and also Siegmund-Schultze 1993, 178–192.

[18] Though there were certainly other libraries in the Oflags, as noted above.

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summer 1942, which was certainly due to the way in which the fate of POWs was instrumentalized by the Vichy regime.[19] It was a "Pétainism of faith and political nostalgia, [which] is also . . . the result of military service" (ibid., 22).[20] The involvement of the French intellectual elite who collaborated with the Vichy regime conditioned the "practices accomplished by the POW mathematicians" (ibid., 35)—at least for Oflag XVII A, as shown by Christophe Eckes (2020).

Hence, one may claim that the imposed power relations to some extent conditioned and narrowed the mathematical research that could have been done at the Oflags. To stress: while Leray's conditions were unique, this narrowing down of the immediate field of research—in terms of access to literature, collaboration with colleagues, or the exchange of ideas via correspondence—could arguably have forced and conditioned a restructuring of the same mathematical research, leading to the invention of new techniques or to the consideration of other research questions.[21] To see this more clearly, and also to examine whether Mehrtens' modern/counter-modern distinction holds for the ephemeral configurations arising in the Oflags, I turn now to d'Orgeval and his research.

3. D'Orgeval before and at the Oflags

Bernard d'Orgeval (1909–2005) was one of the French mathematicians imprisoned in the Oflags. Specializing in algebraic geometry, he prepared his doctorate not only in France but also, in 1936 and 1938, at the University of Rome, working there with Federigo Enriques, before being mobilized to participate in the war. His division surrendered on June 23, 1940. After having been held for a few months in a caserne in Saint-Mihiel, between 1940 and 1945 he was successively transferred to three officers' camps: Oflag XIII A in Nuremberg (1940–end of August 1941), Oflag XXI B in Szubin (end of 1941–end of August 1942), and finally Oflag X B in Nienburg am Weser (1942–1945).[22] The mathematical works produced by d'Orgeval in these Oflags will be discussed in the next section; at this stage, however, it is important to note that at Oflag X B, alongside his mathematical studies, d'Orgeval also prepared a doctoral thesis in law, published in 1950 as *L'Empereur Hadrien*. After the war he became a lecturer in mathematics in Grenoble, then a professor in Algiers, and finally a professor in Dijon, where he remained until his retirement in 1979.

In the first part of this section I would like to unfold d'Orgeval's biography, at least up to his release from captivity, not only in order to review his mathematical career up to that point, but also to examine one of the research directions developed in Mehrtens's *Moderne—Sprache—Mathematik* concerning the connection between the political and the mathematical approaches to (counter-)modernism. While the previous section has demonstrated that French-German cooperation shaped the mathematical research done in the Oflags, here I aim to examine whether, on a more personal level, d'Orgeval's political views were reflected in his mathematical research. In order to situate d'Orgeval's work in a historical context, I will also briefly review the state of mathematics in France during the interwar period. In the second part of this section I will elaborate not only on the university at Oflag X B, where d'Orgeval wrote his PhD thesis, but also on how and under which conditions this research was done. While d'Orgeval's mathematical research during his years in captivity will be discussed in the following section, here I will conclude with an attempt to answer the question of whether d'Orgeval was completely or only relatively isolated.

[19]On the propaganda of the Vichy regime and Pétainism in the Oflags, see also Durand 1987, 189–222, esp. 209–213.

[20]However, this wave of Pétainism ended toward the end of 1942 due to the military situation as well as to counter-propaganda (d'Hoop 1981, 22–24).

[21]That a restructuring or reorientation of a research field may occur even if one does have (partial) access to the literature is attested above with the citation of Braudel, who noted that he would have written another book had he not been in captivity.

[22]I thank Christophe Eckes for pointing this out. See d'Orgeval 1950, 658.

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(i) D'Orgeval's research in the interwar period

> "d'Orgeval, … Royalist, nobleman, historian of law, equestrian, geometer, winemaker and certainly oenologist"[23] (Reeb 1994, 25-26)

Bernard d'Orgeval entered the École normale supérieure in Paris in 1929.[24] He obtained his *agrégation* in 1932, and taught mathematics at the École normale supérieure in Tehran from 1932 to 1935. In 1935–1936 he did his military service at the École d'application de l'artillerie in Fontainebleau. From 1936 to 1938, thanks to a thesis grant, he worked in Rome under the direction of the mathematician Federigo Enriques. Here it is important to stress that Enriques lost his position in 1938 when the Fascist government enacted the *leggi razziali* (racial laws), which in particular banned Jews from holding professorships in universities, a topic I will return to later. During his stay in Italy d'Orgeval also met Oscar Chisini, as he points out in the *avant-propos* of his PhD thesis: "I am grateful to Mr. Chisini … for the precisions that he was kind enough to give me in person on his method of construction of multiple planes, which I used frequently"[25] (d'Orgeval 1943a, *avant-propos*). The "construction of multiple planes," or ramified covers as they are usually termed today, will be the subject of the next section. In 1938, upon returning to France, he was appointed to his first position at the Lycée d'Orléans. On March 13, 1939, he spoke at the Julia Seminar, a seminar on which I will also elaborate below. As noted above, he was a POW from 1940 to 1945, and his PhD thesis in algebraic geometry, begun in Rome with Enriques, was finished in captivity in 1943.

As Michèle Pelletier (2007, 85–86) notes, to increase his chances of obtaining a position at a university, either in science or in the history of law, d'Orgeval decided to prepare for the *agrégation* in the history of law and undertook a thesis in Roman law under the direction of François Dumont (1900–1980), at the time a professor in Dijon, who had already supervised the thesis of d'Orgeval's brother, Pierre d'Orgeval Dubouchet (1908-1978).[26] Bernard d'Orgeval's thesis in the history of law, submitted in 1950, was entitled *L'Empereur Hadrien* and was well received by the jurors.[27] Following his release at the end of the war, he was finally appointed as a lecturer in Grenoble from 1946 to 1951. From 1951 to 1955 he then taught mechanics in Algiers, and from 1955 until his retirement in 1979 he was a professor at Dijon. Between 1942 and 1975 d'Orgeval published about fifty articles dealing with geometry, be it algebraic geometry (the study of surfaces or varieties of dimension 3), projective geometry over fields of non-zero characteristics, or the study of affine Desarguesian planes with a finite number of points.

To return to d'Orgeval's activities before the Second World War, Shafer (2009) notes that d'Orgeval was involved in Action française, a royalist and anti-Semitic political organization—an involvement which started at the end of the 1920s.[28] Indeed, he represented Action française at the École normale supérieure, following Robert Brasillach, in the late 1920s and early 1930s. At that time Action française was popular among French lycée and university students. The then leader of the movement was Charles Maurras (1868-1952), an influential journalist and poet. Maurras called for the "restoration of the monarchy and the elimination of the influence of Judaism, freemasonry, and foreigners in France" (ibid., 22). Shafer also stresses that, when d'Orgeval

[23]"B. d'Orgeval, … Royalist, Adeliger, Rechtshistoriker, Reiter, Geometer, Winzer und bestimmt Önologe."

[24]I follow here Pelletier 2007, and Shafer 2009.

[25]"Je suis reconnaissant à M. Chisini … des précisions qu'il a bien voulu me donner de vive voix, sur sa méthode de construction des plans multiples, que j'ai eue à employer fréquemment."

[26]See d'Orgeval-Dubouchet 1938. Bernard d'Orgeval explicitly notes this in his thesis in Roman law (d'Orgeval 1950, 8): "M. Dumont, après avoir dirigé Ia thèse de mon frère, a bien voulu s'intéresser à mes propres travaux."

[27]The thesis deals with Hadrian's legislative and administrative projects and his governmental methods.

[28]D'Orgeval was involved in this movement already in 1926, as can be inferred from his account on "religious crises" (d'Orgeval 1986).

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"returned [from captivity] in 1945, his condemnation of the collaborators was combined with anger that the liberation also brought punishment for some, like Maurras" (ibid., 23).

The question thus arises whether d'Orgeval's political commitments had an impact on his mathematical work. While one may not associate his royalist political views with a modern or liberal position, I claim that this in itself does not suffice to explain his mathematical position, which, if one follows Mehrtens' categories, may be understood as being more counter-modern than modern. To recall, Mehrtens explicitly claims that such a correlation (between counter-modern political and mathematical positions) exists, though he concentrates on German mathematicians.[29] In order to better understand d'Orgeval's mathematical position, I will briefly examine his research prior to his mobilization, as this can be situated in the context of French mathematics in the interwar period. This is complemented in the next section by a survey of developments in algebraic geometry at the beginning of the twentieth century.

* * *

To better understand the mathematical context in which d'Orgeval's work during the 1930s was situated, I turn to Juliette Leloup (2009), who examines the mathematical aspect of the interwar years through the doctoral theses defended in France during this period.[30] If one examines the theses submitted in Paris and classified under the heading "geometry," then one finds, between 1925 and 1945, nine theses in algebraic geometry,[31] six of which were submitted between 1935 and 1945. These six doctorands were Henri Adad, Sylvain Wachs, Bernard d'Orgeval, Max Eger, Luc Gauthier, and Léonce Lesieur. Leloup (ibid., 208–209) underlines that this group of six doctorands contains another, unique subgroup. This subgroup, consisting of four students, was highly influenced by the methods of the Italian school of algebraic geometry. The four students were d'Orgeval, Eger, Gauthier, and Lesieur, all of whom employed and referenced the works of Enriques, Francesco Severi, or Corrado Segre. However, while the works of these mathematicians from the Italian school of algebraic geometry are taken as a starting point to study certain particular questions, the four PhD students do not refer to the same set of works.

Leloup (2009, 208) notes that, according to Henri Cartan, d'Orgeval used the "algebraic methods of the Italian School" to prove the main theorem of his dissertation concerning the existence of certain families of algebraic surfaces of genus 1. As we will see below, this statement must be relativized, due also to the fact that Enriques and Chisini did not employ or advocate the use of such "algebraic methods." As noted above, between 1936 and 1938, d'Orgeval studied for two years with Enriques in Rome, and in 1938 he published a paper on his research, which probably resulted from this stay (d'Orgeval 1938). This distinguishes d'Orgeval from the other doctoral students, who do not seem to have had any direct contact with Italian mathematicians. Here one can note d'Orgeval's commitment to classical Italian algebraic geometry, which certainly shows an affinity to counter-modern mathematics, as we will see explicitly below. While d'Orgeval and his colleagues were aware of the work of Emmy Noether and van der Waerden (see: Leloup 2009, 224), d'Orgeval took the "classical" problems of algebraic geometry as his starting point. In doing so he was following Chisini's methods and was also influenced by Enriques, who had a complex view of mathematics and intuition. I will return to the positioning of d'Orgeval's mathematical work in the field of algebraic geometry in Section 4.

Another indication of d'Orgeval's counter-modern approach can be found in the talk he gave at the Julia Seminar in 1939. As Eckes (2020, 38–39) notes, the French mathematical field was strongly marked by the creation of the Julia Seminar, which between 1933 and 1939 brought

[29]See Mehrtens 1996b, 520: "The case of Bieberbach as well as the behaviour of some other mathematicians suggest the thesis that mathematical counter-modernism is correlated to nationalism and eventually also to racism. The converse proposition would be that modernism is related to liberalism and internationalism."

[30]On French mathematics during the interwar period, see, besides Leloup 2009, Gispert, Leloup 2009, Goldstein 2009, and Beaulieu 2009.

[31]Including six by former students of the École normale supérieure: Marcel Légaut, Henri Adad, Bernard d'Orgeval, Max Eger, Luc Gauthier, and Léonce Lesieur.

together the elite of the École normale supérieure. The seminar took place at the Institut Henri Poincaré until 1938, and thereafter at the École normale supérieure. Until 1938, the Julia Seminar was dominated by the group of mathematicians Nicolas Bourbaki.[32] As is well known, Bourbaki aimed to rewrite mathematics, and their style, as Leo Corry notes, "is usually described as one of uncompromising rigor with no heuristic or didactic concessions to the reader" (Corry 1992, 321), though Corry calls into question this narrative with respect, for example, to their concept of *structure*. Mehrtens, on the other hand, completely adopts this description, and presents Bourbaki as one of the representatives of modern mathematics (Mehrtens 1990, 315–326).

To return to the Julia Seminar: until 1938 the role played by the founding members of Bourbaki was undeniably central in the choice of themes treated by the seminar's speakers (Ricotier 2021, 25), and the themes during those years (algebra and topology) had an abstract orientation. However, due to the growing opposition between the founding members of Bourbaki and Gaston Julia, resulting from their divergent political and scientific positions, a drastic change of orientation occurred: the founding members of Bourbaki no longer gave talks, the audience became younger and less international, and, no less importantly, the subject of the 1938–1939 seminar (calculus of variations) was more classical than the more abstract subjects chosen in previous years (ibid., 47–48). In view of these developments, one may claim that, in its last year, the Julia Seminar distanced itself from modern mathematics.[33] It is in this framework that d'Orgeval gave his talk at the seminar on March 13, 1939 (d'Orgeval 1939). Indeed, d'Orgeval's talk deals with the "geometrization" of Riemann surfaces embedded in Euclidean spaces (ibid., 1–2). However, the question discussed in the lecture concerns Riemann and Euclidean spaces in any dimension, and cannot be considered as involving an embedding in the visible three dimensional space, and nor does it turn to intuition.

If one follows Mehrtens' modern/counter-modern categories, d'Orgeval's talk, and after 1938, also the Julia Seminar, may be considered as distancing themselves from modern, highly abstract or algebraic approaches, a distancing which can also be seen in the works of the Italian school of algebraic geometry (more on that below). Nevertheless, one cannot characterize d'Orgeval's work as entirely counter-modern, as we will see in the next section. But before dealing with this subject, I first want to discuss d'Orgeval's stay at the Oflags and the conditions that enabled his mathematical research.

(ii) D'Orgeval's research at the Oflags

As noted above, during the first months of his captivity, d'Orgeval was in Saint-Mihiel. In a report he presented in 1950 at the fourteenth International Congress of Sociology held in Rome, d'Orgeval recounts his memories and impressions of the Oflags XIII A, XXI B, and X B, noting that the Oflag XXI B in "Szubin appeared to all those who passed through there as a privileged camp" (d'Orgeval 1950, 658). He also describes various aspects of his four years in captivity. For example, he notes that the purchasing of "books and paper disappeared after the bombings of Leipzig [on December 14, 1943]," adding that "the shortage was so great after [19]43 that matches, razor blades, toilet paper, etc. had to be distributed" (ibid., 661). Concerning the universities, he gives a general account of their formation (ibid., 664), noting, for example, that "in Sciences, the teaching of Mathematics was assured by agrégés, [and] it is only at the end that the chance of the

[32]Note that Leloup (2009, 423–7) calls for a more nuanced image of French mathematics during the interwar period, noting that the 1930s were marked by the emergence of new subjects and new methods in algebra and arithmetic, geometry, function theory, and probability calculus, partly initiated and developed abroad. This break in the 1930s, which was signaled by the arrival of these themes in the theses, and more generally in the French mathematical milieu of those years, was not limited to the research initiated by Bourbaki.

[33]Note that Gray (2006, 381) classifies the developments in calculus of variations during the twentieth century as modern mathematical developments.

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changes of camp brought us the collaboration of [Jean] Favard, professor at the Sorbonne"[34] (ibid., 665). The nature of the collaboration with Favard is not specified, however, as Favard was at Oflag XVIII in Lienz, Austria. Since d'Orgeval wrote his PhD thesis at Oflag X B, I now turn to examine this Oflag more closely.

Oflag X B was a camp for French officers located in Nienburg am Weser, Germany. It opened in May 1940.[35] The creation of the "university" there can be traced back to September 1941. The "university" had three faculties: law, science, and literature, all three managed by polytechnicians. According to a report from August 1943, the law faculty had 100 students, followed by sixty at the science faculty and fifty-five at the literature faculty; the rector of the faculty of science was André Pétrus, an *agrégé* of mathematics (Durand 1994, 173).[36] Another report from 1943, titled "Les camps de prisonniers de guerre en Allemagne," published by the Direction du service des prisonniers de guerre, notes not only the "important library" (Secrétariat d'État à la guerre 1943, 178), but also the POWs' living conditions: "the [prisoners'] rooms are bright, having large windows. . . . In addition, they each have a private library made up of books received individually by the prisoners" (ibid., 176; see Fig. 1).

D'Orgeval was most probably one of the students (at least in the faculty of law, as his thesis shows).[37] He is also known to have been one of the mathematics teachers (Chevaillier 2006). Moreover, d'Orgeval recounts that, during the last year of his captivity, military events and German losses

> "contributed greatly to changing the climate of captivity. The hope of a liberation that was believed to be nearer gradually led to a shift away from intellectual work. . . . In addition, on February 4, 1945, the Nienburg camp [Oflag X B] was bombarded with two bombs, which caused the death of 94 of our people and rendered four barracks unusable. The result was a considerable reduction in the number of living quarters and the virtual disappearance of the communal areas; this state of affairs led to the disappearance of courses and conferences." (d'Orgeval 1950, 671–672)

The above citation underlines that the mathematical research mainly took place between 1941 and 1944. If one recalls Leray's development of sheaf theory at Oflag XVII A and the relative freedom and access to literature he enjoyed there, the question arises whether, with respect to the research process and how this unfolded, d'Orgeval's research had similar traits, and how his relative isolation shaped his research. But before dealing with the mathematical works d'Orgeval wrote at Oflag X B, it is necessary to make a short detour to his law thesis, as this underlines the conditions under which his research in general was carried out. As noted, this thesis (on the Roman emperor Hadrian) was published in 1950, that is, five years after d'Orgeval's release from Oflag X B. While d'Orgeval himself mentions only briefly the fact that large parts of the text were prepared at this Oflag, noting after the foreword that "this book was initiated in German captivity",[38] the foreword by Dumont is more informative about the conditions under which the thesis was written:

[34]"En Sciences, l'enseignement des Mathématiques fut assuré par des agrégés, ce n'est que sur la fin que les hasards des changements de camp nous apportèrent la collaboration d'un maître Favard professeur à la Sorbonne."

[35]For the history of this camp, see Sonnenberg 2005.

[36]From 1937 the mathematician André Pétrus (1900-1957) held the chair of mathematics in the preparatory class for the Naval School at the Lycée Saint-Louis in Paris. He was mobilized in September 1939, taken prisoner on June 25, 1940, and remained in captivity until 1945. Pétrus taught general mathematics and mechanics at the university of Oflag X B from 1941.

[37]As will become clear below, his thesis in law was only submitted after the war, in 1950. Hakim notes that "three theses were actually prepared at Oflag X B" (Hakim 2016, 61), not including d'Orgeval's in his list. The rector of the law faculty at Oflag X B was Pierre David.

[38]"hunc libellum in captivitatem germanicam initiatum de suis studiis B.O. [Bernard d'Orgeval] scripsit" (d'Orgeval 1950, 7).

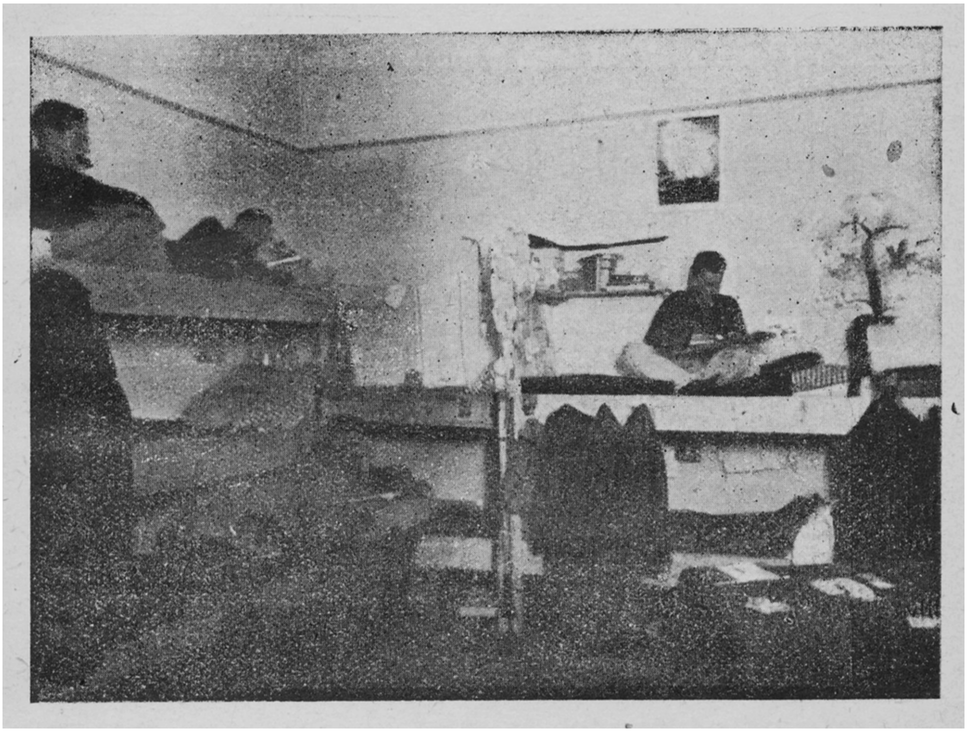

Figure 1. A photo of one of the prisoners' rooms in Oflag X B taken from the report "Les camps de prisonniers de guerre en Allemagne" (Secrétariat d'Etat à la guerre 1943, 177).

> This work, which traces the legislative work of a great Roman emperor [Hadrian], was prepared, for the most part, in a distant Oflag, with a scrupulous concern for precision, but also with enthusiasm. It is a work of scholarship, and much more.
>
> I exchanged official and censored correspondence cards from another camp with the author [d'Orgeval], specifying the purpose of this research. I thought the project had been abandoned when, after my return from captivity, I learned that Mr. B. d'Orgeval was preparing a thesis in mathematics. But the two works went hand in hand, and, when the great return finally came, he gave me the manuscript of his legal study when he got off the plane. Completed by careful research, presented as a thesis to the Faculty of Law in Paris, it is now offered to the public, thanks to the munificence of the National Center for Scientific Research.[39] (d'Orgeval 1950, 5)

While it is well known that letters and postcards sent to and from the Oflags were read and censored, somewhat more surprising is Dumont's claim that "the two works [theses] went hand in hand." Surprising since, while his law thesis was not published until 1950, no other publications by

[39]"Ce travail, qui retrace l'œuvre législative d'un grand empereur romain, fut élaboré, en grande partie, dans un Oflag lointain, avec un scrupuleux souci de précision, mais aussi dans l'enthousiasme. C'est un travail d'érudition, et bien plus encore.

J'échangeai d'un autre camp avec l'auteur [d'Orgeval] des cartes de correspondance, officielles et censurées, précisant l'objet de ces recherches. Je crus le projet abandonné, lorsqu'après mon retour de captivité j'appris que M. B. d'Orgeval préparait une thèse de mathématiques. Mais les deux travaux allaient de front, et, quand vint enfin le grand retour, il me remit à sa descente d'avion le manuscrit de son étude juridique. Complété par d'attentives recherches, présenté comme thèse a la Faculté de Droit de Paris, le voici maintenant offert au public, grâce à la munificence du Centre National de la Recherche Scientifique."

d'Orgeval on this topic were made public prior to this date. As we will see, these circumstances contrast with those of d'Orgeval's mathematical works, since several of d'Orgeval's mathematical works were published during his captivity.

Indeed, during his captivity, d'Orgeval managed to publish three mathematical papers and to submit his thesis in mathematics. Of these four works, only two explicitly mention the fact that they were written at Oflag X B. The paper "Sur certains plans doubles non rationnels de genres $p_a = p_g = 0$," presented by Lucien Godeaux, was published in 1945, but is signed at the end "Nienburg-Weser, juin-juillet 1943" (d'Orgeval [1943] 1945, 425). D'Orgeval's thesis was apparently brought to completion between February and April 1943, as is indicated at the end of the *avant-propos*. This *avant-propos* contains more information about his working conditions:

> This work, begun under the guidance of Mr. Enriques, professor at the University of Rome, during a stay in Italy, was completed in April 1943 in Oflag X B, Nienburg/Weser, where I was a prisoner. The conditions of captivity did not allow me to consult an abundant bibliography, especially on the third chapter; I was able, nevertheless, thanks to the kindness of my teacher [advisor], Mr. [Élie] Cartan,[40] and to that of Mr. Godeaux, professor at the University of Liège, to review the classical textbooks.[41] (D'Orgeval 1943a, *avant-propos*)

This opening paragraph of the *avant-propos* is telling, since it is not only a clear indication that the thesis was written in captivity, but also that d'Orgeval did not have access to all of the available literature. However, this does not mean that d'Orgeval worked without any access to mathematical literature. First, as may be understood from the *avant-propos*, it seems that Cartan and Godeaux sent d'Orgeval some of the articles and books he needed for his research. Second, in 1950 d'Orgeval states the following: "I would like to pay tribute to the memory of my teacher Professor Enriques who, although we were at war with Italy, sent me some volumes that I needed"[42] (d'Orgeval 1950, 666). In view of the fact that, due to the racial laws in Italy, Enriques at that time did not hold a university position, it is remarkable that he still managed to send mathematical books to d'Orgeval. Moreover, after the bombardments of Leipzig on December 14, 1943, d'Orgeval notes that "it was no longer possible to buy books directly in Germany; from that time on, Sonderführer Lindemann, a teacher at a grammar school in Göttingen, was able to obtain books from the university library [there]. Personally, I could only obtain mathematical works; it was impossible for me to obtain epigraphic collections"[43] (ibid.). Even though d'Orgeval's remarks concern the period after December 1943 (that is, after the completion of his thesis) the last comment shows that, at least for his mathematical research, d'Orgeval was able to consult the relevant articles, though his access must have been limited. It also implicitly points toward the involvement of the Vichy regime on the one hand and the German officers at the Oflags on the other hand, which/who supported the activities taking place at the universities. But nowhere in the

[40]The title page of d'Orgeval's paper (d'Orgeval 1943a) mentions Élie Cartan as the president of the doctoral committee and Henri Cartan as one of the examiners.

[41]"Ce travail, commencé sur les indications de M. Enriques, professeur à l'Université de Rome, durant un séjour que je fis en Italie, a été achevé en avril 1943, a l'Oflag X B, a Nienburg/Weser, où je me trouvais prisonnier. Les conditions de la captivité ne m'ont pas permis de consulter une abondante bibliographie, surtout sur le troisième chapitre; j'ai pu, néanmoins, grâce à l'obligeance de mon maître, M. Cartan, et à celle de M. Godeaux, professeur à l'Université de Liège, revoir les manuels classiques."

[42]"Qu'il me soit permis de saluer ici la mémoire de mon maître le Professeur Enriques qui, bien que nous fussions en guerre avec l'Italie me fit parvenir quelques volumes dont j'avais besoin."

[43]"Il ne fut plus possible de se procurer des ouvrages par achat direct en Allemagne ; à partir de cette époque, le Sonderführer Lindemann, professeur dans un lycée de Göttingen put nous procurer des ouvrages de la bibliothèque universitaire de Göttingen. Personnellement je n'ai pu en obtenir que des ouvrages mathématiques; il m'a été impossible par contre d'avoir communication de réceuils épigraphiques."

papers d'Orgeval wrote during his captivity does one find a hint of his personal political opinions or their influence on his research.[44]

The opening paragraph of the *avant-propos* is also telling since it underlines d'Orgeval's connection to the Italian school of algebraic geometry, and more specifically to Enriques. To stress: as will be elaborated below, Enriques advocated the use of intuition in algebraic geometry, and hence, if one chooses to follow Mehrtens' narrative, can be considered as counter-modern. D'Orgeval's research within this mathematical framework, which will again raise the question of the degree to which d'Orgeval's *mathematical* research in the Oflags can be considered as counter-modern, will be examined in more detail below.

With the exception of his law thesis, these are the only two references in d'Orgeval's published work to his captivity or to where and how his mathematical work was written. The two other works written during this period (a one-page note published in 1942 in the *Comptes rendus hebdomadaires des séances de l'Académie des sciences*, presented by Élie Cartan (d'Orgeval 1942, 431), and a longer manuscript (d'Orgeval 1943b), which was presented by Godeaux) do not carry any indication that this research was done in Oflag X B. Here it is clear that these two papers were written not in Oflag X B but either in Oflag XXI B (where d'Orgeval was held between the end of August 1941 and the end of August 1942) or in Oflag XIII A (where he was held from the end of 1940 to the end of August 1941). As we will see below concerning the longer manuscript (d'Orgeval 1943b), Cartan noted that it had been sent to him already in 1942. Hence, one may assume that both papers were written in Oflag XXI B.

Moreover, while the first section of a paper submitted by d'Orgeval in January 1946 and published the same year surveys d'Orgeval's mathematical work from 1942 to 1943 (d'Orgeval 1946, 87), no indication is made as to where this work was carried out. The *avant-propos* of d'Orgeval's thesis certainly indicates that d'Orgeval was aware that captivity shaped and conditioned his work, but, in some of the other works published during these years, this remained somewhat in the background. The question of whether the decision to conceal the place of origin was made by d'Orgeval himself or by the editors of the journals in which the articles were published remains open. It is clear, however, that Cartan and Godeaux, who presented the papers, knew very well that d'Orgeval was imprisoned in an Oflag at the time. But if we return to d'Orgeval's captivity, the question that arises is whether his relative isolation can be detected in the mathematical works themselves, that is, whether this isolation prompted unique mathematical configurations. This aspect—the inspection of the mathematical activity itself—is somewhat absent from Mehrtens' work, and is hence introduced here to complement his account. As we will see, a consideration of the work itself under conditions of captivity and relative isolation in Germany may also lead to a reexamination of Mehrtens' opposition between modernity and counter-modernity.

[44]D'Orgeval (1950, 666) comments rather negatively on the political talks and conferences held at the Oflags: "One cannot pass over in silence the conferences linked to political movements from which, in general, in Nuremberg at least, proselytizing was absent—they aimed more at making known the nature of the reforms introduced by the Marshal's government than at making a value judgment on them. The subject remains rather scabrous and, judging by the personalities of the speakers and their subsequent attitude, is what it is worth. … I would also leave in the same penumbra all the activities generally included under the title of 'Pétain' movement; this would only be an illustration of an unfortunately too general fact: the variation of opinions displayed according to the circumstances." ("On ne peut passer sous silence des conférences liées à des mouvements politiques dont en général à Nüremberg du moins le prosélytisme était absent ; elles visaient plus à faire connaître la nature des réformes introduites par le gouvernement du Maréchal qu'à porter sur elles un jugement de valeur. Le sujet reste d'ailleurs assez scabreux et si l'on en juge par la personnalité des conférenciers et leur attitude postérieure est de ceux qu'il vaut. … Je laisserais également dans la même pénombre toutes les activités comprises généralement sous le titre de mouvement 'Pétain' ; ceci ne serait qu'une illustration d'un fait hélas trop général : la variation des opinions affichées au gré des circonstances.")

4. D'Orgeval's mathematical research at the Oflags

On what was d'Orgeval working during his years in captivity? While a detailed description of d'Orgeval's mathematical research during the 1930s and the 1940s is beyond the scope of this paper, I would like to focus on the topic which stood at the center of his mathematical activity at the Oflags. As we will see below, d'Orgeval had already begun researching this topic during his stay in Rome, as he published an article on this subject in 1938. This topic is the investigation of certain algebraic surfaces, considered as ramified covers of the complex (projective) plane. This section, and especially its second part, may be considered rather technical, but, in order to provide a detailed and richer account of d'Orgeval's mathematical configuration, I consider it essential to examine the mathematical research itself.

This section will therefore consist of two parts. In the first part I will elaborate on the different approaches at work in algebraic geometry during the first decades of the twentieth century. I have already pointed out in the former section the affinity that d'Orgeval had with the Italian school of algebraic geometry during the 1930s, and the first part of this section will elaborate on this school. This review will also provide points of comparison in order to better understand d'Orgeval's contributions in relation to his contemporaries. The second part will then concentrate on d'Orgeval's own research, especially during his years in captivity, characterizing this research as an ephemeral configuration and as oscillating between modern and counter-modern tendencies, to use Mehrtens' terms. An analysis of the work itself that d'Orgeval produced in captivity will be seen to prompt a reexamination of such categories.

(i) A detour: Algebraic geometry during the first decades of the twentieth century

It is well known that the rise of algebraic geometry in the first two decades of the twentieth century was mostly due to the Italian school of algebraic geometry which, between the 1890s and 1930s, contributed greatly to the developing research in this field. Among the main research topics of the Italian school, particular mention should be given to the intensive research on algebraic (complex, projective) surfaces,[45] since it became clear during these decades that algebraic surfaces exhibited some features that had no counterpart in the theory of algebraic curves. To give one example: while for algebraic curves, the rationality of a curve is equivalent to the vanishing of its genus, in 1894 Federigo Enriques discovered an algebraic surface F for which the geometric and the arithmetic genus are 0,[46] though F was not birationally equivalent to the complex projective plane. Such a discovery implied that the task of classifying algebraic complex surfaces would be more complicated than the corresponding task for curves.[47]

This example led Enriques and Guido Castelnuovo, from the 1890s to 1914, to search for new invariants for algebraic complex surfaces in order to distinguish various birational classes of algebraic surfaces. These invariants were called the *plurigenera* of an algebraic surface, and in 1914 Enriques and Castelnuovo announced the classification of algebraic complex surfaces in terms of their plurigenera. One of the objects that was researched during this investigation was the branch curve of the investigated algebraic surface (a curve I will define below). This curve, as I have elaborated elsewhere (Friedman 2022), was couched in different epistemic configurations, which not only prompted novel research directions on such surfaces, but also led eventually to the emergence of new various mathematical configurations in which the branch curve was considered

[45]For an extensive overview of this school and its research, see e.g. Dieudonné 1985; Gray 1994; Brigaglia, Ciliberto 1995; Guerraggio, Nastasi 2006; Casnati et al. 2016.

[46]The genera are invariants of a complex algebraic surface. For such a surface, one may define the *arithmetic genus*, the *geometric genus*, or the *plurigenera*. For a survey of these invariants, see Popescu-Pampu 2016, 81–106).

[47]Indeed, for algebraic curves, it was proved that it is enough to know the geometric genus in order to classify algebraic curves up to birational transformations.

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as the main object of research. In the following I will concentrate mainly on the research done around this curve, as this was one of d'Orgeval's main objects of investigation during his captivity.

In order to better understand d'Orgeval's research, let us first examine what a branch curve is. Taking a complex algebraic surface *F* of degree *n* given by the equation $f(x,y,z) = 0$, when *z* is of degree *n*, one can project it to the complex (projective) plane—for example, by the map $(x, y, z) \mapsto (x, y)$. In this way, one can consider such a surface as a degree *n* cover of the complex plane, since for almost every point (x_0,y_0) on the plane there are *n* pre-images on the surface. Hence, the surface is considered as having *n* sheets, which may interchange. For example, one may consider a cover of degree 3, $z^3 = R(x,y)$, when *R* is a plane curve. The *branch curve* is the set of all points (x,y) on the complex plane above which the surface *F* has less than *n* pre-images. A way to directly obtain the branch curve is to consider the intersection of $f = 0$ and $df/dz = 0$ and to project the resulting curve to the plane (this method was also well known during d'Orgeval's time). Moreover, if the projection map is generic, when examining the pre-images of a local neighborhood of the branch curve, only two sheets of the surface come together and eventually interchange, interchanges which can be described by a set of permutations. One of the common ways to investigate surfaces taken by, among others, Enriques and Castelnuovo,[48] was to look at these surfaces as covers, for example, as double covers (of the form $z^2 = R(x,y)$), asking about their properties and how they are dependent on a given curve *R*. Another way was to examine the obtained set of permutations associated to the branch curve and its possible algebraic structure, a research direction initiated by Enriques.[49]

Returning to the Italian school of algebraic geometry and recalling that d'Orgeval worked with Enriques between 1936 and 1938, one should note the major role Enriques gives to intuition.[50] Enriques emphasized the importance of intuition in both scientific and mathematical research. As early as 1894, he remarked that "we will seek to establish the postulates derived from experimental intuition of the space that appear to be the simplest for defining the object of projective geometry" (Enriques 1894b, 551), and that there is an "infinity of different forms of intuition"[51] (Enriques 1894a, 9–10). These views continue to be present in Enriques' thought until the end of the 1930s, when he highlighted forms of intuition, including the imagination (the intuition "of what can be seen") and the "more abstract [intuition] . . . which makes it possible for the geometer to see into higher dimensional space with the eyes of the mind"[52] (Enriques 1938, 173–174). Enriques' conception of intuition was clearly influenced by Felix Klein (see, e.g., Gray 2008, 122–123; Giacardi 2012, 223–229). I stress this aspect in Enriques' thought since it clearly positions him—if one employs Mehrtens' categories—as a counter-modern.

Among the other mathematicians active in this school, one may name Corrado Segre and his nephew Beniamino Segre, as well as Oscar Zariski, Eugenio Bertini, and Pasquale del Pezzo. It should be noted, however, that "the Italian school was not strictly a national 'school,' but rather a working style and a methodology, principally based in Italy, but with representatives to be found elsewhere in the world" (Brigaglia 2001, 189). Moreover, this school had a heterogeneous character; that is, not all of its participants can immediately be characterized as counter-modern.

This golden age of the Italian school ended toward the end of the 1920s, and some of its main mathematicians turned to research other subjects. Zariski, for example, from 1927 to 1937 focused

[48]Who followed the works of Alfred Clebsch and Max Noether; see Friedman 2022, 71–73.

[49]On how Enriques researched the branch curve from the end of the nineteenth century to the 1920s, see Friedman 2022, 62–90.

[50]A review of Enriques' philosophy of mathematics and of the sciences is outside the scope of this paper, and only a short survey will be given here regarding his conception of intuition; see e.g. Bussotti and Pisano 2015.

[51]The entire citation is as follows: "The importance that we attribute to abstract geometry is not (as may be believed) opposed to the importance attributed to intuition: rather, it lies in the fact that abstract geometry can be interpreted in infinite ways as a concrete (intuitive) geometry by fixing the nature of its elements: so in that way geometry can draw assistance in its development from an infinity of different forms of intuition."

[52]Translation taken from Giacardi 2012, 231. See also Schappacher 2015.

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more on topology, before moving to rewrite algebraic geometry on algebraic foundations. His work during the 1930s focused mainly on the fundamental group, looking at topological problems arising in algebraic geometry. More specifically, in several of his papers during this period he examined the fundamental group of the complement to the branch curve. This group is the set (more precisely, the group) of all loops in the (projective) plane surrounding the branch curve,[53] and Zariski attempted to understand its structure and properties. However, while it is clear that Zariski employed algebraic tools to investigate his group, one cannot claim that this series of papers constituted a precursor or a modern turn in his work. Other mathematicians who delineated other research directions with respect to the branch curve were Beniamino Segre and Oscar Chisini; the latter examined this curve and its degenerations during the 1930s (Friedman 2022, 98–101 and 125–133). I will examine Chisini's research in more detail below, since d'Orgeval's research was based on it.

One of Zariski's major publications in this period is his 1935 book *Algebraic Surfaces* (Zariski 1935), a "definitive account of the classical theory of algebraic surfaces," which, as Parikh claims, "would convince him of the need to rewrite the entire foundations of algebraic geometry" (2009, 51). While the question of whether this book indeed contains the seeds that convinced Zariski "to rewrite the entire foundations of algebraic geometry" goes beyond the scope of this paper, it is clear that Zariski in this book criticizes the Italian school of algebraic geometry. While he delivers a systematic exposition of the Italian literature, creating an impression of a unified Italian school of algebraic geometry operating at the turn of the century, he underlines not only missing or uncertain proofs but also the (missing) epistemic value of rigor.[54] In this sense, Zariski was pointing out the limits of the various counter-modern positions taken by the Italian school.

During the 1930s, another approach to algebraic geometry arose: that of Bartel Leendert van der Waerden, who was also known during the 1930s due to his book *Moderne Algebra*.[55] Van der Waerden's research on algebraic geometry had already begun during the second half of 1920s; as Schappacher notes, his contributions to "algebraic geometry announced a transition from the *arithmetization* [à la Emmy Noether, using ideal theory] to the *algebraization* of algebraic geometry" (Schappacher 2007, 255).[56] His ideas for an algebraic reformulation of algebraic geometry (e.g. using generic points and specializations) were presented in a series of papers, many published during the 1930s, called *Zur algebraischen Geometrie*, an approach which Schappacher describes as a "modest algebraization of algebraic geometry" (ibid., 270).

As noted, while the golden age of the Italian school was in decline toward the end of the 1920s, it did not disappear altogether, and its second period is characterized not only by the activity of Francesco Severi, but also by the influence, starting in the 1920s, of Mussolini's Fascist regime on Jewish mathematicians. Zariski immigrated to the USA in 1927 due to the increasingly alarming situation in Fascist Italy; Enriques, as is well known, was forced to resign in 1938; and B. Segre was expelled from Bologna university. The extent of the influence of the racial laws on Jewish mathematicians has been analyzed thoroughly in several publications (Finzi 2005; Capristo 2005).[57] It is not without relation to these developments that the most original ideas of the Italian

[53]Zariski was nevertheless influenced by Enriques's work, on the one hand, and by Lefschetz's work, on the other; on Zariski's work on this topic, see Friedman 2022, 93–98.

[54]See Friedman 2022, 105–109 for an analysis of Zariski's *Algebraic Surfaces*.

[55]On van der Waerden's work in algebra (esp. his book *Moderne Algebra*) and algebraic geometry, see Corry 2004, 43–54; Schappacher 2007.

[56]It should also be noted that the different mathematical approaches for dealing with algebraic functions at the beginning of the twentieth century were described by Felix Klein in 1926 as the "tower of Babel" (Klein 1926, 327): Klein notes the Italian school of algebraic geometry (or, as Klein noted, the "Italians") during the first decades of the twentieth century with its "geometric thinking," and German mathematicians with their "arithmetic procedures." These two approaches, according to Klein, almost led to a misunderstanding between the various communities.

[57]To briefly recall, the racial laws of 1938 involved, among other things, not only the "purging" and exclusion of Jews from universities but also the prohibition of the use and publication of books and papers written by Jewish authors.

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school during this period can mostly be attributed to contributions from "minor" authors. These mathematicians were isolated from other mathematical communities partly through their own choice (i.e. not to follow the discussions and developments in modern algebra), and partly due to the Fascist regime, which isolated the scientific and hence mathematical community from having contact with other communities outside of Italy. "Minor" refers to an epistemic configuration that deals with objects and techniques that were considered—either at that time or later—as representing marginalized or even outdated research programs.[58] Such is the work, between the 1930s and the 1950s, of Chisini and his students, who chose not to take into consideration other, more algebraic research directions when developing their own research, research which did not, or could not, take into account the rise of modern algebraic geometry.

As we will see when examining d'Orgeval's work between 1938 and 1945, d'Orgeval was influenced both by Chisini's research topics and by his methods of inquiry. While I will elaborate on the mathematical configuration of Chisini himself below, here I would like to discuss his views of mathematical practices. Carlo Felice Manara, one of Chisini's students, noted Chisini's approach to mathematics, which not only emphasized the "vividness of the imagination, understood as spatial imagination," but also expressed "mistrust in front of every formal reasoning and every algorithmic acrobatics" (Manara 1987, 15). Chisini researched a variety of subjects, including complex algebraic surfaces as coverings, their branch curves, and singular curves in general. In previous works (Friedman 2019), I have described Chisini's research on new modes of presentation of plane singular curves with the help of braids, though not with Artin's algebraic formulation of braids, which was published in 1926. Here, however, it is essential to emphasize that Chisini already underlined, in an article from 1933 that working with curves and their associated braids becomes more manageable when one uses "material models" with "material threads with notable thickness" (Chisini 1933, 1146–1147). Both Piera Manara and Maria Dedò, the daughters of Chisini's students,[59] recall Chisini's string models being of different colors used to model curves (Friedman 2022, 128). C. F. Manara notes that Chisini's "distrust [in algebra] led him to want to build tangible and material models" (Manara 1987, 23). These material models of braids were used not only to illustrate complex curves but also to prove certain properties concerning their singularities, as was later developed by Modesto Dedò. Chisini's skepticism also led him to ignore Artin's research (and subsequent research) on the braid group, and may have prompted a disconnect from other research directions that were on the rise during this period, such as commutative algebra.

Here it might be worth pausing to reexamine this episode with Mehrtens' categories. Clearly, the rejection of and objection to the structural turn in algebra and the algebraic rewriting in algebraic geometry characterizes Chisini's (and his students') work as counter-modern in a way which is more radical than Enriques' counter-modern approach. In a paper on material mathematical models published after *Moderne—Sprache—Mathematik*, Mehrtens notes that, before becoming merely pedagogical objects, these models were, at least for a certain period (i.e. during the last decades of the nineteenth century), "boundary objects" (Mehrtens 2004, 301), that is, objects to be found between modern and counter-modern mathematics. More precisely, Mehrtens notes that "mathematical models are creations of human hands and minds," and hence may also be considered as modern mathematics, "but with [Felix] Klein they stand for *Anschauung* and thus for a specific brand of counter-modernism" (ibid., 293). Moreover, as Epple (1997) points out, Artin himself combined modern and counter-modern elements in his 1926 paper. While Artin's work was later reconceptualized as "too modern" by Chisini (as Chisini employed his own material models and braid diagrams), the work of Dedò,[60] who in 1950, following Chisini, eventually tried to develop "an algebra" (Dedò 1950, 228) of braids and their

[58]This however does not necessarily mean that such a configuration is an ephemeral one.

[59]Carlo Felice Manara and Modesto Dedò respectively. On Chisini's string models, see Friedman 2019, 283–289).

[60]On the work of Dedò on braids, see Friedman 2019.

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factorizations, shows that such a strict opposition between the two categories is hardly possible or helpful. We will see in the following that d'Orgeval's work, done in a relative isolation, may also lead to a reexamination of this opposition.

On a more international and less "minor" scale, last but certainly not least in the rapidly changing landscape of algebraic geometry during the 1930s and the 1940s, one must also mention, along with Zariski's work, André Weil's own rewriting of algebraic geometry, reaching one of its highlights with the publication of his *Foundations of Algebraic Geometry* in 1946, a work begun in the 1940s. Both of these rewriting projects can be described as modern.[61] These developments will not be discussed here, however, since during his captivity in the Oflags d'Orgeval would not have had access to or knowledge of these rewritings.

As was already noted, and as I will examine more thoroughly below, d'Orgeval's work before and during his captivity in the Oflags is situated in the framework of the Italian school of algebraic geometry. Leloup (2009, 224) notes that French mathematicians (and mathematics doctorands) knew the works of van der Waerden and Emmy Noether, and in the four theses on algebraic geometry noted above (by d'Orgeval, Eger, Gauthier, and Lesieur), one finds several references to German mathematicians. While d'Orgeval most probably knew van der Waerden's works (as van der Waerden is cited by his colleagues at that time), none of the algebraic rewriting projects (by van der Waerden, Zariski, or Weil) are either used or mentioned by him. On the other hand, all of these four theses refer heavily to the works of Italian geometricians. It is against this background that I want to analyze d'Orgeval's work between 1938 and 1945. As we will see, his work is characterized not by a critique of lack of rigor or of Chisini's distrust in algebra, but by a certain distance from an extreme version of opposition to "modernity" (à la Mehrtens), pointing toward the limits of Chisini's methods. As will be highlighted below, however, reaching these limits does not necessarily mean that a "natural consequence" for the research of algebraic geometry would be a "profound remodeling of algebra" (Schappacher, 2007, 247).

(ii) On d'Orgeval's mathematical configuration: Algebraic geometry at the Oflags

D'Orgeval's investigation of algebraic surfaces, considered as ramified covers of the complex (projective) plane, most likely began during his stay in Italy between 1936 and 1938, though his talk at the Julia Seminar on March 13, 1939 was on a completely different topic. His investigation of ramified covers arose out of his investigations of infinitesimal deformations of a degenerated curve into another curve, the latter being the branch curve of the investigated surface. The aim of his research was to understand the properties of algebraic surfaces (e.g., those whose genera are all equal to 1, the subject of his PhD thesis), which is why d'Orgeval's research focused on a variety of ways to examine this curve, including via deformations.

While the formulation used above ("branch curve") is a modern one, the terms d'Orgeval employs are similar: a ramified surface is called a "plan multiple" or a "plan multiple d'ordre n" (d'Orgeval 1943a, 73), meaning that it is an algebraic surface, being a cover of order n. A branch curve is termed by d'Orgeval a "ligne de diramation" or a "courbe de diramation" (ibid.). These terms were also employed by Enriques and Chisini. Indeed, in a note published in 1938, d'Orgeval stresses that he is following Chisini's method concerning this kind of construction using a degenerated curve: "Mr. O. Chisini has shown that it is possible to obtain a curve φ, which is a branch curve of an n-fold plane [cover], from a sequence of $n - 1$ curves linked in a suitable way"[62]

[61]See e.g. Corry 2004, 296–297: "Zariski, like his French colleagues (and especially Weil), though independently of them, … set out to redefine the main problems and the conceptual foundation of algebraic geometry in terms of the newly consolidated, structural view of algebra."

[62]"M. O. Chisini a démontré que l'on pouvait obtenir une courbe φ, qui soit de diramation pour un plan n-ple, à partir d'une suite de *n-1* courbes liées de manière convenable."

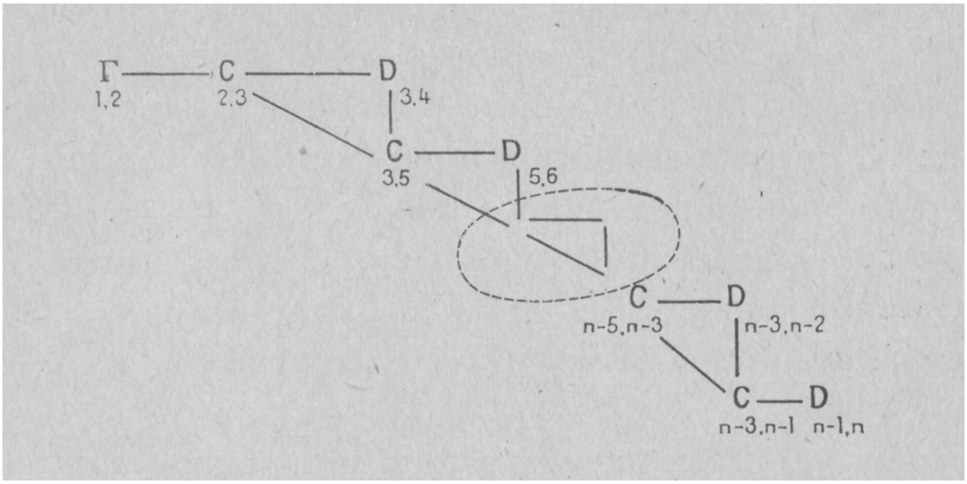

Figure 2. One of the diagrams in d'Orgeval 1938, 1867. Note that a line connects both curves if the associated permutations share one value.

(d'Orgeval 1938, 1866). Moreover, d'Orgeval was not only citing Chisini's writings; he also knew Chisini personally, as was noted above.

Here, in order to understand what Chisini's method is and how d'Orgeval made use of it, but also modified it during his time in the Oflags, another detour is needed. This method consists of taking a curve $\overline{\varphi}$ with $n - 1$ irreducible components $C_1, \ldots, C_n$, denoted as $\overline{\varphi} = C_1 \cdot C_2 \cdot \cdots \cdot C_n$. Chisini looked at the square of this curve $\overline{\varphi}^2$ and claimed that with "infinitesimal variations" of $\overline{\varphi}^2$, which satisfy certain conditions, one can obtain another (irreducible) curve φ, which is a branch curve of an n-degree cover (Chisini 1934). For example, if φ is a curve having two components, C_1 and C_2 (denoted as $= C_1 \cdot C_2$) such that $C_1 = \{f_1(x,y) = 0\}$ and $C_2 = \{f_2(x,y) = 0\}$, then φ^2 is defined by the equation $(f_1(x,y)\, f_2(x,y))^2 = 0$. An example of an "infinitesimal variation" may be, for example, the passage of the curve $xy = 0$ to curve $xy = \varepsilon$ when $\varepsilon > 0$ (in d'Orgeval's research one performs an "infinitesimal variation" of φ^2). Note that the curve $(xy = \varepsilon)$ is smooth, while the limit curve $(xy = 0)$ is singular and has a node.

One of the initial conditions of this method is that, for each component C_i of the initial curve $\overline{\varphi}$, one associates the following permutation $(i,\ i + 1)$ in the symmetric group of n letters, a permutation that eventually describes which sheets of the n-degree cover are branched along the obtained branch curve.[63] D'Orgeval wished to introduce certain "modifications of this construction" (d'Orgeval 1938, 1866) and to show that other permutations may be associated (not necessarily of the form $(i,\ i + 1)$), while still employing Chisini's method, in order to obtain other surfaces.[64] And indeed, in 1938, he presented a diagram of curves (see Fig. 2), a diagram which does not appear in any of Chisini's works on the subject. This diagram describes, for each curve Γ, C, or D (being a cubic curve, a conic, or a line respectively), which permutation is associated to it. To be precise, for every such diagram, the following curve is associated: $\overline{\varphi} = \Gamma \cdot C \cdot D \cdot \cdots \cdot C \cdot D$ (when all of the curves C or D are different from each other); afterward, the curve $\overline{\varphi}^2$ is deformed, obtaining another curve denoted by φ, which is a branch curve of the desired surface. What is new in d'Orgeval's 1938 paper is not only the diagram, but also how the

[63]One denotes with the symbol $(i,i + 1)$ the permutation which permutes the numbers i and $i + 1$ and leaves all the other elements in the set $\{1, \ldots, n\}$ fixed. In the context of d'Orgeval's research, the association of this permutation to C_i means that, in the neighborhood of the component C_i, the sheets of the surface numbered i and $i + 1$ interchange.

[64]More concretely, d'Orgeval's aim, which he also states in his thesis (1943a), was to investigate and construct algebraic surfaces whose genera are all 1 in the framework of the classification project.

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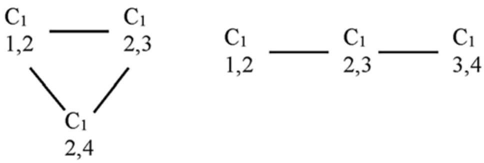

Figure 3. In diagram (a) (left), which is found in d'Orgeval 1942, 341, each of the C_1's is a different line. For this specific construction, d'Orgeval notes that it corresponds to the Veronese surface of degree 4. In d'Orgeval 1943b, 225, both diagram (a) and diagram (b) are presented. Diagram (b) (right) presents the arrangement of curves associated to a ruled surface of degree 4. As before, each of the C_1's is a different line. © Graphic by M.F.

permutations are associated to the curves: while before (in Chisini's configuration), for each component C_i of the initial curve $\overline{\varphi}$, one associates the permutation $(i,\ i+1)$, now the association of permutation to the curves Γ, C, or D is different, since, for several curves, a permutation of the form $(i,\ i+2)$ is associated.

It is exactly this line of investigation that was developed further by d'Orgeval during his captivity, when he introduced several unique methods and terms. As noted above, in 1942 d'Orgeval published a one-page note that was presented by Élie Cartan. Cartan remarks in a footnote that the "present note is a summary, which attempts to be as faithful as possible, of a more developed paper transmitted by the author"[65] (d'Orgeval 1942, 431). Nevertheless, it is not clear whether the initiative to publish this summary came from Cartan or from d'Orgeval himself. The paper Cartan refers to is the more elaborate paper (d'Orgeval 1943b), which was published in the following year and consists of eighteen pages. Indeed, the one-page note (d'Orgeval 1942) is a highly condensed summary of this long paper, and as a result it may seem somewhat imprecise. It is in this publication, however, that a new term is coined for the first time to denote the surface resulting from the special arrangement of the curves presented above: "a multiple plane of entangled sheets" ("plan multiple à feuillets enchevêtrés") (d'Orgeval 1942, 341), meaning that the sheets of the examined surface are entangled because the associated permutations are not successive (i.e. some of them are not of the form $(i,\ i+1)$). A diagram of three lines, all denoted by C_1, is drawn as well, together with the associated permutations, to depict what is meant by "entangled sheets" (see Fig. 3 (left)).[66]

The paper (d'Orgeval 1943b) is indeed a more coherent presentation of d'Orgeval's construction, and also contains a more detailed and precise explanation of Chisini's method (ibid., 218–222) and how it can be modified. Here another new term appears: while the term "plan multiple à feuillets enchevêtrés" (ibid., 225) is again mentioned to denote the surface resulting from the more complicated arrangement of curves, the cover which results from Chisini's arrangement is termed a cover "of successive sheets" ("à feuillets successifs") (ibid., 227). Both arrangements ("feuillets enchevêtrés" and "feuillets successifs") are depicted, as shown in figure 3(left) and 3(right) respectively. Moreover, d'Orgeval stresses not only that Chisini's method can be modified, but that this method may cause difficulties for such research on surfaces (ibid., 653).

D'Orgeval's thesis, titled "Les surfaces algébriques dont tous les genres sont 1,"[67] which he wrote in Oflag X B, deals, among other subjects, with the construction of surfaces according to the above method (d'Orgeval 1943a, 73-94). While summarizing the methods described above, and again using the terms "feuillets enchevêtrés" and "feuillets successifs" (ibid., 75), d'Orgeval aims to

[65]"La présente Note est un résumé, qui veut être aussi fidèle que possible, d'un Mémoire plus développé transmis par l'auteur."

[66]The procedure of constructing the branch curve, and hence of deducing the existence of the branched covering, is the same: deforming $\overline{\varphi}^2$ when $\overline{\varphi} = C_1 \cdot C_1 \cdot C_1$, in order to obtain the branch curve by infinitesimal deformations. Note that each of the C_1's is a different line.

[67]"The algebraic surfaces of which all the genera are 1."

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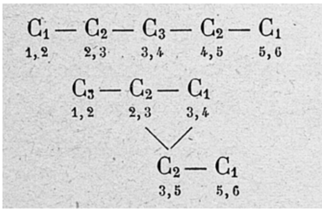

Figure 4. Two equivalent diagrams for surfaces with $\pi = 4$ (d'Orgeval 1943a, 82). Permission to reprint granted by the publishing house Dunod and authorized by the heirs of Bernard d'Orgeval.

show how, for the investigated surfaces (surfaces whose genera are all 1), these curve diagrams can be *manipulated*. This aspect is certainly new, and its introduction stands in a certain contrast to Chisini's method, as I will underline below.

As d'Orgeval notes, if one takes a surface whose genera are all equal to 1, and on it a pencil of hyperplane sections, being curves, then these curves are of genus π and of degree $2\pi - 2$ (ibid., 76). D'Orgeval also shows that the result of his thesis is that "for every given value of π, there exists one family" of such surfaces (ibid., 4). What d'Orgeval concludes from this result is that, for a given value of π, if one has two different diagrams of curves, when from both one can construct ramified surfaces (both with all of their genera being 1 and with the same given value of π), then these diagrams are equivalent, in the sense that one can operate on them and still obtain a surface in this family. For example, for $\pi = 4$, d'Orgeval notes that "we can obtain two types of representation," which are shown in figure 4 (ibid., 82). But since there is only one such surface in the same family,[68] "we hence conclude from that that the transport of the group $C_2 - C_1$ [being two curves found in the diagram] can be done on the multiple plane [the cover] without changing the nature of the surface" (ibid.). The expression "the transport of the group $C_2 - C_1$" refers explicitly to an action on the diagram itself: moving the set of two curves $C_2 - C_1$ from one place in the diagram to another,[69] hence obtaining another diagram (see Fig. 4). Therefore, it is a diagram which can be manipulated. This action may, on the one hand, make the resulting diagram easier to understand. On the other hand, according to d'Orgeval, it does not change the characteristics of the surface obtained. Similar actions on diagrams are performed on surfaces with $\pi = 5$ or with $\pi = 6$, as can be seen in figure 5.

* * *

If we return to Mehrtens' differentiation between modern and counter-modern approaches to mathematics, it may be somewhat difficult to apply this classification to d'Orgeval's research during his captivity. On the one hand, we have seen that d'Orgeval attempted to develop Chisini's method. As was noted above, during his own research on branch curves, Chisini used material models of strings to prove certain results, a method which can be termed intuitive as well as material, and hence can certainly be classified as counter-modern, since Chisini himself often expressed his mistrust of every form of "formal reasoning" (Manara 1987, 15). D'Orgeval did not employ those methods and hence can be considered to be attempting to introduce more modern approaches and tools to Chisini's configuration. His use of manipulable diagrams shows this distancing from Chisini's strict, extreme counter-modern approach.[70]

While the diagrams may also be considered as a visual, even intuitive method to represent surfaces, as if their manipulation happens in the mind of the mathematician (hence associating to her certain cognitive abilities), d'Orgeval's investigation relied on the manipulation of this symbolic means of representation, a manipulation which takes place *on the paper* (i.e. as a formal

[68]Up to a certain equivalence relation called birational equivalence.

[69]Here C_1 represents a line, C_2 a conic.

[70]The literature on diagrams, their manipulation, whether physical or imaginative, and the associated reasoning is vast. See, for example, the recent papers De Toffoli 2022; Giardino 2018; Larvor 2019; De Toffoli and Giardino 2014.

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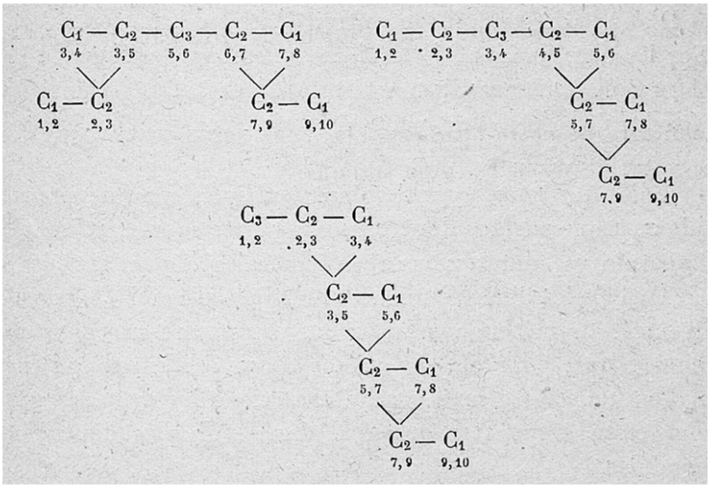

Figue 5. Several equivalent diagrams for surfaces with $\pi = 6$. Here d'Orgeval notes: "in the same way, one can show the identity of the represented surfaces" (d'Orgeval 1943a, 83). Permission to reprint granted by the publishing house Dunod and authorized by the heirs of Bernard d'Orgeval.

procedure). I claim that this manipulation is not similar to manipulation of diagrams of knots (e.g. in our imagination) or of braids (e.g. with materials models). This is because the diagrams do not represent an object similar to themselves (as knot diagrams represent knots or Euclidean diagrams represent rectangles in certain arrangements).[71]

What is left unexplained by d'Orgeval is the equivalent of this manipulative (and at the same time formal) procedure on the level of the surfaces (e.g. which birational mapping transforms the first surface with $\pi = 4$ into the second one), which *are* the object of investigation. Instead, with his manipulation of diagrams, d'Orgeval turns to a manipulation of symbols written on paper, hence introducing, following Mehrtens' terms, a more modern approach to this investigation. While one may indeed claim that there is a diagrammatic reasoning in action here, it is not a purely counter-modern one, since it does not solely turn to intuition or imagination, but rather takes place as a symbolic process. This certainly echoes Mehrtens' understanding of mathematical modernity; Mehrtens claims on numerous occasions that "modernity orients itself towards the signifiers, which it interprets as signs on paper that can be treated empirically," (i.e. manipulated on the paper), without turning to or postulating a unified subject with "Ur-Intuition or the gift of *Anschauung*" (Mehrtens 1990, 414).

While the above discussion shows that d'Orgeval's work may lead to a reexamination of Mehrtens's modern/counter-modern distinction, I claim that d'Orgeval's unique research configuration, developed at the Oflags, was ephemeral, an aspect which was not discussed by Mehrtens. Indeed, this unique configuration was formed during captivity; moreover, it was short-lived. This type of diagrammatical reasoning might have proved to be a novel method to study algebraic surfaces, but d'Orgeval abandoned it in 1946. To recall, d'Orgeval himself notes that, during the last year of his captivity, various aspects of the captives' intellectual lives disappeared, forcing them to discontinue the research and eventually to stop with the activities of the university. Moreover, while similar diagrams appear in his 1946 paper, which deals with similar topics (namely, with how to represent covers with such diagrams, and the conclusions which may be

[71] In this sense, they are certainly not geometric-topological diagrams in the sense posited in De Toffoli 2022, but they still require "enhanced manipulative imagination," as de Toffoli requires for such diagrams.

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drawn), such operations on the diagrams are no longer mentioned or used. In addition, the terms "feuillets enchevêtrés" and "feuillets successifs" are not even mentioned once, and in fact, after 1943, are no longer employed either by d'Orgeval or by any other mathematician.[72]

One of the reasons for d'Orgeval's abandonment of his own methods and terms may lie in his conclusion concerning Chisini's method: "The method of Mr. Chisini, in spite of the few generalizations that I added to it, still allows the representation of many surfaces to escape, even for rather small values of their [associated] invariants"[73] (d'Orgeval 1946, 101). That is, d'Orgeval distances himself from Chisini's "counter-modern" position. Nevertheless, he presents another kind of counter-modern approach, one that acknowledges the limits of radical counter-modern approaches (such as Chisini's) within mathematical configurations. But does this indicate an acknowledgement of the limits of working in isolation?

On the one hand, d'Orgeval's relative isolation in the Oflags and his dependence on the cooperation of the German officers there shaped, but also narrowed, his research. On the other, it also led to the formation of another kind of counter-modern research, at least in the way d'Orgeval handled diagrams and diagrammatic reasoning. It shows, as Epple emphasized when investigating Artin's research on braid theory, not only that there are various shades of counter-modernity (and modernity), but also that ephemeral configurations, such as those formed in the Oflags, may prompt unique combinations and versions of counter-modern and modern practices.

5. Conclusion: Reexamining Mehrtens with the Oflags

As I claimed in the concluding paragraphs of the former section, d'Orgeval's configuration, consisting of manipulable diagrams and idiosyncratic terms for the investigation of algebraic surfaces and their branch curves, may be described as ephemeral. Though created in relative isolation, it was not isolated from other research configurations: d'Orgeval himself viewed his research on the deformations of curves as a development of Chisini's method. But while the methods and terms belonging to d'Orgeval's configuration were communicated to other mathematicians—such as Cartan and Godeaux—the extent to which these mathematicians encouraged their use or used them in their own research remains unclear. Nor is it clear whether either Chisini or his students were aware of d'Orgeval's work in this field, work that would certainly have been relevant to their own work during the 1950s.

While d'Orgeval's configuration was not developed and consolidated in complete isolation, since his results were sent to Cartan and Godeaux and were subsequently published, these results were not further developed after the war either by d'Orgeval or by any other mathematician, and consequently disappeared. At the same time, captivity conditioned and enabled the creation and reorganization of d'Orgeval's ephemeral configuration. More precisely, it was the Vichy regime and, more locally, the universities and the power relations between French prisoners and German officials at the Oflags which provided the framework for this kind of research to take place. These power relations reflect Mehrtens' insights about mathematics and mathematicians during the Second World War, even if only partially, and even if he did not consider the Oflags as a site where mathematical activity may happen. To nuance Mehrtens' history of mathematics in captivity or in the concentration camps in the National Socialist state, one can claim that d'Orgeval's activities at the Oflags, where the "universities" created an environment conducive to research, were a kind of

[72]Chisini and the group of mathematicians surrounding him, which d'Orgeval himself later referred to as the "school of Chisini" (d'Orgeval 1953, 188), would have been the most immediate readership, since d'Orgeval noted Chisini's method and his "representative braid" ("faisceau représentatif") several times (d'Orgeval 1938, 1867). The method consisted of representing a singular curve with a braid (or collection of braids), and it was also a common method used by Chisini's students. On their work, as well as on the work of Chisini on representing singular curves with braids, see Friedman 2022, 123–155.

[73]"La méthode de M. Chisini, malgré les quelques généralisations que je lui ai apportées, laisse donc encore échapper la représentation de nombreuses surfaces, même pour des valeurs assez faibles de leurs caractères."

mobilization of mathematical competence on the part of d'Orgeval himself, in the sense that he was able to take advantage not only of the isolating and isolated place and conditions forced on him at the Oflags, but also of the opportunity to correspond with his colleagues (Cartan or Godeaux, and even Dumont), notwithstanding the relative lack of access to literature. Hence, in its own way, d'Orgeval's captivity also had productive effects, as it prompted a consolidation of terms and diagrammatical techniques which had not been developed before his imprisonment at the Oflags.

It has thus been shown that an examination of mathematical configurations that emerged and were consolidated at the Oflags is able to nuance and expand Mehrtens' account of mathematics in captivity and of its political dimension, also when taking into account the involvement of the Vichy regime in assisting mathematicians to obtain certain privileges and thereby enabling research. Further research in this direction would certainly be profitable and would involve a detailed study of other (not necessarily French) mathematicians and the various mathematical configurations formed at the different Oflags and their associated "universities." Indeed, Mehrtens' account does not consider the particular nature of the mathematics practiced or developed in captivity. Moreover, I claim that, at least in d'Orgeval's case, political positions, such as d'Orgeval's involvement with Action française, which Mehrtens would probably have designated as counter- or even anti-modern, did not influence—at least not explicitly—his mathematical research.

This brings us to examine d'Orgeval's ephemeral mathematical configuration as a configuration which undermines Mehrtens's distinction between modern and counter-modern approaches to mathematics. As Epple notes, the very same mathematical configuration may contain both modern and counter-modern elements and a "grey scale will appear between the white moderns and the black counter-moderns" (Epple 1997, 192), which can be considered the case in d'Orgeval's research during his captivity in the Oflags. What was shown in examining d'Orgeval's research as a case study is that this "grey scale" also has a history, in the sense that certain configurations may emerge only for a relatively short time, being ephemeral. This ephemerality is indeed a direct result of captivity, and one may claim that it is in captivity that a new configuration may emerge, due either to outer political (if implicit) influence or to isolation, which may prompt either a narrowing down or, on the contrary, the invention of a new field of research. The space opened up in this way may allow a distancing from older approaches (in our case, Chisini's counter-modern approach), allowing modern and counter-modern elements to be combined. Be that as it may, it seems appropriate to claim that d'Orgeval would have agreed with Braudel's assessment that captivity conditioned and shaped (mathematical) research, even if d'Orgeval's configuration was much more ephemeral.

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