A Clash of Mathematical Titans in Austin:

Harry S. Vandiver and Robert Lee Moore (1924–1974)

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The mathematical scene at the University of Texas was dominated from the mid-1920s to the late 1960s by two towering, yet very different figures: Robert Lee Moore (1882–1974), and Harry Schultz Vandiver (1882–1973). Starting in the late 1930s, these two giants entered into a conflict that grew to mythic proportions and lasted for more than three decades. Though this affair permeated all aspects of departmental life, and even spilled over into the wider arena of academic affairs in Austin, it became most visible in 1945 when Vandiver—whose research focused exclusively on number theory and associated algebraic fields—was transferred to the Department of Applied Mathematics and Astronomy. In this unlikely setting, the alienated easterner and the feisty southerner carried on their own private cold war that echoed the politics of the post-war era.

In retrospect this conflict may seem rather preposterous. In fact, eye witnesses at Austin have never been able to say precisely when and how the enmity began, though many could later remember the icy non-relations between Moore and Vandiver. After the departments of pure and applied mathematics were joined in the early fifties, Moore and Vandiver made sure that their offices in UT's new Benedict Hall not only were on different floors but also could be reached by separate stairways.[1] Vandiver's son, Frank (1926–2005), a highly respected historian of the American Civil War and president of Texas A&M University, remembered Moore pointing a loaded gun at him when he was a child:[2]

> I was . . . walking home from school one day, . . . and this car pulled up by me on the curb, and Dr. Moore was in it. I thought he was going to offer me a ride home which I was willing happily to accept. Instead of that, he pointed this pistol at me, and said, "Ah ha, what do you think of this?" I was absolutely terrified. I thought he was actually going to shoot me. I don't remember what I said. . . . I realized that Moore and Daddy were not friends, and I had the feeling that maybe he was going to kill me, but I think it was sort of a grim joke he was playing. The gun was loaded, that I could tell, so I was not enamored of that moment.

In *R. L. Moore: Mathematician and Teacher*, John Parker devotes an entire chapter to this legendary feud, fittingly entitled "Clash of Titans." Here I offer a fresh view of this rather bizarre episode in the history of American mathematics against the background of the portrait of Vandiver—a somewhat forgotten figure—presented in my article in the last issue of this magazine.[3] There, the focus was on Vandiver's lifelong pursuit of Fermat's Last Theorem (FLT); now I turn to broader themes in his career, many of which reflect ongoing conflicts at the University of Texas, as well as the particular antagonism that existed between him and Moore. Some of the main elements of this story appear in Parker's book, but I emphasize Vandiver's perspective and complement the picture with some interesting unpublished documents from the latter's archive in Austin.

It is also important, of course, to consider this conflict in context and proportion. There are undoubtedly many such stories of local feuds in mathematics departments or of local figures who single-handedly dominated departmental life. Still, this dispute had a special intensity and tone, heightened no doubt by the stature of both men in the American context at the time. Moore was certainly a much respected figure in the American community; he served as mentor to several students who went

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[1][Greenwood 1988, 47].

[2]Frank Vandiver, interview with Ben Fitzpatrick and Albert C. Lewis, June 30, 1999 (Oral History Project, The Legacy of R. L. Moore, Archives of American Mathematics, Center for American History, The University of Texas at Austin).

[3][Corry 2007].

on to positions of prominence. An assessment of Vandiver's standing in the community is a more complex matter, as I pointed out in my previous article.

Personal differences were no doubt a central factor in igniting and then sustaining and exacerbating this conflict. The gun incident with young Frank Vandiver was just one extreme example of Moore's often aggressive behavior. In 1944, for instance, a heated discussion in the mathematics department reportedly ended up in a fistfight between Moore and Edwin Ford Beckenbach (1902–1982), an associate professor at Austin at the time.[4] As Albert C. Lewis has pointed out, "in Texas, at least, the successful use of nonverbal language need not detract from one's reputation. In fact, for an established male scholar it adds a cachet which can probably only help one's reputation outside the scholarly world."[5] In his younger years, Moore trained intensively in boxing, and his rather aggressive personality could occasionally slip into physical intimidation and even assault.[6] Still, Moore was hardly a singular case; his colleague and life-long friend H. J. Ettlinger was involved, in his youth, in physical incidents (one in response to an anti-Semitic insult), and later "was accused of using less violent but still physical tactics in departmental controversies of subsequent years."[7]

This rough-and-tumble Texas atmosphere was not congenial to Vandiver's naturally reticent personality. He would sometimes isolate himself for days to do research and listen to his large collection of classical records. Vandiver was "hardly the athletic type," and in the winters he worked in a top coat with a portable electrical heater warming his feet and legs.[8] Moore, on the other hand, was a dynamo. A strongly authoritarian personality, he was directly involved in, and made great efforts to shape, every detail of departmental life for decades. Vandiver always kept himself at a safe distance from any kind of administrative duties. He was famous for taking frequent leaves of absence, drawing on the financial support of various foundations in order to visit other departments both in the United States and abroad.

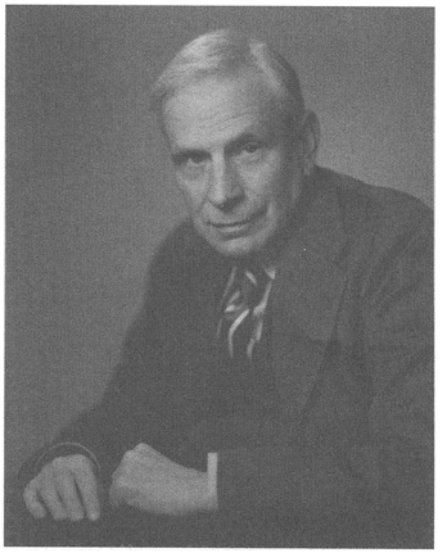


Figure 1. Harry S. Vandiver (Creator: Walter Barnes Studio (HSV).

The clash between these two mathematical titans thus operated at a variety of levels, including cultural and political issues that were charged with tense emotions. As I will show, personal differences by no means tell the whole story. This once-famous feud deserves closer attention because of its deeper, underlying dimensions, which reflect how each of the protagonists saw himself as a researcher and a teacher. Moreover, the contrasting opinions and attitudes of Vandiver and Moore also had ramifications for their respective mathematical activities. As we shall see, Vandiver took a very different approach from Moore's when it came both to mathematical research and mathematics education.

Two Mathematicians, One University, Two Departments

Soon after it opened in 1883, the University of Texas at Austin appointed George Bruce Halsted (1810–1936) its first professor of mathematics. Leonard Eugene Dickson (1874–1954) was the most prominent among the relatively few mathematics students in those early years. After completing an M.A. degree in 1894, Dickson moved to Chicago to become one of the first doctoral students of Eliakim H. Moore (1862–1932). In 1899 Dickson accepted a three-year appointment at Texas, but soon left again for Chicago, this time for good. One of the students in his calculus course during his brief tenure at UT was Robert L. Moore, who also took courses with Halsted. R. L. Moore later went to Chicago for doctoral studies as well, working on foundations of geometry between 1903 and 1905.[9]

Always outspoken and critical, Halsted eventually got into trouble with the Board of Regents, and at the end of 1902 he was dismissed from his post. Mathematical leadership at UT devolved to Milton Brockett Porter (1869–1960) and Harry Yandell Benedict (1869–1937), both of whom had studied at Austin and later completed Ph.D. degrees at Harvard. As university regulations then allowed for only one professor in each department at UT, Benedict was appointed professor in applied mathematics. These regulations were later to change, but the division into two departments would remain, and the relationships between them remained a source of ongoing administrative troubles.[10] The increase in student population in the USA in the period following WWI heightened the demand for mathematics teachers across the country, Austin included. During the war, Goldie Prentis Horton (1887–1972) had worked with Porter and in 1916 became the first recipient of a doctoral degree in mathematics granted by the University of Texas. Soon after graduating she joined the Austin faculty; she and Porter married in 1934.

Porter's aim was to raise research standards at UT by hiring mathematicians of proven quality; he was obviously undeterred by unconventional personalities. R. L. Moore was

[4][Greenwood 1983, 53]. This incident has been confirmed to me in a personal communication by Richard Kelisky, one of Vandiver's students.
[5][Lewis 1989, 225].
[6][Parker 2005, esp. 84–6].
[7][Lewis 1989, 224].
[8]Robert Greenwood, "The Benedict and Porter Years, 1903–1937," unpublished oral interview (March 9, 1988) (MOHP), p. 26.
[9]For historical information on mathematics at UT, I rely on various sources, and especially on [Greenwood 1983, 1988], [Lewis 1989], [Parker 2005].
[10][Lewis 1989, 232].

appointed assistant professor in 1920 after a decade at the University of Pennsylvania. Moore's mathematical capabilities had been recognized while he was just an undergraduate at Austin. In 1902 he succeeded in sharpening Hilbert's analysis of the axioms of geometry (in an early edition of *Grundlagen der Geometrie*) by pointing out a redundancy. This research was part of a new trend of enquiry known as postulational analysis, which emerged in the United States in the first decade of the twentieth century.[11] Three years later he completed his dissertation at Chicago under the supervision of E. H. Moore and Oswald Veblen (1880–1960) on "Sets of Metrical Hypotheses for Geometry," a study that followed the same approach but focused on topological questions. For the remainder of his career—which began with brief appointments at Tennessee, Princeton, and Northwestern, prior to his 10-year-stay at the University of Pennsylvania—Moore continued his research on these same topics. Thus, in an important paper from 1915 he investigated separation properties in a strikingly innovative way. By the time he returned to his Alma Mater in 1920, Moore had published 17 research papers in a field whose name he had coined: point-set topology.

Four years later Vandiver arrived in Austin, having taught for five years at Cornell. A high-school dropout, Vandiver had studied some college-level mathematics in Pennsylvania but never took a college degree. In 1900 he began submitting solutions to problems posed in the *American Mathematical Monthly*, some in collaboration with the young George David Birkhoff (1884–1944). After spending more than ten years as a customs house broker, Vandiver obtained the position at Cornell in 1919, thanks in part to Birkhoff's endorsement. That same year he collaborated with Dickson (then at Chicago) in the preparation of the latter's book on the history of the theory of numbers, especially the chapter on FLT. Dickson became Vandiver's main source of inspiration in all aspects of mathematical activity. Dickson also did much over the following years to promote Vandiver's career. In 1914 Vandiver published his first article on FLT and for many years continued to present short communications to the AMS on that topic. In 1920 he published his first truly substantial contributions to FLT, for which he began to receive recognition. During his early years in Texas he continued this research, which led to a landmark paper in 1929. He was subsequently awarded the first AMS Cole prize for outstanding research in number theory.[12]

Moore's first ten years at Texas were similarly productive. In 1929 he presented a summary of his work in the Colloquium Lectures Series of the American Mathematical Society. Published in 1932, his *Foundations of Point Set Theory* came to be regarded as Moore's *magnum opus*.[13] Other members of the department of pure mathematics at the time included John William Calhoun (1871–1947), Edward Lewis Dodd (1875–1943), Paul Mason Batchelder (1886–1971), and Hyman Joseph Ettlinger (1889–1986). In 1925 Renke G. Lubben (1898–1980) was the first of Moore's students to join the faculty at Austin. Thus Porter's efforts led to the consolidation of a respectable graduate faculty, with Moore and Vandiver as its central pillars.

It seems that relations between Moore and Vandiver began on reasonably friendly terms. As an outsider and a later arrival in Austin, Vandiver was in a less advantageous position. He was also without formal academic training; but in Porter's view "the mere possession of a doctoral degree (or any other degree) was small indication of ability."[14] Moore presumably felt the same way. But later, when Vandiver became recognized world-wide for his research and was elected to the National Academy of Sciences only shortly after Moore himself, the latter took such matters of status very seriously. Moore seems to have been especially irritated when in 1946, at the height of their feud, an Honorary Doctorate of Science was conferred on Vandiver by the University of Pennsylvania, an institution that Moore always saw as his second academic home.

In view of the deep differences in background and personality between the two men, one can hardly be surprised that Vandiver and Moore did not develop a strong friendship. Moreover, a glance at the trajectories of their respective careers does suggest reasons why they became such fierce rivals. Beginning around 1930, Moore's research output gradually declined, both in numbers and in impact. Throughout the 1930s he published only five research papers, choosing instead to devote most of his time and efforts to teaching. By now he was also supervising large numbers of graduate students, several of whom would become distinguished researchers. The Moore school flourished in no small part because the Texas topologist knew how to use his influence effectively when it came to landing key positions for his former students. Vandiver, by contrast, would remain fully devoted to research for decades to come. At the same time, he never distinguished himself as a lecturer and attracted relatively few students. Instead, he worked with a faithful circle of collaborators, most of them from outside Austin. He met with them often, especially during his frequent leaves of absence. Whereas Moore excelled in the classroom, Vandiver favored scholarship. His expository papers and authoritative accounts related to FLT and the theory of cyclotomic fields were widely read.

These striking differences between Moore and Vandiver went to the core of their respective identities as mathematicians, and there can be little doubt that those differences contributed to the mutual animosity that developed between them. An anecdote from many years later is telling: In 1963, at the age of 81, Vandiver submitted his final paper to be published in the *Proceedings of the National Academy of Science*.[15] On this occasion, Edwin Wilson (1879–1964) wrote to express his delight that Vandiver was still working at an age when "most have had enough." To this, Vandiver replied that if people stop

[11]See [Corry 2004, 172–182].

[12]For details see [Corry 2007].

[13][Moore 1932]. The revised edition of 1962 also contains many acknowledgements of results obtained by his students.

[14][Greenwood, *et al.* 1973, 10929].

[15][Vandiver 1963].

publishing at an old age it is not because they have had enough, but in many cases, because "they permit teaching duties and certain other academic pursuits to take up so much of their time that it is impossible to prepare any original mathematical paper of their own."[16] Vandiver evidently took pride in saying that he had never let this happen to him. He did not need to add that the other Texas titan, who was still teaching in Austin, had given up research decades earlier.

Moore's Method and Vandiver's Lack Thereof

Nothing better signifies the stark contrast between the personalities of Moore and Vandiver than their respective attitudes toward teaching. The subtitle of Parker's biography very aptly captures the essence of Moore's character: "Mathematician and Teacher." If a reliable biography of Vandiver is ever written, the word "Teacher" will most certainly not appear in its title. Even his closest collaborators and friends stressed his poor abilities as a lecturer. His intellectual and personal energies were never directed toward teaching or supervising graduate students. Nor did he maintain close relations over the years with the few he did supervise (one in 1941 and four in the 1950s).

Parker emphasizes the centrality of teaching throughout Moore's entire career, including the development and influence of the famous Moore Method:

> The 50 students he guided to their PhDs can today claim 1,678 doctoral descendants. Many of them are still teaching courses in the style of their mentor, known universally as the Moore Method, which he devised. Its principal edicts virtually prohibit students from using textbooks during the learning process, call for only the briefest of lectures in class and demand no collaboration or conferring between classmates. It is in essence a Socratic method that encourages students to solve problems using their own skills of critical analysis and creativity. Moore summed it up in just eleven words: 'That student is taught the best who is told the least.[17]

To be sure, a precise definition of the Moore Method is not a straightforward matter. Moreover, given the quantity and quality of mathematicians who came under Moore's direct and indirect influence, one must presume that many developed their own versions of this teaching method.[18] Parker gathers a large number of testimonials from grateful and admiring students who went on to successful careers; many pointed to the training they received from Moore as the single most decisive factor in the consolidation of their mathematical outlooks and scientific personalities. One distinguished pupil, Raymond L. Wilder (1896–1982), offered this vivid account of his former teacher's methodology:[19]

> He started the course with an informal lecture in which he supplied some explanation of the role to be played by the undefined terms and axioms. But he gave very little intuitive material—in fact only meager indication of what "point" and "region" (the undefined terms) might refer to in the possible interpretations of the axioms. . . . The axioms were eight in number, but of these he gave only two or three to start with; enough to prove the first few theorems. The remaining axioms would be introduced as their need became evident. He also stated, without proof, the first few theorems, and asked the class to prepare proofs of them for the next session. . . . In the second meeting of the class the fun usually began. A proof of Theorem 1 would be called for by asking for volunteers. If a valid proof was given, another proof different from the first might be offered. In any case, the chances were favorable that in the course of demonstrating one of the theorems that had been assigned, someone would use faulty logic or appeal to a hastily built-up intuition that was not substantiated by the axioms. . . .
>
> The course continued to run in this way, with Moore supplying theorems (and further axioms as needed) and the class supplying proofs. . . . Moore *put the students entirely on their own resources* so far as supplying proofs was concerned. Moreover, there was no attempt to cater to the capacities of the "average" student; rather was the pace set by the *most talented* in the class.

Not everyone, of course, shared this enthusiasm for the Moore Method, which was roundly criticized by students as well as established mathematicians from the time the master first began to promote it. Vandiver was by no means an overt critic, but he also clearly showed no sympathy for such a radical approach. Nor was he willing to invest a similar amount of time and energy in teaching and supervision, and he remained essentially sceptical that any didactical method, including Moore's, could systematically turn out outstanding research mathematicians. Vandiver also disliked Moore's aggressive tactics when it came to hunting down promising students in UT's entering classes. In this manner, Moore gained indirect control over many of the best talents, including those who received financial aid, while depleting funds that might have gone to students associated with Vandiver and other, more passive, colleagues.

With regard to the training of graduate students, Vandiver's views were close to those of another Dickson protégé, Eric Temple Bell (1883–1960). Indeed, Vandiver and Bell had much in common, beginning with their mutual interests in number theory, though Bell's research never attained the level of Vandiver's. Like his Texas counterpart, Bell took a dim view of certain of his colleagues at Caltech who were constantly hunting for brilliant new students.[20] Nor did Bell ever distinguish himself as a lecturer,[21] though he was

[16]Wilson to Vandiver, March 18, 1963; Vandiver to Wilson March 27, 1963. Like other letters cited in this article, this one is kept in the Vandiver Collection, Archives of American Mathematics, Center for American History, The University of Texas at Austin (hereafter cited as HSV). Letters are quoted by permission.

[17][Parker 2005, *vii*].

[18]For information on Moore's students as teachers, see [Parker 2005, 144–159], [Zitarelli & Cohen 2004].

[19][Wilder 1959].

[20][Reid 1993, esp. 261–265].

[21]For a devastating criticism of Bell's didactic abilities voiced by a former student, Clifford Truesdell, see [Reid 1993, 284].

much more active than Vandiver when it came to supervising doctoral students. Still, Bell's antipathy toward teaching is apparent from a letter sent to Vandiver in 1933 in which he bluntly expressed his views about the futility of training researchers. Concerning Moore's avowed ability to produce original research mathematicians, he wrote:

> I don't blame you for getting away from the damned students. The more I see of them, the more I am convinced that trying to *train* people to do research is a waste of time. What few ideas a trainer has left after ten years of it are too precious to be thrown away. A man who is worth a damn will train himself.[22]

Raymond Wilder's account of Moore's classroom technique, cited above, highlights another aspect of decisive importance, namely the close connection between the subject matter taught, point-set topology, and the didactical approach taken. As noted earlier, R. L. Moore's mathematics was part of the new trend of research in postulational analysis through which he emerged as a central figure in American mathematics. His didactical method thus arose as a natural concomitant of this new research orientation.

In contrast, for Vandiver, axiomatic analysis was of very limited interest. For one thing, axiomatics simply were not needed for the kinds of problems he was pursuing in number theory and the theory of cyclotomic fields. In fact, his stance toward modern, structural algebra was ambivalent at best. Vandiver's mathematical strengths lay in very different directions, and because didactical concerns were not high on his mathematical agenda, he did not develop a systematic approach to teaching that could be related to axiomatics.

This was evident even in his occasional attempts to imitate Moore's method in his own teaching. According to one of Moore's prominent students, Richard D. Anderson, describing a course in 1941:

> Vandiver didn't realize that Moore had a very carefully organized structure sequence in his questions, with prompts in between so he didn't just send us off and tell us to see what we could do. He was definitely leading students towards more and more sophisticated thinking, towards research with the goal of developing research mathematicians, people who were really creative.
>
> Vandiver, on the other hand, would just come in sort of casually and ask things and eventually gave up on that and went to reading books, chapters from Albert's *Algebra* and from Vandiver's own books.[23]

To the extent that Vandiver did adopt any pedagogical principles, these reflected a reliance on classical mathematical literature (preferably read in total isolation). This approach he had learned from Dickson, as he repeatedly explained in later years:

> [Dickson] had an office adjoining the Mathematical Library, which fine library was *very quiet*, a fact, of course, which helped him in concentrating on any matter at hand. Also, if he wished to consult or review any mathematical article, all he had to do was walk a few steps to locate it. . . . This situation may have had a great deal to do with the fact that as far as the publication of original mathematical articles is concerned, Dickson was probably the most prolific mathematician of his time.[24]

It is therefore interesting to notice that back in the 1920s Dickson had been among the early critics of Moore's then-emerging pedagogical views. Moore himself reported that in the early twenties, during a summer visit to Chicago, he discussed effective methods of teaching mathematics with E. H. Moore and Dickson. R. L. Moore explained the approach he had been developing at the University of Pennsylvania: posing questions or theorems for students and insisting that they settle them on their own. Assistance of any sort, including conversations with fellow students and searching in books, were strictly forbidden. Students should rely on their own capabilities. Dickson "tended to quickly deride that approach, but E. H. Moore, as was his wont, said little. He customarily gave some thought to new ideas before reacting to them."[25] Vandiver was working in close collaboration with Dickson at that time, especially on the latter's *History of the Theory of Numbers*, which Dickson saw as highly important for both teaching and research in mathematics. Whether or not Vandiver explicitly heard Dickson speak critically about Moore's didactical method, he certainly shared a similarly critical attitude toward it.

From Mounting Tension to Open Clash (1937–1952)

The interwar period was one of thriving expansion for the departments of pure and applied mathematics at Austin. Some faculty members, above all Porter, did not think Texas was a truly first-class university or that the atmosphere there was conducive to its becoming one but, arguably, the two mathematics departments came closer than any others at the time to meeting Porter's high standards.[26] This was, above all, due to the combined presence of Moore and Vandiver, both of whom were associate editors of leading mathematical publications. Both were elected to the National Academy of Sciences (in 1931 and 1934, respectively), and both had received the distinction of being named as AMS Colloquium Lecturers, as well as, respectively, President (1937–1938) and Vice-president (1933–1935) of the AMS.

Toward the end of the 1930s, however, when political tensions were mounting in distant Europe, and Texas politics entered a tumultuous period that eventually swept UT into its midst, the personal clash between the two mathematical figures reached its height. The first concrete evidence dates to 1937 when Moore was nominated "Distinguished Professor" at UT. This recently created status was not only an academic honor reserved for "nationally

[22]Bell to Vandiver: November 1, 1933 (HSV). Emphasis in the original.
[23]Quoted in [Parker 2005, 182]. Actually, Vandiver published no book of his own.
[24][Vandiver 1960, 50].
[25][Traylor 1972, 92].
[26][Lewis 1989, 236].

distinguished" faculty members, it also came with a substantial increase in salary. Moore was among the first three recipients of that honor to be elected by the entire graduate faculty.

In 1939, Vandiver sent his long list of publications and grants to his colleague Calhoun, now acting president of UT, arguing that his reputation might be damaged were he not to be considered sufficiently distinguished.[27] His impressive credentials notwithstanding, Vandiver would not be named a Distinguished Professor until 1947. Even then, the title he received was Distinguished Professor of Applied Mathematics and Astronomy, in accordance with the name of the department to which he had recently been transferred. Vandiver sarcastically commented to a friend that "he was the only distinguished professor of applied mathematics and astronomy in the world who knew not a damn thing about either one."[28] And indeed, the rather ridiculous transfer of Vandiver to applied mathematics in 1945 came as a consequence of the by then unbearable relations between UT's two mathematical titans.

The broader background leading up to these events was marked by mounting general tension in Texas during the midst of the Great Depression. Texas governor W. Lee O'Daniel (1890–1969) was elected in 1938 on a Democrat ticket. After reneging on several campaign promises, he became an outspoken critic of the New Deal, especially after Franklin Delano Roosevelt's election to a third term in 1941. O'Daniel was particularly disgusted by the price-fixing policies that affected the Texas oil industry, but he also loathed Eleanor Roosevelt's support for legislation aimed at racial desegregation. Soon after his appointment in 1939, UT President Homer P. Rainey (1896–1985) became a major target of O'Daniel's attacks against New Dealers. Rainey had openly challenged accusations of alleged un-American activities at UT, claims aired by Texas Congressman Martin Dies, who chaired the recently founded House Un-American Activities Committee (HUAC). Dies warned of Stalinist and Marxist cells operating at the university under Rainey's nose. Capitalizing on this hysteria, O'Daniel nominated his own conservative supporters to UT's Board of Regents. These new appointees were expected to carry out his policies for getting rid of "subversives, Communists, and homosexuals," but also to enforce tighter budget controls and to influence academic life in general.

And indeed, the Board of Regents did its best to please the governor. Between 1941 and 1945 the Regents undertook a series of aggressive steps to strengthen its control over academic matters. Rainey was ordered to fire professors of economics who espoused New Deal views, and the board sought to ban the study of literature they deemed subversive and perverted, works such as John Dos Passos's *USA* trilogy. The Board also attempted to weaken tenure conditions and ordered the cancellation of research funds for the social sciences. The peak of the crisis came on November 1, 1944, when the Regents fired Rainey for his liberal policies and his lax attitude regarding racial issues. Students protested this action and academic organizations expressed their dismay. The American Association of University Professors (AAUP) put the University of Texas on its blacklist, where it remained for the next nine years, and The Southern Association of Colleges and Secondary Schools also put UT on probation.[29]

The situation at UT initially made national headlines and attracted considerable attention, but of course the events in Austin were quickly overshadowed by the far more dramatic events taking place overseas. Press coverage of local affairs, like the one at UT, quickly faded, but the events that shook Austin in 1944–1945 were hardly forgotten. In order to understand the respective reactions of Moore and Vandiver to this critical situation, some information about their political views is needed, bearing in mind the difficulty of judging their actions in the absence of documentary evidence.

Moore's politics—as Parker succinctly put it—"were firm and outspoken, and still steeped in the Southern principles by which he was raised. He would have no truck with American left-wingers."[30] This certainly applied to his active opposition to New Deal policies, but it also reflected his general views on the erosion of states' rights by those who advocated an expansion of the powers of the federal government. Clearly, Moore never equivocated when it came to issues like the right to bear arms. He was also far from enthusiastic about the arrival of large numbers of European émigrés who were offered positions in mathematics departments at American universities. Concerning Jews, Moore was outwardly respectful of their mathematical abilities, and he had close personal relations with Ettlinger (who was well-known also as a Roosevelt supporter). But Moore explicitly opposed an open-door policy for Jewish mathematicians. Above all, on the issue of segregation, Moore's record is unambiguous: he was firmly reluctant to accept African-American students into his courses. Moore once told Walker E. Hunt, "you are welcome to take my course but you start with a C and can only go down from there."[31] As elsewhere in the South, the process of integration was exceedingly slow in Texas. Following a Supreme Court decision, UT would open its doors to black students in 1951, but only to those accepted by the law school or the graduate school. Seen in this light, Moore's traditional Southern outlook was in no way outside the mainstream. And while his flamboyant style and prominence no doubt made his positions more visible than those of other UT colleagues, his views were not exceptional for the time.

Vandiver was less outspoken when it came to politics, so one can only speculate about his views. He worked for many years at a segregated university,

[27]See [Greenwood 1983, 20], [Lewis 1989, 235–236].

[28][Frank Vandiver, interview. Also quoted in [Parker 2005, 227].

[29]See [Parker 2005, 194–205] for additional details on this story.

[30][Parker 2005, 165].

[31]Scott W. Williams, Professor of Mathematics at Buffalo, maintains a website called: "R. L. Moore, racist mathematician unveiled," with information on this matter. See http://www.math.buffalo.edu/mad/special/RLMoore-racist-math.html.

apparently without qualms. Although we have no direct testimonies of any initiatives he took to address the injustice embodied by institutionalized segregation, nevertheless, a letter that Vandiver wrote in 1951 suggests that his political sympathies were essentially very different from Moore's:

> You speak of visiting Austin again next Christmas. The situation here is such that I wish that matters were reversed and that I was coming to Princeton next fall. After you left here the Texas legislature really went after our institution and the present indications are that the appropriations for next year will be cut 40% below what it was for the last biennial. They also demanded that one of our economic professors be investigated on suspicion of being a *Socialist* and so the place is in somewhat of a turmoil. Perhaps their next move will be to have a faculty member fired for being unkind to dumb animals.[32]

Vandiver's close friendship with Emma and Derrick Henry (Dick) Lehmer may perhaps also be taken as an important indicator of his political inclinations, or at least his tolerance of leftists. Dick Lehmer was among nineteen faculty members of the University of California who were dismissed in 1950 for refusing to sign a loyalty oath; he was reinstated only after the oath was declared unconstitutional.[33] Lehmer helped raise funds for the defense of colleagues prosecuted on charges of anti-American activities (most notably Lee Lorch in 1957).[34] This was at the height of Vandiver's collaboration with the Lehmers on the use of electronic computers for increasingly high values of exponents for FLT.[35] Political issues related to the Supreme Court's deliberations frequently appear in letters from Emma Lehmer to Vandiver (though I could not find letters in which Vandiver *explicitly* addressed those issues and stated his own opinions).

Clearly there was no love lost between Vandiver and Moore as the UT crisis reached its climax, and these polarizing events surely ended whatever chance they might have had for salvaging a civil relationship. Vandiver sided with most on the UT faculty, who felt that the Board of Regents had seriously damaged academic freedom at the university. Moore, on the other hand, was among the minority who supported the Regents' policies and who actively opposed their critics. In a letter to the secretary of AAUP he declared that its recent decision to censure UT only served to discredit the AAUP. "I do not know—he adduced—a single instance in the last twenty years in which any board of regents of this University has violated what I consider to be sound principles, either of academic freedom or of tenure."[36]

In a rare appearance at the General Faculty Meeting on May 12, 1945, Moore presented in great detail his views on the issue of tenure, a main source of contention between the UT faculty and the Board of Regents. At stake was a new scheme suggested by the faculty whereby any instructor would, after four years of service, either be offered a commitment for promotion or else would receive one year's notice to find alternative employment. Moore stated, axiomatically, two principles that in his view defined a first-class university: "(1) a very substantial amount of really fundamental research of a high order is carried on by members of its faculty, and (2) there are some members of the faculty who are intensely on the alert to discover and develop outstanding research ability on the part of their students and who are both capable of recognizing such ability in the early stages of its manifestation and of developing it when it is discovered." He followed this with a detailed argument leading to the conclusion that UT "will never be of the first class . . . if it is dominated by the ideals of those who are more concerned with *uniformity* of standards and 'fair' treatment of the mediocre than they are with the establishment and maintenance of *high* standards and the discovery and fostering of outstanding ability."[37]

In this highly self-serving performance, Moore obviously preferred to ignore the potential abuses of a weaker tenure system, which could be exploited as a political weapon by the Board of Regents. And while it seems likely that Vandiver would have agreed with Moore on the need to avoid tenure schemes that might lead to low academic standards, he clearly opposed the intrusions of politicians in the university's academic affairs. By this time a deep chasm divided the Austin faculty into two clearly defined camps. Vandiver and Moore found themselves in an additional and now very significant confrontation.

In both mathematics departments, tensions only heightened as Moore became more powerful than ever. Faculty members had been long openly complaining that financial support was easily available to students of Moore, Ettlinger, and Wall,[38] but not those working with Vandiver or other professors in the department (Dodd, Lubben, Betchelder, and Beckenbach). The fistfight between Moore an Beckenbach took place at this time. Despite the sudden availability of funds for graduate students at the end of WWII, this situation did not change.

In 1945 Vandiver submitted his resignation. He gave no explicit reasons and many factors may have played a role, but surely the unbearable confrontation with Moore and the highly politicized atmosphere at UT were high among them. At that time, Vandiver was also deeply involved in his own research and was overworked almost to the point of exhaustion. But the university authorities, under increased pub-

[32]Vandiver to Ankeny: March 27, 1951 (HSV).

[33]An interesting website containing information on this topic is http://sunsite.berkeley.edu/uchistory/archives_exhibits/loyaltyoath/symposium/timeline/short.html

[34]Several letters related to the Lehmers' support are found in the Emma & Dick Lehmer Archive, UC Berkeley.

[35][Corry 2007a].

[36]Quoted in [Parker 2005, 205].

[37]Quoted in [Parker 2005, 203]. Emphasis in the original.

[38]Hubert Stanley Wall (1902–1971) joined the faculty at Austin in 1946, at a late stage in his career, and became a devoted follower of Moore's method in teaching. See [Wall 1963]. See also, "In Memoriam. Hubert Stanley Wall," Memorial Resolution, Documents and Minutes of the General Faculty, The University of Texas at Austin, 1971, 10433–10438 http://www.utexas.edu/faculty/council/2000–2001/memorials/SCANNED/wall.pdf.

lic scrutiny, worried that losing a mathematical star might expose them to further criticism, external and internal. They suggested instead that Vandiver be transferred to the department of applied mathematics. Initially Vandiver saw this as a possible solution, but then for some reason the administration decided to leave him in pure mathematics after all and appointed a committee to work with Vandiver to find a compromise.

Typically, Vandiver conducted a good part of his negotiations with the university in writing, and from a safe distance; this time he did so in the calm surroundings of Princeton, where he was spending one of his frequent leaves of absence. The correspondence, in the summer of 1945, between Vandiver and President Theophilus S. Painter (1889–1969), a well-known geneticist and Rainey's successor, and Vice-president James Clay Dolley suggests the difficulties the authorities had in dealing with Vandiver; he raised many different topics simultaneously, discussed with Dolley recent baseball games he had watched, and continually changed his positions vis-à-vis the administration's proposals. Finally, on December 12, 1945,[39] he asked to be transferred to Applied Mathematics, and there he went. The Pure Mathematics Department, surely under the initiative of Moore, insisted that Vandiver could not take his courses with him. Vandiver's old course "Theory of Numbers" thus became, in his new department, "Theory of Integers."

In 1952 the two departments were united, but this administrative act did not immediately translate into full collaboration. Indeed, according to Robert Greenwood (1911–1993), who spent his 55-year mathematical career at Austin, a "spirit of antagonism developed in the minds of the young graduate students in the old Pure Mathematics Department, and R. L. Moore was unrelenting in keeping pressure on former Applied Mathematics members." Indeed, Moore told UT administrators "that there wasn't a single person in the Applied Mathematics Department who was a real mathematician."[40] He obviously included Vandiver in his assessment.

A Mini-Cold War at Austin (1952–1969)

In 1952 Moore turned seventy, the age at which, by university rules, a professor became a "modified service" member of the faculty. He continued to work full-time for half the pay, and his presence was felt in all aspects of departmental life as it always had been. In many ways, his influence became more visible than ever before. Thus, for instance, between 1952 and 1969 Moore supervised twenty-eight doctoral students, and six of his former students became presidents of the Mathematical Association of America (MAA) after 1950. From a more general perspective, various versions of the Moore Method of teaching became increasingly common in American universities, even though Moore himself never made any specific effort to foster such a development.[41]

Vandiver, too, became a "modified service" member of the faculty at this time. His earlier transfer to the Department of Applied Mathematics and his new formal status only strengthened his natural tendency to estrange himself from departmental life. Moreover, the contrasts between the two mathematicians became even more pronounced in their last years at UT, as Vandiver continued to be rather active in research, actively collaborating with other researchers in his fields of expertise, whereas Moore had long before withdrawn. The conflict between the two entered a phase of "cold war" that eventually became a source of embarrassment for everyone at Austin.

Yet, strangely, at the twilight of his career Vandiver began to discuss publicly his ideas about school-level mathematical education and the proper training of teachers. This turn may have had some connections with contemporaneous debates on reforms in US mathematics education, and the nomination of Ed Begle (1914–1978) as director of the School Mathematics Study Group (SMSG), from which the New Math later arose.[42] Moore's ideas can be seen indirectly in the background of these debates, as Begle was a student of Raymond L. Wilder. Likewise, Edwin Moise (1919–1998), another well-known Moore student, wrote influential high-school textbooks. Interestingly, Moise emphasized that Moore himself never expressed any opinions on SMSG or about the New Math and made it clear that he did not want to be regarded as a pedagogue.[43]

Vandiver's ideas on teaching at this time appeared in a two-part research article published in 1952–53 in the *Mathematics Magazine*, "A Development of Associative Algebra and an Algebraic Theory of Numbers." Perhaps it is not a mere coincidence that this is one of the few places where Vandiver spent some effort in a technical discussion about a new system of postulates. This was a system for defining associative algebras "in a bit unusual way," and he remarked that "many secondary school students are alienated from arithmetic and algebra because the only way they learn these topics . . . is by following a set of rules which are never stated explicitly by the teacher." Vandiver said he learned this from his own experience as a high-school student. The mathematically gifted students, he thought, deserved a clear presentation of "a few explicit postulates in arithmetic and algebra."

The ideas discussed in the articles are of limited mathematical interest, but they are clearly related to Moore's method. Vandiver stated that he developed these ideas in his courses and seminars over twenty years, and especially in a recent seminar in which three of his five doctoral students participated.[44] He also "discussed these topics with sophomores with apparently some success," and attributed this to the

[39]Dolley to Vandiver: Aug 13, 1945 (HSV).

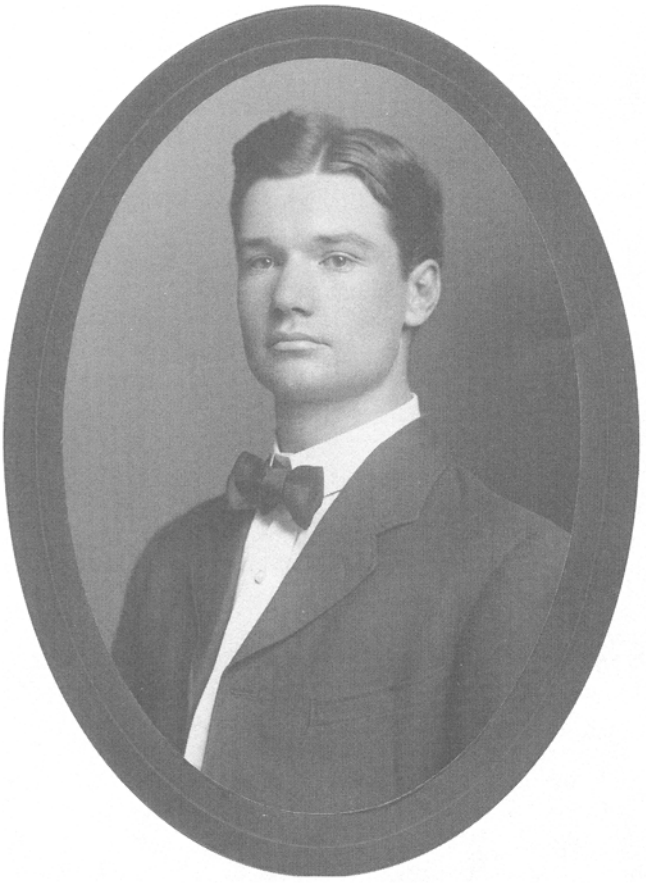
[40][Greenwood 1983, 47].

[41][Parker 2005, 232–234].

[42][Usiskin 1999]; [Raimi 2005].

[43][Anderson & Fitzpatrick 2000]. The possible influence of Moore's ideas on New Math is a topic that deserves some further thought, but it cannot be pursued here for lack of space.

[44][Vandiver 1953, 4].



Figures 2 and 3. Robert Lee Moore in his youth (left), and in October 1930 (right). Photos are published by permission of the Center of American History, the University of Texas, Austin; they are part of the R. L. Moore Legacy Collection in the Archive of American Mathematics.

fact that he "did not do anything except try to set up some rules to justify the operations they were already used to in algebra." While in his advanced courses, he "suggested to the students that they forget everything they know about mathematics, since we would try to start from scratch"; he doubted this would be a "good suggestion to make to a sophomore."[45]

Somewhat later, in an unpublished manuscript, Vandiver also addressed the question of the proper training of teachers of mathematics. Besides other possible motivations, one gets the impression that Vandiver at least wanted to stress what he saw as his own lasting contribution to the teaching of mathematics. A research scientist, Vandiver wrote, is actually a good teacher by virtue of his very research activity, "and in some instances he fulfills the qualifications of a teacher even better than a professor who delivers lectures in a university."[46] Euler, for example, had no students but, by virtue of his enormous original work, "was the greatest teacher of mathematics who has lived in the last 200 years." Gauss too would rank among the greatest teachers of mathematics according to Vandiver's definition, an individual A, who "communicates in any way whatsoever to an individual B some idea which is new to B and which B retains in his mind." He concluded,

> At present I think the practice may be pretty widespread at universities to give their teachers time off and funds to travel to various places in order to consult the various research men in their own line of study; however, some scientist may be so situated that he cannot leave his university for a long period. In this case I think it would be excellent if the university would pay for as many long distance telephone calls as he deemed necessary in order to keep in touch with other scientists with the idea of going forward in his work. (p. 9)

Vandiver was also concerned with problems faced by mathematics teachers in elementary schools.[47] Elementary school teachers did not receive proper training. For example, an examination of many textbooks showed that they were not taught the essence and meaning of—of all things—the decimal system. Vandiver claimed that if his advice was followed, in five years time foundations would be able to save huge amounts of money currently devoted to coaching teachers. Vandiver sent the editors of the *American Mathematical*

[45][Vandiver 1953, 16].

[46][Vandiver, unpublished 1].

[47][Vandiver, unpublished 2].

Monthly a manuscript of 49 pages; a shorter version of five pages was not published either, though in several letters he mentioned that it would soon appear in the 1959 volume of the *Texas Quarterly*.

Whatever drew Vandiver into a discussion on pedagogical topics, we find here a rather ironical situation. On the one hand Moore, who devoted so much of his professional energies to his university teaching, distanced himself from the debate about mathematics in secondary and primary schools. On the other hand, Vandiver, for whom teaching was essentially a burden to his university activities, contributed his own ideas and tried to influence mathematical education in the United States through improved training of teachers.

A Role for Mathematical Scholarship

As already suggested, mathematical scholarship was of major importance for Vandiver but played a lesser role in Moore's overall conceptions. This emerges in certain initiatives Vandiver undertook late in his career, when he attempted to influence additional aspects of mathematical life in the United States. In 1957 Vandiver read with great interest the Retiring Presidential Address delivered by Edward J. McShane (1909–1989) at the Annual Meeting of the MAA in December 1956, entitled simply "Maintaining Communication."[48] McShane worried that modern research was running out of control and that mathematics had grown wild and unstructured during the last decades; this could lead to a breakdown into sub-disciplines in which only specialists could understand each other. McShane was especially alarmed about the lack of general communication among modern researchers. He pointed to three main spheres of mathematical activity which, in his view, should complement one another: teaching, research, and scholarship. Yet this third sphere of activity "is all too often left unmentioned."

> McShane lamented, in particular, the dearth of good expository articles, which were badly needed to bridge the communications gap. Dickson once said that "every mathematician owed a debt to mathematics that he should repay by one hard job of scholarly writing." His *History of the Theory of Numbers* had been Dickson's own way of paying that debt. McShane was aware that few would consider an undertaking of such magnitude; nonetheless, he insisted that "each of us owes the debt, and should not repudiate it if he is mathematically solvent." (p. 313) Expository articles were needed for the continued renewal of the teacher's activity. On the research side, he bemoaned the low quality of writing and the failure to make research papers accessible beyond the limited circle of specialists with whom authors were already in direct contact.

As the author of accomplished expository articles in his own field of expertise, Vandiver read McShane's speech with pleasure. In fact, McShane made a flattering allusion to Vandiver's work:

> I am not recommending the writing of expository papers as a sort of pastime for gentlemen (young, old, or middle-aged) who have determined by careful self-examination that they haven't a research paper left in their systems. A man of thirty may have attained position and recognition and broad knowledge; a man past seventy may be active in research, as the current volume of the *Proceedings of the National Academy of Sciences* will show.

On the other hand, McShane's case for the importance of expository writing in teaching ran contrary to the essence of Moore's method, as one of Moore's maxims was that students not read other people's work (even though, in thesis work, Moore definitely expected novelty vis-à-vis the existing literature, which the students were expected to know in detail). McShane called for increased breadth of mathematical scholarship in teaching from the very early stages of a student's training. The fact that McShane mentioned Dickson's work in this context was also certainly significant for Vandiver; little wonder that McShane's article struck a sympathetic chord with him.

Inspired by these ideas, Vandiver decided to set forth his own views. Aside from the publication of research papers, he was convinced of the "desirability of publishing complete bibliographies of the literature on various branches of mathematics, with reviews when possible."[49] The editors of the *Bulletin of the AMS* may have had different ideas, though more likely they rejected Vandiver's article on this topic as inappropriate for their journal. The editors of the *Monthly* were also initially unenthusiastic, although they finally acquiesced and the paper was published in 1960.

Vandiver based his argument on Dickson's book, which he considered as important in 1960 as it had been at the time of publication. Quoting his own 1924 review of Volumes I and II,:[50]

> It often happens in the history of mathematics that a mathematician becomes a specialist in a particular topic, and, after years of experience with it, he publishes a treatise giving a harmonious and comprehensive development of the subject, the material being arranged and presented according to his own particular point of view. This treatise may become a classic, and its readers are likely to get in the habit of ignoring, to a considerable extent, the literature that preceded its publication. In this way, the points of view of the older writers are often lost sight of, as these treatises rarely, if ever, reproduce all the older material on a particular topic. It would seem that there is too great a preponderance of books of this sort in the literature and too few histories of reports of the type of Dickson's work.

Many works cited by Dickson contained results that had been published earlier by someone else. As Vandiver wrote to one of his correspondents, he himself had "been haranguing mathematicians to do something about the situation," with no visible result.[51]

Vandiver was aware of the immense

[48][McShane 1957].

[49]Vandiver to R. D. James (Editor of the *Monthly*): August 6, 1958.

[50][Vandiver 1924].

[51]Vandiver to Leo F. Epstein: May 11, 1960 (HSV).

effort that would be required to continue Dickson's work. The number of relevant references between 1920 and 1956 were about 8,500. If five mature, top-rate number-theorists would collaborate, with five years to complete the job, each would need to write almost one review per day. Dickson had reviewed 8,382 works—leaving out major issues like algebraic number theory, Bernoulli numbers, and the law of quadratic reciprocity. And these papers, Vandiver stressed, were far less difficult than more recent work, whose volume was rapidly growing. It would be difficult to find mathematicians willing to do the job. And this is just in number theory. In a field like differential equations, the most one could hope for would be the "preparation of a nearly complete list of references," while dividing the literature into sub-topics "so that a research man does not have to look up too many listed papers to decide that the results he has arrived at are new."

Vandiver knew that "the work of a bibliophile on first glance is not attractive," and indeed many mathematicians reacted with "deep disgust at the idea." Yet following McShane's lead, Vandiver argued that such bibliographies were crucial for the advancement of mathematical research and teaching. Mathematicians should undertake the task not only as a duty to the discipline but also for its personal benefits. He himself had found, preparing such lists for a number of topics in number theory (part of which are kept in his archive), "that his own knowledge of each topic increased greatly thereupon, and the publication of a number of his papers was due to this."

Vandiver received several letters in response to his article, most of them positive. He decided to transform his basic message into a plan for action along two fronts. First, he wanted to reform the existing reviewing system (which is essentially the one still in use today) to facilitate later compilations of complete bibliographies. Vandiver's main source of dissatisfaction with the current system was that "persons reporting on papers failed to remember that they are supposed to be *reporters* and not *critics*."[52] To correct this situation, authors should begin their articles with an abstract that could later be published in the *Mathematical Reviews* or in a future bibliography of the subject. The referee for the journal would also approve the abstract for the *Reviews*. That such abstracts might merely reflect the opinions of the author was a minor problem, Vandiver felt, compared with the advantages gained in speed and efficiency. The situation was different for mathematical books; here criticism was welcome and necessary, "since there might be a question as to whether it would be advisable to have money spent to add such books to mathematics libraries."[53] All of these ideas were inspired, Vandiver said, by what he had learned from his collaboration with Dickson, especially on the *History*.

Vandiver wrote to various mathematicians, especially editors of known journals, who he believed would support this project, among them Leonard Carlitz, J. Barkley Rosser, Max Shiffer, Peter D. Lax, Joseph Walsh, Marshall Stone, Richard Bellman, and Gordon Whyburn. Some reacted with useful comments. Walsh suggested that authors should be instructed to choose meaningful names for their papers (rather than, say, "Proof of a Lemma due to Wye Zed"). Stone wrote that, although he very much favored some of the suggestions, he would not like to have his name included as an unconditional backer.[54] One correspondent objected that reviewers sometimes make valuable suggestions for extensions of results and this important input would be lost under Vandiver's suggestion. Bellman fully supported Vandiver's initiative as he had a very low opinion of the current state of the refereeing system:

> I think that the only intelligent and efficient technique is one based upon a board of associate editors empowered to present any paper which they think fit. The system of anonymous refereeing which we use now in most journals has so many defects and so many abuses that I think any unprejudiced observer would say that it had failed almost completely. Oddly enough, it serves the purpose of passing the mediocre paper along with no difficulty, and almost completely hindering the novel paper with original and unconventional results and ideas.

Vandiver summarized the reactions and his own responses to them in a detailed, formal letter to the President of the AMS, Deane Montgomery (1909–1992), and expected Montgomery to raise this matter in a forthcoming meeting of the AMS Council.[55] It seems that his initiative did not reach any further, and his ideas on reviewing were never adopted in the *Reviews*, although *Zentralblatt* often uses "Autor-referats".

Vandiver was involved in a second undertaking that shows how he tried to turn his views on mathematical scholarship into a concrete plan of action. In 1961 William J. LeVeque submitted a proposal to the National Science Foundation calling for the publication of "A General Survey of the Theory of Numbers Leading to the Compilation of a Topical History and Critical Review of the Theory of Numbers, 1915–1960." Not surprisingly, Vandiver was enthusiastic about this project and wrote a highly positive report.[56]

LeVeque mentioned three main topics not originally covered by Dickson that should be included: Analytic Theory of Prime Numbers, Diophantine Approximations, and Algebraic Numbers. Vandiver suggested that a chapter on Bernoulli and Allied Numbers should also be included, as well as the very important topic of Higher Reciprocity that Dickson had left for a fourth volume but never published.[57] He insisted that only abstracts of articles should be included, with somewhat longer ones when the original paper had appeared in an out-of-the-way journal. If Dickson

[52]Vandiver to Bellman: May 12, 1960 (HSV).
[53]Vandiver to Bellman: May 12, 1960 (HSV). Emphasis in the original.
[54]Stone to Vandiver: January 21, 1962 (HSV).
[55]Vandiver to Montgomery: January 13, 1962 (HSV).
[56]Vandiver to Grad: February 27, 1962 (HSV).
[57]On this matter, see [Fenster 1999].

had included criticisms in his book "such material would now be worthless." Finally, he referred to the intention to rely on the *Mathematical Reviews*:

> Since experienced reviewers are hard to obtain in order to write reviews for the *Math. Reviews*, I regard most of the reviews appearing in that journal as quite inadequate. And from what I have seen of the other review journals, I do not think they are much, if any, better.[58]

The NSF decided not to fund the project, and it was postponed and eventually abandoned.[59] Grad explained to Vandiver that although most reviews were favorable "the bibliography was considered to be of second importance as compared with research of the usual type."[60] Vandiver replied, "if the NSF continues to support 'research of the usual type' to the exclusion of support of bibliography projects, then as time goes on it will be supporting the publication of the results of research which already are described in the literature."[61]

Parting Company in Silence

Both Moore and Vandiver remained active until a very advanced age. For decades, Austin's two leading mathematicians hardly exchanged a word socially, if at all, and their careers ended quite differently. Not everyone in Austin welcomed Moore's "volunteering spirit" when he continued to work at the department after 1952 under a "modified service" contract. On becoming Dean of Arts and Sciences in 1967, John R. Silber "made no attempt to conceal his view that Moore's very presence and reputation hindered the recruitment of new faculty."[62] Silber, formerly chair of the Philosophy Department, thought mathematics should be taught by experienced teachers in fewer sections with more students in them. This, of course, ran counter to Moore's pedagogical philosophy.

Silber brought in visiting scholars to evaluate the performance of various departments and attempted to introduce mandatory retirement at the age of seventy-five. This only raised tensions between the administration and Moore's still large and influential group of supporters. A lengthy and rather nasty process ensued that finally led to Moore's forced retirement in September 1969 at age eighty-seven. Almost seventy-one years after he arrived as a freshman and less than three years before his death, R. L. Moore walked off the University of Texas campus for the last time, refusing to attend any events to "honor" him. When, in 1973, the new mathematics building was named the Robert Lee Moore Hall, he was noticeably absent at the dedication ceremony.[63]

Moore's long-time rival, Henry S. Vandiver, voluntarily took emeritus status in 1966. Despite poor health in his later years, he continued to do research and even received a research grant at the age of seventy-six. Yet the only public honors conferred on him at the end of his career were quiet affairs that largely escaped notice. In 1961 he was invited to deliver the keynote address at the Texas Section of the Mathematical Association of America.[64] Five years later, a few friends and collaborators put together in his honor a special issue of the *Journal of Mathematical Analysis and Applications*, a publication otherwise devoted to topics unrelated to his own research.[65] No buildings were named after Vandiver, nor did he leave a mark as a teacher at the University of Texas. None of his five doctoral students went on to become a leader within the American mathematical community. Of his many interesting contributions to mathematical research, only the conjecture of 1934 bears his name, and this remains barely known, except to specialists. But most ironic of all, when Fermat's Last Theorem—the problem to which he devoted so much of his energy and on which he became the world's leading expert during his lifetime—was finally proved in 1994, it unleashed a flurry of publicity inside and outside the mathematical community, but Vandiver's noteworthy achievements were completely overlooked.

Some fifty years before their passing, Moore and Vandiver had begun their mathematical careers at the University of Texas together. Each went on to become distinguished in his own particular way, but their paths parted quickly and never again crossed. Vandiver died on January 4, 1973, aged 91; Moore was close to 92 when he passed away on October 4, 1974. But both are buried in Austin's Memorial Park Cemetery.

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[58]Vandiver had considered not including this latter comment so as not to jeopardize the prospects of the project's being approved, but he obviously changed his mind. See Vandiver to Grad: February 7, 1962 (HSV).

[59]LeVeque to Vandiver: March 9, 1962 (HSV).

[60]Grad to Vandiver: March 5, 1962 (HSV).

[61]Vandiver to Grad: March 13, 1962 (HSV).

[62][Parker 2005, 322].

[63][Parker 2005, 332].

[64][Greenwood, *et al.* 1973, 10939]. See [Vandiver 1961].

[65][Corry 2007].

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