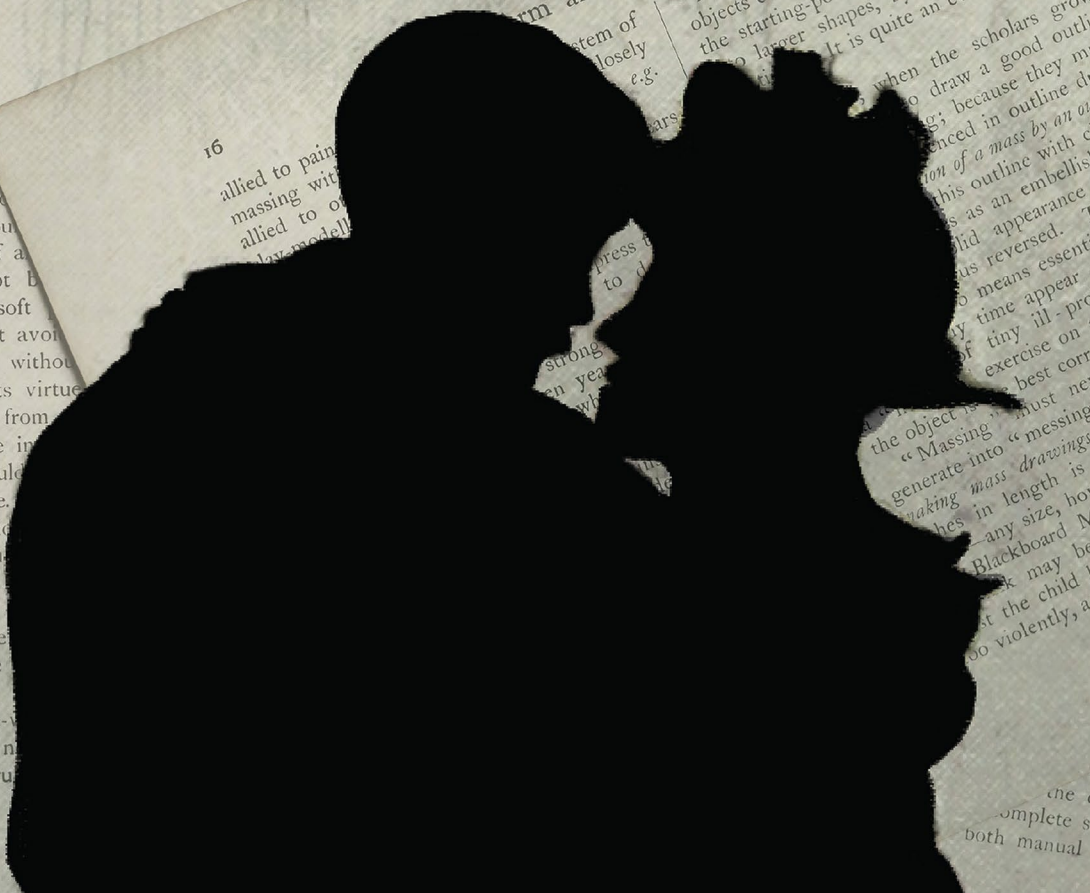


BREAKING CONVENTIONS

FIVE COUPLES IN SEARCH OF MARRIAGE-CAREER BALANCE AT THE TURN OF THE NINETEENTH CENTURY

PATRICIA AUSPOS





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2. A “Two Person Career”: Grace Chisholm Young and William Henry Young

When Grace Chisholm argued against women’s suffrage in a debate at her all-female English college in 1889, she was disdainfully dismissed by a female don as “one of those charming young ladies who marry the nice young man at the end.”¹ Grace did marry — her mathematics coach, no less — but that was hardly the end of it. Along the way, she got a PhD in mathematics in Germany (one of the first awarded to a woman); trained to become a medical doctor; helped her husband, William Henry Young, with his mathematical research; won acclaim for her own mathematical studies; authored two children’s books on scientific topics; wrote poetry and an historical novel; and raised six children in Germany and Switzerland.

Like many women of her generation, Grace found it easier to pioneer new roles for women outside the home than inside the home. She was a trail-blazing professional, but did not want to be seen as an ambitious “modern woman” who thought only of herself. She took as much pride and pleasure in creating a warm domestic environment as in developing an elegant mathematical proof or performing a skillful dissection. She successfully balanced her roles as homemaker and mother with the demands of her medical training. Her efforts to pursue an independent professional life while simultaneously helping her husband in his career proved more challenging. For years Grace managed to do both,

1 University of Liverpool Library, Special Collections and Archives, D.140, Papers of Professor W. H. Young and his wife Grace Chisholm Young (Young Papers). D.140/12/22, Grace’s Cambridge Autobiography.

but ultimately she had to choose between supporting Will's work or advancing her own.

Becoming a Mathematician

Grace Chisholm was raised in an "eminently respectable", upper-middle-class household that valued education, intellectual achievement, and cultural accomplishment — qualities that would become touchstones of her own life. On her father's side, she came from a line of distinguished civil servants. Her formidable grandmamma on her mother's side was a "very rich, very placid, and very intellectual" lady who hosted many musicians of note in her London home.²

The youngest child of elderly parents — Henry William Chisholm was almost sixty when she was born in 1868; Anna Bell Chisholm was forty-five — Grace felt overshadowed by her two older siblings, and wished her parents were more demonstratively affectionate.³ Her brother Hugh was considered brilliant. Her sister, Helen, who had had polio as a child, was regarded as a paragon of artistic sensibility and the personification of goodness and sweetness. (None of Helen's sweetness was shown to her, Grace complained.) In an era when children were supposed to be seen and not heard, she was frequently in trouble for being heard too much. Rambunctious and strong-willed, she felt both blamed and blameworthy. A frequent punishment was being locked in a bathroom. When she was very young, she reacted by crying and kicking at the door. But when she grew "older and bolder", she escaped by climbing out of the window and down the drain pipe.⁴

Grace showed an early interest and aptitude for mathematics. When she began to suffer from headaches, sleepwalking, and nightmares, the family doctor advised leaving her free to roam the grounds of her home

2 This account of Grace's childhood is based on her autobiographical writings (D.140/6/14/6 and D.140/12/1. Young Papers). See also, Ivor Grattan-Guinness, "A Mathematical Union: William Henry and Grace Chisholm Young", *Annals of Science* 29:2 (1972), 105–86 (pp. 106–10, 115–29), and D.140/2/2, R. C. H. Tanner Notes, Young Papers.

3 The Chisholms' first-born child suffered accidental brain damage and lived in a nursing home until her death at age twenty, according to Grace's son, Laurence. L. C. Young, "The Life and Work of WH and GC Young", formerly posted at <http://www-history.mcs.st-and.ac.uk>, pp. 1–18 (p. 6).

4 D.140/8/249, GC to WHY, June 2, 1896. Young Papers.

in Haslemere, Surrey, about 60 miles outside of London, and not giving her lessons unless she asked for them. The only subjects she wanted to study were mental arithmetic and music. After her father retired as head of the British Department of Weights and Measures in 1877, he encouraged her interest in geometry and helped her design three-dimensional models in his carpentry workshop.

When Grace turned ten, her mother decided it was time for Grace to be properly educated. The siblings' different educational experiences reflected the usual gender gap between boys and girls: expected to have a career, Hugh was sent to a public school and Oxford University.⁵ Expected to devote themselves to charitable activities, amateur cultural pursuits, and domestic affairs, Grace and Helen had lessons with a governess. The girls were taught Latin and Greek, but Grace's mother vigorously opposed her desire to study medicine. Nevertheless, urged on by her husband, Anna Chisholm eventually allowed 21-year-old Grace to attend Girton College at the University of Cambridge where she won a scholarship to study mathematics in 1889.

In a college that had strong ties to the British feminist movement, Grace garnered little support when she argued against female suffrage in a college debate. Although her own mother was an early supporter of women's suffrage, Grace argued the opposition case "with diffidence but conviction."⁶ In the light of her later life, her anti-suffrage views are not surprising.

It was a heady time for women to study mathematics at Cambridge. During Grace's first year, Philippa Fawcett, the daughter of feminist Millicent Fawcett and niece of Elizabeth Garrett Anderson (the first woman to qualify as a doctor in Britain), rocked the academic world by scoring higher than the highest-ranked man in the Cambridge Mathematics Tripos, the final examination for mathematics students. Fawcett's achievement challenged popular assumptions about women's intellectual abilities and made newspaper headlines throughout the world. Grace recorded the excitement that erupted when Fawcett's name and rank were announced.⁷

5 Hugh Chisholm became financial editor of the *London Times* and the editor-in-chief of the illustrious 1911 edition of the *Encyclopedia Britannica*.

6 D.140/12/22, Grace's Cambridge Autobiography. Young Papers.

7 Ibid.

Two years later, Grace had her own moment of glory. After being coached by William Henry Young, a young Fellow of Peterhouse College, she was ranked in the first class (top third) of scholars when she took Part I of the Tripos. One of 12 women and 112 men who took the exam in 1892, she was placed between the 23rd and 24th man. She scored another triumph a few days later when, on a dare, she and her friend, Isabel Maddison, took the final examination in mathematics at Oxford. The women sat for the Oxford exam unofficially, but Grace was again ranked in the first class (top third) of examinees, giving her what her brother called a “remarkable double first.”⁸ She returned to Girton for a fourth year to prepare for the more specialized second half of the Tripos examination. The only woman to take the exam in 1893, she was disappointed to be ranked in the bottom third of the fifteen examinees.⁹

Eager to continue her mathematics training, Grace had to look for opportunities abroad. She went to Germany to study with the illustrious Felix Klein at the University of Göttingen, one of the leading centers of pure mathematics in Europe. Undeterred by her mother’s disapproval, Grace insisted her decision was a practical measure to ensure that she would be able to earn her own living if she needed to do so.¹⁰

Grace was one of a triumvirate of women — the other two were Americans — who arrived to study with Klein in 1893. A progressive educator as well as an innovative mathematician, Klein encouraged foreign women with excellent qualifications to audit classes at Göttingen and pressure the university to grant them degrees.¹¹ Grace was proud to be opening up opportunities for all women, but she pursued mathematics

8 Tripos Examination Results: D.140/12/16. Oxford exam: M. L. Cartwright, “Grace Chisholm Young”, *Girton Review*, 31 (Easter 1944), 17–19 (p. 17); D.140/6/28c, Hugh Chisholm to GC, June 30, 1892. Young Papers.

9 Disappointment: D.140/6/39, GC to Frances Evans, June 14, 1893. Examination results: D.140/12/19. Young Papers.

10 D.140/6/34, GC to Helen Chisholm, February 17, 1893. Young Papers.

11 The three women were enrolled as “exceptions” at Göttingen. German champions of women’s education encouraged foreign women to seek degrees in Germany because it was assumed that they would return to their native countries to find employment and not compete with German men for jobs. See Margaret W. Rossiter, *Women Scientists in America*, 3 vols. (Baltimore: Johns Hopkins University Press, 1982–2012), I, pp. 35–38. For Klein’s efforts on behalf of women students, see Renate Tobies, “Internationality: Women in Felix Klein’s Courses at the University of Göttingen (1893–1920)” in *Against all Odds: Women’s Ways to Mathematical Research since 1800*, ed. by Eva Kaufholz-Soldat and Nicola M. R. Oswald (Cham, Switzerland: Springer, 2020), pp. 9–38.

out of love for the subject, not in order to make a feminist statement. She liked being treated as a colleague by the male faculty and students, but insisted that she and the other women students wanted "freedom" from "all unnecessary & conventional distinctions between men & women" rather than "equality" with men.¹² She was not a feminist, but knowing she was being judged as a representative of all women, she felt a "terrible" responsibility to set a good example by her behavior and scholarly accomplishments.¹³ She eagerly asserted her identity as a woman as she became a scholar. She filled her letters to her family with accounts of her cooking, lacemaking, musical accomplishments, and social activities as well as her progress in mathematics.¹⁴ Her anxious relatives were relieved to know she had not "sunk the woman in the scholar" but instead maintained the "qualities of the true and genuine woman."¹⁵

Feeling more "free and independent" than ever before, Grace vowed she would "move heaven and earth" to return to Göttingen for a third year and try for the PhD degree.¹⁶ She was the first of the three women studying with Klein to finish her coursework and dissertation. Following his instructions, she went to Berlin in the spring of 1895 and successfully petitioned the Ministry for Culture for permission to take the oral examination, defend her thesis, and qualify for the doctoral degree. The only hitch was getting to the oral exam in April 1895. Assuming that a doctoral candidate would be a man, the cab driver who came to take Grace to her defense drove off with an empty cab after being told that there was no male boarder at her lodging. Grace had to run to the examination room on foot. She passed her defense *magna cum laude*, the first woman to win a doctorate in mathematics at a German university by completing the doctoral program and taking an oral examination.

12 D.140/8/3, GC to her family, November 5, 1893. See also, D.140/8/2, GC to Helen Chisholm, October 29, 1893. Young Papers.

13 D.140/8/60, GC to Anna Bell Chisholm, April 27, 1895. Young Papers.

14 Identity: GC to Helen Chisholm [June 4, 1894], and D.140/8/3, GC to Family, November 5, 1893. Activities: for example, GC to Helen Chisholm, D.140/8/73, June 30, 1895; D.140/8/67, May 12, 1895; D.140/8/41, December 20, 1894; D.140/6/2, GC to Helen Chisholm, October 24, 1893. Young Papers.

15 D.140/6/69, Gertrude Bell to GC, June 1, 1895. Young Papers.

16 Free and independent: D.140/8/11, GC to Frances Evans, December 23 [1893]. Vowed: D.140/6/52, GC to Frances Evans [February 25, 1894]. Young Papers.

When they heard the news, she and one of her American colleagues broke into a “war dance” of celebration for her landmark achievement.¹⁷

Courtship and Early Marriage

When she returned to her parents’ home in London in the summer of 1895, armed with a doctoral degree and increased confidence, Grace found that her standing as a scholar clashed with her role as younger daughter in an upper-class home. She was offended by the efforts of her mother and sister to squelch her and keep her from talking in social gatherings. Although women had opportunities to teach in women’s colleges and in all-girls’ high schools, Grace was under no financial pressure to work, and there is no indication that she was looking for an academic post.¹⁸ Her very conventional family would undoubtedly have been shocked had she sought paid employment. She herself felt that Cambridge dons did “enervating” work that stamped out “freshness and brilliance.”¹⁹

Instead, Grace began to develop her dissertation into articles for publication. She sent a copy of her thesis to William Henry Young, the coach who had tutored her for Part I of the Tripos examination. When she visited Girton in the fall of 1895, they became so involved in discussing her experiences at Göttingen that Will forgot he had a roomful of students waiting for him.²⁰ They began to correspond and to meet, and he encouraged Grace to continue her mathematical work. In October he asked her to join him in writing a textbook on astronomy,

17 D.140/6/71, GC to Henry William Chisholm, April 27 [1895]. Young Papers. The Russian Sonia Kovalevsky (1850–1891) was awarded a PhD by Göttingen University in 1874, but without taking the oral examinations or thesis defense required of male candidates (she went on to have a brilliant career). Grace was the first woman to be awarded the PhD under the more stringent rules. See Lynn M. Osen, *Women in Mathematics* (Cambridge, MA: MIT Press, 1974), pp. 117–40.

18 On women’s teaching opportunities, see Martha Vicinus, *Independent Women: Work and Community for Single Women, 1850–1920* (Chicago: University of Chicago Press, 1985), p. 127; Philippa Levine, *Victorian Feminism, 1850–1900* (Tallahassee: Florida State University Press, 1987), p. 38.

19 D.140/8/41, GC to Helen Chisholm [December 20, 1894], Young Papers. Rita McWilliams-Tullberg described the isolation and restrictions female dons suffered in their teaching and research careers at Cambridge in *Women at Cambridge: A Men’s University Though of a Mixed Type* (London: Victor Gollanz, 1975), p. 105.

20 D.140/12/21, Grace’s biographical jottings. Young Papers.

which was then a branch of mathematics and one of the subjects he taught at Cambridge. She agreed, but wanted to complete her own work before starting on his.²¹ Solidifying her position as a mathematician, she joined the London Mathematical Society in January 1896.

A month later, Will abruptly proposed marriage. His impetuous behavior was characteristic, Cecily, the Youngs' oldest daughter, would note many years later.²² According to family lore, Grace initially refused, insisting that she must remain single so she could provide for her mother and sister in the event of her elderly father's death. However, Will did not understand that he had been turned down, and Grace quickly changed her mind. Within a week their engagement was announced to family and friends, and Grace was describing herself as deliriously happy.

Acutely conscious that Will was "unlike any of the men of my circle", Grace was greatly relieved that her family appeared to like him.²³ By conventional standards, she was marrying down. Will's family was less distinguished and less financially well-off than hers. His father, Henry Young, was a grocer, who had left school at age fourteen. In England's class-conscious society, being "in trade" was not an acceptable occupation for a gentleman. Religion was another strike against Will when membership in the established Church of England offered social status, professional mobility, and educational opportunities unavailable to members of nonconforming religions. The second of six children and the eldest son, Will had had been brought up as a Baptist but converted to Anglicanism when he was an undergraduate at Cambridge. From the time he went to Cambridge, Will was self-supporting. When he married, his father had been on the verge of bankruptcy for several years. Will had taken over some of his investments and mortgages in order to keep him solvent; he also helped to support one of his sisters.²⁴ The Young family's personal interactions were as strained as its finances. Henry Young was a "bitter and difficult" person who suffered such serious indigestion that he took his meals separately from the rest of his family,

21 D.140/8/82, GC to WHY, October 13, 1895. Young Papers.

22 Grattan-Guinness, "Mathematical Union", p. 131 and D.140/2/2, R. C. H. Tanner notes. Young Papers.

23 D.140/8/135, GC to WHY, March 11, 1896; D.140/6/694a, GCY to WHY [October 18, 1903]. Young Papers.

24 D.140/29/12-64. Solicitor Henry Cooke's letters to WHY, especially 18 April 1894 and 18 June 1896. Young Papers.

reading while he ate. He passed his fascination with travel and a facility for languages on to his son. He also bequeathed Will his irritability and impatience.

When they married, Will's academic achievements were less than Grace's. He had gone to the prestigious City of London School on scholarship and won important scholarships to Peterhouse College at the University of Cambridge.²⁵ He placed fourth in the Mathematics Tripos in 1884, but did not submit an essay for a prestigious prize in mathematics; instead he won a major theological prize. Will was a Fellow of Peterhouse College between 1886 and 1892, but no one advised him to do mathematical research or gave him helpful guidance. He made his living as a teacher, examiner, and coach at a series of prep schools and then at Girton College, where he had coached Grace.²⁶ He had increased his assets by investing in the stock market and saved a substantial amount of money.²⁷

By choosing Will, a man whose social standing, class background, and professional status was lower than hers, Grace showed a disregard for convention. Instead of material success, he offered her romantic love and intellectual companionship. When she first brought him home, Grace would recall, her mother looked at her "with the mixture of

25 The headmaster of the City of London School was a friend of Will's father. Entrance was by competitive examination, and the fees were paid out of public funds. Unlike most public schools, it was a day school and had no religious test.

26 Grattan-Guinness, "Mathematical Union", pp. 110–15. D.140/2/2, R. C. H. Tanner notes. Young Papers.

27 According to Cecily Young (D.140/2/2, R. C. H. Tanner notes, Young Papers) and Grattan-Guinness, "Mathematical Union", p. 132, Will had 6,000 pounds in savings and investments that was put in a Trust when he married. (This is roughly equivalent to 188,000 pounds or \$1 million today, using the CPI inflation calculator at <https://www.officialdata.org/> to compare 1896 and 2021 values.) The financial records of the Youngs in the University of Liverpool archives are not clear about this. A week after the wedding, Will was advised that investments held by him, valued at 1,591 pounds in the Marriage Settlement, were both risky and low-yielding. The trustees recommended that Will and Grace sell them, even though it would mean a loss of capital. These might have been investments Will had taken over from his father. If the entire Marriage Settlement amounted to 6,000 pounds, this would have included Grace's portion from her family, as well as contributions from Will and his family. Grace's brother Hugh was a trustee, along with Henry Cooke, Will's solicitor and friend; under the terms of the Settlement, both Grace and Will had to agree when changes were made to any of the investments. See D.140/12/31a and b, Henry Cooke to WHY, 18 June 1896, and D.140/29/63, an incomplete copy of the Youngs' Marriage Settlement.

admiration and contempt that mother hens award to their special ugly ducklings." Grace was proud that she herself recognized Will's true value, even though he was "so unlike all my familiar pictures of the male being."²⁸ Although he had not yet accomplished very much, they both believed he would achieve great things. She found him more refined than other men of her acquaintance, meaning not more cultured, but more intellectual and more devoted to the life of the mind. She also valued him for not being set in his ways, and for being less egotistical than most men of her acquaintance. Many decades later, she again asserted that it was the breadth of his vision that first attracted her: he was the only person she had ever met who was not "cribbed, cabined, & confined."²⁹ Equally important, he encouraged her to continue with mathematics. Nevertheless, she counted on her "strong lover" to help her to become a better woman, "to fulfill the old ideals, not forsake them."³⁰

Conscious of the class differences that separated her family and Will's, Grace agonized over the wedding preparations and the protocol for bringing the two families together. She herself may have looked down on Will's family. In later years, when Will's sister May lived with the Youngs, their daughter noted that Grace made fun of May's provincial manners.³¹

Grace's closest friend from Girton, Frances Evans, laughed at her for being ruled by the "bogey of impropriety" in planning the wedding, but Grace took such matters seriously.³² On the big things that really mattered to her, she was courageous enough to do as she pleased. But she generally sought to portray herself in a very conventional light even when she deviated from traditional norms. She did not want to be gossiped about or criticized, especially by her family, and she was careful not to give offense when it could be avoided. Above all, she wanted to avoid conflict.

28 D.140/6/694, GCY to WHY, October 18, 1903. Young Papers.

29 D.599/1/1/1/6, Grace's notebook, entry dated 22-1-1931. University of Liverpool Library, Special Collections and Archives, D.599, Papers of Dr. R. C.H Tanner, including papers of her parents W. H. Young and Grace Chisholm Young (Tanner Papers).

30 D.140/8/146, GC to WHY, March 18 [1896]. Young Papers.

31 D.140/2/2, R. C. H. Tanner notes. Young Papers.

32 D.140/8/301, GC to WHY, June 6, 1896. Young Papers.

Will encouraged Grace to take on new roles and stand up to her family. He wanted her to become knowledgeable about his financial holdings and business transactions, meet with his lawyers, attend stockholder meetings, and find them a house to rent in Cambridge — activities which Grace's parents thought inappropriate for a young woman. Before her marriage, when Will and her mother advised different courses of action, Grace deferred to her mother.³³ But after she married, Grace would side with Will against her family.

The whirl of wedding preparations — shopping, sewing her trousseau, embroidering household linens, and making obligatory social calls — left Grace no time for mathematics, but she looked forward to getting back to work after her honeymoon.³⁴ Although some of her relatives thought she had been badly spoiled by her parents, Grace thought of herself as an ugly duckling or a Cinderella within the family unit. Enjoying the attention and gifts she received during her engagement, she seemed to feel she was coming into her own. Nearly 150 guests attended the wedding reception at her parents' London home in June 1896. Grace and Will made a handsome couple. Both were fit and athletic. Always self-conscious about her height, she repeatedly reminded him that he would need to stand "very straight," so he would not appear shorter than she when she stood erect in her long satin train.³⁵ As always, Grace clung to convention in the little things.

Vagabond Scholars

After a honeymoon in Switzerland and Italy, the Youngs settled into married life in Cambridge. Will continued coaching and worked on the astronomy textbook; Grace helped him and pursued her own mathematical interests. The pattern that would mark their lives — Grace balancing intellectual pursuits with housekeeping and childcare, Will focusing only on work and urging her to do the same — was quickly set. Grace informed Frances Evans, "However negligent I am of everything

33 D.140/8/232, WHY to GC, May 5, 1896; and D.140/8/201, WHY to GC, April 27, 1896. Young Papers.

34 D.140/8/105, GC to WHY, February 25, 1896; D.140/8/216, GC to WHY, May 2, 1896; D.140/8/301, GC to WHY, June 6, 1896; D.140/8/267, GC to WHY, May 27, 1896. Young Papers.

35 D.140/8/272, GC to WHY, May 28, 1896. Young Papers.

except 'the book' Will gets in a fever & talks of my many distractions. You must not think I am not very happy: I would like to have 'no distractions' & be able to work all day, but there are other things which however one puts them off have to be done in the end."³⁶ Pregnant in the fall of 1896, Grace devoted many happy hours to sewing and embroidering the baby's wardrobe, leaving little time to work with Will.³⁷

The Youngs' relationship was romantic, passionate, and intense. On the first anniversary of their engagement, Grace gushed, "How could I know then that my love for you & yours for me were the biggest truths for us in the universe."³⁸ She found him "the most loving true & sympathetic of friends [...] as well as [the most] ardent of lovers."³⁹ They were personally happy but professionally frustrated. In the spring, Will's unsuccessful candidacy for an examinership in Wales forced the Youngs to take stock of their prospects. He was unhappy with his coaching work and both felt that the Cambridge mathematical tradition, which prepared undergraduates for intellectually arduous but unimaginative examinations, was too narrow and stifled creativity. Encouraged by Felix Klein, they decided to study in Europe with mathematicians who were exploring new branches of mathematics rather than refining a well-established body of knowledge.⁴⁰ Grace was familiar with this world from her days at Göttingen, but her insular and chauvinistic relatives were shocked and disapproving — "horrified", she noted.⁴¹

Grace and Will left England in September 1897, when their son Francis (called Frankie or Bimbo, an Italian word for male baby) was just three months old. Despite the dire predictions of Grace's relatives, the Youngs managed to make ends meet by living on savings, investments, and rental income. They regarded their new life as an exhilarating and productive adventure and relished the opportunities to travel, learn languages, and study mathematics. After spending a few

36 D.140/6/150, GCY to Frances Evans, September 3, 1896. Young Papers.

37 D.140/6/158, GCY to Frances Evans, January 1, 1897. Young Papers.

38 D.140/6/166, GCY to WHY, February 22, 1897. Young Papers.

39 D.140/6/158, GCY to Frances Evans, January 1, 1897. Young Papers.

40 For the contrasting intellectual environments in mathematics at Cambridge and Göttingen, see Joan L. Richards, *Mathematical Visions: The Pursuit of Geometry in Victorian England* (Boston: Academic Press, 1988), and Laurence Young, *Mathematicians and their Times*, North-Holland Mathematics Studies 48 (Amsterdam and New York: North Holland Publishing, 1981), p. 285.

41 D.140/6/172, GCY to Frances Evans, April 7, 1897. Young Papers.

months in Göttingen, they traveled through Italy. They arrived in Turin in November 1898, where they spent six months studying geometry with Corrado Segre, one of Italy's most eminent mathematicians. Will worked on a series of papers on the geometry of n -dimensional space, developing what Grace described as a new and "powerful" idea.⁴² She acted as his "secretary and critic" and wrote a few papers of her own, applying the new mathematics she was learning to the theories developed in her dissertation.⁴³ By the end of 1899, she had published two papers, and Will had published four.

For brief periods, the Youngs shared domestic chores as well as intellectual pursuits. Often making do without servants, they initially treated housekeeping as an entertaining game. Not surprisingly, Grace soon took over the domestic work not done by hired help. Servantless in the fall of 1898, she bragged, "I did *everything*, & Will praised my cooking & I felt bursting with pride at the cleanliness of my kitchen & sitting room & bedrooms." She proudly reported how, on the opening day at the University of Turin, she made coffee, prepared lunch, dressed the baby, and did the washing up before rushing off to attend a lecture.⁴⁴ As always, she was anxious to convince her relatives and friends — and perhaps herself — that she was a model wife, mother, and homemaker despite being a mathematician.

At first, Grace found it difficult to give up the care of her son.⁴⁵ Nevertheless, after they went to Europe, she often hired a servant to help with Frankie, so she could work on mathematics and go on holidays with Will. Arriving to discuss mathematics with a renowned scholar in Italy, she nonchalantly handed the baby over to the maid "like an umbrella to be looked after." After their talk, Grace flung Frankie around her shoulder like a shawl, and she and Will went sightseeing.⁴⁶

This freewheeling period soon came to an end. After Grace became pregnant in the late spring of 1899, the Youngs decided to settle in Göttingen where she had colleagues and friends. They continued their researches and Grace quickly established herself as part of the

42 D.140/6/222, GCY to Frances Evans, May 18 [1898]. Young Papers.

43 D.140/6/228, GCY to Henry William Chisholm, [n.d.]. Young Papers.

44 D.140/6/260, GCY to Frances Evans, November 16, 1898. Young Papers.

45 D.140/6/199, GCY to WHY [August 15, 1897]; D.140/6/207, GCY to Frances Evans, January 15, 1898. Young Papers.

46 D.140/6/214, GCY to Frances Evans, April 4, 1898. Young Papers.

university's international mathematical community. Mathematicians came to visit and talk shop with her, and Klein hired her, and eventually Will, to translate articles for his *Encyclopedia of Mathematical Sciences*.

Grace was cheerful and optimistic when she wrote to her family about her life in Göttingen, but to Frances Evans, whom she trusted not to "tattle", she revealed her anxieties and frustrations. Her main concern was to help Will realize the potential they both saw in him. "I shall not be really happy until his book is out," she admitted, vowing to do what she could to aid him. Convinced of Will's genius, she feared becoming like Xantippe, the famously shrewish wife of Socrates, who lost patience with her husband because she was "a perfectly ordinary woman, & quite incapable of appreciating the abnormal & wonderful & grand."⁴⁷ Grace drew inspiration from reading the biographies of great men, and felt a kinship with the poet Elizabeth Barrett Browning, who left England for Europe and sometimes railed against English critics who failed to appreciate her husband's literary talents.⁴⁸

The Youngs prided themselves on having given up material comforts in order to live on a higher intellectual plane. Neither of them wanted to return to Cambridge, but they were increasingly worried about their finances. Will was in England for several weeks in December 1899, presiding over the entrance exam at the Rugby School to earn a little income, and visiting friends. Spending Christmas with Frankie in Göttingen and eight months pregnant, Grace was lonely and depressed. Will's return did not lighten her mood. On the eve of the new century, she resolved to free herself from her youthful dreams, and devote herself to her new life as a wife and mother.

I feel that I shall throw overboard a lot of useless lumber with this old year, ties & regrets & the old life and be myself, wife & mother & let the rest go: that is what I mean by throwing off *youth*. I shall not any more let myself be persuaded into the wearying task of trying to reconcile new duties with what people are pleased to call *old*. Whether the old ones ever existed except in my imagination is I think open to doubt.⁴⁹

47 D.140/6/318a, GCY to Frances Evans, December 10, 1899; see also, D.140/6/275, GCY to Frances Evans, February 28, 1899. Young Papers.

48 D.140/6/318a, GCY to Frances Evans, December 10, 1899. Young Papers.

49 D.140/6/328, GCY to Frances Evans, December 30 [1899]. Emphasis in the original. Young Papers.

Grace's determination was strong, but the decision was painful. Informing Frances of her resolution, she could not stop crying and sought to hide her tears from Will. She was steeling herself to throw off not just her personal ambitions, but also her ties to her English relatives and some English friends. She had never been close to her family, and her relationships with them deteriorated after she went to Europe. She felt they undervalued Will, discouraged her from visiting, and were petty about finances. When Grace's mother died, unexpectedly, in 1900, Grace felt they were partially estranged.⁵⁰

Medicine or Mathematics?

The birth of Rosamund, called Cecily, in February 1900 forced the Youngs to adapt their lifestyle once again. They had already borrowed money from Grace's father, and with two children to support, they needed more income.⁵¹ They decided that Will would resume his coaching work at Cambridge in the fall of 1900, where he was required to be in residence at the university for a total of twenty-two weeks over three terms. Convinced that Göttingen was less expensive than Cambridge and a preferable place to rear a family, they agreed that Grace and the children would remain in Germany and Will would go to Cambridge alone.

Will's return to Cambridge precipitated an equally dramatic change in Grace's professional life. Despite her resolution to give up old aspirations, Grace did not want to be just a wife and mother. A few months after Cecily's birth, she attended a dinner party at Felix Klein's home and was delighted when the other (male) mathematicians "made much" of her and made it clear that they expected more from her "than a thorough knowledge of housekeeping & the management of babies & a somewhat delicate husband with great thoughts and aims."⁵² Knowing that Will could be away for eight weeks at a time, the Youngs felt Grace should have an intellectual outlet to keep her happy during his absences. By the time he left Göttingen in the fall of 1900, they had

50 D.140/6/419, GCY to WHY, 20 January [1901?]. Young Papers.

51 D.140/6/418, WHY to GCY, 19 January 1901. Young Papers.

52 D.140/6/336, GCY to Helen Chisholm, 19 May 1900. Young Papers.

agreed that she would start the medical training she had always wanted but had not pursued because of her mother's disapproval.

As a female student starting a medical curriculum at the University of Göttingen in 1900, Grace was less of an anomaly than she had been when she arrived to study mathematics in 1893. Although women could not officially enroll as medical students, they had been auditing medical classes at Göttingen University since 1895. Starting in 1899, they were allowed to take state-administered exams and could be licensed to practice medicine.⁵³ Although women's fitness for medical careers and the propriety of training them in co-educational classes were hotly debated topics in both Britain and Germany, Grace and Will were untroubled by such considerations.⁵⁴ The question they debated at length was whether Grace should pursue a medical career or help Will with his explorations in pure mathematics.

Will had hardly arrived in Cambridge before he reopened the discussion. Mistakenly thinking that Grace was having second thoughts, Will assured her there was no need to study medicine if she did not want to. "If we can keep the wolf from the door we shall probably all of us be much happier if you don't [study medicine]," he admitted. The alternative plan, a mathematical partnership with him, would come closer to fulfilling his vision of "the ideal life" than pursuing separate careers, he admitted. He outlined a course of work that would take eight to ten years to complete and require Grace "to work hard at bookwriting" while he was in England.⁵⁵

Will continued to weigh the advantages and disadvantages of mathematics versus medicine even after Grace indicated she was very

53 Thomas Neville Bonner, *To the Ends of the Earth: Women's Search for Education in Medicine* (Cambridge, MA and London: Harvard University Press, 1992), and Patricia M. Mazon, *Gender and the Modern Research University: The Admission of Women to German Higher Education, 1865-1914* (Stanford, CA: Stanford University Press, 2003). Grace was one of thirty-seven women who studied medicine as auditors at Göttingen University between 1895 and 1908, the year when German women were allowed to officially matriculate in Prussian universities. (Bonner, *To the Ends*, p. 114.) After 1908, foreign students were still required to get the instructor's permission to attend classes.

54 Grace noted that the most prominent women doctors were married women. D.140/6/392, GCY to WHY, November 11 [1900?]. Young Papers.

55 D.140/6/371, WHY to GCY, October 19, 1900. His mistake: D.140/6/376, WHY to GCY, October 23, 1900. Young Papers.

happy with her new career.⁵⁶ Medicine might provide a better outlet for her talents than mathematics, and the income she could earn as a doctor would be helpful, he admitted. But his “other self” did not want Grace to embark on a medical career, admittedly for selfish reasons. “It objects to being away from you & would like to have you at its beck & call to save it some drudgery in the production of maths books & the like. It is inclined to object strongly at the notion that ten years hence it may only see you at certain stated hours of the day,” he explained. But he did not think such feelings should stand in Grace’s way if she really wanted to embark on a career in medicine.⁵⁷

Will’s letters had a powerful effect on Grace. After further reflection and discussion with friends, she decided to give up medicine. She informed Will: “If you and the children were not there I should do [medicine] certainly, I do not see that there is anything to deter me. I should be more glad to be able to do it now even than I should have been years ago.”⁵⁸ Despite her deep desire to be a doctor, Grace could not free herself from the stereotypes of her time that taught women to put family before all else. “It is *no* sacrifice to me to give it up,” she stressed. “The two determining factors are (1) that I want to help you with your work & (2) that I want to have a large hand in educating the children [...] I think I should have shattered my own idea of womanhood if I had allowed myself to be so completely taken from you & the children,” she assured Will.⁵⁹

After receiving this letter, Will quickly sent a telegram — an expensive and atypical method of communication between them — that specified: “Try medicine!” In his next letter, he countered her arguments against medicine and emphasized the benefits that could result: more income, perhaps enough for the family to live in England, and better care for the children’s physical health. Downplaying her concerns about the children, he argued that she would be likely to spend more time with them than the average mother, and suggested that he might sometimes help with their care. But he stressed, as always, that she would have to let the servants do more. Struggling to overcome his own interests,

56 D.140/6/372, GCY to WHY, October 19, 1900. Young Papers.

57 D.140/6/373, WHY to GCY, October 20, 1900. Young Papers.

58 D.140/6/357a, GCY to WHY, October 22, 1900. Young Papers.

59 Ibid. Emphasis in the original. Young Papers.

he insisted that it would not be "fair" to ask for Grace's help in his work and he could advance without her assistance. Moreover, he felt the partnership role he envisioned for her — being at his "beck & call," saving him from the drudgery of preparing his work for publication — would not make sufficient use of her considerable talents. Moving from mathematics to medicine was the right course, he concluded. "[D]o it *because of me and the children*," he urged.⁶⁰

Until this point in their discussion, Will seemed to be steering Grace to do mathematics with him. Very likely he was happy to reopen this possibility because his return to Cambridge set off new concerns about his future. Stimulated by the innovative mathematics that he was introduced to in Germany and Italy, Will had found the topic that would make his reputation. Klein had suggested that the Youngs familiarize themselves with the work of the mathematician George Cantor, and Will was quickly captivated by his work on set theory. Cantor's analysis of the nature of sets, the elements that make them up, and the correspondence between the elements in different sets, raised profound, somewhat metaphysical, questions about mathematical concepts like continuity and infinity, and offered practical applications for measuring areas. Set theory is now regarded as one of the essential underpinnings of modern mathematics, but when Will began working on it, in the summer of 1900, it was a very controversial field of inquiry, not well known or highly regarded in England.⁶¹

When Will got to Cambridge, he found that no one was interested in the topics that excited him. The prospect of soldiering on alone in an academic environment that was, at best, indifferent to and, at worst, hostile to his mathematics must have been daunting indeed. Working with Grace would give him a partner who valued and understood his work; without her, he would be intellectually isolated. Given Will's temperament, this was not a recipe for success. His self-doubts returned.

Grace relied on Will's support and encouragement as much as he relied on hers. She had few if any models for combining marriage and

60 D.140/6/379, WHY to GCY, October 25, 1900. Emphasis in the original. Young Papers.

61 On the revolutionary nature of set theory, see Grattan-Guinness, "Mathematical Union", pp. 139–40, and William Dunham, *Journey through Genius: The Great Theorems of Mathematics* (New York: John Wiley and Sons, 1990), pp. 252–81.

motherhood with a career. As a dutiful wife, she felt she needed his blessing to embark on this new endeavor. Lacking female mentors, she had always been dependent on male approval: her father was her champion when she went to Girton College; Felix Klein was her champion in graduate school, and she continued to rely on his advice and contacts when she returned to Germany. In these letters, she did not tell Will what she wanted to do and try to convince him. Rather it was Will who framed the issues and guided the discussion, interpreted what Grace was saying, and made the case for her to go to medical school. In the end, he argued more forcefully on her behalf than she did.

At the same time that Will was supportive of Grace's efforts, he was also highly critical of her. He praised her "exceptional powers" but blamed her for being too emotional. "Grace is all ups and downs," he reminded himself. Chastising her for being too "impetuous" and "impulsive" — classic male complaints about female behavior — he warned her that such volatility might be harmful to her future patients.⁶²

Despite her misgivings, Grace allowed herself to be persuaded by Will's arguments. Soon she was writing to him about how happy she was and how well her classes were going. Relieved that she would have a practical career to fall back on, Will sent her information about women's medical education and licensing in England. They agreed that she should take the London Matriculation Examination as a preliminary to taking the London Medical Examination needed to qualify to practice medicine back home.⁶³

Balancing Medicine, Mathematics, and Family: 1901–1903

Will's ability to put Grace's interests above his own and treat her as someone deserving of equal consideration was lamentably intermittent and short-lived. His support for her medical training waxed and waned. The economic motivation for Grace to become a doctor — the hope that she could someday support the family — became less urgent

⁶² D.140/6/378, WHY to GCY, October 25, 1900. Young Papers.

⁶³ D.140/6/383, GCY to WHY, October 29, 1900 and D.140/6/389b, GCY to WHY, November 4, 1900. D.140/6/391a, WHY to GCY, November 9, 1900 and D.140/6/393b, WHY to GCY, November 15, 1900. Young Papers.

after her ninety-two-year-old father died in January 1901 and left her an inheritance which they thought would provide an annual income of about 160 pounds. This was enough to sustain a lower-middle-class life style, but it was supplemented by Will's earnings and income from other investments and holdings.⁶⁴

The prospect of more income eased the Youngs' financial burdens considerably. Feeling released from the enforced "penury" of their lives, they started to spend money more freely, and Will became more outspoken about the toll Grace's training took on her family.⁶⁵ He begged her, just after her father died, not to "sacrifice your husband & your children [...] to your medicine!" Reminding her of the distress he felt when he returned from Cambridge and saw her "tired face & the disorder around me", he bluntly challenged, "should we have allowed medicine to have come between us as it does?"⁶⁶

Despite twinges of guilt, Grace stood firm about forging ahead with her medical training. "My own work is going on most satisfactorily &, whether it becomes a profession or not, will be invaluable to us all," she asserted a month after her father's death.⁶⁷ She passed several parts of the London Matriculation Examination in the summer of 1901, but needed additional work in Latin.⁶⁸ When a potential teaching job for Will in Australia fell through in 1902, she was relieved because she did not want to give up her medical work.⁶⁹ She steadfastly defended her time against interruptions from relatives. After her unstable sister-in-law, Ethel Young, had a breakdown in 1902 while she was living with the Youngs, Grace (with Will's encouragement) announced that a woman

64 Her inheritance: D.140/6/421, WHY to GCY, January 23, 1901; D.140/6/422a, WHY to GCY, January 24, 1901; D.140/6/423a, WHY to GCY, January 25, 1901, as well as multiple letters from Solicitor Henry Cook in 1901 and 1902 in D.140/29/12–53. Young Papers. Each Chisholm child received 1,448 pounds. For what it took to maintain a lower-middle-class life style, see F. S. Musgrove, "Middle Class Education and Employment in the Nineteenth Century", *Economic History Review* 12:1 (1959), 99–111. Supplemental income: D.140/6/1581, WHY to Mr. MacMahon, 25 August 1913. Young Papers.

65 They bought bicycles and a typewriter for Grace, and planned to travel more. D.140/6/561, WHY to GCY, 13 March 1902; D.140/6/547, GCY to WHY, February 18, 1902. Young Papers.

66 D.140/6/422, WHY to GCY, January 24 [1901]. Young Papers.

67 D.140/6/429, GCY to WHY, February 10, 1901. Young Papers.

68 D.140/6/461, WHY to GCY [June 1901]. D.140/24/2 Autobiographical notes by GCY on 1901–1902 (written in 1917). Young Papers.

69 D.140/6/597, GCY to WHY, 20 July 1902. Young Papers.

“as busy as I” could not provide adequate supervision, and the family would have to make other arrangements for Ethel’s care. Grace did not want her own sister Helen to visit in 1902, because she could not afford to lose time from the lectures she was attending.⁷⁰

But when Will needed her assistance, Grace dutifully struggled to provide it. When she started her medical training, they agreed she would no longer help him with his mathematical studies. Nevertheless, she was soon working with him again. Convinced that he needed to publish a book to be a serious job candidate and fearful that he would not finish one without her assistance, feeling guilty about her failure to be a helpmate wife, Grace offered to help “heart & soul as much as I can.”⁷¹ Pregnant in the fall of 1901 and not attending classes, she developed formulae for him, readied his papers for publication, and conducted his correspondence with other mathematicians.

Delighted to have her assistance, Will mapped out his plans for future publications and became increasingly proprietary about Grace’s time.⁷² Their third child, Janet, was born in December 1901. (Grace read Dante while waiting for her labor to begin.⁷³) Two months later, Will admonished her, “Just now the [mathematical] work is *extremely important*. I don’t like your not beginning before 3 p.m. & really don’t see why this should be the case.”⁷⁴ The following week he urged her not to do anything except mathematics, even though he was “disappointed & somewhat anxious at the nonresumption of the medical work.”⁷⁵ This dual imperative — that Grace should devote as much time as possible to his work while advancing quickly through her medical training — was typical of Will’s exhortations. She did her best to comply, but the pressure was grueling.

In the fall of 1902, when she was taking twenty-one class hours per week, Grace planned to devote three hours per day to mathematics late in the week and seven to nine hours per day to medicine early in the

70 D.140/6/579a, GCY to WHY, May 17, 1902. Young Papers.

71 D.140/6/429, GCY to WHY, February 10, 1901. Young Papers.

72 D.140/6/515, WHY to GCY, November 27, 1901. Young Papers.

73 D.140/6/521a, GCY to WHY, December 11 [1901]. Young Papers.

74 D.140/6/537, WHY to GCY, February 7, 1902. Emphasis in the original. Young Papers.

75 D.140/6/557, WHY to GCY, February 13, 1902. Young Papers.

week.⁷⁶ Will wanted her to prepare examination questions for him and work on his articles. Feeling overwhelmed, she offered to cut back on her medicine. When he did not insist, she persevered with her medical courses and took intense pleasure in them. She dreamed about anatomy, took pride in drawing connections between her botany and anatomy classes, and was surprised to learn that she had signed up for more chemistry classes than most medical students.⁷⁷

During some weeks, she was too busy to help Will. When he pressed her for the exam questions, she reminded him that preparing for her London entrance exams took priority. "We must see that *nothing* interferes with this," she insisted, adding that it would facilitate her progress if he would leave Cambridge and stay in Göttingen with her and the children.⁷⁸

Two weeks later, Grace's unmarried friend, Frances Evans, sent her a heartfelt tribute. "Your life is wonderful to me," Frances wrote, noting how exceptional Grace was in managing to "work out her own personal aims" while maintaining a loving home circle. "I meet devoted mothers & wives, but they can be nothing else — or I meet clever women with no home ties," she explained. Frances praised Will as well. "He has never tried to absorb your individuality and your career. Do you realise how wonderfully rare that is?" she queried.⁷⁹

The reality was more complicated than Frances imagined. Will's career was a family enterprise, dependent on Grace's efforts as well as his. Time and again, his enthusiasm for Grace's medical studies warred with his ever growing desire for her help with his own work. As a result, he gave her frustratingly mixed messages. He repeatedly told her not to give up medicine, but insisted it should not interfere with the work she was doing for him.

His demands consistently undermined her progress, but Grace very rarely put her own needs first or expressed irritation. Instead, she did her best to accommodate him. Occasionally, she tried to protect her time by suggesting that she delay a visit to him in Cambridge or postpone a

76 D.140/6/619, GCY to WHY, November 13, 1902; D.140/6/620, GCY to WHY, 18 November, 1902. Young Papers.

77 D.140/6/619b, GCY to WHY, 13 November 1902. Young Papers.

78 D.140/6/622, GCY to WHY, November 26, 1902. Emphasis in the original. Young Papers.

79 D.140/6/627, Frances Evans to GCY, December 9 [1902]. Young Papers.

European holiday until she completed some portion of her own work. But she qualified her request by stressing “if you can spare me.” Or she demurred, “I do not want to press it.”⁸⁰

The more pressure Will felt to advance his own career, the more likely he was to lose sight of the burdens he placed on Grace. Very occasionally, he apologized for driving her too hard. “I love you, my darling wife, admire you, respect you, reverence you too but all this does not prevent me letting you think of my comfort rather than your own!” he confessed in November 1904.⁸¹ He also knew that he was overly critical of her and others.⁸² But instead of sympathizing with her, he was more likely to berate her for failing to manage her time and her household efficiently.

When she started her medical training in the fall of 1900, Grace employed two servants to help with the children — Frankie, three years old, and Cecily, six months — and the housework. Nevertheless, believing that she could give the children better care than the servants, she arranged her schedule so that she could dress, bathe, and feed the children herself, spending several hours with them before they went to bed.⁸³ As the strain of doing both medicine and mathematics intensified, and the family continued to grow — Janet was born in December 1901, Helen (Leni) in September 1903, Laurence (Laurie) in July 1905, and Patrick (Pat) in March 1908 — Grace had to surrender more of the childcare and housekeeping. In addition to the servants, she had assistance from Will’s younger, unmarried sisters. Ethel Young joined the household in May 1901 to help care for children. After she left in 1902, she was replaced by Mary Ann Young (Auntie May), who lived with the family for more than ten years. Even when she had help, Grace made time for her children. She wrote Will in the fall of 1902, “I did my daily quota of Physiology this morning before 7 AM. Cecily & Frankie were building castles in the bedroom. Janet was sitting on the fur hearthrug, nodding at me & laughing when I caught her eye, &

80 D.140/6/597, GCY to WHY, 20 July 1902. D.140/6/750, GCY to WHY, 6 February 1904. Young Papers.

81 D.140/6/848, WHY to GCY, November 28, 1904. Similarly, D.140/6/712, WHY to GCY, November 9, 1903. Young Papers.

82 D.140/6/416, WHY to GCY, January 18, 1901. Young Papers.

83 Better care: D.140/6/357, GCY to WHY, October 22, 1900. Schedule: D.140/6/389, GCY to WHY, November 4, 1900; see also, D.140/6/392, GCY to WHY, November 11 [1900]. Young Papers.

eating a biscuit."⁸⁴ On a day when a servant was off and Grace had sole charge of the children, she managed to make a dress for Cecily, read physics, and do mathematics for Will.⁸⁵

The cost of this all-but-impossible balancing act was high. Grace was often physically exhausted and suffered from chronic and debilitating headaches. The headaches were attributed to a liver condition that later caused gall stones, but the stresses and strains of her life undoubtedly contributed as well.⁸⁶ In the midst of preparing for exams in the summer of 1902, while also working on Will's mathematics, she confessed to being "run down, off my feed, & got the blues."⁸⁷ In February 1904, when Will queried about the status of the work she was doing for him just after she had finished a set of exams, she responded rather sharply, "Really darling, I am too hard worked! but I am most anxious to get everything done & am very well & so are we all."⁸⁸ Such complaints were rare, however. For the most part, Grace undertook her multiple activities with enthusiasm and seemed to thrive on the challenges of her demanding life.

Will, in contrast, was anxious and frustrated. During most of the year, he was in England, trying to write papers on pure mathematics while coaching undergraduates at Cambridge University (1900–1904), conducting examinations at a variety of other schools, and serving as the Chief Mathematical Examiner for the Central Welsh [Education] Board (1902–1905), which administered examinations in primary and secondary schools and colleges throughout Wales. He was miserable in Cambridge. "[P]rivate teaching is very exhausting and unsatisfying [...]. It's awful here! Little knowledge, little time [crossed out] & much jealousy," he complained to Grace in November 1901.⁸⁹ Always sensitive to slights, he felt unappreciated and knew that he gained status by being the husband of "a distinguished woman."⁹⁰ Drained of will and enthusiasm, weakened by indigestion and minor physical ailments, he was often unable to work productively. He continued to apply for

84 D.140/6/615, GCY to WHY, October 29, 1902. Young Papers.

85 D.140/6/612, GCY to WHY, October 19, 1902. Young Papers.

86 D.140/2/2, R. C. H. Tanner notes. Young Papers.

87 D.140/6/590, GCY to WHY, June 30, 1902. Young Papers.

88 D.140/6/751, GCY to WHY, February 10, 1904. Young Papers.

89 D.140/6/501, WHY to GCY, November 5, 1901. Young Papers.

90 D.140/6/422, WHY to GCY, January 24 [1901]. Young Papers.

teaching positions in British universities and continued to be turned down.

Grace responded to his complaints, anxieties, and disappointments with stoic cheerfulness and redoubled her efforts to help him. "Let them give the readership & the examinership to Tag, Rag, and Bobtail. I really don't care a straw if you don't," she announced in November 1901.⁹¹ She sweetly, but steadfastly, urged him not to lose heart, not to wallow in self-pity, and not to resign from Cambridge without having another position. Knowing that he needed "managing" (his term), she counselled him on his job searches and used her connections to influential scholars, friends, and relatives to get endorsements for him. She had to "drag" a testimonial out of Felix Klein for him in 1901, she told Will, because "nearly all our mathematical communications with him have been carried on through me."⁹² She pushed Will, too, warning him that he would have to get himself "in harness" and work hard if they were to finish their book.⁹³ "Our honor is at stake," she reminded him, linking her professional reputation with his.⁹⁴ But she knew her own worth. When Will was thinking about giving a lecture on descriptive geometry in his effort to get the Welsh examinership in 1901, Grace advised him not to, because he did not know the topic and it would take him too long to learn it, even with her help. "I could lecture on it tomorrow if I was wanted!" she proudly noted.⁹⁵

Helpmate Wife and Anonymous Partner

With Grace's help, Will produced numerous publications on set theory and its applications to various branches of mathematical analysis, including calculus. He had a profusion of ideas, and their work developed important theorems on problems of differentiation (constructing tangents) and integration (measuring areas under curves). Throughout their long collaboration, both Grace and Will persisted in treating her as the junior partner to her more illustrious, and ostensibly more gifted,

91 D.140/6/513, GCY to WHY, November 21, 1901. Young Papers.

92 D.140/6/504a, GCY to WHY, November 7, 1901. Young Papers.

93 D.140/6/499a, GCY to WHY, November 1, 1901. Young Papers.

94 D.140/6/429, GCY to WHY, February 10, 1901. Young Papers.

95 D.140/6/499a, GCY to WHY, November 1, 1901. Emphasis in the original. Young Papers.

husband. He referred to her as "the bottle washer" in his "experiments", the talented pupil who solved the problems that he, the teacher, set for her.⁹⁶ He claimed to have taught her set theory and persuaded her that she understood it well enough to help him.⁹⁷ She described herself as his "helper", "secretary", and "critic." Her role was to save him from much "drudgery" and the "troublesome and weary work" of preparing his manuscripts for publication.⁹⁸ She took notes while Will dictated, conducted his professional correspondence, and typed his manuscripts. She worked out the formulae to prove his theorems, found and corrected errors in his work, drafted early versions of some of his papers, and edited and rewrote others. In their accounts of the partnership, Will had the big ideas; Grace filled in the details and provided the structure and framework that defined his theories, freeing him to move quickly on to the next big idea.

Accepting Grace and Will's characterization of the partnership, their children portrayed Grace as an enabler and catalyst rather than a partner who contributed her own original insights to his work. Cecily, the Youngs' eldest daughter and a mathematician herself, explained,

[M]y father had ideas and a wide grasp of subjects, but was by nature undecided; his mind worked only when stimulated by the reactions of a sympathetic audience. My mother had decision and initiative and the stamina to carry an undertaking to its conclusion. Her skill in understanding and in responding, and her pleasure in exercising this skill led her naturally into the position she filled so uniquely. If she had not had that skill, my father's genius would probably have been abortive, and would not have eclipsed hers and the name she had already made for herself.⁹⁹

96 D.140/6/558, WHY to GCY, February 15, 1902; D.140/6/380, WHY to GCY, October 25, 1900. Young Papers.

97 D.140/6/4938, WHY to Patrick Young, October 31, 1931. Young Papers.

98 D.140/16/1, GCY, "Per Ardua ad Astra" (1917), p. 85; D.140/6/2244, GCY to Frances Evans, 4 October 1916; D.140/6/499, GCY to WHY, November 1, 1901; D.140/6/709, GCY to WHY, November 2, 1903. Young Papers.

99 Cecily Young (Tanner) to Professor Lida Barrett, circa 1968. Quoted in Sylvia Wiegand, "Grace Chisholm Young and William Henry Young: A Partnership of Itinerant British Mathematicians" in *Creative Couples in the Sciences*, ed. by Helena M. Pycior, Nancy G. Slack, and Pnina G. Abiram-Am (New Brunswick, NJ: Rutgers University Press, 1996), pp. 126–40 (p. 137). Similarly, D.140/2/2.1, R. C. H. Tanner notes. Young Papers. For Laurence Young's view of Grace's contribution, see Laurence Young, *Mathematicians*, p. 283 and Wiegand, "Grace Chisholm Young and William Henry Young", pp. 137–38.

In fact, Grace did much more than that. The Youngs' correspondence shows that she was a full intellectual partner, not just someone who carried out Will's instructions. Working out their views on set theory, they argued back and forth, questioned each other's reasoning, found mistakes in each other's work, and jointly carved out their approach. "I have not got a proof of this theorem yet from *our point of view*," Grace informed Will in the spring of 1902, emphasizing that the approach George Cantor, the father of set theory, had taken was one "*we* want to avoid."¹⁰⁰ Describing how she developed another proof, she explained, "it's what we planned except as regards the last step."¹⁰¹

Grace challenged Will, pushed him to think more deeply, expanded his vision, and improved their line of argument. She incorporated her own ideas into his work. Wanting to amend a paper that Will had already sent out for review, she explained,

I see something new, & I want to alter the end materially & make it much simpler & more lucid & more consequential. I think even you yourself have not quite grasped the light which the intervals throw on derivation & I remember you doubted whether there was any process other than derivation, the process I call deduction. It is the fact that there is such a process & that I have not clearly brought this out in the final article of the paper on sets of intervals that make the reasoning there inadequate if not actually wrong.¹⁰²

When Will questioned her proof, she continued to wrestle with it, ending up with "some *very* pretty work on overlapping intervals brought out by your criticisms & suggestions."¹⁰³ A year later, she assured him that the corrections she had made in another paper "were most necessary." She had fixed some mistakes and made the article "so lucid, so fundamental, [that it] leads to just what we want in the paper on sets of points."¹⁰⁴

As part of the University of Göttingen's international community of mathematicians, Grace kept Will informed about what other mathematicians were doing and tested their reactions to the Youngs'

100 D.140/6/612, GCY to WHY, 19/10/02. Emphasis added. Young Papers.

101 D.140/6/578, GCY to WHY, January 22 [1902]. Young Papers.

102 D.140/6/611, GCY to WHY, 16/10/02. Young Papers.

103 D.140/6/619b, GCY to WHY [13/11/02]. Emphasis in the original; *very* is underlined multiple times. Young Papers.

104 D.140/6/647, GCY to WHY [4 May 1903]. Young Papers.

work.¹⁰⁵ She attended a weekly colloquium of mathematicians, and went out with the members afterwards to talk shop.¹⁰⁶ When a scholar who disagreed with the Youngs visited the university, Grace proposed that he give a talk to the colloquium so she would learn what others thought of him without revealing her own views. "See how the hard world is teaching your harmless dove the wisdom of the serpent," she warned Will.¹⁰⁷

Grace's subordinate role in the Youngs' partnership was premised, in part, on the idea that Will was the more gifted mathematician. Awed by the mathematics he was doing in Italy in the late 1890s, she wrote a friend, "[Will] is so unlike most people that I find my greatest comfort & joy in reading about really great men; how often do I find his rare qualities, qualities which put him out of touch with ordinary people, reflected in those of the most celebrated people."¹⁰⁸ Years later, she still marveled at the originality of his mind and compared herself unflatteringly to him as well as to their sixteen-year-old son. Describing how Frankie developed a proof and discovered an error in her work, she wrote to Will, "I feel at once with him as I do with you, that I have to do with a mathematical power altogether beyond my own."¹⁰⁹

Trapped in the gendered stereotypes of their time and uncomfortable with ideas of gender equality, Grace and Will failed to appreciate how much her thinking added value to his work. The belief that women could be excellent students but lacked the capacity for creative, original thought was seared deep into the Victorian mind.¹¹⁰ Greatness in mathematics has traditionally been equated with genius, and the nineteenth-century world understood "genius" to be a characteristic of the male mind exclusively.¹¹¹ Early in the nineteenth century, the

105 D.140/6/611, GCY to WHY, 16/10/02. Young Papers.

106 D.140/6/619b, GCY to WHY [13/11/02]. Young Papers.

107 D.140/6/932, GCY to WHY, March 2, 1906. Young Papers.

108 D.140/6/318, GCY to Frances Evans, December 10, 1899. Young Papers.

109 D.140/6/1842, GCY to WHY, March 20, 1914. Young Papers.

110 Such attitudes die hard. Ben Barres, an acclaimed twentieth-century neuroscientist who spent the early years of his professional life as a woman, noted that when she was the only person in an MIT class to solve a particular problem on a test, the professor accused her of cheating, insisting that her boyfriend must have solved it for her (Neil Genzlinger, "Ben Barres, Neuroscientist and Equal-Opportunity Advocate, Dies at 63", *The New York Times*, December 31, 2017, A25).

111 See Claire G. Jones, *Femininity, Mathematics and Science, 1880–1914* (Basingstoke and New York: Palgrave Macmillan, 2009). Jones's illuminating exploration of the role

mathematician Mary Somerville (who worked at the intersection of mathematics, physics, and astronomy) trivialized her extraordinary talents by noting, "I have perseverance and intelligence, but no genius, that spark from heaven is not granted to the [female] sex."¹¹² In Grace's day, the male colleagues of the revered German mathematician Emmy Noether, awed by her formidable talents, adopted masculine nouns and pronouns when they talked to her or about her, as a way of indicating that her mind was as powerful as a man's.¹¹³ Will bluntly told Grace that she was not a mathematical genius. "I value your help enormously up to a point. I do not believe, however, that your chief strength is in mathematics pure and simple. You can do everything well, & it is easy to do some things well, but mathematics is not one of those unless one has genius," he wrote her early in their collaboration.¹¹⁴

Recognizing Will's intellectual prowess was vital to the personal dynamic that fueled the Youngs' marriage. When he was elected a Fellow of the Royal Society in 1907, Grace rejoiced that he was fulfilling the promise of future success he had made when they became engaged.¹¹⁵ The modern woman, "whatever her personal ambitions, really longs for a superior male mind, just as she admires the strength, & craves the protection of the complete man," she wrote in 1920.¹¹⁶ Treating Will's work as more important than Grace's, and making his career their joint career righted the imbalance that had characterized their marriage at its start. Even when Grace challenged his conclusions or approach, she

that gender played in mathematics and science education and practice around 1900, and in the institutions and associations that supported them, provides an important context for understanding the career opportunities and dilemmas encountered by women of Grace's era. She and fellow Girtonian, Hertha Ayrton, a physicist and engineer, are featured in Jones's study.

112 Quoted in Teri Perl, *Math Equals: Biographies of Women Mathematicians and Related Activities* (Menlo Park, CA: Addison-Wesley, 1978), p. 91. Mary Fairfax Somerville (1780–1872) received strong support for her work from her second husband who helped her by searching for the books she needed, and copying and recopying her manuscripts.

113 Lynn M. Osen, *Women in Mathematics* (Cambridge, MA: MIT Press, 1974), p. 152. Albert Einstein noted that Noether (1882–1935) was regarded by leading mathematicians as "the most significant creative mathematical genius thus far produced since the higher education of women began." She studied at the University of Göttingen and later taught there, working closely with Felix Klein.

114 D.140/6/558, WHY to GCY, March 9, 1902. Young Papers.

115 D/140/24/1, Typed copy of GCY to WHY [March 1907]. Young Papers.

116 D.140/14/1, GCY essay, dated Xmas Day, 1920. Young Papers.

deferred to him and acknowledged his preeminence. Sending him the draft of a paper, she demurred, "I am rather pleased with it myself but think you are certain to improve it."¹¹⁷

Will's sense of superiority was bolstered by the fact that Grace's work habits conformed to neither the male-defined image of a professional in the late nineteenth century nor the more traditional concept of a highly gifted person with a calling. She emphasized the importance of balance and moderation and integrated her intellectual work with the demands of daily life.¹¹⁸ Alarmed by the demands that Will's obsession with work and professional advancement placed on her and the children, she wrote in an undated fragment of a letter to Will that was possibly never sent:

We must never go through another five weeks like last Christmas. Life was given to us to use & also to enjoy & whether you or I or someone else is the first person to publish some particular discovery is a matter of comparatively small importance. Far more important is that we should taste the full cup of life, enjoy it & be invigorated by it, rear healthy & capable children, & help carry on the world's business, & look our own fate calmly in the face.¹¹⁹

The equilibrium Grace struggled to achieve involved balancing different types of intellectual and cultural pursuits as well as work and family. In the midst of her medical studies and mathematical work, she managed to write children's books, compose poetry and fiction, and play music with her children. Such a broad range of interests did not serve Grace well in a world in which academic disciplines were becoming more specialized, dilettantism was frowned upon, and careers were supposed to be all-consuming. The notion that a professional career entailed total commitment, unstinting labor, and progressive advancement was born in late nineteenth-century England and America and reflected a

117 D.140/6/528, GCY to WHY, January 22 [1902]. Young Papers.

118 Modern day female mathematicians have commented on the persistence of such judgments and argued that their interrupted days have been a stimulant, not a deterrent, to their creativity and productivity. Margaret A. M. Murray, *Women Becoming Mathematicians: Creating a Professional Identity in Post-World War II America* (Cambridge, MA: MIT Press, 2000), pp. 151–98.

119 D.140/7/1.20, GCY to WHY, [n.d.], end missing. Young Papers. It is not clear whether Grace actually sent this to Will. She was rarely so directly critical of Will or so impassioned in challenging him.

distinctly male culture.¹²⁰ In contrast, the term “amateurism” connoted work that was “superficial, desultory” and associated with “less than a serious commitment, the pursuit of an activity for amusement and distraction.”¹²¹

Will accepted these distinctions. He himself had dallied and focused too broadly when he was at Cambridge. In retrospect, he believed these habits contributed to his early lack of success as a mathematician and marked him as unambitious. When he wanted Grace’s help, he could not tolerate distractions. He was not just making up for lost time; he was living the life he thought was required of a scholar. Nevertheless, Grace was a steadier and harder worker than Will. While he required ideal conditions in which to think and write, she applied herself efficiently and productively to the multiple tasks she undertook, coped with multiple interruptions, and often worked late into the night. Rejecting the Cambridge adage (developed by male scholars) that mathematics can be productively worked at for only six hours a day, Grace noted that she could profitably spend two or three hours reading mathematics after devoting a day to problem solving. Her notebooks are filled with notes and summaries of mathematical studies in English, French, German, and Italian.¹²²

In Will’s eyes, Grace also failed to measure up to the older ideal of work as a “calling,” a service done in the pursuit of a higher good. He explained to their daughter Cecily, “The exceptionally intellectual person has a duty — that of developing the intellectual powers to the utmost limit, both for the sake of his own individuality & also for the possibilities it creates of contributing to the utmost extent to the intellectual & higher progress generally of mankind.”¹²³ Dedicated to the pursuit of Truth, Will rode roughshod over anything that interfered with his work. Grace’s failure to do the same — when she insisted on

120 See the Introduction to this volume, p. 19.

121 Burton J. Bledstein, *The Culture of Professionalism: The Middle-Class and the Development of Higher Education in America* (New York: W. W. Norton, 1976), p. 31. E. Anthony Rotundo, *American Manhood: Transformations in Masculinity from the Revolution to the Modern Era* (New York: Basic Books, 1993), pp. 175–76, notes that men typically approached their work with an all-engrossing “passion,” and argues that the “habit of pouring heart and soul into their work [...] became a defining mark of American manhood” in the nineteenth century.

122 D.140/34/52–55, Notes by GCY in Small Notebooks. Young Papers.

123 D.140/6/3904, WHY to Cecily Young, May 12, 1927. Young Papers.

spending time with the children, refused to hire more household help, or allowed herself to be "distracted" by her other interests — fueled Will's sense of entitlement and superiority and justified the sacrifices he expected her to make on his behalf. She acquiesced without complaint, but it became harder for her to do so as time went on.

Grace was not only a subordinate partner but also an anonymous partner whose contributions were mostly hidden from the world. In private, Will gratefully acknowledged his reliance on her assistance. Their mathematical exchanges acted as "stimulants" that kept him "working and thinking."¹²⁴ Without her help, he felt lost. "Alone I can do nothing [...] my usefulness would be vitally attacked if you were not by my side strong & well," he wrote to her in 1903.¹²⁵

Nevertheless, Will was conflicted about whether to publicly acknowledge Grace's help. He recognized that they should both be authors of the work they were producing in early 1902, but he feared that acknowledging Grace's work would hurt his chances of getting an academic job. Torn between equity and expediency, he opted for expediency. He laid out the problem for Grace:

The fact is that our papers ought to be published under our joint names but if this were done we should neither of us get the benefit of it. No. Mine the laurels now & the knowledge. Yours the knowledge only.

Do you suppose people will venture to say the laurels ought to be yours? No they would be very unwilling to allow that. They are on the horns of a dilemma. Each alternative annoys them. Divide and we are lost for they would pooh pooh both. Everything under my name now, & later when the loaves and fishes are no more procurable in that way, everything or much under your name. There is my programme. At present you can't undertake a public career. You have your children. I can and do.¹²⁶

Will's assertion that no one would think the laurels ought to be Grace's was disingenuous and self-serving. Prejudice against women scientists was strong, and prejudice against married women scientists was even stronger. Yet progress was being made. Not all prizes, honors,

¹²⁴ D.140/6/553, WHY to GCY, February 15, 1902. Young Papers.

¹²⁵ D.140/6/712, WHY to GCY, November 9, 1903; similarly, D.140/6/461, WHY to GCY [June 1901]. Young Papers.

¹²⁶ D.140/6/553, WHY to GCY, February 15, 1902. Young Papers.

and outlets would have been closed to Grace. In February 1902, just when Will was thinking about an authorship policy for himself and Grace, the Royal Society, Britain's premier organization devoted to the promotion and improvement of science (including mathematics), rejected the first woman who applied for membership on the grounds that she was married. Hertha Ayrton had many publications and inventions in physics and electrical engineering, and the support of several (male) members of the Society, including her husband. But legal opinion ruled that the language of the founding charter, written in 1662, excluded married women because under English common law they were not deemed to be individuals with separate identities apart from their husbands.¹²⁷ No woman, single or married, joined the Royal Society until 1945.

The door of the Royal Society was barred, but the London Mathematical Society, founded in 1865, the preeminent association of mathematicians in Britain, had begun admitting women to membership in the 1880s and allowed them to give papers.¹²⁸ Grace had been a member since 1896. Moreover, when they published under their own names, married women as well as single women were winning recognition, prizes, and honors. Despite being denied membership in the Royal Society, Hertha Ayrton became the first woman to read her own paper at the Society in 1904, and was honored with its Hughes Medal in 1906, an award given to an outstanding researcher in the field of energy. Marie Curie famously won two Nobel prizes, in 1903 and 1911, as well as the Royal Society's Davy Prize.

Will's fear that neither he nor Grace would benefit if they published jointly because the world would "pooh pooh both" was equally disingenuous and self-serving. The greater likelihood was that he would get credit for his contributions but she would not get credit for hers. What twentieth-century scholars called "the Matilda effect" — the

127 Joan Mason, "Hertha Ayrton (1854–1923) and the Admission of Women to the Royal Society of London", *Notes and Records of the Royal Society of London*, 45:2 (1991), 201–20.

128 There were nine female members of the London Mathematical Society in 1895, about 4 percent of the total membership. In 1905, there were fourteen female members (15.5 percent). Claire Jones, "Grace Chisholm Young: gender and mathematics around 1900", *Women's History Review* 9:4 (2000), 675–91, <https://doi.org/10.1080/09612020000200266>. See also, Jones, *Femininity*, pp. 155–63.

longstanding habit of devaluing women's contributions in science and giving credit to men for work done by women — was already well-established. Then, as now, women struggled against the assumption that a woman who collaborates with a man provides assistance-type help while he does all the conceptual, original work. The history of collaborative couples in science is filled with relationships that fit — or were made to fit — that image. Wives' contributions have often been downplayed, unacknowledged, or hidden, due to a combination of institutional barriers, gendered stereotypes, social pressure, and personal choices.¹²⁹

Faced with similar circumstances and dilemmas, some accomplished couples who were contemporaries of the Youngs — Marie and Pierre Curie, Hertha and William Ayrton, and Beatrice and Sidney Webb — made very different choices and found ways to honor the wife's achievements and contributions. They are striking exceptions to the general pattern. Had it not been for Pierre Curie's protests and avowals about his wife's role, Marie Curie would not have been a co-recipient of the Nobel Prize along with Pierre in 1903.¹³⁰ Nevertheless, the erroneous perception that Pierre discovered radium persisted. Hertha Ayrton, the wife who was rejected for membership in the Royal Society, wryly observed in 1909, "Errors are notoriously hard to kill, but an error that ascribes to a man what was actually the work of a woman has more lives than a cat."¹³¹ A feminist and suffragette, Ayrton deplored that women's achievements were often overlooked "because no one will believe that

129 See Helena M. Pycior, Nancy G. Slack, and Phina G. Abir-Am, "Introduction", in *Creative Couples in the Sciences*, pp. 3–35. The term "Matilda Effect" was coined by Margaret W. Rossiter in honor of Matilda J. Gage (1826–1898), an American suffragette and feminist, who described the habit of crediting men for work done by talented women in an 1870 essay, "Woman as Inventor." Margaret W. Rossiter, "The Matthew Matilda Effect in Science", *Social Studies of Science* 23:2 (May 1993), 325–41. See also, Nancy G. Slack, "Epilogue: Collaborative Couples: Past, Present, and Future" in *For Better or Worse? Collaborative Couples in the Sciences*, ed. by Annette Lykknes, Donald L. Optiz, and Brigitte Van Tiggelen (Basel: Springer, 2012), pp. 270–94.

130 American Institute of Physics, "Marie Curie and the Science of Radioactivity", <https://history.aip.org/exhibits/curie/>. If the Curies published separately, each highlighted the work the other had done to lay their common groundwork. See Helena M. Pycior, "Pierre Curie and 'His Eminent Collaborator Mme Curie'" in *Creative Couples*, ed. by Pycior, Slack, and Abiram-Am, pp. 39–56.

131 Letter to the *Westminster Gazette*, March 14, 1909, quoted in Mason, "Hertha Ayrton", p. 210.

if a man and a woman do a bit of work together the woman really does anything.”¹³² To avoid that problem, Hertha and her husband — William Ayrton, a professor of physics, electrical engineer, and staunch supporter of women’s rights — agreed that they should not collaborate. “[H]e wanted me to get the full kudos for all I did, not only for my sake, but for the sake of all women,” Hertha explained.¹³³ Beatrice and Sidney Webb, discussed in Chapter 4, also adopted more egalitarian views and practices in their long collaboration on social investigation and public policy reform.¹³⁴

Because they lacked a feminist consciousness and were conditioned to expect female inferiority and subservience, it is not surprising that Grace and Will constructed a partnership that recognized his achievements and contributions and masked hers. Instead of addressing the problems Will identified, they helped to perpetuate them.

Authorship mattered greatly to Will in 1902 because he was struggling to get both an advanced degree and a university position. As a candidate for a Doctor of Science (DSc) degree from Cambridge University, he was required to demonstrate a capacity for original research. Co-authored publications might have made it harder to show this. Will’s primary rationale was economic and pragmatic: he had to procure the “loaves and fishes” for his growing family, and publishing under his name alone would help him to do that. But he was also eager to enjoy the “laurels” of success and win prestige, honors, and awards. His sense of manly pride and masculine self-worth depended on career advancement and

132 Letter to the *Westminster Gazette*, March 14, 1909, quoted in Mason, “Hertha Ayrton”, p. 216.

133 Ibid. Nevertheless, a very mean-spirited obituary of Hertha by Henry E. Armstrong (who had opposed her admission to the Royal Society) questioned her originality and suggested she owed more to her husband’s influence than the couple thought. Armstrong’s obituary also criticized Hertha for not being the kind of domestic, helpmate wife who would have enabled William Ayrton to live “a longer and happier life and done far more effective work.” (Henry E. Armstrong, “Mrs. Hertha Ayrton”, *Nature*, 112 (1923), 800–1.) Ayrton’s first wife, Matilda Chaplin Ayrton, who died in 1883, was one of the first English women to earn a medical degree. She continued to practice medicine during her marriage.

134 For additional examples, see *For Better or Worse? Collaborative Couples in the Sciences*, ed. by Lykknes, Optiz, and Van Tiggelen. Nancy G. Slack’s “Epilogue: Collaborative Couples: Past, Present, and Future” (pp. 270–94) provides a useful assessment of the roles wives and husbands have traditionally played in collaborative efforts in science. She found that the men typically won the greater share of professional success when they collaborated with women.

affirmation from the outside world. Both he and Grace wanted him to step out of her shadow and be recognized as the brilliant thinker they believed him to be.

Convinced that his career was finally taking off, Will was acting with a new sense of urgency in 1902.¹³⁵ He had a topic he was genuinely excited about, unlike the astronomy book that had dragged on for five years and would never be completed. He was asked to review other mathematicians' work and contribute papers to European journals. To make the most of these opportunities, he told Grace, "we must flood the societies with papers."¹³⁶ To ensure his success, he wanted to publish their joint material under his name alone.

In this, as in so many aspects of their married life, Grace acquiesced to what Will wanted. They may have talked about their views on authorship when they were together, but they did not hash them out in their correspondence. She did not comment on his proposed policy in her letters.¹³⁷ Her silence may have been a form of protest, but it also signaled acceptance. Three weeks earlier, she had sent Will a draft of a paper that used material they had discussed together. She urged him to improve it, put his name on it, and then submit it for publication.¹³⁸ If she resented not being acknowledged as a collaborator in these early years, she never said so, and it was not evident to others. Grace's correspondence with the mathematician Max Dehn in 1906, about a theorem which Will had published in 1903, shows how joint their work was and how fully she was identified with and invested in it, even when the public credit went to Will. These letters also reveal how forcefully she defended their ideas against what she thought were undeserved critiques.¹³⁹ Nevertheless, whenever she had opportunities to publish on her own or as a co-author, she took them.

135 D.140/6/537a, WHY to GCY, February 7, 1902. Young Papers.

136 D.140/6/553, WHY to GCY, February 15, 1902. Young Papers.

137 Will specifically asked Grace to tell him when she received his letter, which he wrote on February 15, 1902. She replied on February 18, saying that she had received his letter on February 17. D.140/6/547, GCY to WHY, February 18 [1902]. Young Papers.

138 D.140/6/528, GCY to WHY, January 22 [1902]. Young Papers.

139 See Elizabeth Muhlenhausen, "Grace Chisholm Young, William Henry Young, Their Results on the Theory of Sets of Points at the Beginning of the Twentieth Century, and a Controversy with Max Dehn" in *Against all Odds*, ed. by Kaufholz-Soldat and

The pragmatic reasons Will outlined would have made sense to Grace. She was as anxious for him to get a good job and win acclaim as he himself was. A better job would not only ease the Youngs' financial worries, but also, they hoped, allow the family to live together in England. She and Will would not have to be separated for weeks and months at a time.

In addition, Grace had her own reasons to remain anonymous, reasons that highlight the social constraints that limited female achievement in her day. As a well-brought-up Victorian woman, she had been taught not to seek praise or public recognition. When she was a graduate student at Göttingen University, she was reluctant to be interviewed by an English newspaper, fearing it was "not wholesome or desirable" to call public attention to herself. Informing her sister that she had passed her dissertation defense *magna cum laude*, Grace wrote, "I have heard things [about] myself which are so extremely flattering that they are not repeatable."¹⁴⁰ As a medical student, she recounted to Will the praise she had received from her anatomy professor but dismissed such "flattery" as "very naughty & a little like champagne." Repeating other compliments about her work to Will, she explained in her typically self-effacing way, "I tell you all this because I know it will please you probably more than it did me."¹⁴¹ Downplaying her success, she assured Will that her relationship with him was more important than any academic achievement: "as for my husband, wouldn't I fly from every bit of flattery to nestle in his heart & be just his Baby again and no more."¹⁴² (Because Grace did not like her given name, Will called her by her childhood nickname, "Baby", except when he was angry with her.¹⁴³)

Grace's concerns about being an ambitious woman were compounded by her desire not to outshine her husband. Will and the family unit mattered more to her than public acclaim. Her sense of identification

Oswald, pp. 121–32. See also, D.140/6/932, GCY to WHY, March 2, 1906. Young Papers.

140 D.140/8/61, GC to Helen Chisholm, 29 April, 1895. Young Papers.

141 D.140/6/383, GCY to WHY, October 29, 1900. Young Papers.

142 D.140/6/372, GCY to WHY, October 19, 1900. Young Papers.

143 D.140/2/2, R. C. H. Tanner notes. Young Papers. Patrick Young also reported that Will called Grace "Baby." D.140/2/4.1, Patrick Young to Ivor Grattan-Guinness, 1 November 1970. Young Papers.

with him was so strong that she experienced his success as her success. The satisfaction of work well done, the appreciation of her husband, and the admiration of her family and friends were sufficient reward, Grace maintained. She explained to her sister:

I liked being *in cog*. [*in cognito*] to the outside world, & felt I had a perfect right to do so, husband & wife being one. I confess it seems to me a trifle 'ordinaire' to put my name with his on the title page. I don't want to be mistaken for the modern ambitious female, ambitious for herself & her own glorification. Our work has just been our work, as our children are our children.¹⁴⁴

Grace's fear of appearing "ordinaire" — by which she meant "common" — suggests that her views were shaped by considerations of class as well as gender. As always, she did not want her family to think her actions were unbecoming for a woman of her upbringing and status.

Grace fully embraced the ideal that women found fulfillment in serving their loved ones. As a graduate student, she had expressed admiration for the "life of devotion and usefulness" that a friend derived from caring for her family.¹⁴⁵ When Will's unmarried sister gave up a job in order to "take charge of her motherless nephews & niece", Grace praised her for doing "the right thing."¹⁴⁶ Working with Will on a paper when she was a young bride, she rejoiced to find "there is so much for which I am needed." To her closest friend she confided, "it is *wonderful and delightful to me to feel how much I have helped & spurred [Will] on*."¹⁴⁷ Twenty years after her wedding, Grace asserted that when a woman married, she "shut the door of personal ambition for herself, & passed through into another chamber where her life was to be merged with something broader & better."¹⁴⁸ She did not comment on whether she struggled to keep that door closed.

Assuming the role of helpmate wife eased Grace's guilt about pursuing an independent career and appearing to be ambitious for herself. Blaming herself for Will's failure to complete the book he had

144 D.140/6/872, GCY to Helen Chisholm, April 30, 1905. Young Papers.

145 D.140/6/63, GC to Frances Evans [October 1894]. Young Papers.

146 D.140/6/277, GC to Anna Bell Chisholm, March 5, 1899. Young Papers.

147 D.140/6/158, GCY to Frances Evans, January 1, 1897. Emphasis in the original. Young Papers.

148 D.140/16/1, GCY, "Per Ardua", pp. 2–3. Young Papers.

been planning to write when they married, she despondently queried whether others would think she had “failed in my task of being your helpmeet” by taking up medicine.¹⁴⁹

Grace was following a well-established tradition by being a helpmate. In many upper-middle-class, intellectually elite households in nineteenth-century England, two spouses shared a single career — the husband’s. Educated wives handled their husbands’ professional correspondence, edited manuscripts, corrected galley proofs, prepared translations, took notes, and served as critics and sounding boards. In almost all cases, the wife’s efforts were acclaimed by friends and relatives but not publicly acknowledged. These marital unions were characterized by intense affection and a strong sense of mutual satisfaction in the work.¹⁵⁰ The women’s colleges at Cambridge also produced learned partners and helpmates for learned husbands. In Grace’s circle in Göttingen, too, educated wives helped scholarly husbands with their correspondence and wrote out their manuscripts in neat handwriting.¹⁵¹

Like other couples who partnered in work, Grace and Will saw their mathematical collaboration as a tangible symbol of their love. Working together enhanced their sense of romance and helped them achieve the “oneness” that was the ideal of nineteenth-century couples. “There is nothing in the whole world for me without you, and it is only the feeling that I am helping you to develop your truest self and to show yourself as you are, that keeps up my spirits and energies in your absence,” Grace wrote to Will.¹⁵² He rejoiced in knowing that they were “rising *together* to new heights.”¹⁵³ Her assistance increased his devotion. “I cannot tell you, my darling, how I admire, how I adore you, how grateful I am to you when I think of all you have done and are doing [...]. My best self is turned ever to the pole star of your love and self-sacrifice.”¹⁵⁴

149 D.140/6/429, GCY to WHY, February 10, 1901. Young Papers.

150 See M. Jeanne Peterson, *Family, Love, and Work in the Lives of Victorian Gentlewomen* (Bloomington: Indiana University Press, 1989), pp. 18, 166, 176–78.

151 Jones, *Femininity*, p. 48 notes the examples of Anna Klein, wife of Felix Klein (and granddaughter of the philosopher, Georg Wilhelm Friedrich Hegel), and David Hilbert’s wife, Kathe.

152 D.140/6/496, GCY to WHY, October 30, 1901. Young Papers.

153 D.140/6/558, WHY to GCY, March 9, 1902. Young Papers.

154 D.140/6/712, WHY to GCY, November 9, 1903; see also, D.140/6/461, WHY to GCY [June 1901]. Young Papers.

Grace's role, background, and contributions were quite different from the typical helpmate wife of her day, however. She was a professionally trained mathematician with a PhD from a renowned center of mathematical research, fully capable of carrying out her own mathematical studies. Her insights and ideas were as valuable to Will as her secretarial and editing skills. She was also taking time away from her medical studies to help him. She accepted a secondary, subordinate, and unrecognized role in their partnership without complaint because she loved him and thought it was her wifely duty. But she deserved better, and Will knew it.

The Domestic Partnership, 1900–1913

Grace's subordinate role in the professional partnership with Will mirrored the role she was expected to play in their domestic partnership. In both spheres, she assumed the role of faithful lieutenant who executed Will's orders. In fact, because Will was away so much, Grace had to make many decisions on her own. Nevertheless, it was important to both Grace and Will that he was treated as the all-knowing, all-wise decision maker. Despite her intelligence, education, and force of mind, she looked to Will for guidance and protection. Living up to the virtues suggested by their names, both Will and Grace exemplified the nineteenth-century gender stereotype that posited male authority (will) against female acquiescence (grace).

Because he was so often absent from home, Will struggled all the harder to impose his ideas and opinions on the Youngs' domestic life. He trained Grace to do things the way he wanted them done and demanded a close accounting of her activities, expenditures, and general behavior. "Please don't draw any cheques except with my permission," he instructed her in 1901. "Though the money is to your credit, I want you to consult me about the spending of every penny of it."¹⁵⁵ Throughout their marriage, he bombarded her with unsolicited advice and detailed instructions about how to handle the servants, manage her time, improve her looks and dress, and bring up the children. Irritable and anxious by nature, he very frequently found fault with what she did.

155 D.140/6/501, WHY to GCY, November 5, 1901. Young Papers.

If she appeared to disregard his instructions, ignore his requests for information, or mismanage her responsibilities, he reacted with anger and sometimes with ridicule or contempt. He criticized the way she kept the household accounts, budgeted money, conducted the family's correspondence, and raised the children.

Grace deferred to Will because she loved him and felt deeply indebted to him. When Will promised, after her father died in 1901, to be both father and husband to her, Grace was deeply touched. "How much you have helped me, influenced me & moulded me beside your love! It is no empty form of words with me to speak of obedience and of your sanction. I could never be happy otherwise, and my will is in every respect yours," she proclaimed.¹⁵⁶ Several months later, she confided, "I love you dearest more than anything, & that means everything, because to please you means to do right and to think right."¹⁵⁷ Her insistence, "it is for you to decide for your wifie, & she will second your decision whatever it should be," applied to small as well as large matters.¹⁵⁸

Nevertheless, Grace did not always agree with Will. Like other wives of her day, she found ways to circumvent his directives without challenging his authority. When she and Will disagreed, she expressed her objections in a way that indicated her willingness to obey him regardless.¹⁵⁹ When concerns about the children's health prompted Will to veto Grace's plans to bring them to England on holiday, she responded, "I think on this occasion dearest you are wrong, but of course I will not do anything against your orders."¹⁶⁰

When Will was angry about something she did, Grace tried to appease him by humbly apologizing, expressing distress at his displeasure, or suggesting that there had been a miscommunication. When he criticized the arrangements she had made for the children's lessons, she meekly responded, "I am *so* sorry you think I have been slack, I have tried to do the nearest I could under the circumstances to what we had arranged."¹⁶¹ On other occasions, she simply ignored his complaints and questions.

156 D.140/6/419, GCY to WHY, January 10 [1901]. Young Papers.

157 D.140/6/480, GCY to WHY, October 9, 1901. Young Papers.

158 D.140/6/750, GCY to WHY, February 6, 1904. Young Papers.

159 See the discussion of "reframing" in Chapter 1, pp. 77–80.

160 D.140/7/1.17, GCY to WHY [May 1906]. Young Papers.

161 D.140/6/980, GCY to WHY, October 31, 1906. Young Papers. Emphasis in the original.

She tempered her resistance with flattery and sweet talk. Always, the presumption was that Will knew best and was motivated by the best of intentions, and she should be guided by his example and wisdom. When she felt especially strongly about the need to convince him of a course of action, she framed her advice in terms of what a trusted friend or colleague thought he should do — rather than being insistent about what she wanted.

As a man and the head of the household, Will enjoyed privileges that other family members did not. Despite the Youngs' financial concerns, money was made available to pay for travel and vacations for him. Honey was too expensive for the whole family to enjoy, but a jar was kept for Will's personal use (for medicinal reasons, he told his son, Laurie).¹⁶² He was rarely asked to shoulder household responsibilities, such as caring for the children or arranging care for his troubled sister, Ethel. Grace encouraged him not to come home when the household routines were disrupted by children's illnesses or other crises.

Will was "coddled", as he put it, but Grace was infantilized.¹⁶³ The Youngs' use of Grace's childhood nickname, Baby, with its connotations of weakness, dependence, and immaturity was telling. Both Grace and Will wanted him to shield her from disturbing news and distressing circumstances. "I cannot write a word about [world] events. Will does not let me read the newspapers as I get too upset by the horrors, but he just tells me any news," she wrote a friend during the Boer War.¹⁶⁴ Feuding with her brother and sister over financial issues after her father died, Grace begged Will to handle the increasingly acrimonious correspondence with her family. "[M]y dear strong rock, it is so sweet to feel I can hide myself in your caves when the world is cruel," she wrote in relief, grateful to have "a protector & an advisor who is much wiser and cooler than I am."¹⁶⁵ She complained about Hugh's "detestably proud overbearing nature"; Will found him "selfish and arrogant."¹⁶⁶

162 L. C. Young, "Life and Work", p. 11.

163 Coddled: D.140/6/774, WHY to GCY, May 6, 1904. Young Papers.

164 D.140/6/343, GCY to Frances Evans, July 26, 1900. Young Papers.

165 D.140/6/536, GCY to WHY, February 6, 1902. Young Papers.

166 "Proud overbearing": D.140/6/521b, GCY to WHY, December 11, 1901. "Selfish and arrogant": D.140/6/572a, WHY to GCY, 20 March 1902. Young Papers. Janet Hogarth Courtney, who knew Hugh Chisholm from their student days at Oxford and later became a close friend, observed that Hugh had a "confidence of statement and assumption of superior knowledge which clung to him through life", giving

Far from smoothing things over, Will managed to insult Hugh and alienate other members of Grace's family when he questioned the distribution of the Chisholm household goods that Hugh had proposed. (Will also went to great lengths to convince Grace not to give away any of her inheritance to her sister, Helen.) Although Grace assured Will that her relatives were overreacting and misinterpreting what he had written, she urged him to take the high moral road and try to rectify the problem.¹⁶⁷

But the damage was done. Hugh resigned as a trustee of the Youngs' marriage settlement, and relations between the siblings remained badly strained.¹⁶⁸ In 1904, Grace's cousin, Edith Bell, with whom Grace's sister Helen lived, wrote Grace that they hoped she would come for lunch when she was in London, but Will would not be welcome. "We do not wish to meet him again. The straight truth is that we none of us ever liked him, and always thought his influence on you regrettable; & his correspondence with Hugh quite determined Helen & me to avoid further intercourse with him."¹⁶⁹ The rift continued for many years, leaving Grace virtually isolated from her family in England and more dependent on Will's guidance and direction. She deeply lamented the "miserable estrangement" from her family, and the children's isolation from their English relatives, but she came to agree that Will had been right to curb her emotional and impulsive reactions.¹⁷⁰ Together they formed an indissoluble unit, united against both her unsympathetic, judgmental family and an academic world that failed to appreciate Will.

Knowing that she did not like confrontation, fearing that she was too inclined to do what others wanted, Will encouraged Grace to stand up for herself and not allow others to take advantage of her. Very occasionally, he even urged her to stand up to him. Debating where they should take a brief holiday when she was busy with her medical studies, he pressed, "You are to choose and you may choose anywhere *you like*, not what

him the appearance of arrogance, and at times, "the air of a Mussolini." Quoted in Denis Boyles, *Everything Explained that is Explainable: On the Creation of the Encyclopedia Britannica's Celebrated Eleventh Edition, 1910-1911* (New York: Knopf, 2016). Boyles notes that Hugh "exuded self-assurance."

167 D.140/6/579c, GCY to WHY, May 17, 1902. Young Papers.

168 D.140/29/53, Henry Cooke to WHY, 3 April 1902. Young Papers.

169 D.140/6/843a, Edith Bell to GCY, 11 November 1904. Young Papers.

170 D.140/24/2, Autobiographical notes by GCY, written in 1917, after the death of her oldest son. Young Papers.

you think I should like."¹⁷¹ But she rarely asserted herself. Although she was the strength of the household, she served her loved ones without asking much for herself — especially for time to do her own work or for recognition from the outside world.

Progress in Mathematics and Medicine, 1903–1904

Even with Grace's help, Will's career advanced slowly. He hoped to earn a Doctor of Science (DSc) degree from Cambridge University in 1902, but he had to wait until 1903.¹⁷² As evidence of original research, he had about twenty papers that had been published or submitted to academic journals beginning in 1897, written in German and Italian as well as English; many were papers that Grace had worked on with him. He secured a contract from Cambridge University in 1903 to write a textbook on set theory, but failed to get a Cambridge lectureship and a professorship at King's College, London, a post that Grace dearly wanted him to win.¹⁷³ Still bursting with ideas, he repeated his claim for her assistance. "It really seems to me that the efforts of both of us should in the coming year be directed to further improving *my* position," he informed her.¹⁷⁴

Grace blamed Will's job difficulties on his failure to publish a book, but there were other problems. His specialty was of little interest to English mathematicians in the early twentieth century. His unusual career trajectory — producing no research for many years and moving abroad — made it hard for him to establish himself among more traditional British academics. In addition, as his letters indicate, Will could be difficult to get along with: sensitive, critical, impatient, and

171 D.140/6/793, WHY to GCY [5 June 1904]. Young Papers. Emphasis in the original.

172 The DSc degree recognized the recipient's ability to do original scholarship, as did the PhD, but was a less prestigious degree. Will explained that the DSc degree was "only awarded after many years of standing & after having done *conspicuous original work*" and claimed to be the youngest recipient in mathematics. (D.140/6/739, WHY to Mrs. Jeyes [n.d., 1903]. Emphasis in the original. Young Papers.) English universities did not award the PhD degree until after 1917. The first PhD in mathematics was awarded in England in 1924. See David Bogle, "100 Years of the PhD in the UK" (2018), <https://discovery.ucl.ac.uk/id/eprint/10068565/>.

173 D.140/4/720a, GCY to WHY, November 12, 1903. Young Papers.

174 D.1410/6/724, WHY to GHY, November 22, 1903. Emphasis added. Young Papers.

sure of his own opinions, he easily took offense and often rubbed people the wrong way.¹⁷⁵

Grace made steady if slow progress in her medical training, but juggling her children and Will's work with her studies weakened her performance. When she began her medical training, she was confident that she could compensate for spending less time on her work than her fellow students by being more efficient.¹⁷⁶ But as she progressed, she felt increasingly at a disadvantage. She felt so far behind in her medical work in 1902 that she was reluctant to schedule a major exam because she doubted she "could get a first class except by cramming."¹⁷⁷ Early in 1904, she warned Will, "I do not know a fraction of what the others do, & unless I am able to study seriously next semester I shall come off very poorly."¹⁷⁸ Nevertheless, her time was repeatedly interrupted by Will's work and the children's needs.

Will suffered a major setback early in 1904, when he discovered that the innovative formula he developed to calculate areas under circles by using set theory — a major challenge in the field of integration — had been independently worked out two years earlier by the French mathematician Henri Lebesgue. Their techniques were different enough that Will could publish his approach, but the honor and glory of discovery went to Lebesgue.¹⁷⁹ Will withdrew his paper and rewrote it — with Grace's help — in the spring of 1904, just a few months before she was scheduled to take her medical qualifying examinations at the University of Göttingen. Her preparations for the exam were further interrupted when the three older children and Auntie May fell ill in June and the youngest child was teething. Noting that Leni "roared from 10 to 1 AM" one night, Grace wrote laconically, "I manage to work in scrappits."¹⁸⁰ She passed the Physikum at Göttingen, a preliminary examination that covered botany, zoology, anatomy, and physiology, but failed to get the high marks she desired.¹⁸¹

175 Grattan-Guinness, "Mathematical Union", p. 148. Laurence Young, *Mathematicians*, pp. 286–87.

176 D.140/6/392, GCY to WHY, November 11, 1900. Young Papers.

177 D.140/6/619, GCY to WHY, November 13, 1902. Young Papers.

178 D.140/6/750, GCY to WHY, February 6, 1904. Young Papers.

179 Grattan-Guinness, "Mathematical Union", pp. 142–43.

180 D.149/6/796, GCY to WHY, 15 June 1904. Young Papers.

181 D.140/7/1.13, GCY to WHY [?1904]. D.140/6/796, WHY to GCY, pc, July 24, 1904. Young Papers.

Having passed the Physikum, Grace became a candidate in medicine (abbreviated "Cand. Med."), the official term for a medical student in Germany, a title she proudly used along with her other academic degrees. Students typically took the Physikum after four semesters of study, but it took Grace, interrupted by pregnancies and Will's work, four years to complete the coursework. Another two to three years of course work lay ahead, followed by a year of clinical work. But first there was more mathematics to do with Will.

Mathematics Wins Out, 1905–1913

After years of being rejected for university teaching jobs, Will was hired as a Special Lecturer in Mathematics at the University of Liverpool in the fall of 1905. Founded in 1881 but not able to grant degrees until 1903, serving local students rather than a national elite, the university lacked the prestige and resources of the ancient universities like Cambridge and Oxford.¹⁸² Will gave lectures, but he had no authority to shape the department and was not paid well.¹⁸³ He took the post because it was a step up from examining and coaching, and left him time for research. But he had barely arrived before he began to complain about the pay, his title, and his lack of influence, to the department chair as well as to Grace. No matter what Will was doing, his restless nature was rarely satisfied for long, a trait he himself recognized.

Will instructed Grace not to give up their home in Göttingen and contemplated resigning from Liverpool. He did not want the family to move to Liverpool, which he considered a cultural, social, and mathematical backwater; he also feared that the local industry made the city an unhealthy environment for children.¹⁸⁴ He stayed, but reduced his teaching load from three terms to two, so he had more time to research, write, and travel.¹⁸⁵ Will counseled Grace that she would be

182 Thomas Kelly, *For Advancement of Learning: The University of Liverpool, 1881–1981* (Liverpool: Liverpool University Press, 1981). Before 1903, University of Liverpool students were awarded degrees as external students at the University of London.

183 D.140/2/2, R. C. H. Tanner notes. Young Papers. Will earned a salary of 100 pounds for teaching two terms. Eventually his pay was increased to 150 pounds a year.

184 D.140/6/1069, WHY to GCY, February 28, 1907. Young Papers.

185 D.140/6/986, Draft letter of resignation, WHY to F. S. Carey, June 26, 1906. Young Papers. From January to late March 1907, Will did not teach but travelled in Italy.

better able to pursue her medical studies at Göttingen than Liverpool, but his claims for Grace's assistance with his mathematics increased.¹⁸⁶ He was no longer asking for her help, he was demanding it, without apology and without regard for the toll it took on her medical studies. "[I] am very anxious your lectures [in medicine] should not prevent the progress of mathematics work which seems to me now of quite the first importance," he wrote in September 1905, two months after the birth of their fifth child, Laurence (Laurie). The next week, he announced, "We must concentrate on the maths for the next few months — no time, I think for [medical] lectures."¹⁸⁷

Between 1905 and 1907, Grace co-authored two mathematics textbooks with Will, worked with him on numerous articles that expanded their work on set theory, and wrote two science books for children by herself. Sparked by the work he was doing as a school examiner in Wales, Will was interested in writing textbooks with Grace in order to make money.¹⁸⁸ In 1905, they published *The First Book of Geometry*, a textbook that introduced solid geometry and geometric concepts to grade school students by teaching them to make models of solid objects by folding paper. Grace, who had a strong interest in educating children and extensive experience in geometric projection drawing and three-dimensional modeling — expertise that Will lacked — worked out the exercises by practicing them with their seven-year-old son. (Frankie referred to the volume as "our Geometry book", and redrew one of Grace's illustrations because he thought nobody would understand it.¹⁸⁹) She produced almost 140 drawings to illustrate the

Grace did not join him until March because she felt the children needed her at home.

186 By 1905, women were enrolled as medical students at the University of Liverpool; the first woman, Phoebe Powell, graduated from its medical school in 1910. See Manuscripts and More, Special Collections and Archives at the University of Liverpool, "International Day of Women and Girls in Science, 11 February 2020", <https://manuscriptsandmore.liverpool.ac.uk/?p=5137>. Powell later married a doctor, had two daughters, continued to practice medicine, and taught pathology at the university as Phoebe Powell-Bigland. See "Obituary: A. Douglas Bigland", *British Medical Journal* (1938:1), 545. <https://doi.org/10.1136/bmj.1.4026.545>.

187 D.140/6/892, WHY to GCY, September 6, 1905; D.140/6/894, WHY to GCY, September 11, 1905. Young Papers.

188 D.140/6/826, WHY to GCY, October 17, 1904. Two years earlier, he had talked about writing textbooks with Grace and his sister Ethel. D.140/6/558a, WHY to GCY, March 9, 1902. Young Papers.

189 D.140/24/1, Diary Fragments from 1905, and 12 March 1907. Young Papers.

folding exercises and supervised the photographic illustrations; it is likely she wrote the entire text.¹⁹⁰

In a departure from the policy Will had enunciated in 1902, Grace was listed as first author of *The First Book of Geometry*.¹⁹¹ She was also co-author of *The Theory of Sets of Points*, published in 1906, an important book that introduced set theory to English readers and explained its relevance to numerous branches of mathematics.¹⁹² Making her co-author was Will's idea, not hers, Grace assured her sister. Their son, Laurie, concurred: he later wrote that Will "occasionally slipped in her name in as co-author — she certainly did not."¹⁹³

Perhaps Will thought acknowledging Grace as a co-author would help sell the books, given her reputation as a pioneering female mathematician and the potential appeal of a textbook for young children written by a mother who was also a scholar. Perhaps his conscience temporarily got the better of his ambition. Whatever the reason, they continued to highlight Will's work and minimize Grace's. The preface to *The Theory of Sets of Points*, which laid out the book's significance and accomplishments, was signed only by Will and used the singular pronoun "I" more often than the plural "we." When Grace applied, unsuccessfully, in 1905 for a research grant to study how mathematics was taught to youngsters in several European countries, she stressed that the work would be done "in collaboration with and under the direction of" her husband.¹⁹⁴

Nothing more came of Will's interest in writing textbooks, but Grace published two science books for children under her name. *Bimbo* (1905) and *Bimbo and the Frogs* (1907) explained biology and reproduction in a narrative about an English family living in Germany that was closely

190 D.140/6/872, GCY to Helen Chisholm, April 30, 1905. Young Papers.

191 Grace Chisholm Young and W. H. Young, *The First Book of Geometry* (London: Dent, 1905). A German translation was published in 1908, and an Italian edition in 1911. It was translated into Yiddish in 1921, and subsequently published in Magyar and Swedish. Felix Klein was instrumental in getting it translated into German. See Tobies, p. 33.

192 W. H. Young and Grace Chisholm Young, *The Theory of Sets of Points* (Cambridge, UK: Cambridge University Press, 1906; repr. 2009).

193 D.140/6/872, GCY to Helen Chisholm, April 30, 1905. Young Papers. Laurence Young, *Mathematicians*, pp. 282–83.

194 D.140/6/869, Grace's Application for the Pfeiffer Studentship, 1905.

modelled on the Youngs.¹⁹⁵ The explanations of cell theory and embryo development in humans and animals were elucidating, but shocking for some. Congratulating her on the publication of *Bimbo and the Frogs*, Grace's close friend, Frances Evans, admitted, "I don't know how much the folks I know will approve of its views — & of the knowledge it gives — much of which I myself was quite ignorant."¹⁹⁶

After jointly publishing the geometry textbook and *The Theory of Sets of Points*, the Youngs reverted to producing a torrent of papers under Will's name alone. He published more than forty papers in 1907 and 1908, and was elected a Fellow of the Royal Society in 1907. Grace rarely submitted anything under her name alone. She was annoyed when a paper she submitted under her own name in 1907 was rejected for publication.¹⁹⁷ A year later, Will encouraged her to write a paper on a function that especially interested her, suggested how she should do one of the proofs, and told her to send it off in her own name.¹⁹⁸ From 1909 through 1911, when Will was back on the job market, the Youngs published four articles jointly, Will published forty-seven, and Grace published none.¹⁹⁹

Grace's contributions were not entirely unrecognized in the mathematical community, however. George M. Minchin, who like Will was an examiner at the University of London, recommended Will for a teaching position at the University of Edinburgh in 1911. Writing independently to Will, Minchin acknowledged that he was really recommending "the Firm of W. H. Young and Co." which he knew relied on Grace's work as well as Will's.²⁰⁰

The flurry of publications and membership in the Royal Society were of little avail to Will's job search, however. He failed to win positions at universities in Glasgow (1909), Durham (1910), and Edinburgh (1912).

195 Grace Chisholm Young, *Bimbo: A Little Real Story for Jill and Mollie by Auntie Will* (London: Dent, 1905) and Grace Chisholm Young, *Bimbo and the Frogs: Another Real Story* (London: Dent, 1907). Bimbo, an Italian word for a male baby, is the nickname the Youngs gave Frank when they moved abroad.

196 D.140/6/1145, Frances Evans to GCY, November 13, 1907. Young Papers.

197 D.140/6/1067, GCY to WHY, February 27, 1907. Young Papers.

198 D.140/6/1169, WHY to GCY, July 2, 1908. Young Papers.

199 Author's calculations from the bibliography in Ivor Gratton-Guinness, "Mathematical Bibliography for W. H. and G. C. Young", *Historia Mathematica* 2 (1975), 43–58.

200 D.140/9/146, George M. Minchin to WHY, November 17, 1911. Young Papers.

Losing out at Edinburgh was a bitter disappointment for both Grace and Will — the university had hosted both of them during the application process — but they did their best to console each other.²⁰¹ Will was given the title of Associate Professor at Liverpool in 1912, but his work and pay scale remained the same.

Will’s escalating demands effectively put Grace’s long-term goal of practicing medicine on hold. After 1904, her medical work largely fades from sight, and is rarely mentioned in her correspondence with Will. Responding to his pressure, she seems to have shifted her primary focus from medicine to mathematics, a shift that would define the rest of her professional life. The amount of work she did with Will, the amount of time she was with him in England, the failure to mention her training in her letters — all suggest that Grace was not pursuing a medical degree with the same urgency and drive — or perhaps, the same support — as she had earlier in the decade, when the Youngs’ letters are full of discussions about her courses, exams, and schedules. Prioritizing her role as a helpmate wife, she now fit her medical classes around the work she did for Will, rather than fitting his work around a grueling schedule of medical courses.

By 1905, Grace’s medical courses seem to have become what Will had long suggested they should be — an intellectual outlet for her probing mind and an activity that kept her busy when he was not at home. Despite the many demands on her time, she took courses whenever she could and made progress in her medical studies. In the spring of 1906, when she was studying pathology with the celebrated Max Borst, Will complained that she was so “feckless,” he feared she would poison herself doing a dissection.²⁰² But the dream of becoming a licensed doctor and having a practice of her own was receding.

In 1908, Grace turned 40, her sixth and last child, Patrick (Pat), was born in March, and the family moved to Geneva in the late summer. The Youngs said they left Germany to escape from the increasingly hostile anti-British sentiment that resulted from the Anglo-German arms race and imperial rivalries, and to find better educational opportunities for

201 D.140/40/5/1, Grace’s Pocket Diaries, 22 February, 1912. Young Papers.

202 Feckless: D.140/6/959, WHY to GCY, May 11, 1906 postcard. Studying with Borst: D.140/24/1, Diary fragments. Young Papers. Max Borst, an expert in tumors, started teaching the University of Göttingen in 1905.

the children.²⁰³ Moving to Geneva, where the university had a long history of educating women doctors and welcomed foreign students, ensured that Grace could continue her medical training, although that was not the impetus.²⁰⁴ She matriculated as a medical student at the University of Geneva in the winter of 1908.²⁰⁵ The rigorous medical curriculum typically took five years to complete.²⁰⁶

Will's mathematics continued to take precedence over Grace's medical studies, but she managed to fit some courses in.²⁰⁷ Starting in 1908, she regularly spent six to eight weeks with Will in Liverpool during January and February and again in the fall. In some years she was with him during June as well. Nevertheless, she was registered for laboratory courses at the University of Geneva in 1910, and later reported that she had worked there for some years with the eminent Swiss surgeon, Charles Girard.²⁰⁸ Grace's pocket diary for May 1913 is filled with notes, in French, on the pathology of gout. When Will went to India for six months that fall, Grace attended lectures given by Robert Hippolyte Chodat, a Professor of Medical and Pharmaceutical Botany at the University of Geneva, in the midst of working on articles with Will and learning about the philosophy of mathematics.²⁰⁹

203 Grattan-Guinness, "Mathematical Union", p. 147.

204 Will had thought about moving to Switzerland as early as 1904. D.140/6/784a, WHY to GCY, May 21, 1904. Young Papers.

205 Université de Genève, *Liste des Autorités, Professeurs, Etudiants et Auditeurs. Semestre D'Hiver 1908–1909*, p. 72 and *Liste des Autorités, Professeurs, Etudiants et Auditeurs. Semestre D'Hiver 1910–1911*, p. 56. <https://www.unige.ch/archives/adm/documents-en-ligne/listes-des-autorites-professeurs-etudiants-auditeurs-et-laboratoires/>

206 Between 1900 and 1910 Switzerland trained more women doctors than the United States and the rest of Europe combined. Bonner, *To the Ends*, Table 1, p. 62. Training length: Thomas Neville Bonner, *Becoming a Physician: Medical Education in Great Britain, France, Germany, and the US, 1750–1945* (New York and Oxford: Oxford University Press, 1995), p. 323. See also, Thomas Neville Bonner, "Pioneering in Women's Medical Education in the Swiss Universities, 1864–1914", *Gesnerus: Swiss Journal of the History of Medicine and Sciences*, 45 (1988), 461–73.

207 Université de Genève, *Liste*.

208 Laboratory courses: D.140/6/910, May Young to GCY, p.c., February 5, 1910, and Université de Genève, *Liste*, 1910. Studied with Girard: D.140/15/1, "Bimbo", and GCY letter, 19 November 1916, to the British military authorities seeking permission to go to France to nurse her son Frank, who was injured in a flight accident. She was informed by telegram, "Don't trouble wounded knee healing beautifully." Young Papers.

209 D.140/5/1 Grace's Pocket Diaries, May 4, 1913 and after. D.140/6/1636, GCY to WHY, October 31 [1913]. Young Papers.

Grace never became a licensed doctor. She wrote in a fellowship application in 1924 that she had completed all the course requirements for a medical degree, but "home duties" prevented her from completing the required hospital internship.²¹⁰ She left no account that explains when she finished her coursework, what circumstances prohibited her from doing an internship, or how she felt about the outcome of her long and arduous struggle to become a doctor. Will explained in 1940 that Grace had been prevented from doing her internship by his brother Alfred. According to Will, Alfred had peremptorily insisted that May leave the Young family and return to Germany to take charge of their sister, Ethel, rather than stay for an extra year so Grace could do her internship.²¹¹ After May left, Will wanted to cut off the financial support he had been providing for Ethel.²¹²

The truth is hard to uncover. May did leave the Young family in May 1913 and returned to Göttingen to live with Ethel. She informed Grace of her plans in March 1913, writing that she intended to make the move that October. She did not mention that Alfred played a role in her decision.²¹³ It is possible that forty-five-year-old Grace had hoped to leave May in charge of the children while she completed an internship, but there is no evidence of such a plan. Will's explanation was written almost thirty years after the event, when his mental and physical health was compromised, his sense of grievance was very strong, and not all of his recollections jived with the facts. The two brothers had long been at odds, and Will never forgave Alfred for taking the side of the Youngs' rebellious youngest daughter, Leni, when she moved out of her parents' house in the early 1920s. Blaming Alfred might have made it easier for Will to ignore his own role in blocking Grace's efforts to become a doctor.

210 D.140/12/36, GCY's Draft Application for the Yarrow Scientific Research Fellowship (1924). Young Papers.

211 D.140/12/5 Autobiographical Notes by WHY 1940, and the insert entered by Will on November 27, 1940 to Grace's pocket diary entry for May 31, 1913 (D.140/5/1). Cecily Young accepted Will's explanation and reproduced it in a summary of Grace and Will's lives (D.140/2/2). Young Papers.

212 D.140/6/1568, GCY to Herr Frank. Hostile relations between the brothers persisted into the fall of 1913. See D.140/6/1636, GCY to WHY, October 31, 1913. Young Papers.

213 D.140/6/1544a, May Young to WHY and GCY, March 5, 1913. Young Papers. May wrote that she was very sorry to leave, but referred to tensions in her relationship with Grace and Will over her supervision of the children.

Helpmate Wife Versus Hands-on Mother

Grace had hesitated to embark on her medical training in part because she would have less time with her children. Being Will's helpmate made it even more difficult for her to be a hands-on mother because he wanted her to devote so much time to his mathematical studies and stay with him in England. During her absences, Auntie May took charge of the children and the household with the help of several servants and eventually a governess.

Will had no doubts about whose interests were paramount. "I feel strongly that when you are not attending lectures your place is with me," he informed Grace in 1901.²¹⁴ Planning for her to come to Liverpool for six weeks in the spring of 1906, he pronounced, "The bairns could spare you as long as that."²¹⁵ In February 1911, he insisted that Grace remain in Liverpool instead of returning to Geneva when May felt overwhelmed by the children's illnesses and difficulties with the servants. During other of Grace's visits, May sent plaintive letters asking when Grace would return home and why she was staying longer than planned.

Grace occasionally balked at leaving home when she felt the children needed her. After spending six weeks with Will in Cambridge in the summer of 1901, she returned to Göttingen to await the birth of her third child in December rather than staying through the fall as Will wanted. In the summer of 1904, she put off a working holiday with Will because Auntie May and the children were ill. In 1907, she refused to meet him in Italy because she feared that, without her supervision, Frankie's schoolwork, music lessons, and general conduct would deteriorate. "Nothing but the children would keep me here now," she assured Will.²¹⁶ But most of the time, Grace tried to arrange her schedule — and the children's — to suit Will's convenience.

The difficulty Grace found in balancing her husband's needs against her children's needs was emblematic of a major shift in women's domestic roles after the start of the twentieth century. Throughout the nineteenth century, middle- and upper-middle-class white women were

214 D.140/6/454, WHY to GCY, May 10, 1901; see also, D.140/6/457, WHY to GCY, May 15, 1901. Young Papers.

215 D.140/6/907, WHY to GCY [November 27, 1905]. Young Papers.

216 D.140/6/1067, GCY to WHY, February 27, 1907. Young Papers.

taught to think of wifehood as their primary role and responsibility. Children of the British upper-middle class and aristocracy were typically cared for by domestic servants and spent very little time with their parents. Grace's own upbringing fit this model. Although she had her first lessons with her mother, she was mostly in the care of nursemaids and governesses (the Chisholms employed five maids), and rarely saw her mother during the day when she was very young.²¹⁷ Nineteenth-century homes, especially homes in which wives served as helpmates in their husband's work, were parent-centered rather than child-centered. Spousal relationships and work were more important than parental roles.²¹⁸

The idea that well-educated mothers should be more directly engaged in childrearing began to take hold in the early decades of the twentieth century. In both England and America, mothers were encouraged to apply scientific principles to housekeeping and childrearing and expected to meet more demanding standards of "mothercraft."²¹⁹ Motherhood began to be seen as a scientific vocation that required intelligence and training rather than something that could be accomplished by intuition and natural inclination. By the 1920s, women in both England and America were told that raising their children should take priority over other concerns and obligations.

Grace was an heir to one tradition and a precursor of the other. Her childrearing was deeply informed by her knowledge of medicine and pedagogy. Fearing that her children would not get sufficient intellectual stimulation and the highest quality physical care without her direct involvement, she arranged her schedule in her first year of medical training so she could be with her young children at meals and bath time, and she often studied while they played around her. She planned, supervised, and arranged for their lessons and activities, but as her studies and her work for Will expanded, and she spent more time with him in Liverpool, she had to hand over more of their daily care to maids, governesses, and Auntie May.

When she was away with Will, Grace supplied menus for the household's meals and sent detailed advice and instructions about the

217 D.140/6/14/6 and D.140/12/1. Young Papers.

218 Peterson, pp. 103–04, 107–08.

219 See the Introduction to this volume, p. 20.

children's care. She expected caregivers to carry them out, apply the Youngs' rules, and instill the Youngs' values in the children. In Auntie May, she had a faithful caregiver and housekeeper, who, according to Cecily, the Youngs' oldest child, willingly carried out "all the decrees of the master of the house as interpreted by the mistress."²²⁰ May's letters to Grace suggest that she found her brother's punishments too harsh, wanted the children to have more treats and pocket money, and wished that Grace would provide more variety in her weekly menus. But she nevertheless followed the parents' lead.

Will's parenting style was more characteristic of a mid-nineteenth-century patriarch than the domesticated husband and companionate dad that would emerge as an ideal in the 1920s in England and America.²²¹ As long as Grace was at the helm, he felt no need — or desire — to spend a great deal of time with his children, although he believed he was more involved in their upbringing than the typical father. With Grace's encouragement, he guiltlessly prioritized his work, his desire to travel, and his own comfort above spending time with his family. On occasion, with Grace's blessing, he chose not to come home when he had the opportunity to do so.

Physical absence did not stop Will from setting exacting standards for the children's upbringing. From the time the children were very young, his letters were full of observations and instructions about their health, behavior, leisure activities, formal education, and general development. No detail of the children's lives was too small to escape his attention. He specified the route they should follow on their daily walks; he instructed Grace to lengthen Frankie's lunchtime; he worried that Cecily's sewing projects would hurt her eyes, despite Grace's assurances that the stitches were large and the lighting sufficient. He fussed about their schooling, painstakingly planned a course of independent lessons to supplement the school curricula, corrected spelling errors and grammatical mistakes

220 D.140/2/3.1, R. C. H. Tanner Notes, Young Papers.

221 According to David Roberts, "The Paterfamilias of the Victorian Governing Classes" in *The Victorian Family: Structures and Stresses*, ed. by Anthony S. Wohl (London: Croom Helm, 1978), pp. 59–81 (pp. 59–60), Victorian fathers expected deference from their children, and children were taught to "worship" their fathers and accept their opinions as always right. Stephen Mintz, *A Prison of Expectations: The Family in Victorian Culture* (New York: New York University Press, 1983), pp. 12 and 111, argues that the father was the chief disciplinary figure and the embodiment of moral and intellectual authority in the Victorian home.

in their correspondence, and kept careful track of their academic progress.

Will loved his children deeply and worried greatly about their future, but he wanted their obedience and deference rather than intimacy or easy affection. When he was home, he ran the household as a "high-minded benevolent dictatorship", their eldest daughter, Cecily, recalled. He would "hold forth in anger [...] in fear that his authority was being undermined [...] he felt, in his own words, that he was 'captain of the ship' & it would go under if he was not implicitly obeyed, & also if he was not meticulously informed of the minutest details from which he could plan the destiny of all."²²² Cecily's younger brother, Laurie, described how decisions were made at one family meeting: everyone could speak, but Will dominated the conversation, and eventually the family came round to his way of thinking.²²³ When Laurie was around seven years old, his father took him for long walks and lectured to him about mathematical sets. When the boy professed not to understand, Will stalked away in anger.²²⁴

Grace's letters to Will expressed her delight in a new baby, warm descriptions of the children's progress and activities, and accounts of happy times reading aloud, playing educational games, and practicing music with the children. She wrote poems and stories for them, amusing tales that featured the children as characters who interact with talking animals that teach moral lessons. She also wrote accounts of how the children solved scientific problems.²²⁵

Nevertheless, Grace was an exacting parent and a tough disciplinarian. (She once punished two servant girls who did not come back on time from an evening out by locking them into their bedroom.²²⁶ She reprimanded another for flirting with students.) Grace's eldest daughter described her as a "highbrow" who did not "suffer fools gladly", but her sons found her more supportive and kind. Laurie noted her "characteristic look of intelligent sympathy, as if she was always ready to help someone else."²²⁷ He recalled how "magnificent" she was

222 D.140/2/3, R. C. H. Tanner notes, Young Papers.

223 L. C. Young, "Life and Work", p. 10.

224 Ibid., p. 11.

225 D.140/14/1, GCY stories. Young Papers.

226 Laurence Young, *Mathematicians*, p. 235.

227 L. C. Young, "Life and Work", p. 14.

when two famous mathematicians arrived at their home in Switzerland to talk shop on the day the Youngs moved into new lodgings. (Will was away.) Grace excused herself for a short time, and came back with tea and freshly baked rock cakes (a family favorite, similar to scones) which she served on the family's best china.²²⁸ Pat, the youngest child, revered his mother as a rare example of a woman who combined "brain power with deep feeling and undying loyalty."²²⁹ Nevertheless, it was May to whom Cecily turned for warmth and nurturing. Unlike Grace and Will, Auntie May "believed in tempering severity with demonstrative affection," Cecily wrote.²³⁰ She regarded May as a second mother, and as an adult, surmised that Grace might have been jealous of the children's relationship with May, even though the two women appeared to get along very well.²³¹

Although Grace had hesitated to take up medicine for fear that she would be "sacrificing husband and children to a whim of my own", she wrote in 1917 that she had managed to get through her medical education "little by little without sacrificing home or mathematics."²³² She drew comfort from knowing that, even if she "had not been all to [her children] that other mothers are to their children, they do not resent it, & are far more loving than I could hope."²³³ In fact, however, it was her work for Will, not her medical studies, that took Grace away from the children for extended periods.

Nevertheless, she and Will were outraged when Grace's relatives — that Greek chorus of disapproving commentary — criticized their "unusual" lifestyle in 1911. Grace responded indignantly, "[I]t has always been the path of duty & not that of pleasure that Will and I have chosen [...]. I have only done what any good woman would do. I have followed my husband's fortunes."²³⁴ Will explained that Grace had always joined him during his English school terms, except when she

228 *Ibid.*, p. 12.

229 D.140/6/5234, Patrick Young to WHY, August 8, 1934. Young Papers.

230 D.140/2/3.1, R. C. H. Tanner notes. Young Papers.

231 D.140/2/3.6, Cecily [Young] Tanner corrections for Ivor Grattan-Guinness, September 10, 1970. Young Papers. Cecily addressed May as "dear, dear mother" in a letter she wrote when she was twelve (D.140/6/1487, Cecily Young to May Young, November 8, 1912. Young Papers).

232 D.140/16/1, "Per Ardua", p. 64. Young Papers.

233 D.140/6/2358, GCY to Frances Evans, New Year's Day, 1917. Young Papers.

234 D.140/6/1288, GCY to Maud Bell, October 17, 1911. Young Papers.

could not leave their children. "When it was not possible [to be together], we were certainly deserving of pity, & not of blame," he protested.²³⁵

In fact, Will was away from home for longer periods than the Youngs cared to acknowledge. Sometimes he chose to be absent because his boisterous household interfered with his work or because his work wreaked havoc on family routines. He also insisted on indulging his wanderlust for foreign travel. "I can't be chained to a desk. I must have motion & change of scene in my life," he raged during one academic term.²³⁶ Frequent separations did not mean that their ties were not strong or affection was wanting. On the contrary, like Alice and George Palmer (discussed in Chapter 1), Grace and Will felt their separations intensified their love. When Will was away, they wrote to each other daily — sometimes twice daily. Romance and passion were important parts of their relationship. Grace was thrilled when a good friend remarked that she and Will "have a recurrent honeymoon, & are like lovers when we are together."²³⁷ Will imagined he was kissing Grace's ears and eyes when he wrote to her, and sent her 1,000 kisses by letter. He swooned before her, "the blood royal of womanhood." In January 1912, they worked all day on mathematics, and then crept downstairs at 11:30 at night, lit the Christmas tree lights, and danced together.²³⁸

Changes in the Partnership, 1913–1919

Grace and Will's lives changed dramatically in the fall of 1913 when Will became the first Hardinge Professor of Mathematics at the University of Calcutta in India. The three-year appointment allowed him to build a mathematics department, investigate mathematical education systems in other countries, and paid considerably more money than his position at Liverpool.²³⁹ He sailed to Calcutta from Brindisi in October 1913 and returned home in April 1914. (Because they involved residencies

235 D.140/6/1291, WHY to Mrs. Gillim, November 5, 1911. Young Papers.

236 D.140/6/483, WHY to GCY, October 12, 1901. Young Papers.

237 D.140/6/604, GCY to WHY [October 6, 1902]. Young Papers.

238 D.140/5/1, Grace's Pocket Diaries, January 2, 1912. Young Papers.

239 The University of Calcutta paid Will 1,000 pounds a year, compared to the 150 pounds he received from the University of Liverpool for giving 53 lectures a year — after eight years of teaching there (D.140/6/1581, WHY to Mr. MacMahon, 25 August 1913, Young Papers).

at different times of the year, Will was able to hold the Calcutta and Liverpool appointments simultaneously. The University of Liverpool gave Will a more prestigious title — honorary Chair in Philosophy and History of Mathematics — but did not increase his salary or responsibilities.)

Not surprisingly, the long separation took a toll on the Youngs' relationship. Grace assured Will she was happy and busy, but she worried that he missed her less than formerly, and feared they were growing apart because he had so many new experiences she could not share. Will missed having her with him to discuss his ideas, act as his secretary, and purchase what he needed for daily living. But he repeatedly discouraged her from coming to India, telling her that she would not like the journey, the people, or the place. "I am very inclined to think it would be a *serious blunder* for you to come out to India even for a few months," he asserted.²⁴⁰ Although Grace had told a cousin that she hoped to spend some time in India with Will, she did not argue the point or express a desire to join him in her letters.²⁴¹ Will was even happier that he had not brought his sons. Evincing the racism of his era and class, he admitted that he was filled with "horror" at the thought that one of their boys might marry a Eurasian and produce "*black*" grandchildren.²⁴²

While Grace fretted about her relationship with Will, he feared losing control over his family. He issued a steady stream of instructions about the children's education and activities, and berated Grace when things were not done to his specifications or he felt ill-informed about their activities. Sending their oldest son, Frank, a long list of Will's instructions, Grace sympathized, "I am afraid you will be tired of all these rules and regulations."²⁴³ Very likely, she was projecting her own feelings about the strictures Will placed on her.

The household in Switzerland underwent many changes while Will was away. Auntie May's departure from the family at the end of May 1913, after ten years of helping with the children, was especially

240 D.140/6/1622, WHY to GCY [n.d., 1913], written while Will was on the ship to India. Emphasis in the original. Young Papers.

241 D.140/6/1588, GCY to Cousin Alick, August 29, 1913. Young Papers.

242 D.140/6/1716, WHY to GCY, 1 January 1914. Emphasis in the original. Similarly, D.140/6/ 1740, WHY to GCY, January 22, 1914. Young Papers.

243 D.140/6/1615, GCY to Francis Young, 7 October, 1913. Young Papers.

unsettling. Without her, Grace and the children struggled to get everything done. When the quality of Laurie's school work declined after May's departure, Grace told his teacher that she was too busy to supervise his homework as May had done. Twelve-year-old Janet took over the job.²⁴⁴

Replacing the children's German governess in the fall of 1913 — she too had been with the children for many years — was also difficult. Grace trained the new governess not to interrupt her when she was working, but Grace spent a lot of time managing the older children's schooling and extra-curricular lessons and nursing all the children through bouts of illness — activities that "sadly" eroded her work time, she told Will.²⁴⁵ He, too, made many demands on her time. She prepared material on the relationship between Greek philosophy and mathematics for lectures he planned to give during the University of Liverpool's summer term. He wanted her help on a book about integration and a new edition of *Sets of Points* and expected weekly accounts of her progress.²⁴⁶

Grace was fully involved in formulating their ideas on all these topics. When Will thought she was going off in a wrong direction on a proof, he advised her to leave the rest for him, but she forged ahead.²⁴⁷ She sent him many letters describing the work she was doing and what she was gleaning from reading the works of other mathematicians. He found her exploration of Greek philosophy and mathematics particularly insightful and planned to use it in a paper.²⁴⁸

Will's vacillations about whether to go first to Geneva or directly to Liverpool when he returned in the spring of 1914 must have reinforced Grace's fear that they were drifting apart. While she eagerly looked forward to the "heavenly weeks" they would have together after his return, he maintained that a few additional weeks of separation after

244 D.140/14/1. Young Papers.

245 D.140/6/1691, WHY to GCY, December 19, 1913. Young Papers.

246 *The Theory of Sets of Points* was out of print, but they had a contract for a new edition from Cambridge University Press. Neither it nor the book on integration was ever completed. Their daughter, Cecily (R. C. H. Tanner), worked with Ivor Grattan-Guinness to publish a second edition of *Sets of Points*, with a new preface and appendix, in 1972: W. H. Young and Grace Chisholm Young, *The Theory of Sets of Points*, 2nd edn. (New York: AMS Chelsea Publishing, 1972).

247 D.140/6/1686, WHY to GCY, December 15, 1913; D.140/6/1691, GCY to WHY, December 19, 1913. Young Papers.

248 D.140/6/1810, WHY to GCY, March 2, 1914. Young Papers.

such a long time apart would not matter.²⁴⁹ In the end, he spent a few days in Geneva before going to the University of Liverpool. Grace stayed in Geneva and worked on turning his lectures into publishable articles.

Will was back in Geneva with his family when World War I broke out in August 1914. Forced to abandon his plans to study how mathematics was taught in various European countries, he remained at home until December 1914, when he returned to India. He was away for fifteen months, until April 1916. He was mostly in Calcutta, but he also travelled to Japan, other parts of the Far East, and the United States to study their university systems. On his return voyage to Europe, he visited South Africa and Spain. While he was away, the family moved to Lausanne, so Frank could live at home while he studied engineering at the University of Lausanne.

Living in neutral Switzerland while Britain was at war with Germany was difficult for Grace. Bursting with patriotism, she longed to contribute to the British war effort.²⁵⁰ Her patriotic fervor led her to support Frank's desire to volunteer for military service in the fall of 1915 when he was eighteen, despite Will's repeated insistence that the boy should not enlist until he turned twenty.²⁵¹ During the first year Will was away, she and Frank happily followed his orders. But a "sudden change of circumstances" made them reconsider. Unable to reach Will, who was traveling in Japan and Ceylon, they acted on their own, confident that he would support their decision.²⁵²

Grace and Frank were most likely responding to two events. In May 1915, a German submarine torpedoed the *Lusitania*, a British ocean liner, killing 1,200 civilians. Grace was so upset after hearing the news in town that she could barely walk home.²⁵³ The second event was the introduction of a new recruitment strategy by the British military in the fall of 1915, a last-ditch effort to avoid conscripting men into the armed

249 D.140/6/1641, GCY to WHY, November 14, 1913; D.140/6/1742, WHY to GCY, 25 January 1914; D.140/6/1806, 1807 and 1808, WHY to GCY, all dated March 1, 1914. Young Papers.

250 D.140/6/1905, GCY to Frances Evans, October 4, 1914. Similarly, D.140/6/2308, GCY to Francis Young, November 18, 1916. Young Papers.

251 The conscription policy, enacted in late January 1916 and implemented in March 1916, required single men ages 18–41 to serve. British subjects living abroad (as Frank was) were not conscripted until July 1917.

252 D.140/16/1, GCY, "Per Ardua", p. 255. Young Papers.

253 D.140/5/1, Grace's Pocket Diary, first week of May 1915. Young Papers.

forces. Under the Derby Scheme, as it was known, men could enlist as volunteers but defer active service until a later date. Recruitment efforts were intense, and recruiters went from household to household throughout England urging men to enlist.²⁵⁴ Unable to reach Will, and presumably feeling pressure to act before the Derby Scheme expired in December, Grace and Frank decided they could not wait for Will's advice.²⁵⁵

Grace maintained that she had tried to do what Will would have done if he had been at home, but they were not in agreement on this issue. He did not share the passionate patriotism of his wife and son, and was much less susceptible to the pressure of public opinion. In a poem written on Christmas Day 1915, Grace encouraged young Englishmen throughout the world to "Go forth, our boys, at England's word!"²⁵⁶ Frankie confessed that the German aggressions against civilians "made his blood boil."²⁵⁷ But Will admired German culture and believed that "if Germany were to disappear it would be one of the greatest calamities which could befall the human race."²⁵⁸ Nor did he want his son's extraordinary talents to be wasted as a cog in the British war machine.

Grace was as concerned as Will about Frank's future, but, influenced by British friends and family (including her perennially disapproving cousins), she feared that Frank would jeopardize a future career in Britain if he did not volunteer to serve in the war. She and Frank convinced each other that Will — who was 8,000 miles from Europe and had been away for more than a year — was too out of touch with British sentiment and

254 The Derby scheme was named after Edward Stanley, Lord Derby, who became Director-General of Recruiting on October 11, 1915. Frank's enlistment was encouraged by Grace's dear friend, Frances Evans. Grace may also have been influenced by her cousin Maud Bell. Maud corresponded with Grace in the fall of 1915 about Frankie's future, after Will had had an unpleasant encounter with other of Grace's Bell relations during his travels in the Far East. Reminding her how "spiteful" Maud was, Will advised Grace to throw her "meddling" letters into the fire and avoid being drawn into an epistolary dispute. D.140/6/2039, WHY to GCY, November 4, 1915; D.140/6/2056, WHY to GCY, November 23, 1915. Young Papers.

255 Some of Grace's letters were very delayed reaching Will when he was in Japan and Ceylon; others never reached him.

256 D.140/14/1, GCY, "The Great Recruitment." Young Papers.

257 D.140/15/8, GCY, "Frank: A Little Monograph Written by Request for Mrs. Evans [n.d.]." Young Papers.

258 D.140/6/2025, WHY to GCY, October 8, 1915. Young Papers.

European events to make a fully informed judgment. They confidently expected that he would see things differently when he returned.

And so, with Grace's blessing, Frank left his engineering studies in Lausanne and went to London in early December, intent on enlisting. After a few days, he decided to join the Royal Flying Corps. Knowing how opposed Will was, and having been instructed not to do anything without his permission, Grace was unwilling to let Frank sign up without his consent. When Frank cabled Will for permission, Will initially opposed the plan and expressed alarm at the family's "hysteria."²⁵⁹ He eventually acquiesced, although he insisted he did not understand what he was agreeing to, and only consented because Grace asked him to do it "for her sake."²⁶⁰

Grace was uplifted by Frankie's enlistment, but for Will it was a catastrophe. Regarding Frank as "our eldest & best" child, Will had planned his future with great care. Now all the plans were wrecked and Frank's "career [lay] in Ruins," Will mourned.²⁶¹ Convinced that Frank had made a "terrible blunder", Will blamed Grace for disregarding his explicit "commands" and encouraging the boy.²⁶² Fearful that he would never see his son again, he fulminated, "Why oh why did you send Frankie to England against my express wishes?"²⁶³ Will's latent misogyny quickly surfaced. "It's because women so often make decisions, without knowing all the facts, & influenced by their emotions, that the world goes wrong," he told Grace.²⁶⁴ "A woman can never know the world as a man does, & she misses important bits of knowledge," he railed.²⁶⁵ He accused her of disloyalty and criticized

259 D.140/6/2062, WHY to GCY, December 11, 1915. His letter to Frank was much softer in tone (D.140/6/2064, WHY to Francis Young, Letter No. 2, December 13, 1915). Young Papers.

260 D.140/6/2072, WHY to GCY, December 22, 1915; D.140/6/2074, WHY to Francis Young, December 22, 1915. Young Papers.

261 D.140/6/2104, WHY to GCY, January 12, 1916. Young Papers.

262 Blunder: D.140/6/2062, WHY to GCY, December 11, 1915. Commands: D.140/2091, WHY to GCY, January 1, 1916. Young Papers.

263 D.140/6/2075, WHY to GCY, December 26, 1915. Similarly, D.140/6/2091, WHY to GCY, January 1, 1916; D.140/6/2094, WHY to GCY, January 3, 1916, and D.140/6/2096, WHY to GCY, January 4, 1916. Young Papers.

264 D.140/6/2082, WHY to GCY, December 29, 1915. Young Papers.

265 D.140/6/2091, WHY to GCY, January 1, 1916. Young Papers.

her "precipitate and impulsive behavior" — denunciations that "upset [her] horribly."²⁶⁶

Will was somewhat mollified when the British military instructed Frankie to complete his engineering course in Switzerland and return to England in June 1916, when he would be nineteen and could enlist as an officer. Nevertheless, this contretemps heightened Will's fears about his family's growing independence. He became more reluctant to rely on the judgment of others and more determined to control the destiny of his other children.²⁶⁷ Grace showed a positive and optimistic spirit to Frankie, but was greatly distressed by the "disharmony" and "mutual misunderstanding" that had developed between her, Will, and Frank.²⁶⁸

Confident that she and Frankie were right, Grace did not back down. In classic reframing mode, she told Will that, had he been fully aware of the circumstances, he would have made the same decision, and when he returned from India, he would see the wisdom of their action. After a month of heated exchanges, she put an end to the discussion by writing, "I am not going to say another word about this business till you come home, except that, trying as it all has been, I do not regret it, & that I am sure we shall all agree as to what is to be done when you come home."²⁶⁹ Will agreed that they should stop discussing what had gone wrong and focus on planning for the future.

This was the most dramatic, but not the only indication of Grace's growing independence while Will was in India. She continued to assist him, but also developed her own mathematical work, and pushed Will in new directions. They debated their ideas, proofs, and theorems at length in their letters. Will was often critical of the work she was doing for him, but she forged ahead, and urged him to include some new ideas about probability, a topic she was independently discussing with

266 D.140/14/3, Typed Letters, Copy of WHY to GCY, January 12, 1916 with Grace's reaction added. Young Papers.

267 D.140/6/2089, WHY to Cecily Young, January 1, 1916, and D.140/6/2114, WHY to Cecily Young, January 19, 1916. Young Papers.

268 Optimism: D.140/6/2001, GCY to Frank Young, January 9, 1916. Grace's distress: D.140/14/3, Typed Letters, Copy of WHY to GCY, January 23, 1916 with reaction from Grace. D.140/16/1, GCY, "Per Ardua", p. 255 notes the "agony" Grace suffered when Will wrote she was disloyal. Young Papers.

269 D.140/6/2112, GCY to WHY, January 18, 1916. Young Papers.

another mathematician.²⁷⁰ With her help, Will published eight papers under his own name between 1914 and 1916.²⁷¹ In a jointly authored paper, submitted a few weeks after his return from India in April 1914, they developed a theorem that became known as the Heine-Young theorem.²⁷² In addition, Grace won acclaim for five papers on the foundations of differential calculus, which were published under her own name in leading mathematical journals between 1914 and 1916. When she presented a paper at the centenary meeting of the Swiss Natural Science Society, in September 1915, she enjoyed “a most flattering reception” from an audience that included mathematicians, physicists, and medical scientists.²⁷³ The Youngs also began to publish more co-authored papers. During 1916, after Will’s return from India, they submitted four papers that were published under their joint names.²⁷⁴

As usual, we do not know how Grace and Will made their decisions about authorship, or why Grace began to publish more under her name alone and jointly with Will. Late in 1913, after each had published a paper, Will noted that he was more pleased to see Grace’s paper in print than his own; perhaps this emboldened her.²⁷⁵ Certainly, his lengthy absence gave her more opportunity to work on her own projects.²⁷⁶ Whatever the impetus, the Youngs seemed, at long last, to be starting to implement what Will had promised in 1902: “Everything under my name now, & later when the loaves and fishes are no more procurable in that way, everything or much under your name.”²⁷⁷

270 Will’s criticisms: WHY to GCY, D.140/6/1952, February 8, 1915; D.140/6/1981, June 6, 1915; D.140/6/1965, March 12, 1915. Probability: D.140/24/3, GCY to WHY, January 10, 1914. Young Papers.

271 One article, published in 1914, acknowledged Grace’s assistance in a footnote. Sylvia M. Wiegand, “Grace Chisholm Young”, p. 248, and Grattan-Guinness, “Mathematical Bibliography”, Entry 139.

272 Grattan-Guinness, “Mathematical Bibliography”, Entry 143.

273 D.140/6/2016, GCY to Mrs. Carey, 20 September 1915. Young Papers.

274 Grattan-Guinness, “Mathematical Bibliography”, p. 55.

275 D.140/6/1709, WHY to GCY, December 29, 1913. Young Papers.

276 Grace did not write an algebra textbook for use in India, as proposed by an Indian publisher who suggested she should write it under Will’s “supervision.” D.140/6/1978, K & J Cooper to WHY, 19 May 1915, following up an inquiry originally sent a year prior. Young Papers.

277 D.140/6/553, WHY to GCY, February 15, 1902.

Grace's publications solidified her scholarly reputation among mathematicians who were working to develop the modern theory of real functions and assured her a lasting legacy.²⁷⁸ The distinguished mathematician M. L. Cartwright would later write, "In the opinion of many experts her work in this field is deeper and more important than her husband's."²⁷⁹ Grace's name was given to a theorem she worked out in one of her published papers.²⁸⁰ At the end of 1915, she won the Gamble Prize, awarded by Girton College to a graduate who had done outstanding research, for another paper. Noting that Grace had developed "one really very good theorem" in that prize-winning paper, the renowned mathematician G. H. Hardy cautioned the selection committee that using Grace's paper to judge the caliber of future entries might set an "extravagant" standard for the prize.²⁸¹ Two modern-day male mathematicians who have tried to assess Grace and Will's respective contributions have concluded that because their work was so entwined after they began to collaborate in 1901, it is impossible to determine who was responsible for what.²⁸² Even when the Youngs published separately and independently, their papers reflected their joint thinking, these scholars argue, extending to Grace the recognition that Will held back.

At last, Grace was winning recognition and honors that had been long denied her. But the timing of her success lessened her happiness in it. The Gamble Prize was awarded in the midst of the contretemps about Frank's enlistment, and she hesitated to send Will the news. A draft telegram asking Will to send his consent to Frank has several crossed out mentions of "Gamble Prize." When Will got the news of the award

278 M. L. Cartwright, "Grace Chisholm Young", *Journal of London Mathematical Society*, 19:75 (July 1944), 185–92 (p. 189).

279 Cartwright, "Grace Chisholm Young", *Girton Review*, p. 19.

280 Others were working independently on the same idea and shared credit with Grace. The theorem is known as the Denjoy-Young-Saks Theorem.

281 Quoted in Marjorie Senechal, *I Died for Beauty: Dorothy Wrinch and the Cultures of Science* (New York: Oxford University Press, 2013), p. 64. The Gamble Prize was awarded annually, but rotated triennially among disciplines. Reviewing the winning submission of mathematician Dorothy Wrinch in 1918, Hardy noted that her work was distinctly inferior to Grace's.

282 Andrew M. Bruckner and Brian S. Thomson, "Real Variable Contributions of G. C. Young and W. H. Young", *Expositiones Mathematicae* 19 (2001), 337–58, [https://doi.org/10.1016/S0723-0869\(01\)80019-0](https://doi.org/10.1016/S0723-0869(01)80019-0).

a few weeks later, Grace was disappointed that he did not respond enthusiastically about her achievement.²⁸³

Grace's opportunities for recognition in her own right were short-lived. When Will returned from India in the spring of 1916, brimming with plans to write a series of articles about university reform, Grace abandoned her own mathematical projects and slipped back into her accustomed role of helpmate wife. Once again, Will's work took precedence over everything else. "I am not allowed to do any housekeeping, & am up to my ears in papers," she reported in August.²⁸⁴ She was still working "morning noon & night" on Will's projects in December and the grueling pace caused "a nasty little breakdown" in health and a recurrence of her debilitating headaches.²⁸⁵

Having experienced more independence during Will's time in India and proven her mettle as a mathematician in her own right, Grace found it more difficult to play the role of his assistant after he returned. She wrote despondently to Frances Evans, "The [domestic work] is good, the mathematics is Will's & so also good, but I fear my part in it is very mediocre; a good secretary could have done better."²⁸⁶ Much of Grace's discontent arose from her thwarted desire to serve her country, especially after Frank began active duty as a second lieutenant in the Royal Flying Corps in July 1916.²⁸⁷ This time he went to England with Will's backing, much to Grace's relief.

Nevertheless, Will soon began to pull strings to get his son reassigned to a job behind the lines, despite being told that the work Frank was doing was the most helpful he could do for the war effort, and he was very happy being "a mere pilot."²⁸⁸ Grace typed the letters Will dictated,

283 Draft telegram: D.140/15/1. Will's response: D.140/6/2116, WHY to GCY, January 23, 1916. Grace's disappointment: D.140/24/3, Typed copy of WHY to GCY, January 23, 1916, with Grace's reaction added. Young Papers.

284 D.140/6/2210, GCY to Francis Young, August 24, 1916. Young Papers.

285 D.140/6/2342, GCY to Francis Young, December 19, 1916; D.140/6/1354, GCY to Francis Young, December 28, 1916. Young Papers.

286 D.140/6/2244, GCY to Frances Evans, October 16, 1916. Young Papers.

287 His call up, originally set for June 1916, was delayed by a month so he could take his final university exams.

288 D.140/15/1, Lt. Col. Wyndham to WHY, October 28, 1916; D.140/6/2366, Francis Young to WHY, January 6, 1917. Young Papers.

and wrote some of her own to potentially influential contacts. But she assured Frank she wanted him to manage his own career.²⁸⁹

With Frank in the Flying Corps, Grace's desire to offer patriotic service intensified. "I have been trying hard to do my duty as 'the older sister in the family of mathematicians' [...] I have been Will's secretary, & worked on my own small account, & the work is recognized, both in England & out of it. But, but all this while I would rather be with the Red Cross at the Front," she confessed to Frances Evans.²⁹⁰ To Frankie, she lamented, "My duty is to play second fiddle, & do it all the time & all the time. I try to do it & I fail. I hope you will succeed, & I hope you will serve your country well [...]. I love to think you are actively serving England as I should like to do."²⁹¹ Grace's reference to playing second fiddle and repetition of the phrase "all the time and all the time" suggests she was finding her life more onerous than formerly. She started volunteering for three hours a week in an eye hospital, learning theory and getting practical experience.²⁹²

And then disaster struck. Frank was killed in action in February 1917, when the plane he was flying was shot down by the Germans. Both Grace and Will were devastated by the loss of their beloved son. Will felt Grace suffered a much greater personal loss, while he endured "the shattering of a whole chain of carefully laid plans" for Frank's future. Believing that Frank had rare talents, and determined to overcome the deficiencies of his own upbringing, Will had devoted himself to giving Frank the experiences, education, and advantages that would ensure his future success.²⁹³ With Frankie's death, "the conventional triumphed yet once again & the unusual, the rare exception, was sacrificed," Grace wrote bitterly.²⁹⁴

289 D.140/6/2308c, GCY to Francis Young, November 18, 1916. Grace did not extend the same encouragement or sympathy to her rebellious daughter, Leni. Pleased that Will was trying to "manage" Leni after he returned from India, she noted, "Will certainly understands training his family, & if ever these girls get married, their husbands will have something to be grateful for." D.140/6/2222, GCY to Frances Evans, September 11, 1916. Young Papers.

290 D.140/6/2411, GCY to Frances Evans, February 6, 1917. Young Papers.

291 D.140/6/2342, GCY to Francis Young, December 19, 1916. Repetition in the original. Young Papers.

292 D.140/6/2308, GCY to Francis Young, November 18, 1916. Young Papers.

293 D.140/16/1, GCY, "Per Ardua", pp. 267–68, copy of a letter to an unidentified correspondent. Young Papers.

294 D.140/16/1, GCY, "Per Ardua", p. 282. Young Papers.

Her grief was intensified by the guilt she felt for having encouraged Frankie to enlist. In the rambling memoir she wrote about Frank shortly after his death, "*Per Ardua ad Astra*", she repeatedly told herself that Will did not blame her, but she continued to fear that he did.²⁹⁵ Nevertheless, Grace held to the belief that, under the circumstances, she had made the right decision. And she took comfort from knowing that Frank had died a "heroic", even a "grand" death.²⁹⁶ But Will's trust had been undermined. In future years, he would occasionally — and cruelly — remind Grace of the incalculable harm that resulted from her poor judgment. When they disagreed about the wisdom of moving back to England in the 1930s, he cautioned, "How afraid I am that you will take some irrevocable decision during my absence which like that about Frankie would go far to ruin our lives."²⁹⁷

Having lost Frank, Grace clung more closely to Will. Preparing to write her account of Frank's short life in 1917, she reread the letters she and Will had written to each other during the first decade of their marriage. It became clear to her as never before that Will had always had her best interests at heart and protected her against her own worst instincts and impulsiveness. She concluded that his loving care had failed in 1915 only because, when he "was not there to control, Frank and I had no natural protector to stand between us & personal feeling."²⁹⁸ She did not consider whether she had been asked to sacrifice too much for Will over the years, and whether she needed protection against the incessant demands he made on her.

After Frank's death, Will again prioritized his professional advancement over Grace's. In May 1917, when he was contemplating resigning from the University of Liverpool, he bluntly informed Grace that a wife ought to put her husband's career ahead of her own. "A woman ought not to mind playing second fiddle, it is not really such a hardship," he claimed. Adding insult to injury, he pointed out that if

295 D.140/16/1, GCY, "*Per Ardua*," pp. 252, 255, 266. Young Papers. The title she gave the memoir of Frank's life, "*Per Ardua ad Astra*", meaning "through adversity to the stars" or "through struggle to the stars", was adopted as the motto of the Royal Flying Corps in 1913.

296 D.140/16/1, GCY, "*Per Ardua*," p. 255. Young Papers.

297 D.140/6/5299, WHY to GCY, August 3, 1935. In late 1939, when Will's behavior was becoming more and more erratic, he reproached Grace at length about Frank. D.140/6/5123, GCY to Janet Young, December 2, 1939. Young Papers.

298 D.140/24/2, Grace's Autobiographical Notes on 1901–1902. Young Papers.

Elizabeth Barrett Browning (with whom Grace had long identified) had helped Robert Browning "to express himself more clearly and exactly, and think more conscientiously, his work would have been infinitely better, and a great deal of her stuff would never have been published. Browning may have published two or three really good things herself and nothing lost," Will asserted. The phrase "playing second fiddle" echoes the sad refrain in Grace's letter to Frankie and suggests that this was not the first time she had heard this argument. She recorded Will's words in her notebook without comment, but it was a role that was becoming increasingly difficult for her to accept.²⁹⁹

A month later, in June 1917, Will won the London Mathematical Society's most prestigious prize, the de Morgan Medal, awarded for outstanding contribution to mathematics. He continued to turn out mathematical papers with Grace's help — mostly under his name alone³⁰⁰ — but their productivity declined, and his relations with academia remained problematic. He did not return to India, and never fully finished his report on university education systems for the University of Calcutta.³⁰¹ He resigned from the University of Liverpool in the fall of 1919, partly because he did not like the terms he was offered — an extension of his existing salary and duties — and partly as a protest against the university's standards for awarding doctorates, which he thought insufficiently rigorous.³⁰²

The Young family felt they could not return to England unless Will got a post that paid enough to send the children to good schools. But Grace knew this was unlikely. "[British universities] have served us envy, hatred, & malice & uncharitability in the past & there is not the

299 D.599/16, recorded by Grace in a notebook, and dated 25.V.17. Tanner Papers.

300 They were co-authors of a paper published in 1923 and another in 1928. Grattan-Guinness, "Mathematical Bibliography", p. 57.

301 Grattan-Guinness, "Mathematical Union", p. 157.

302 Ibid., pp. 157–58. Kelly, *For Advancement of Learning*, pp. 154 and 526, lists Will as holding an honorary Chair in Philosophy and History of Mathematics from 1913 to 1919. According to the official announcement prepared by the University of Liverpool, Will was to be "Lecturer in Higher Analysis" with a salary of 100 pounds per session (D.140/6/2595, July 10, 1917, Young Papers). The undated draft letter of resignation Will dictated to Grace is a litany of the slights and injuries he felt he had received from the university (D.599/1/1/1/7, Grace's Notebooks, Tanner Papers). Another draft letter (D.140/15/1) protests the hiring of other men to positions in which Will has "special knowledge" as well as his criticisms of the PhD criteria. Young Papers.

slightest sign of them doing anything else in the future," she wrote, with unaccustomed bitterness, to Frances Evans.³⁰³

Later Marriage: the 1920s and 1930s

Will did get a better teaching position, but not one that met his family's needs. In the fall of 1919, he became chair of the Department of Mathematics at the University of Wales in Aberystwyth, a position that allowed him to hire staff, bring in visiting scholars, and develop a cohort of graduate students. Nevertheless, the school was a mathematical outpost in the hierarchy of British universities. The appointment did little to reduce Will's sense of injustice in never having won a post commensurate with his talents and his standing in the field. The eminent British mathematician G. H. Hardy agreed that Will deserved a more prestigious teaching position.³⁰⁴ A year after he went to Wales, Will was elected president of the London Mathematical Society, a signal honor. Nevertheless, his reputation remained higher abroad than in Britain.

Although he was required to be in residence in Aberystwyth from September to May, Will decided not to bring his family with him because he needed solitude to work, and it would be too expensive to educate the children in England. "We must be content to be separate most of the year. The advantages are many," he informed Grace.³⁰⁵ Nevertheless, he did not want to be left entirely to his own devices. When a move to a new house and a recurrence of gall stone problems made it impossible for Grace to come to Wales, their daughters went instead. Cecily spent two academic years with Will, acting as his assistant and keeping house for him; Janet spent one. Grace, back home in Switzerland, continued to work on the manuscript of a second edition of *The Theory of Sets of Points*, but it was never completed.

303 D.140/7/1.70, GCY to Frances Evans [probably 1918]. Young Papers.

304 See Grattan-Guinness, "Mathematical Union", p. 161. Hardy reiterated this view in G. H. Hardy, "William Henry Young, 1863–1942", Royal Society of London, *Obituary Notices of Fellows*, 4:12 (November 1943), 307–23, <https://royalsocietypublishing.org/doi/10.1098/rsbm.1943.0005>.

305 D.140/6/2850, WHY to GCY, November 18, 1919; similarly, D.140/6/2855, WHY to GCY, November 20, 1919; D.140/6/3120, WHY to GCY, March 12, 1922. Young Papers.

Will was outraged by any show of independence on Grace's part. Still convinced that he knew what was best for his family, and ever fearful that calamity would ensue if his wishes were not heeded, he heaped instructions and criticisms on Grace and the children. "The real difficulty," he wrote angrily to Grace when she was arranging to move the family to a new home outside of Lausanne in 1920, "has always been that I never give orders but reason & advice. And you have got into the way of disregarding anything but positive commands & you don't by any means always carry out these."³⁰⁶ He upbraided her for acting "contrary to orders" and derided the decisions she made on her own.³⁰⁷ "We are all fond of you, & proud of you, but we think you are inclined not to do the *intellectual* work that is needed to run a house, or a family, or a property with judgment & success," he wrote dismissively about her plans.³⁰⁸

Grace increasingly responded to Will's criticisms with silence, which added to his anxiety and irritation.³⁰⁹ Occasionally, she protested. "I should like a few lines of news of yourself & not any directions or orders," she informed him in the mid-1920s.³¹⁰ More typically, she began to use her notebooks, and sometimes her pocket diaries, to vent her frustrations with him. From the late teens on, her reflections, observations, and criticisms of Will are sprinkled through the notebooks in which she took dictation from him, wrote notes on mathematical treatises, and worked out formulas and proofs. These occasional entries reveal what she was feeling and thinking while she exhibited a quiescent, obliging, self-sacrificing exterior.

Grace was beginning to see herself as a victim and longed for more affection from Will. In the fall of 1921, she noted that she had saved Will from many mathematical errors by being as stubborn as a donkey and digging in her heels — and he had "whacked" her for it. Two weeks later, she wondered whether he would have liked to have been born Louis Quatorze. She sadly concluded that she had been at her best during her

306 D.140/6/2941, WHY to GCY, May 18, 1920. Young Papers.

307 D.140/6/2894, WHY to GCY, February 2, 1920; D.140/6/2896, WHY to GCY, February 3, 1920. Young Papers.

308 D.140/6/1941, WHY to GCY, May 18, 1920. Emphasis in the original. Young Papers.

309 D.140/6/3071, WHY to GCY, May 21, 1921. Young Papers.

310 D.140/6/3453, GCY to WHY, March 29, 1925. Young Papers.

engagement and the early years of married life — a bleak commentary after twenty-five years of marriage.³¹¹

When she spent time with Will in Wales in 1923, Grace referred to herself as his “scapegoat.”³¹² To withstand his temper, she drew inspiration from a fourth-century Catholic saint, Monica, the mother of St. Augustine. After reading St. Augustine’s *Confessions*, she wrote to her daughter, Janet,

Saint Monica must have been a very wise & intellectual woman, an admirable wife & mother [...] [St. Augustine’s] father was very hasty in temper & violent, but he never quarreled with Monica, because she was too wise & loving. Only when she differed from him she always managed to persuade him afterwards! Give Babbo [the Italian word for papa, which is what the children called Will] a big kiss for me & tell him I am going to try & be like Monica!³¹³

Will was incensed by any suggestion that he made too many demands on Grace. When his sister May told Grace she “was too unselfish” and urged her to take a much-needed vacation, Will sent a furious letter to Grace:

What does [May] mean [by urging you to] ‘strike for time off’? [...] have you not been your own mistress for years at a time? Just as if you had been looking after me while I was in India or Aberstwyth [...]. You disposed of your time as you chose, & had money enough all that time to take servants as many as you wanted.³¹⁴

By the summer of 1923, 60-year-old Will was full of complaints about his work at the University of Wales.³¹⁵ He retired from teaching and joined Grace in Switzerland. During the first years of his retirement, the Youngs spent time together in their Swiss home, attended international mathematical conferences, and soaked in medicinal waters at German spas. When they took a lengthy trip to Canada and

311 D.599/1/1/1/7, Grace’s Notebook of WHY dictations & oral notes, entries dated 5-IX-21 and 19-IX-21. Tanner Papers.

312 D.140/6/3219, GCY to Laurence Young, February 12, 1923. Similarly, D.140/6/3149 and D.140/6/3150, both GCY to Cecily Young, June 10, 1922. Young Papers.

313 D.140/6/3018, GCY to Janet Young, January 11, 1921. Young Papers.

314 D.140/6/3281, WHY to GCY [n.d., May 1923]; D.140/6/3278, May Young to GCY, May 22, 1923. Young Papers.

315 Draft letters in D.140/15/1, Grace’s Pocket Diaries, dated January 15, 1923 and May 7, 1923. Young Papers.

the United States in 1924, Grace lectured on the concept of infinity at Bryn Mawr College, where Isabel Maddison, a friend from Girton and Göttingen days, taught mathematics. Between 1919 and 1929, Grace published six mathematical papers under her name, several of which explored the mathematics in Greek philosophy.



Fig. 2 Grace in 1923.
Courtesy of Sylvia Wiegand and
the American Physics Society.
CCBY ND-2.0.



Fig. 3 Will in 1920.
Photo by Walter Stoneman.
© National Portrait Gallery,
London.

Despite the honors and recognition he had received, Will's deep-rooted feelings of insecurity and rivalry persisted. The Russian mathematician, A. S. Besicovitch, who first came to England in 1924, recalled being asked by Will, "Are you one of those people who think my wife is a better mathematician than I am?"³¹⁶ Will did no further work in pure mathematics, but he gave occasional lectures and worked tirelessly to rebuild a spirit of international good will and collaboration as president of the International Mathematics Union and its successor organization, the International Congress of Mathematicians. He began to write a book on international finance, read Roman law and legal history, taught himself a number of European languages, and started to write

³¹⁶ Quoted in Patricia Rothman, "Grace Chisholm Young and the Division of Laurels", *Notes and Records of the Royal Society of London* 50:1 (1996), 89–100 (p. 97), <https://doi.org/10.1098/rsnr.1996.0008>.

his autobiography. As always, he wanted Grace's help with all these endeavors. As always, he pressured her to spend more time on his work and less time on domestic chores and her own projects, and feared he had lost control of his loved ones. As late as 1937, he took Grace to task for going to England to help Cecily look for housing without consulting him first. A woman needs her husband's advice, he protested.³¹⁷

Although Grace and Will enjoyed periods of warmth and affection in the 1920s and 1930s, stresses were mounting. It was easier for Grace to suffer Will's temper and devote herself to furthering his work and reputation when their relationship was passionate, emotionally fulfilling, and grounded in common interests and goals. After he retired, their interests were diverging and their personal relationship was deteriorating. When she was with Will, Grace tried to be a cheerful and supportive helpmate and caregiver. But to her children she expressed irritation about his incessant demands and constant interruptions. It took her three years to write an article on Plato's mathematical theories because she could work on it only in between Will's projects, she noted.³¹⁸ After several difficult weeks working with him on a major address, she complained, "writing up other people's ideas is much more trying than writing one's own."³¹⁹ Will's insistence on the "urgent" need to finish an article in 1931 turned the household into chaos. Four months later, Grace wrote in relief, "I am at last going ahead with my book [...] as long as Babbo was here I could hardly write at all."³²⁰

As they aged, Grace and Will chose to spend more time apart. Will indulged his wanderlust by travelling extensively on his own in Europe, Turkey, and Greece, in connection with his work as President of the International Congress of Mathematicians. He spent another six months traveling by tramp steamer in South America, and made frequent trips to England. By 1930, Grace and Will agreed that they preferred to take their vacations separately.³²¹ She often went to England or France to see

317 D.140/6/5427, WHY to GCY, January 8, 1937. Young Papers.

318 D.140/6/3217, GCY to Cecily Young, February 23, 1923; D.140/6/3240, GCY to Cecily Young, April 1, 1923. Young Papers.

319 D.140/6/4072, WHY to Cecily Young, with note from GCY, February 15, 1928. Young Papers.

320 D.140/6/4776, WHY to GCY, February, 20, 1931; D.140/6/4843, GCY to Cecily Young, June 5, 1931. Young Papers.

321 D.140/6/4523, GCY to Cecily Young, March 8, 1930. Young Papers.

her children and grandchildren, but she was also very happy staying in her Swiss home by herself.

In 1929, Grace branched out in a new direction and began writing an historical novel set in Elizabethan England. It interwove romance, adventure, and court intrigues, and also included Grace's speculations about the possible author of several plays attributed to Shakespeare. She circulated a draft of *The Crown of England* to several publishers in 1933, but none accepted it. She was working on revisions in 1935, but it was never published.

Grace was increasingly resentful about the way Will treated her, but she was still awed by his intellectual prowess. "Your mind like a butterfly hovers over all the flowers in turn. You are international & interscientific, there is no shutting you up in one nation or one science," she marveled as she wrote down his thoughts in 1931.³²² But as Will's focus narrowed, and his thoughts became more circumscribed, Grace's frustration grew. In 1935, she silently criticized him, interjecting reactions like "[Dear me! How dull he is!]" and "[This is meandering!]" as bracketed statements in the midst of pages of dictation about his boyhood and his approach to writing autobiography. Later, she dutifully transcribed his words, eliminated her interpolations, improved the writing, and turned out a very polished version of his thoughts.³²³

Repressing her thoughts and feelings undoubtedly took a strong psychological toll on Grace — all the more so because her feelings for Will were so conflicted. At times she seemed to seethe with anger and a sense of injustice at the way he treated her, but often she was loving and heartsick. The poetry she wrote in the 1930s captured this fundamental duality. "The Trot of the Scapegoat" balances her strong sense of mistreatment against her unflagging devotion to Will, deep dependence on him, and determination to care for him despite his temper. The Scapegoat comes when "the Master" calls, bears the Master's sorrow and gloom, and cheerfully awaits his commands. She flees when told to leave, and joyfully returns when the Master's mood "is serene and

322 D.599/1/1/1/7, Grace's Notebook of WHY dictations & oral notes, entry dated 22–1–31. Tanner Papers.

323 Ibid., entry dated 13–11–35. Tanner Papers. Polished version: D.140/11/5, Young Papers.

content."³²⁴ Another poem — untitled, unfinished, and undated, but filed with materials from the late 1930s — reveals a darker and angrier side of Grace. After crossing out two milder stanzas, and struggling with the wording, she left a single stanza that reads:

I love the man who reads to think & learn
As to the critic, poisonous, sneering, smug
I'd like him to shut up his ugly mug
Or better still, depart & ne'er return.³²⁵

As a college student, Grace wrote that she composed poetry as a solace when she was depressed.³²⁶ The raw emotion in this stanza is a sharp contrast to the sentimental expressions of many of her poems. The uncharacteristic coarseness of the language and harshness of her judgments are powerful and shocking — and very revealing.

Grace did not question that women should defer to male opinions and judgments, but during her fifties and sixties she began to acknowledge how difficult it was to be both a rigorously trained scholar and a woman who was expected to be subordinate to men. Conflicted herself, Grace gave a mixed message to her daughters. "We want you to be what hardly any modern unmarried woman of your age is, both sweet & gentle & loving & modest & also successful with a brilliant career of your own," she wrote her oldest daughter, Cecily. "But that is a very large order, it means *having* & *acting* on your own judgment & yet *distrusting* it & *giving way* to male opinions & desires. I am myself only very faintly realising the weakness & the strength of a really *great* woman." Once again, Grace drew inspiration from a religious model. "Remember how St. Francis lay down and made the monks walk over him," she advised Cecily.³²⁷ It is not surprising that Grace's models for action were self-denying, self-sacrificing centuries-old saints, not modern, forward-looking, self-actualizing women.

Issues of gender, family obligation, and professional status became increasingly complicated for the Youngs as their daughters, as well as their sons, embarked on careers. Both Grace and Will had a preference for male children and were more pleased at the birth of a son than a

324 D.140/14/13, 1936. Young Papers.

325 D.140/14/1, [n.d.], filed with poetry written in the 1930s. Young Papers.

326 D.140/14/1, "My Poetry" [Dec. 31, 1890?]. Young Papers.

327 D.140/6/5494, GCY to Cecily Young, November 9, 1937; emphasis in the original. Young Papers.

daughter.³²⁸ Although all their children were expected to attend college, pursue graduate training, and earn a living, Will admitted that he was more interested in planning his sons' careers than his daughters' and took the boys' successes and failures more to heart.³²⁹ When Grace tried to calm his agitation over teen-aged Frankie's multiple spelling errors, pointing out that she herself was a poor speller, Will angrily responded, "Remember you are a woman & the fact that you spell wrong occasionally has not a tenth of the same importance."³³⁰

The children's lives and careers avoided many of the career-family tensions that had plagued Grace and Will's marriage. Both Cecily and Laurie earned higher degrees in mathematics and taught mathematics at the university level. Cecily did not marry until she was in her fifties and had no children. Laurie married and had six children. His wife was a stay-at-home mother, but her mother, Agnes Dunnett, was one of the first women to practice medicine in England; Dunnett became the sole provider for her husband and five children after her husband's business went bankrupt.³³¹ Janet was the only one of Grace's daughters to combine marriage, motherhood, and career. She had the life her mother once hoped for: after completing her medical training, she married and continued to practice medicine while raising two children. Leni, the family rebel, was the only child who did not earn a graduate degree and have a career; she left a graduate program in mathematics after she married. The mother of three, she proudly touted the virtues of domestic life and full-time motherhood.³³² Pat, the youngest child, earned a DPhil in chemistry and worked in chemical engineering and international finance. He married his secretary.

Grace and Will's belief that women were meant to support and serve men applied to daughters and sisters as well as to wives. Will expected his daughters to assist him when he was teaching in Wales in the early 1920s, and insisted on having Cecily's help at other times in the 1920s and

328 D.140/6/496, GCY to WHY, October 30, 1901; D.140/6/881, GCY to WHY, July 12, 1905; D.140/6/5375, WHY to GCY, August 9, 1936. Young Papers.

329 D.140/6/1495, WHY to Mrs. Pratt, November 22, 1912. Young Papers.

330 D.140/6/1611, WHY to GCY [October 1913]. Young Papers.

331 Sylvia Wiegand, "Grace Chisholm Young and Agnes Dunnett." Blog posted February 19, 2013, <https://ggstem.wordpress.com/2013/02/19/sylvia-wiegand-grace-chisholm-young-and-agnes-dunnett/>.

332 D.140/7/2.2, Leni Young [Canu] to GCY, September 23 [n.y.]. Young Papers.

1930s. Both he and Grace were offended if Cecily treated his demands as an imposition. In contrast, when Grace was ill during the winter of 1920, she and Will advised Janet not to interrupt her medical studies in order to care for Grace and manage the household in Switzerland.³³³

Laurie, the eldest surviving son, deserved special treatment, Grace and Will believed. In the late 1920s, when Laurie and Cecily were both studying mathematics at Cambridge University, she was drafted to proof, edit, and type his papers. Grace made it clear that it was Cecily's duty to help advance her younger brother's career. During the summer of 1931, when Will had already used several weeks of Cecily's time, Laurie wanted her to type the manuscript of his book, which was to be published by Cambridge University Press. Grace wrote to Cecily, "As for your work, of course we are proud of it, & glad you are forging ahead now. But we feel that from now to the time when Laurie's work has to be sent in, you ought to devote a great portion (if not all) of your time to his affairs."³³⁴ Several years later, when Cecily was teaching mathematics at the Imperial College of Science and Technology at the University of London, Grace informed her that Laurie's "future [...] is all important, & any influence for the good which you [...] exercise on him & in his career will be gratefully recognized by us."³³⁵ The children's unequal status was underscored when Will gave his entire collection of mathematics books to Laurie and none to Cecily.³³⁶

The rationale was the same that drove Will and Grace's unequal division of the laurels of their partnership: Laurie's work was considered more important than Cecily's because it was more important that he, a man, establish himself in a career. As the oldest surviving son, he was to be "the Head" of the family. The family honor and prestige would come from his professional success, not from his sisters' achievements. As the eldest daughter, Cecily was expected to be the "*centre of the family*" and exercise an "unselfish and attractive force" in its affairs, Grace stressed.³³⁷

333 D.140/6/3018, GCY to Janet Young, January 3, 1921; D.140/6/3017, WHY to Janet Young, January 4, 1921. Young Papers.

334 D.140/6/4868, GCY to Cecily Young, July 16, 1931. Young Papers.

335 D.140/6/5494, GCY to Cecily Young, November 9, 1937. Young Papers.

336 D.140/6/5490, Laurence Young to GCY and WHY, October 28, 1937; D.140/6/5494, GCY to Cecily Young, November 9, 1937. Young Papers.

337 D.140/6/5494, GCY to Cecily Young, November 9, 1937. Emphasis in the original. Young Papers.

The End of the Partnership

Will continued to win honors and acclaim, and Grace continued to defend him against criticisms and slights. In 1928, he was awarded an honorary doctorate by the University of Strasbourg and won the British Royal Society's prestigious Sylvester Medal, given to an outstanding researcher in mathematics. But when Cambridge failed to mark the fiftieth anniversary of Will's association with the university in 1932, Grace wrote to Laurie in distress, "I always feel indignant at any discourtesy, ingratitude, or want of consideration towards the noblest & most un-self-interested of men. Mind you always do your duty to your good father, who has been so neglected by those who owed most to him."³³⁸ Nor would she tolerate any disrespect or criticism of Will from the children. On the contrary, she expected them to revere and defer to him as she did.³³⁹

As Will's mental health declined in the late 1930s, he became even more dependent on Grace's steadfast care. His behavior suggests that he may have been suffering from what would now be diagnosed as Alzheimer's disease: he was very forgetful, unable to perform ordinary tasks such as dressing himself, and increasingly erratic in behavior and temper. The children were scattered: Laurie lived in South Africa; Leni was in France; Cecily, Janet, and Pat were in England. Grace and Will discussed moving back to England, but remained in Switzerland.

Once again, the family was uprooted and divided by war. Janet's family was visiting Grace and Will in Lausanne when World War II broke out. Janet and her husband, Stephen Michael (a half-Jewish German who had changed his name from Siegfried and recently become a British citizen), quickly returned to England but left the children and their nanny, Nellie Green, with Grace and Will. As the war progressed, Janet urged her parents to come with the children to England. Fearful that his pro-German sentiments would cause him to be arrested in England, Will refused to leave. By early May 1940, Grace admitted that she was not the right person to care for Will in his decline, but she did not want other family members to sacrifice themselves in order to take

³³⁸ D.140/6/4982, GCY to Laurence Young, February 24, 1932. Young Papers.

³³⁹ D.140/6/5205, GCY to Jean Canu, July 21, 1934. Young Papers.

charge of him.³⁴⁰ Two weeks later, she set off with her grandchildren, leaving Will in Switzerland in Nellie's care. Grace managed to get seats for herself and the two children on the last commercial flight from Paris to London before France surrendered to Germany.³⁴¹

Although Grace had intended to return quickly to Will, the family decided, after the fall of France, that the journey would be too hazardous. Happy to be in England, but anxious about Will, Grace devoted herself to taking care of Janet's children. In November, she moved with them "to the wilds of Shropshire" to keep them away from air raids while Janet and her husband remained in London.³⁴² Will's mental and physical health continued to deteriorate. Nellie moved him into a nursing home, in June 1942, and left for England. Will died several days later, on July 7, 1942, at the age of seventy-eight. He and Grace had been married for forty-six years. In an obituary, the mathematician G. H. Hardy called Will "one of the most profound and original of the English mathematicians of the last fifty years."³⁴³

* * * * *

The two themes that had defined Grace's life — devotion to family and intellectual achievement — were still entwined at its end. Janet's daughter, Dorothy, has happy memories of playing and learning to read with her grandmother in England.³⁴⁴ A tower of maternal energy and resourcefulness, Grace managed to get General Jan Smuts, the wartime prime minister of South Africa, to bring the baby booties she had knitted for Laurie's children to him in South Africa during the war.³⁴⁵ Meanwhile, Grace's mathematical reputation and prominence were growing. In March 1944, the fellows of Girton College proposed to make her an Honorary Fellow in recognition of her distinguished and original work in mathematics.³⁴⁶ But before the resolution could be acted

340 D.140/6/5832, GCY to Janet Young, May 2, 1940. Young Papers.

341 Grattan-Guinness, "Mathematical Union", p. 180.

342 D.140/6/5906, Janet Young to WHY, 12 November 1940; D.140/6/5982, Janet Young to WHY, 13 October 1941. Young Papers.

343 Hardy, "William Henry Young", p. 307. <https://royalsocietypublishing.org/doi/10.1098/rsbm.1943.0005>

344 Author interview with Dorothy Sampson, July 27, 1990.

345 Laurence Young, *Mathematicians*, p. 234.

346 Cartwright, "Grace Chisholm Young", *Journal of London Mathematical Society*, p. 191.

on, Grace suffered a heart attack, and died on March 29, 1944, at the age of seventy-six.

Grace's mathematical legacy similarly recognizes her strong commitment to family and mathematics. The London Mathematical Society currently awards two Grace Chisholm Young Fellowships a year to "mathematicians who need support when their mathematical career is interrupted by family responsibilities, relocation of a partner, or some other similar circumstance, making possible some continuous mathematical activity, so enabling the fellow to be in a position to apply for posts when circumstances allow."³⁴⁷ The fellowships provide opportunity and support to individuals who have made choices similar to Grace's when faced with conflict between home duties and professional achievement. They are administered by the Women in Mathematics Committee of the Society, but men as well as women are eligible to apply.³⁴⁸

³⁴⁷ <https://www.lms.ac.uk/grants/grace-chisholm-young-fellowships>.

³⁴⁸ Grace and Will are also memorialized in the Grace Chisholm Young and William Henry Young Award established by their granddaughter, Sylvia Wiegand, and her husband, Roger, to support graduate student research in mathematics at the University of Nebraska, where both the Wiegands began teaching in 1972. Wiegand was the first woman to teach in the department. <https://math.unl.edu/department/awards/graduate#young>.

