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Mary Boole and curve stitching: a look into heaven

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Mary Everest Boole had a lifelong interest in the unconscious mind, the psychology of learning, and how these relate to the teaching of mathematics and science. She recommended many practical exercises and teaching aids, one of which was the technique of curve stitching, which she had invented while still a child herself.

> "I can see nothing except the master pulling back a curtain which had been keeping out the light and leaving me alone to look into Heaven for myself." Mary Boole on her childhood arithmetic tutor, Monsieur Déplace [1]
>
> "The teacher who would educate the mathematical imagination of pupils must begin by cultivating his own" [2]

Mary Everest Boole (1832–1916) had an unusual upbringing (Fig. 1). At the age of five she moved with her family to France. Her father, Thomas Roupell Everest (d. 1855), rector of Wickwar, Gloucestershire, had left England because of his poor health and moved to Paris to be close to Samuel Hahnemann (1755–1843), the founder of homoeopathy. By 1840, the family had settled in the more rural setting of the Chateau de l'Abbaye at Poissy, where Mary seems to have survived rather than thrived under the strict homeopathic system followed in the Everest household. Mary was sent for a short time to the village school run by Madame Déplace, but her parents soon decided to educate her at home. It was at this point that she began to receive lessons in arithmetic from Monsieur Déplace, whom she idolized as the 'hero' of her childhood. She recalled of an arithmetic lesson, 'The master told me nothing, he asked me a succession of questions and made me write down each answer as I gave it, and then let me perceive that the answer to the complicated question on which we had started came out of its own accord in my own handwriting.' [3]. Déplace's method of teaching would later form the core of Mary's beliefs about how mathematics should be taught.

When the family returned to England in 1843, Mary went to boarding school for a while but soon returned home where she assisted in her father's parish, teaching in the Sunday school and copying out his sermons. At the age of eighteen, while on a visit to Ireland, she met George Boole (1815–1864), a 35-year-old professor of mathematics at Queen's College, Cork. Boole, a brilliant and largely self-taught mathematician who had opened his own school by the age of 20, shunned traditional methods of learning by rote, favouring a more practical approach. In spite of differences in age and background, Mary and George found common ground in their shared interest in mathematics and science, and especially in their shared approach to learning. Mary recalled telling George about her introduction to differential calculus at the age of 16. She couldn't understand the method as described in the book she had been given, but then found an old book on fluxions which she understood easily. Her father, on discovering her reading the fluxions book, took it away, explaining that the notation was old-fashioned, inconvenient, and no longer used at Cambridge. She went back to the first book but now found it perfectly clear. George commented that while differential notation was indeed more convenient, it was less clear 'as to the philosophy of procedure' and moreover,

Fig. 1. Mary Boole. Reproduced from [6].

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that no young person should see a differential book without first studying fluxions [4].

In 1855, after the death of her father, Mary married George, and over the next nine years they had five daughters. In 1865, a year after George's death, Mary began work as a librarian in the first English ladies' college, Queen's College in Harley Street, London. She recalled, 'The pupils were all women; the professors all men; women were admitted on the teaching staff only as subordinate assistants.' [5]. Mary Boole may not have been a teacher in name, but she certainly became a teacher to the students who were, for the most part, being educated to become governesses. She held informal weekend seminars in which she discussed her ideas about childhood education with these young women. Her practical advice was based on theories about the role of the unconscious and the psychology of learning gleaned from her own experience. She continued to develop her ideas over the next 50 years and her theories were eventually put into practice, especially in America, by educators such as John Dewey (1859–1952), Francis W. Parker (1837–1902) and Ralph W. Tyler (1902–1994) [6]. Tyler, who was Chairman of the Department of Education at the University of Chicago, said of her, 'Her conceptions of child psychology and of learning, as well as her understanding of the psychological nature of mathematics and science, make her a pioneer in this generation as in the last.' [7].

There is no precise record of when Mary invented curve stitching, but her own account suggests that she was still quite young. In her book, *The Preparation of the Child for Science* (1904), she described how the idea took shape:

> In my young days cards of different shapes were sold in pairs, in fancy shops, for making needle-books and pin-cushions. The cards were intended to be painted on; and there was a row of holes round the edge by which twin cards were to be sewn together. As I could not paint, it got itself somehow suggested to me that I might decorate the cards by lacing silk threads across the blank spaces by means of the holes. When I was tired of so lacing that the threads crossed in the centre and covered the whole card, it occured to me to vary the amusement by passing the thread from each hole to one not exactly opposite to it, thus leaving a space in the middle. I can feel now the delight with which I discovered that the little blank space so left in the middle of the card was bounded by a symmetrical curve made up of a tiny bit of each of my straight silk lines; that its shape depended upon, without being the same as, the outline of the card, and that I could modify it by altering the distance of the down-stitch from the up-stitch immediately preceding. As the practical art of sewing perforated card was already quite familiar to me, my brain was free to receive as a seed the discovery I had made, and to let it grow naturally; all the more because no one spoke to me then of tangents, or tried to teach me any algebraic geometry, till some years had elapsed. Therefore, when I did begin to learn artificially about tangents, the teacher was not obliged to put cuttings into raw soil; he found ready a good strong wild stock of living interest in the relation between a curve and the straight lines which generate it, on to which he was able to graft the new knowledge. The teacher came, not as an outsider thrusting on me the knowledge of something unfamiliar and strange; but as a brother-seer more advanced than myself, who could show me how to make further progress on a path which I had already entered with delight [8].

Looking at a complex curve stitched design like a cardioid (Fig. 2), it may seem hard to believe that a child could do it, let alone come up with the idea. But, as the author of a brilliant practical book on the subject remarked, 'First and foremost it is a handicraft which is accessible to quite young children and which can be enjoyed without any need to understand the mathematical fundamentals which lie beneath.' [9]. Indeed, Mary Boole recommended it as an activity for children in kindergarten [10]. For one thing, Boole realised that it is easier to 'sew' a straight line than to draw one. Moreover, the underlying mathematical principle seems to present

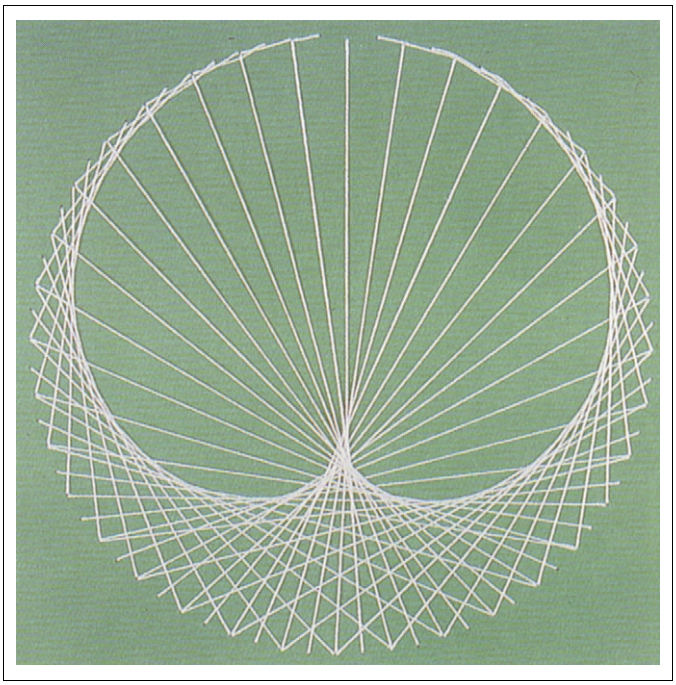

Fig. 2. Cardioid. Reproduced, with permission, from [9].

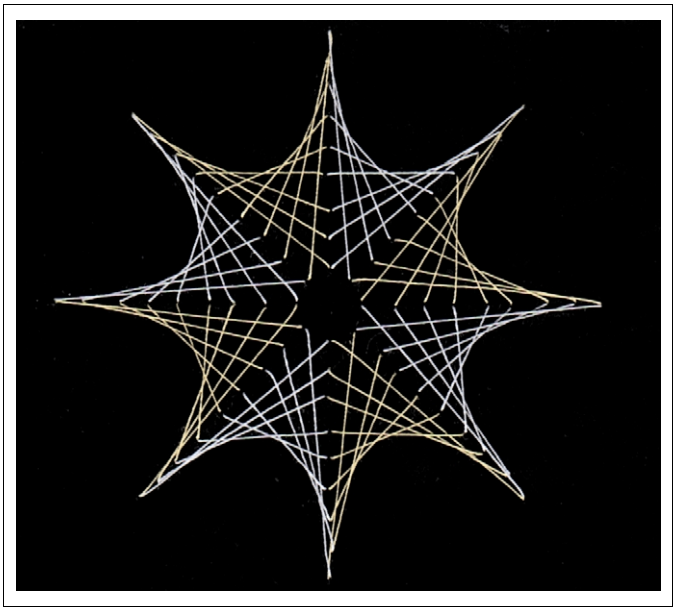

Fig. 3. Eight pointed star, stitched by the author's ten-year old son.

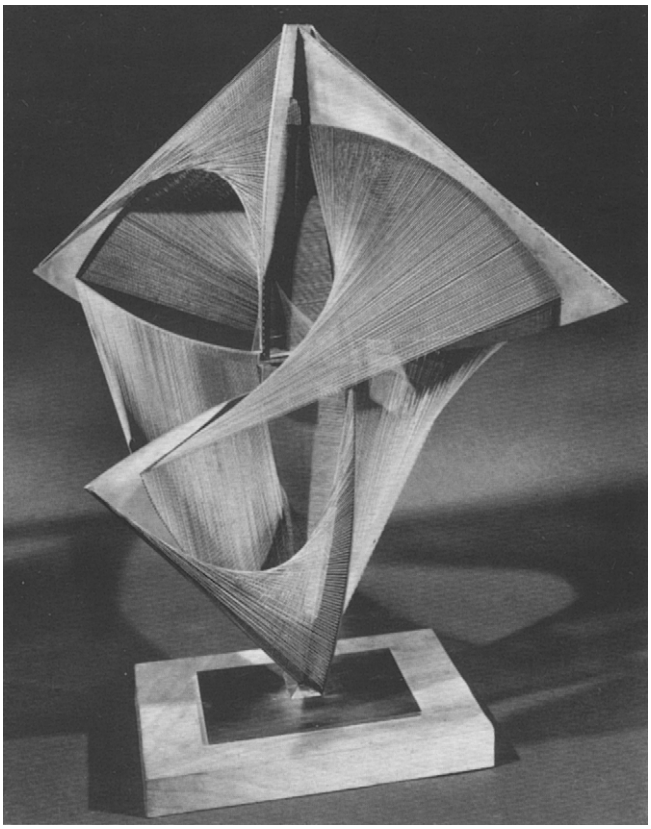

Fig. 4. Curve stitching in art. Naum Gabo's 'Torsion Variation'. Reproduced, with permission, from [9].

itself effortlessly. After looking at a few of the designs in Jon Millington's book [9], my own child, who was nine at the time, remarked, 'Cool, but you know, Mum, there really aren't any curved lines.' (Fig. 3). This apprehension, unmediated by any explanation of a rule or instruction about what 'should' be seen is exactly the sort of unconscious knowledge that Boole felt was accessible to everyone from an early age, and which would prepare the ground for later teaching. She remarked, 'In its essence, the tangent is a sublime effort of the scientific imagination; it pictures the result of a sudden cessation of the action of gravity. In practice, the tangent is a convenient line for indicating the curvature at any given point.' [11]. The beauty of curve stitching is that it encompasses both the sublime and the practical; it excites mathematical and artistic imagination but requires only the most basic skill level (Fig. 4).

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