



Triangular Relationships

Dr Patricia Fara

4 November 2010

I feel honoured to be giving this annual lecture for the British Society for the History of Mathematics.

I am going to be talking primarily about the end of the 18th Century this evening, but will start in what might seem rather an odd place. Several years later, in 1860, there was a notorious debate at Oxford between Bishop Samuel Wilberforce - he was nicknamed Soapy Sam, he was an eloquent, reactionary campaigner who objected to Darwin's theory of evolution - and Thomas Huxley, who was known as Charles Darwin's bulldog, because while Darwin liked to stay at home, in the safety and security of his house at Downe, in Kent, Huxley went out and championed his new theory of evolution.

So, allegedly, after failing to defeat his opponent on scientific grounds, Wilberforce, famously, resorted to enquiring whether it was from his grandfather or his grandmother that Huxley was descended from a monkey. This has become a notorious jibe, but the follow-up is not quite such a well-known story. 13 years later, Huxley got his final revenge. Wilberforce fell off his horse and died, and Huxley quipped that Wilberforce's brains had "at last met reality, with fatal results".

There is a fascinating caricature - one of my favourites - of Charles Darwin, which was the result of an image competition that was run by the British Society for the History of Science.

So, the same year as the debate in 1860 at Oxford, Wilberforce published, anonymously, a very vitriolic review of Darwin's book "On the Origin of Species." It is a very long review. Wilberforce was the sort of person, like many other Victorians, who never said anything in one word when he could provide 10 instead. This paper goes on for a long while, but right at the end, there is a much longer version of the jibe at Huxley about Huxley's grandparents, and this time, it was directed at Erasmus Darwin, who was Charles Darwin's grandfather.

Wilberforce joked that Charles had inherited ridiculous opinions from "his ingenious grandsire". To back this up, Wilberforce reproduced a long extract from a poem called "The Loves of the Triangles" which is going to be the main subject of my talk this evening. It was a three-part poem that parodied the ideas of Erasmus Darwin.

Wilberforce claimed, in this review in 1860, that it would be very familiar to many of his readers. I asked several people at Cambridge who are Victorian specialists and none of them had heard of it. However, I went into several online sources, and I very quickly found that this poem, "The Loves of the Triangles", was repeatedly referred to throughout the 19th Century, and even into the 20th Century, when G.K. Chesterton wrote about it. So, it was a poem with a very long life.

The title refers directly to a poem by Erasmus Darwin, which is called "The Loves of the Plants". Rather confusingly, "The Loves of the Plants" initially came out as the first part of a two-part poem called "The Botanic Garden", but Darwin then switched the order round. So the first part is called "The Economy of Vegetation" and the second part is called "The Loves of the Plants the frontispiece of "The Loves of the Plants", shows Flora at play with Cupid, from which you can infer, probably correctly, that this is a semi-erotic poem about women and plants.

This is an extract. I am not asking you to like this poetry. I am just asking you to appreciate that, at the end of the 18th Century, it was very popular and it sold an awful lot and came out in many editions.

"Meadia's soft chains five suppliant beaux confess,
 And hand in hand the laughing belle address;
 Alike to all, she bows with wanton air,
 Rolls her dark eye, and waves her golden hair..."

It goes on in similar vein for many pages - for four cantos.

Now, "The Loves of the Triangles" was shorter, but it was written by three young men who had just left university, and they clearly really enjoyed themselves satirising Darwin. I am going to show you a couple of their verses.

"...And first, the fair Parabola behold,
 Her timid arms with virgin blush unfold!
 Though, on one focus fix'd, her eyes betray
 A heart that glows with love's resistless sway..."

So, it is a sort of mathematical pornography - if you can imagine such a contradiction in terms!

This is another typical verse as I wanted to give you a flavour of the poem.

"...For me, ye Cissoids, round my temples bend
 Your wandering Curves; ye Conchoids extend;
 Let playful Pendules quick vibration feel,
 While silent Cyclois rests upon her wheel..."

This came out in a journal but was reproduced many times in books at the end of the 18th Century.

At the bottoms of the pages of "The Loves of the Triangles", there were very long footnotes, and those footnotes were, in themselves, a parody of Erasmus Darwin's poem as his poems also had very long, scholarly footnotes. The three young writers who wrote this parody really went to town in the footnotes, although it is rather difficult for us to interpret now.

So, I am going to show you those two consecutive lines.

"...How Loves and Graces in an Angle dwell; *
 How slow progressive Points protract the Line...**"

You can see the asterisks at the end of the line, and that was how people did footnotes in those days. They did not have little ones and twos and threes like we do. They had symbols, like asterisks.

The second footnote, I managed to work out fairly quickly. The last line has got a pun about the "pebbly channel", and I knew that, because I am so ancient that I did Latin at school, "calculus" was the Latin for a "pebble".

The first footnote I found rather more difficult to decipher, but I discovered, thanks to Google, that it is a line from Horace, which means "the sweet laughter of a girl hiding in a secret corner".

For these 18th Century writers, there would be no point in having footnotes which were so incredibly complicated to work out. 18th Century readers would have immediately understood these jokes, and that this was something that was very witty and funny. They came out on a weekly basis, so it was something that these young people tossed off, I imagine, when they had had a couple of drinks. All their readers would have laughed at them, although they are very difficult for us to decipher now.

One challenge for me has been to try to work out what some of the footnotes mean, and I have completely given up on many of them. However, there is a far more interesting question to ask about Darwin's poem which nobody has really asked, and that is: why did these three young men go to so much bother to parody Erasmus Darwin and a poem about plants?

I will tell you a little bit about the journal first. It was a very pro-Pitt journal and one of Pitt's major political platforms was to protect the British establishment against the French Revolution.

In 1792 there was another cartoon by Rowlinson, called "The Contrast", which made an exaggerated contrast between the ideals of British traditional liberty, and French radical liberty. He portrayed the enormous misery that the French were supposedly living in under the Revolution.

At first, in 1789, many British people had supported the French Revolution. They recognised its ideals and endorsed it, but particularly after the Terror started, from about 1792 onwards, there was an enormous backlash. People, especially wealthy conservative people with a lot to lose, were very concerned that all this revolutionary activity might come over the channel. So anybody with even vaguely radical ideas was slated as a Jacobin - to be a Jacobin became a term of abuse.- and so, this gave its name to the "Anti-Jacobin", the paper in which "The Loves of the Triangles" appeared. It was a political journal that was very pro-Pitt and very anti-French.

Here is another verse from "The Loves of the Triangles", where the satirists have given up the mathematical pornography; they got rather bored of that after the first instalment. Here, they were inciting panic about Napoleon's preparations for war against Britain, and they imagine him preparing a fleet to invade the island.

"...Nor long the time ere Britain's shores shall greet

The warrior-sage with gratulation sweet;

Eager to grasp the wreath of Naval Fame,

The Great Republic plans the Floating Frame!..."

So, my challenge is to understand why Erasmus Darwin, a Midlands doctor with a passion for botany, poetry and invention, should he have been the target for this very conservative, Francophobic publication. That is my basic question, I am still exploring it and I am currently writing a book on the poem. In this lecture, I will tell you some of the answers that I have come up with so far.

As triangles have three sides and three angles, I thought I ought to divide the talk into three parts: quantification, progress and slavery. There were also three Anti-Jacobin satirists and the poem appeared in three instalments.

I will show you a verse from Darwin about the number three.

"...The freckled iris owns a fiercer flame,

And three unjealous husbands wed the dame..."

I have the direct satire by the "Anti-Jacobin", and you can see very clearly the political ideals and the reflection on the French Revolution.

"...Three gentle swains evolve their longing arms,

And woo the young Republic's virgin charms..."

So even when this was mathematical satire, it was, at the same time, very much political satire, and want to explore that relationship.

As well as having triangles in its title, the "Anti-Jacobin" poem plays on other very famous threesomes, such as the Three Witches in Macbeth and Lear's three daughters. In fact, they go into a sort of riff on the number three.

The first section of my talk is about quantification. Triangles were, of course, emblems of enlightenment during both the French and the American Revolutions. There was this new trinity, almost a holy trinity, of liberty, equality, and reason.

In addition to that, the satirists' choice of mathematical imagery for their poem is, in itself, a mathematical statement.

At a very general level, throughout the 17th and 18th Century, the British juxtaposed themselves with French rationalism. This rationalism was emblematised through the garden at Versailles, with its geometrical layout, and contrasted with English country gardens, of men such as Capability Brown, which, allegedly, were completely natural, only of course they were actually very carefully and artificially contrived to look natural. This mathematical approach, towards the end of the 18th Century, in England, came to symbolise the power of the state and these new rational procedures that were displacing traditional British liberties.

So, for example, there was great hostility in Britain towards excisemen, who were using very accurate instruments to tax beer according to its alcohol content. Measurement was seen, in principle, as a threat to local autonomy and its replacement by centralised power.

Triangles themselves had a more specific significance. Triangulation is a surveying technique, in which you lay out imaginary triangles on the ground in which each apex is visible from a fourth external high point. Surveyors then measure the baseline and the three angles, and that enables them to work out the lengths of the other two sides. You can have a chain of triangles sort of snaking across the countryside.

In the year that this parody appeared, two French astronomers were just completing a triangulation project to determine the length of the metre, by measuring a line of longitude. Of course, measuring the metre is, ideologically, a very rational measurement because instead of taking an arbitrary unit of length, you are defining it by the dimensions of the Earth itself. It is a rational form of measurement. However, in Britain at least, it was seen very much as a French nationalist project, partly because the method of triangulation had been adopted against the British preference, which was a method based on pendulums. Also the French had, rather conveniently, decided that there was only one line of longitude that would be suitable for making these measurements, and that was a line of longitude through France.

I always think it is rather interesting that one of the astronomers made a mistake while he was doing all this triangulation, but he was so embarrassed that he never told anybody, so the metre that ended up being on display in Paris was actually slightly the wrong length.

There was a French revolutionary poster advertising the new metric measurements. The picture at the top showed how litres, grams and metres were replacing pints, pounds and ohms, which were one of the French measurements; and at the bottom, there were ways of measuring wood and money.

From a modern point of view, the metric system does seem greatly preferable to all those yards, feet and inches, and all those interminable sums that I had to do in primary school with 12s, 20s, 36s and 8s. However, it was perceived, at the time, as a way of controlling from the centre, because all the different regions of France had had their own individual measurements. Obviously, it is more rational to impose one single metric system over the entire country, but it is a way of suppressing local identity because all the provinces were forced to follow the Parisian regime.

From a British perspective, it implied imposing artificial order on a centuries old system that was based on tradition and also on human dimensions, such as feet and inches.

The revolutionaries also introduced decimal time. A contemporary British poster showed a familiar clock with 12 hours. However, at the top, there was a revolutionary clock, with 10 hours. In particular, note that the revolutionary figures were depicted wearing red caps, the bonnet rouge of the revolutionaries, which were known as Phrygian caps. They were a symbol of liberty and revolution in Paris, but in Britain, they became a symbol of Jacobin insurrection. I think the Parisians hated the 10-hour day because that came with a 10-day week, which meant that the working week was considerably extended. From a British point of view, it was very sacrilegious because it was replacing the seven-day week which was laid down in the bible.

So there was a lot of opposition to the French Revolution and to the new measuring systems. In Britain, one of the most vocal, prominent people articulating this resentment against the French Revolution was Edmund Burke, the Irish politician. He wrote a bestselling book called "Reflections on the Revolution in France", which came out in 1790, and he commented that the variations between different parts of France "...render mensuration a ridiculous standard of power-and equality in geometry the most unequal of measures in the distribution of men." So what he meant by this was partly what I mentioned earlier: people in different parts of the country had been using different measuring systems, so the imposition of the centralised system of the metre was stamping out local identities.

There were also debates, at the time, about reforming the electoral system, by making constituencies of equal population.

Burke was not the only person who objected to the French Revolution. You do not normally think of encyclopaedias as being hotbeds of political activity, but the frontispiece of the Third Edition of the Encyclopaedia Britannica, was advertising the classical traditional ideals of classical Rome and Greece. They brought out a two-volume supplement in 1801, and the main purpose of the supplement was designed to counteract the influence of the French Encyclopedie. So, according to the Encyclopaedia Britannica, the French Encyclopedie was "a pestiferous work" that disseminated "anarchy and atheism".

There were very contrasting views towards mathematics in France and in England at the end of the 18th Century. In France, mathematicians and physicists were very interested in using calculus, and that was totally looked down on in England, and did not appear in England until well into the 19th Century. The French mathematical methods, according to the British, were like the French themselves - they were flowery, they were superficial, and they were ostentatious.

The Encyclopaedia Britannica was also very scathing about botany and said: "...A man would not naturally expect to meet with disgusting strokes of obscenity in a system of botany, but...obscenity is the very basis of the Linnean system..."

In case you had not noticed the obscenity in the Linnean system before, I will explain it to you. Linnaeus wanted to quantify and rationalise the way that plants were classified, and the basic system he set up had 24 classes for male stamens which were sub-divided by the number of female pistils that the flower has. Of course, it was quite natural for Linnaeus, coming from an Enlightenment society, that the male sexual characteristics should be the major criterion of classification and the female ones the secondary. Everyone was absolutely happy with that, whereas I suspect women might not be now, however, there were several reasons why this was, initially, a very controversial method of classification.

One was that it imposed mathematical order onto God's creation, and that was seen as being rather sacrilegious, and so there were debates about whether people could quantify God's world. In England, although not in France or on the Continent, there was a lot of hostility because this was a sexual classification and botany was a science that women were encouraged to practise. However, Linnaean botany was seen as being very dangerous because it was encouraging women to think about sex.

Botany, like other sciences, also had political implications. Joseph Banks was President of the Royal Society and sailed with Cook to Australia as a botanist. That is why Botany Bay is named after Banks. He was depicted as having wings with shells on, and in his left wing, near his shoulder, the shell was replaced by a Phrygian cap of liberty and he was wearing the red, white and blue of the French revolutionaries.

Another example of a political caricature showed, in the centre, a yellow cornucopia in the shape of the red cap of liberty, called "The Cornucopia of Ignorance", and had four red-capped citizens holding it up. It was a political horn of plenty and is shown disgorging books and newspapers that were written by so-called Jacobins - I said it was a term of abuse - such as William Godwin, Mary Wollstonecraft and Coleridge.

Immediately behind the cornucopia there was a street vendor with a basket on his head, and it had plants growing out of the basket. The flower basket was labelled "Zoonomia or Jacobin plants" and these were not any ordinary plants - they blossomed into the bonnet rouge and the tricolour cockades of the French revolutionary. Also, "Zoonomia" was the title of a two-volume book that Erasmus Darwin had written on medicine and which contained, towards the end, some very radical suggestions about life, evolution and the creation of life.

This was actually the central portion of a much larger cartoon by Gillray for the last volume of the "Anti-Jacobin" so it appears in the same publication as "The Loves of the Triangles", and there are a few familiar features.

There was a sort of crocodile thing at the front, wearing stays, and that represents Tom Paine, because he was originally a corset-maker and he came from Norfolk, and he was one of the staunchest supporters in England of the French Revolution.

There were also two frogs. Frogs initially represented Dutch men, but by this stage, frogs symbolised French men, and they were shown holding up this sheet of paper, headed "blank verse", which I assume was a reference to Darwin's poetry.

Every character in that caricature can be identified, and there were three other politicians, waving their red caps of liberty on top of a rather grotesque monster.

So, those are some examples of how quantification had political implications, and I am going to show you a rather different version. A Dutch naturalist called Peter Camper was very influential in Britain. His book came out, in English, at the end of the 18th Century. He was an anti-slavery campaigner, and what he claimed that he set out to do was to use measurement to show how small the differences are between people of different races by producing a series of images of the skull. He measured the sort of facial angle, the angle at which your nose and your forehead slope back, and he performed some geometrical transformations, and he managed to display skulls on continuous scales, ranging from orang-utans through to Black Africans and then he ends up, on the right, with the epitome of beauty, which is the Greek Apollo -

divine perfection, for a white European at the end of the 18th Century. Whatever his intentions might have been, these quantified, measured diagrams of skulls ended up supporting a lot of the racial discrimination that was prevalent throughout the 19th Century.

So, my initial question was why did these three "Anti-Jacobin" satirists bother to write "The Loves of the Triangles". I have outlined some of the reasons why maths, measurement and botany had political implications, and I think that goes some way towards answering my question, but I am now going to change tack and talk about progress, because the satirists presented "The Loves of the Triangles" as a sequel to the poem called "The Progress of Man". "The Progress of Man" was a didactic poem, dedicated to R.P. Knight Esq. who is best known now as a landscape designer. However, he had also written a long rhyming poem, rather like Darwin's, which was rather tedious, called "The Progress of Civil Society", which expressed evolutionary views. He had also scandalised everyone. He was an extremely knowledgeable antiquarian and he had published a book about religious cults of phallic worship, and this book was very scandalous, so he was rather an ostracised man, although he did become very famous for being a landscape designer.

I think we are so used now to evaluating everything in terms of progress. There is that awful phrase "we're going to progress the company forwards" - progress is always seen as positive. I think it is difficult to remember that it was not always seen in that way so I am going to just do this sort of brief race through Renaissance Europe, where there were basically two ways of thinking about time.

One of them, you could symbolise by Ouroboros, the serpent biting its own tail. It recalls the Greek attitude towards time which thought that there was a cyclical universe that kept recurring, rather like the annual seasons on a grand cosmic scale. That was one tradition coming into 18th Century Britain.

The more familiar view is the Judaeo - Christian belief, that God formed the world in a specific moment of creation. So, in this version of time, time flies like an arrow, shooting out from its origin in one direction, and it ties in very closely with modern cosmology - the idea of the Big Bang fits very well with this model, but there is a crucial difference. The bible states that the universe was originally created as it is now, whereas Big Bang theorists believe that the universe has been developing ever since its beginning.

I think this faith in progress, both in the universe and in society, has become so ingrained that we forget that in the 18th Century, it was still quite controversial. It is often called the luxury debate. A lot of people were very opposed to the idea of progress.

A very famous picture, by Joseph Wright of Derby, "An Experiment on a Bird in the Air Pump" encapsulates some of these tensions. The lecturer is dressed in red, and he has an evacuated globe in which there is a bird, a white cockatoo, inside it, which might represent the holy dove - the Holy Spirit. He has his hand on the stopcock, and he can choose either to let the air in and the bird will live, or he can keep the stopcock closed and the bird will die. The mixed reactions of the people round the experiment are clear for all to see. A couple, over to the left, who have been identified, had just got engaged and they really could not care about anything except each other, so they are not interested in any of this at all. There are mixed reactions from two little girls, two sisters, one of whom is fascinated and the other who is looking away in absolute horror.

It encapsulates, for me, some of the questions that people were asking in this period: did technological advance necessarily bring moral improvement? They worried that, perhaps, with too much convenience and luxury, people would lapse into decadence and moral decay.

In the wake of the French revolution, the anti-Jacobin propagandists were challenging the value and meaning of progress. They were threatened by a very unstable political situation, and so they sought safety in maintaining the status quo, rather than venturing into a future which was uncertain and which also might possibly be a Frenchified future.

Erasmus Darwin was definitely on the side of progress, and he praised the technological inventions of his friends in his poetry. Cotton spinning, for example, represented progress.

"...With quickened pace, successive rollers move,

And these retain, and those extend the rove;

Then fly the spoles; the rapid axles glow;

And slowly circumvolves the labouring wheel below..."

The anti-Jacobins' version of these lines stressed traditional ways, like cooking the roast beef, a very traditional English meal, and they also were mocking his clunky poetry.

*"...The spiral grooves in smooth meanders flow,
Drags the long chain, the polished axles glow,
While slowly circumvolves..."*

I cannot imagine anyone else except Darwin ever writing "circumvolve"!

*"...the piece of beef below:
The conscious fire with bickering radiance burns,
Eyes the rich joint, and roasts it as it turns..."*

However, from the anti-Jacobin point of view, Darwin's views on technological progress were not nearly as bad as his ideas about social and physical progress. Earlier, I mentioned that he had written a two volume textbook on medicine, called "Zoonomia", and most of it was very highly regarded. However, near the end, he included some very controversial ideas. For example, "...all nature exists in a state of perpetual improvement..." The idea that nature itself was progressing and changing aroused the most offence and was most often reproduced as being very sacrilegious.

So: "...in the great length of time, since the Earth began to exist, perhaps millions of ages before the commencement of the history of mankind..." That was an extraordinary thing to be saying at the end of the 18th Century. "...Would it be too bold to imagine that all warm-blooded animals have arisen from one living filament..." - also, that phrase, "one living filament", ran him into a lot of trouble - "...which the great first cause," God, "endued with animality, with the power of acquiring new parts, attended with new propensities...and thus possessing the faculty of continuing to improve by its own inherent activity..." - so this was materialism, the idea that matter could improve itself was absolutely sacrilegious at this period - "...and of delivering down those improvements by generation to its posterity, world without end!..." It was a very clear statement of an evolutionary principle.

The "Anti-Jacobin" wrote an extremely long footnote about this quotation of which I will show you two sections. The first one is the mathematical version:

"...We may conceive this Primeval Point, evolving itself by its own energies, to have moved forward in a right Line, ad infinitum, till it grew tired, after which, the right Line, which it had generated, would begin to put itself in motion in a lateral direction, describing an Area of infinite extent, capable of containing the present existing Universe..."

This probably makes about as much sense as Darwin's original statement, but they obviously had a lot of fun writing that!

They went completely to town, a few lines later:

"...It seems highly probable that the first effort of Nature terminated in the production of Vegetables, and that these supplied themselves with wings or feet...in time, would restrict themselves to the use of their hind feet: their tails would gradually rub off by sitting in their caves or huts..."

This was a complete mocking of evolution.

One of the reasons why this poem worked so well as a satire was that it was not exclusively aimed at Darwin. Darwin was not the only person talking about evolution and other radical ideals. They set Darwin up as a target but other people were talking about progress as well.

For example, Joseph Priestley, the very famous chemist who discovered the gas now known as oxygen, wrote:

"...It is nothing but a superior knowledge of the laws of nature that gives Europeans the advantages they have over the Hottentots. Science advancing as it does, it may be taken for granted that mankind some centuries hence will be as much superior to us as we are now to the Hottentots."

So, there was this idea that knowledge was improving and that British society was improving. Also, the thought was that the whole of mankind was improving and progressing as well. This idea of racial progress, which Priestley was articulating, was closely associated with the ideals of political and social progress expressed by the French revolutionaries, and one caricature expressed it effectively.

It was a view from the North Pole, so America was on the right and France was on the left. It showed a Jacobin revolutionary on one side and the Devil, who was black, on the other. It was linking slavery with the American and the French Revolutions, and its immediate inspiration was a slave rebellion in the French colony of St Domingue, on what is now known as Haiti. This was a Caribbean uprising and had been directly promoted by the one in Paris. For wealthy British people, the implications seemed very clear: that the spirit of insurrection might not only cross the Channel but might also infect workers on plantations near St Domingue that were owned by the British people's own friends and relatives who might be massacred like their French counterparts had been. While the French and the American Revolutions seem very different to us, they were both linked with slavery and those three questions were very closely bound together at the end of the 18th Century, which is why I am now going to talk about slavery.

The most obvious triangular relationship in this period was the triangular slave trade across the Atlantic. Textiles were exported to Africa from Britain, where they were exchanged for gold that had been mined by black Africans, and then the gold and slaves were sent across to the plantations in North and South America. They mined silver and produced sugar, tobacco and other crops, which were exported to Europe and made the slave owners extremely wealthy. It was a sort of global triangular slave trade, with slaves effectively acting as a form of currency. In Africa, the rate of exchange was roughly one slave to one gun.

In Britain, the movements to abolish slavery started in the 1770s and they focused on what was called the "Middle Passage", which was when slaves were transported from their African homes to the American plantations.

A piece of abolitionist propaganda, and was a diagram of a very closely packed ship, which was a masterpiece of geometrical planning. The allowance per slave was five foot by 11 inches by 23 inches in height, so officially, this particular ship could have 482 slaves crammed in, lying down, although it sometimes carried over 600. There was one absolutely horrendous occasion, a ship called the Zong, where the captain threw 133 slaves overboard for insurance policies. They were reported only as numbers and in terms of their monetary values, not as individual names, which remain unknown. This was very characteristic of the slave trade.

On each rack where a slave would lie only had a number on it. That is how the slaves were identified. They were numerical quantities being shipped across the Atlantic.

These are quotations from the diary of a slave trader, when he was anchored just off the African coast, and they had picked up some slaves.

"This day, buried a fine woman slave, number 11, having been ailing some time. Sent a girl, ill of the flux, number 92, on shore. This morning, buried a woman slave, number 47."

So this is how slaves were thought of, in terms of their numbers, their monetary value, how they could be set off against insurance, rather than by their names.

So, the triangular slave trade hinged on sugar, and consumption absolutely rocketed in Britain. By 1790, they were exporting four kilograms of sugar per year per person, which was more than the rest of Europe combined. The poet Robert Southey called tea "the blood-sweetened beverage", by which he meant the sugar was literally stained with the blood of slaves, because the leaves of the sugar cane were very sharp and so slaves' arms were literally being cut and they were dripping blood into the sugar; but also, metaphorically, the tea was sweetened by sugar which involved slaves dying.

In the West Indies, you could buy a slave for two-thirds of a ton of sugar. So, from the plantation owners' point of view, it made economic sense to work the slaves to death in a few years and then just simply buy another one.

Rather like the modern Fairtrade movement, it became very fashionable to support the slaves in the West Indies by boycotting sugar.

Another caricature showed George III, with his wife Charlotte, and the daughters looking terribly dismayed because they were not getting any sugar in their tea. King George was saying, "Oh, delicious, delicious!" and the Queen was telling them how good tea tasted without sugar. You can see she had her teeth filed into points, and she was very bony, so it was implying that they were acting out of miserliness rather than out of fine feeling, so that was why they were economising on sugar.

The boycotting the sugar movement was run, to a large extent, by just ordinary families. A lot of women were very involved in it.

During the 18th Century, there were probably around 10,000 blacks living in England, and they were very often given classical names like Pompey or Socrates. It was a very patronising, condescending thing to do. I found this little statute called Aesop, in the Fitzwilliam Museum in Cambridge.

I think we think of slavery as being an American phenomenon, but it flourished in Britain, with very little opposition, for well over a century, and it was legal in Britain right up to the 1770s.

Darwin came from Lichfield, near Derby, in the Midlands, and there were advertisements, from 1772, for slave auctions in his home town of Lichfield. People like Darwin must have been aware that this trade in slaves was going on in Britain itself up to the 1770s.

In his poem, "The Botanic Garden", Darwin reproduced a picture of the very famous medallion by his friend Josiah Wedgwood, with the slogan "Am I not a man and a brother?" It became the first sort of political logo, the picture and the first political slogan really, and Darwin wrote some lines to go with it.

*"The slave, in chains, on supplicating knee,
Spreads his wide arms, and lifts his eyes to thee;
With hunger pale, with wounds and toil oppressed,
"Are we not brethren?" sorrow chokes the rest...."*

Darwin's description appears in the middle of a long poetic tirade about political oppression in Europe.

In an aforementioned cartoon Darwin's slave is asking, "Are we not brethren?" but for Darwin and for his Enlightenment readers', brotherhood did not imply equality. I think the right to vote now seems one of the most fundamental in a democracy, yet all sort of restrictions were in place. You had to be over 21, you had to own property, and you had to be a man, so brotherhood definitely excluded sisterhood.

The most famous slogan promoting Enlightenment brotherhood originated in the French Revolution - liberty, equality and fraternity - another example of how slavery and the French and the American Revolutions, at the time, were linked together because political equality and racial equality were very closed allied.

I will not tell you all of Darwin's verses on this theme because it goes over pages, but I will summarise it. In effect, Darwin was expressing the same associations as in the caricature, linking slavery with the French and the American Revolutions. He personified "liberty" as a warrior, whose first stop had been America, and he wrote that once Benjamin Franklin had slain the vampires of tyranny, Liberty, the warrior, set sail for Europe and France, which he released from its restraining bonds of the Catholic Church and the monarchy.

In the same section as his description of Wedgwood's medallion, Darwin used a biblical metaphor to visualise the sleeping giant of France, triumphantly towering over the ruins of the Bastille.

*"High o'er his foes his hundred arms he rears,
Plowshares his swords, and pruning hooks his spears;
Calls to the good and the brave with voice, that rolls
Like heaven's own thunder around the echoing poles..."*

The "Anti-Jacobin directly parodied, in "The Loves of the Triangles", this bit:

*"...O'er the huge plane gigantic Terror stalks"
The commune spreads, the gay departments smile,
Fair freedom's plant o'ershades the laughing isle;
Fired with new hopes, the exulting peasant sees
The Gallic streamer woo the British breeze..."*

You have the satire of "The Loves of the Plants" in this mathematical poem, which was very much warning the British people about invasion by Napoleon and the French Revolution coming over the Channel.

So, those are some of the answers I have reached so far in my quest to understand "The Loves of the Triangles", and I had absolutely no idea, when I started doing this, that I would end up thinking about slavery and the French Revolution, but that is one of the great delights of research. I do not know if there

are any politicians in this audience who are cost-cutting, but if they are listening, I would urge them to remember that you cannot fund research on the basis of what you know in advance is going to come out of it, so please stop cutting research funding - that is another issue!

"We are," the Anti-Jacobin satirists wrote, "more satisfied with things as they are than Darwin, but less convinced of the practical influence of didactic poems." I think academics are often rather annoying people, because as soon as they see a statement, their first instinct is to think about how can they contradict it! Therefore, I am going to suggest why I think this is wrong, and I am going to suggest that their didactic poem did have a very great influence. To start with, it had an immediate impact on Darwin, and it encouraged him to rework the draft manuscript of his next major book. Initially, it was called "The Progress of Society", and then "The Loves of the Triangles" came out, linking Darwin with Paine, Knight, and this phallic cult and the progress of man. Darwin hated being associated with Knight, a lot of adverse publicity was generated, so to distance himself, he re-titled and rewrote his book and he called it "The Temple of Nature" or "The Origin of Society". It eventually appeared in 1803, which was half a century before another book, on evolution, as "The Temple of Nature", on evolution, with a very similar title, "On the Origin of Species", the title of Charles Darwin's books.

So, of course, I cannot predict or retrodict what would have happened if "The Loves of the Triangles" had not appeared, but, as I pointed out at the beginning of this lecture, its influence did extend right through the 19th Century and into the 20th. I am also not going to speculate, unlike many people, about the influence of Erasmus Darwin on his grandson, but I am going to leave with a puzzle, a question: which Darwin, Erasmus or Charles, wrote these lines?

"...such is the condition of organic nature, whose first law might be expressed in the words, "Eat or be eaten!" and which would seem to be one great slaughterhouse, one universal scene of rapacity and injustice."

So thank you very much for listening - that's the end of my talk.

© Dr Patricia Fara, 2010