# Jane Marcet and the Popularisation of Science in Britain



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> without entering into minute details of practical chemistry, a woman may obtain such knowledge of the science as will not only throw an interest on the common occurrences of life, but will enlarge the sphere of her ideas, and render the contemplation of nature a source of delightful instruction (Marcet I: 3)

# Introduction

The importance of the discursive strategies used in popularising science, more particularly in the nineteenth-century press,<sup>1</sup> has been becoming increasingly apparent in my works dealing with science and culture in Great Britain, especially those concerned with the fictionalisation of science in the nineteenth and twentieth centuries. This paper deals with the way such aspects feature in a book written by Jane Haldimand Marcet (1769-1858), a figure largely forgotten nowadays, but who was widely referred to in the Portuguese press of the mid-nineteenth century as a great populariser of science.

For this reason, the paper will deal briefly, at the outset, with the reception of Jane Marcet's work in the periodical press in Portugal, which associated her not only with the celebrated scientific developments which were taking place in Britain, but also with the role of women in Victorian society. Secondly the paper will focus, in greater depth, upon the discursive strategies used to propagate scientific knowledge by Mrs. Marcet in her book entitled *Conversation on Chemistry* (1805), which was a real best-seller at the time. The paper will discuss to what extent the recourse to such strategies, ostensibly used with the aim of propagating scientific knowledge, achieved its goals. Although it is a fact that the book was an enormous sales success, being accessible to the public and even popular, it does not follow that the author was guilty of oversimplification of language or content. For the dividing line between the "scientific" dissemination of Science and the so-called vulgarisation or popularisation of the same is sometimes fainter and more fluid than might at first be supposed.

# 1. English Women and the Advancement of Science in Britain: Echoes in Portuguese Periodicals

The evocation of Jane Marcet in the Portuguese periodical press of the second half of the nineteenth century is to be found in a series of articles which praise the British educational system and the education of women, in particular.

In an era marked by an awareness of the precarious situation of the Portuguese education system and by a profound belief in reforms which would extend state education, the journalists in question held the view that the well-organised British system, traditional yet in touch with the times and provenly successful, was a true model to be emulated. Indeed, according to many cultural and literary magazines, Britain owed its superiority in the world to its education system, as education was seen as an indispensible way of achieving material progress for a nation and intellectual and moral development for its people. Conscious of the backwardness of Portugal compared with what they considered to be the more civilised European nations, these journalists appealed for the country to take advantage of its irrevocable position by learning from the experiments carried out in Britain, and taking a vigorous leap forward to raise the state education system to a place amongst the best in the world.<sup>2</sup>

The comparison between the Portuguese education system and the British model was inevitable. Whilst reforms in Portugal had been revealed as inept, due to the fact that the real problems had never been properly analysed and solved, in Britain, on the other hand, such questions were assessed by specialists and any alterations introduced were not according to the whims of a ill-informed Minister, but in response to the real needs of the country, preserving, rather than destroying for personal reasons, what had worked well and improving in full awareness what had proved to be wanting.<sup>3</sup>

From the exemplary British system, the Portuguese press tended to emphasise female education, which was frequently associated to the intellectual emancipation of Portuguese women.<sup>4</sup> Mediated by the teaching of Hippolyte Taine (1828-1893) in his *Notes sur l'Angleterre* (1872),<sup>5</sup> the Portuguese journalists considered that the education of women in Britain, as it took place both in educational institutions and in the home, was an example to be followed. In an article translated from French and published in the magazine *A Mulher* (Lisbon, 1883-1885), particular attention is devoted not just to learning in the different fields of science but specifically to the practice of fossil collecting:

In the case of both modest and wealthy families, all [the young ladies] learn . . . a lot of natural history, botany, mineralogy, geology; they have a particular inclination for the things of nature; and in the countryside, at the seaside, in their frequent travels, they are able to see minerals, plants, shells and can make collections . . . . so they are better taught, more solidly educated, than our girls are (Taine, "A Mulher Inglesa" 45).

Particularly significant to the topic of this paper are the concrete examples of British women who had distinguished themselves in the Sciences, who were given as models to be emulated by Portuguese women. Amongst them was the famous Mary Somerville (1780-1872),<sup>6</sup> of whom much has been written, but also the less well-known Jane Marcet, the science populariser who is the subject of the present

paper. It is worth recalling what the editor of *A Voz Feminina*, which was published in Lisbon, between 1868 and 1869, wrote about this remarkable woman in one of the articles in her magazine:

> "Conversations on Chemistry", by Mrs. Marcet, is still the work from which one can gather the clearest and most concise notions on that fascinating Science. Without tiring one's understanding, the author makes us familiar with a thousand and one phenomena, and with the thousand and one transformations which go on around us in everyday life (Wood, "As Senhoras Inglesas" 2).

The journalist was referring to the book *Conversations on Chemistry. Intended more Especially for the Female Sex*, published for the first time anonymously in 1805 and which by 1850 would have had 16 editions in England and 23 in the United States,<sup>7</sup> becoming a true best-seller for the first half of the nineteenth century, particularly in the English-speaking world, as there were only three French translations,<sup>8</sup> and no Portuguese translation, as far as can be determined.

Having explained the context of this encounter with Jane Marcet -- the Portuguese press of the second half of the nineteenth century and the relationship of English women with Science, particularly with regard to the education they were given and the role they played in the propagation of such knowledge -- I will now move to the central issue of this paper: the analysis of the discursive strategies employed by Mrs. Marcet in her book *Conversations on Chemistry*. In the preface to the 1805 edition, the author herself sets down her aim of popularising this branch of scientific knowledge, particularly amongst female readers, whilst, at the same time, justifying the title and the discursive strategies she employs:

In venturing to offer to the public, and more particularly to the female sex, an Introduction to Chemistry, the author, herself a woman, conceives that some explanation may be required; . . . frequent opportunities having afterwards [after attending experimental

lectures]<sup>9</sup> occurred of conversing with a friend on the subject of chemistry . . . . Hence it was natural to infer, that familiar conversation was, in studies of this kind, a most useful auxiliary source of information; and more especially to the female sex, whose education is seldom calculated to prepare their minds for abstract ideas, or scientific language (Marcet I: v).

# 2. The 'Popularisation' of Science in *Conversations on Chemistry*: Discursive Strategies

Having chosen to employ an eminently didactic style in the two volumes which make up *Conversations on Chemistry*, Jane Marcet makes use of several strategies which are characteristic of fictional writing (particularly the narrative, but also, in certain cases, the dramatic register) to achieve her aim of disseminating knowledge on chemistry. Hence, at certain times, the author creates the illusion in her targeted readership (female) that they are reading a work of fiction, a novel, perhaps, and not really a scientific treatise.

Right from the start she introduces three female characters and an ambience which might well be familiar to her potential readers: a sweet and knowledgeable governess, Mrs. B or Bryan,<sup>10</sup> and two exemplary pupils, Emily and Caroline.<sup>11</sup>

These three outlined or two-dimensional characters begin to become meaningful and establish differences and affinities between themselves through the words they say. Both the governess and her pupils can be defined by a single trait, a fundamental characteristic which accompanies each of them throughout the whole text. In the case of Mrs. Bryan, the characteristic can be defined as a blend of great wisdom, unflagging sweetness towards her charges and a profound commitment to her task, as she encourages them along the learning process by positive reinforcement. The expressions she uses are demonstrative of such attributes, for example: "my dear Caroline", "very true Caroline, that is an excellent objection", "very well indeed Emily", "you have both explained it extremely well", "you are perfectly right", "very well observed, Caroline", "You are mistaken, my dear" or "you see, my dear, how easily you have became acquainted with these modifications".

Emily and Caroline are absolutely identical as characters, their most salient features being intelligence, an infinite curiosity and desire for knowledge, and enthusiasm as far as new discoveries are concerned. These characteristics are apparent in reoccurring expressions, such as: "but, pray, tell us more", "that is very extraordinary indeed!", "I am very curious to know", "it is wonderfully curious!" or "what a blaze!", but also in the way they formulate questions, make inferences or reach certain conclusions. The following are paradigmatic examples:

#### Mrs. B.

(...) It [the acid] has at present the appearance of a blue liquid; but when the union is completed, and the water with which the acid is diluted is evaporated, the compound will assume the form of regular crystals, of a fine blue colour, and perfectly transparent. Of these I can show you a specimen, as I have prepared some for that purpose.

#### Caroline

How beautiful they are, in colour, form, and transparency!

#### Emily

Nothing can be more striking than this example of chemical attraction. (Marcet I: 18-19)

or

#### Emily

If it is known, then, with which of the electricities [sic] bodies are united, it can be inferred which will, and which will not, combine together?

#### Mrs. B.

Certainly. I should not omit to mention, that some doubts have been entertained whether electricity be really a material agent, or whether it might not be a power inherent in bodies, similar to, or, perhaps identical with, attraction.

Emily

But what then would be the electric spark which is visible, and must therefore be really material?

# Mrs. B.

What we call the electric spark, may, Sir H. Davy says, be merely the heat and light, or fire produced by the chemical combinations with which these phenomena are always connected. (Marcet I: 25)<sup>12</sup>

Simply sketched out as they are, the three characters are totally predictable from the beginning of the second chapter. Indeed, in obedience to their bi-dimensional nature, none of them alters their behaviour in any way during the lengthy narrative, and consequently the reader is never surprised by any enigmatic gesture or contradictory reaction. Mrs. B or Bryan, Caroline and Emily, each correspond to idealised stereotypes of a governess and her two charges, belonging to the uppermiddle class of the beginning of the nineteenth century.

For a writer of science books rather than novels, using two-dimensional characters is not only an easier choice, as it is not necessary to bother with their posterior development, but it also serves the purpose perfectly. In effect, Mrs. Marcet was not interested in attracting the reader's attention with a complex plot, but rather in teaching the basic fundamentals of a branch of science in an undemanding and pleasant way. These outlined characters, therefore, serve her purpose by keeping the reader focussed on the content of the dialogues. Indeed, the voices of the three characters are heard only in direct discourse, through the previously mentioned dialogues. It is through them that the characters carry out the teaching and learning process, express their uncertainty, clarify ideas or exchange points of view regarding certain issues or experiments, whilst simultaneously giving voice to potential doubts, the perplexity or emotion which is shared by the (female) reader or even by specialists. As far as the ordinary reader is concerned, this kind of subterfuge is related to the heuristic methods so often employed in the

transmission of knowledge, at least since the days of Ancient Greece. The following is a case in point:

## Caroline

But in what matter does life enable these organs [organized bodies] to perform their several functions?

#### Mrs. B.

That is a mystery which, I fear, is enveloped in too profound darkness for us to hope that we shall ever be able to unfold it. We must content ourselves with examining the effects of this principle; as for the cause, we have been able only to give it a name, without attaching any other meaning to it than the vague and unsatisfactory idea of an unknown agent.

#### Caroline

And yet I think I can form a very clear idea of life.

#### Mrs. B.

Pray let me hear how you would define it?

#### Caroline

It is perhaps more easy to conceive than to express – let me consider – Is not life the power which enables both the animal and the vegetable creation to perform the various functions which nature has assigned to them?

#### Mrs. B.

I have nothing to object to your definition; but you will allow me to observe, that you have only mentioned the effects which the unknown cause produces, without giving us any notion of the cause itself.

#### Emily

Yes, Caroline, you have told us what life does, but you have not told us what it is.

#### Mrs. B.

We may study its operations, but we should puzzle ourselves to no purpose by attempting to form an idea of its real nature. (Marcet II: 98-99)<sup>13</sup>

On this point, it should be recalled that the dialogic subterfuge is not exactly an innovation in this context. For instance, amongst many works from different

periods, there are the *Dialogues* of Plato, *Dialogo dei massimi sistemi* by Galileo or *Entretiens sur la pluralité des mondes* by Bernard le Bovier de Fontanelle. The use of female characters, alone, in *Conversations on Chemistry* leads one to presume that, in elite circles at the end of the eighteenth and the beginning of the nineteenth centuries, the appreciation of female ability had already attained a relatively high level, probably due to the influence of the Enlightenment and the French revolution, which were both relatively recent.<sup>14</sup>

It is generally accepted that dialogues or the dialogic structure are also an essential aspect of any fictional text. Though always conveying information on a certain activity, generally a scientific experiment performed by the characters, the text under study hinges essentially on the dialogue, i.e. the "conversations" which continually take place between the characters. The discourse is thus made up exclusively of dialogues, segments which Anglo-American critics call "scenes".

In drama this structure is predominant, so it could be argued that Jane Marcet often adopted discursive strategies which are shared by stage writing. From the outset, the author of the text is concealed or disguised, both to the characters and the readers of the book. The immediate and explicit responsibility for the acts of enunciation is assumed by the characters, who communicate with each other and with the readers, without intratextual mediation. Hence it is that any aspects which are presented in descriptive form, such as the experiments, only occur within a dialogic structure, in verbal interaction dominated by performative discourse, i.e. the discourse in which the characters – the enunciative instances –, "do things with words". For example:

#### Mrs. B.

... Ether is of this description [of fluids]; it will boil and be converted into vapour, at the common temperature of the air, if the pressure of the atmosphere being taken off.

Emily

I thought that ether would evaporate without either the pressure of the atmosphere being taken away, or heat applied and that it was for that reason so necessary to keep it carefully corked up?

#### Mrs. B.

It is true it will evaporate, but without ebullition; what I am now speaking of is the vaporization of ether, or its conversion into vapour by boiling. I am going to show you how suddenly the ether in this phial will be converted into vapour, by means of the air-pump. Observe with what rapidity the bubbles ascend, as I take off the pressure of the atmosphere.

## Caroline

It positively boils: how singular to see a liquid boil without heat!

# Mrs. B.

Now I shall place the phial of ether in this glass, which it nearly fits, so as to leave only a small space, which I fill with water; and in this state I put it again under the receiver. (Plate IV. Fig.1) You will observe, as I exhaust the air from it, that whilst the ether boils, the water freezes.

## Caroline

It is indeed wonderful to see water freeze in contact with a boiling fluid! (Marcet I: 111-113)<sup>15</sup>

In *Conversations on Chemistry*, like in a dramatic text, there is an "I" (Mrs. Bryan) who always speaks in direct discourse, to two "yous" (Emily and Caroline), whilst all three perform in a space which they perceive and organise in relation to themselves, using the present tense, to which the past and future are subordinated:

# Caroline

Yes; I know that all bodies are composed of fire, air, earth, and water; I learnt that many years ago.

# Mrs. B.

But you must now endeavour to forget it. I have already informed you what a great change chemistry has undergone since it has become a regular science. Within these thirty years especially, it has experienced an entire revolution, and it is now proved, that neither fire, air, earth, nor water, can be called elementary bodies. For an elementary body is one that has never been decomposed, that I to say, separated into other substances; and fire, air, earth, and water, are all of them susceptible of decomposition.

#### Emily

I thought that decomposing a body was dividing it into its minutest parts. And if so, I do not understand why an elementary substance is not capable of being decomposed, as well as any other. (Marcet I: 7-8)

Whereas there are no stage directions or scene breakdowns, the structure of *Conversations* is entirely made up of responses or linguistic acts performed by the characters, which make up the essence of the text, like in a drama which is intended to be read. Though not described, the scenery can be constructed by the reader's imagination.

In effect the atmosphere or environment in which the dialogues and scientific experiments occur, though not described, can easily be inferred by the reader from the conversations between the three characters. Sharing a friendly relationship, they are part and parcel of a space which has no external interference, and in which they have at their disposal instruments and materials to carry out the different experiments. It is not difficult, then, to imagine a spacious, well-lit drawing room, in a mansion, where two sisters are given private tuition by a kind governess who is extremely well prepared, from the intellectual viewpoint, for the times. Such a *milieu* would not have been unfamiliar to the author. In *Jane Marcet. An Uncommon Woman* (1993), her biographer Bette Polkinghorn describes the impeccable education provided by Anthony Francis Haldemand for his children, at home. Haldeman ensured that his daughters were not discriminated in any way, especially Jane, who showed signs of being intelligent, curious and gifted from an early age.<sup>16</sup>

The biography suggests that, up to a point, Jane may have based the atmosphere in which the characters of *Conversations* interact and converse on her

own experiences as an adolescent. It may, therefore, be affirmed that there is a degree of autobiographical projection in the book, which for this reason, too, is closer to a fictionalised narrative than a compendium on Chemistry.

# Final Considerations: Popularisation or Scientific Dissemination of Science?

By using the discursive strategies which belong to fictional writing, rather than those which would be expected in a compendium or treatise on Chemistry, Jane Marcet created an illusion in the mind of the reader regarding the simplicity of scientific knowledge, which made it more accessible to readers who were unfamiliar with the subject, particularly women. It can be seen, however, that the recourse to these processes and artifices, far from oversimplifying or banalising the subject, was successful both in passing on knowledge about Chemistry, and making it interesting and accessible to the uninitiated reader. Whereas the discursive strategies she employed captured her readers' attention, her success was also due to the surprisingly up-to-date content of the subjects that Mrs. B tirelessly presented for discussion.

In effect the contents of the dialogues are a true treatise upon what was known at the time on Chemistry and other branches of Science which were in any way linked to this area. Indeed, Jane Marcet regularly attended lectures and experiments carried out at the Royal Institution,<sup>17</sup> particularly those of the eminent scientist, Sir Humphry Davy (1778-1829), who is abundantly referred to in Marcet's work. She also had the opportunity to discuss the lectures and to repeat the experiments at home, with her husband, the doctor Alexander John Gaspar Marcet (1770-1882), who, after his wife had inherited an enormous fortune, devoted himself to scientific research.<sup>18</sup> For this reason many of the questions and comments seem improbable when they are placed in the mouths of two adolescent girls of the first decade of the nineteenth century, a fact which Marcet, herself, recognised.<sup>19</sup>

Seen from this angle, the communicative interaction between the characters, though effective as far as the targeted readership is concerned, is somewhat artificial, as it is produced in a peculiar enunciation context and with a specific purpose – to teach chemistry.

Although it is often seen as being less erudite and directed towards a public which was less culturally aware, (particularly if it is compared with the last few decades up to the present), the popularisation of Science at the turn of the nineteenth century was not, in fact, very different from what is denominated as the "scientific" dissemination of Science. Or, to put it a different way, using Stephen Hilgartener's terminology, the difference between "real and genuine science" and "popularised science" is more fluid than one might at first realise (520, 524).<sup>20</sup>

On this point it is curious to verify that in the first edition of the book, published anonymously in 1805, the subtitle was "intended more especially for the female sex" whilst in later editions it was substituted by "in which the elements of that science are familiarly explained and illustrated by experiments." The success of the book was certainly not due to women alone but also to readers with more specialised interests. It may be recalled in this context that the famous scientist Michael Faraday (1791-1867) would recognise the decisive influence *Conversations on Chemistry* had on himself.<sup>21</sup>

Broadly speaking, the fortunes of this and other books by the same author were excellent until the middle of the century, it having been used as a school text book in England and particularly in the United States. *Conversations on Chemistry* was, therefore, widely disseminated, making it comparable, albeit on a more modest scale, with the publication of later works by William Whewell (1794-1866), Mary Somerville (previously mentioned) or even the tremendous impact of *Principles of Geology* by the great geologist Charles Lyell (1797-1875). Moreover, Marcet would also influence the economic and political thinking of Harriet Martineau (1802-1876), particularly with her book *Conversations on Political Economy* (1816), but this, of course, would be a topic for a different paper.

<sup>2</sup> Cf. R.[?], "Administração Pública Interna" and Chagas, "Algumas Reflexões", 56.

<sup>3</sup> Cf. Chagas, "Algumas Reflexões" 18-19, "Algumas Reflexões" 56.

<sup>4</sup> On this question, note the references to the thinking of John Stuart Mill (1860-1873) as he expressed it in *The Subjection of Women* (1869), particularly in the periodical *O Progresso* (1869) whose editor was Francisca de Assis Martins Wood, a woman who had been educated in England and was married to an Englishman. Cf. Wood, "O Que se Faz Lá fora" 213.

<sup>5</sup> On French mediation in the representation of images of Great Britain in the Portuguese press cf. Terenas, "French Mediation", and "A Grã-Bretanha".

<sup>6</sup> Mary Somerville (1780-1872) published several works of a scientific nature, was a member of London intellectual circles and was friendly with Herschell, Lyell and De Condolle, amongst other scientists of her day. Amongst her more important works are: *The Magnetic Properties of the Violet Rays of the Solar Spectrum* (1826), *The Connection of the Physical Sciences* (1834), *Physical Geography* (1848) and *Molecular and Microscopic Science* (1869).

<sup>7</sup> It should be noted that in several editions, the author took care to update the information in accordance with the latest discoveries, as she herself affirmed, for example, in the *Advertisement* to the 1817 edition: "The author, in this fifth edition, has endeavoured to give an account of the principal discoveries which have been made within the last four years in Chemical Science, and of the various important applications, such as the gas-lights, and the miner's lamp, to which they have given rise" (Marcet I: iii).

<sup>8</sup> Cf. Bahar 29.

<sup>9</sup> It should be recalled that, in the final decades of the eighteenth century, the presence of women in talks and lectures on science was very common. On this question Cf. Polkinghorn 17.

<sup>10</sup> Although in the editions which I was able to consult (1806, 1817 and 2010) this character is only identified as Mrs. B., certain authors have recognized in her the figure of Anna Barbauld (Shteir) or Margaret Bryan (Lindee 10). In the recent Cambridge University Press publication (2010), the editor refers to her clearly in a note as Mrs. Bryan.

<sup>11</sup> It should be noted that certain authors consider Emily to be more "earnest" and Caroline more "flighty". However, in my opinion, at least in the work under analysis, this is not the case, this distinction being based, perhaps, on other works by Marcet in which the two characters are better defined.

<sup>&</sup>lt;sup>1</sup> Cf. Terenas, "Modelos Britânicos".

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<sup>12</sup> See also Marcet I: 6, 27, 29, 72-73, and Marcet II: 135-136.

<sup>13</sup> See also Marcet I: 161-162, 240, and Marcet II: 194-195.

<sup>14</sup> According to Ann B. Shteir, in the final decades of the eighteenth century and the first of the nineteenth, several women devoted themselves to the popularisation of Science, particularly Botany. Amongst them were Priscilla Wakefield, Maria Jacson and Elizabeth Fitton. During the nineteenth century and particularly in the first decade of the twentieth, the number of publications of a scientific nature written by women increased substantially, as can be seen from the table supplied by Mary Creese (276).

<sup>15</sup> See also Marcet I: 17-18, 93-95.

<sup>16</sup> Cf. Polkinghorn: 4, 131.

<sup>17</sup> The principal function of the Royal Institution (founded in 1799) was to provide public enlightenment through popular lectures. Science was then in fashion and chemistry was all the rage. The demonstrations lectures on science at this time were genuinely theatrical spectacles and attracted large and fashionable audiences. Under Sir Humphry Davy, the Royal Institution became simply the most elegant and fashionable centre for such rational entertainment. Cf. Rosenfeld 789, and Bahar 43-44.

<sup>18</sup> Cf. Marcet I: vi, and Rosenfeld 787.

<sup>19</sup> Cf. Marcet I: viii-ix.

<sup>20</sup> In his paper "The Dominant View of Popularization: Conceptual Problems, Political Uses", Stephen Hilgartner criticises the culturally-dominant view of popularisation of science based on an "idealized notion of pure, genuine scientific knowledge against which popularized knowledge is contrasted." Therefore, he argues that this dominant view oversimplifies the process, as the scientists themselves, "when it suits their purposes", issue "simplified representations for broader audiences . . . with the authority of the cultural symbol 'Science'". In fact, "when one looks carefully for the precise location of the boundary between genuine scientific knowledge and popularized representations, one runs into trouble, stemming from the fact that scientific knowledge is presented in many contexts" (520, 524).

<sup>21</sup> Cf. Marcet I: n. pag., and Polkinghorn 29.

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