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Popularizing and Translating Science in 18<sup>th</sup> century Europe:  
Francesco Algarotti's *Newtonianismo per le dame* and its English-language Editions (1737-1772)

Abstract

Francesco Algarotti's *Newtonianismo per le dame* (1737) played a significant role in the popularization of Newton(ianism) on the Continent and in Britain in the 18<sup>th</sup> century. Compiled as a seduction manual for ladies after the fashion of contemporary poems and novels, it targeted the largest possible lay audience in order to gain potential advocates for the new experimental science and to covertly denounce Italy's stagnant political, social, and cultural condition. This study discusses some of the most recent scholarly interpretations the text and its four English issues (1739, 1742, 1765, and 1772) have so far received, explaining how it was transmitted differently in Italy and in Britain. It then examines the linguistic popularizing strategies, focusing especially upon the terminology employed by Algarotti to address a lay audience and its English-language rendering in Elizabeth Carter's first English translation (1739). Results show that diverse popularizing techniques were employed, which were mainly translated into English literally by Carter, although some important instances of adaptation and reformulation emerge revealing precise strategies not only to further simplify the text but also to accommodate it to a different readership and separate aims. The investigation combines methods derived from (Critical) discourse analysis (Fairclough 2013; Gee 2014) and historical pragmatics (Culpeper and K yto 2010). Studies of popularization strategies (Garzone 2006), English for scientific purposes (Gotti 1992, 2011, 2013), English historical linguistics (Bergs and Brinton 2012), and models of translation analysis (Vinay and Darbelnet 1958; Reiss 1976; Newmark 1988; Baker and Saldanha 2011) are also referred to.

1. *Introduction*

Italian philosopher, art critic, and member of the Royal Society Francesco Algarotti (Venice, 1712 – Pisa, 1764) published his most renowned work, *Il*

*Newtonianismo per le dame, ovvero dialoghi sopra la luce e i colori* (hereafter *Newtonianismo*), in 1737. The treatise described some of Newton's experiments on the nature of light and colours in the form of a genteel dialogue between a chevalier and a marchioness, a generic form which proved to be particularly serviceable to convey scientific thoughts and concepts to a female readership (Mazzotti 2004, 119). It proved to be one of the main channels through which Newtonian ideas reached the general public in Continental Europe and, as such, was a bestseller at the time. The publication's French, English, Spanish, German, Swedish, and Portuguese translations (Wallis and Wallis 1977; Hall 1984, 34; Arato 1991; Hutton 2017) testify to a crucial moment in the complex and intriguing history of linguistic, literary, and cultural relations between European countries in the 18<sup>th</sup> century.

This paper presents the cultural and ideological context of scientists, scholars, learned people in general, and the lay public, who collectively encouraged the prosperous production of texts and translations in Europe indicating a genuine interest in scientific matters (in particular, Newtonian science) in the period under scrutiny. It then concentrates on discursive and linguistic strategies, with a specific focus upon terminology, which were employed to popularize scientific ideas for a lay public in Italy and to translate and adjust them for an English-speaking inexpert readership. To do this, I discuss some of the most recent interpretations of *Newtonianismo* and its complex transmission, concentrating on diverse English editions circulating in Britain between 1739 and 1772, before analyzing how Algarotti's popularization and discursive strategies were rendered by Elizabeth Carter's first translation into English (1739). The investigation relies mainly upon methods derived from (Critical) discourse analysis (Fairclough 2013; Gee 2014) and historical pragmatics (Culpeper and Kytö 2010). Studies of popularization strategies (Garzone 2006), English for scientific purposes (Gotti 1992, 2011, 2013), English historical linguistics (Bergs and Brinton 2012), and models of translation analysis (Vinay and Darbelnet 1958; Reiss 1976; Newmark 1988; Baker and Saldanha 2011) are also referred to.

## 2. *The non-specialist reception of Newtonianism in 18<sup>th</sup> century England*

The scientific revolution, and the popular shock, which attended Newton's theories granted his ideas instantaneous and immense popularity and notoriety, which continued well into the 18<sup>th</sup> century, as Newtonianism was disseminated to non-specialist audiences of many sorts through print. Newton's *Philosophiæ Naturalis Principia Mathematica* (1687) has not received much attention outside the history of science since its content is particularly difficult. By contrast, his *Opticks: or, a Treatise of the Reflexions, Refractions, Inflexions and Colours of Light* (1704), which was written in English, proved to be more accessible for a larger audience and extremely relevant to explain how experimental methods work.<sup>1</sup> A number of diverse non-specialist media contributed to such wide dissemination, all of which constitute 'popular Newtonianism'. These included "summaries and recensions of Newtonian physics, journals, public lectures, sermons and a children's primer" (Hutton 2017, 103). Many of them were simplified versions of his works, as they were devoid of numbers, and were targeted at "gentlemen, students, bourgeois citizens, [as well as] women and children" (Ibid.). Moreover, the celebration of Newton in verse contributed to the creation of an ampler, receptive public for Newtonian natural philosophy.

Newton himself was treated as a popular literary character in popularizations of his work; his image could no longer be controlled publicly because of the extensive reach of publications aimed at enlightening readers on scientific issues (Miller 2018, 351). To understand how successful Newton's works were, suffice it to say that *Opticks* was reprinted six times in English between 1704 and 1721 and twice in Latin translation (1706 and 1719). Different textual genres – from expository texts to Newtonian textbooks and non-technical handbooks, from books for children and women to popular magazines and even literary compositions – were directed at a non-specialist audience, which desired to keep itself abreast of science for diverse reasons. This editorial production contributed to spreading Newtonianism in En-

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<sup>1</sup> On the popular influence of Newton's *Opticks*, see Nicolson 1946.

gland, both before and after Algarotti's *Newtonianismo* and its first English translation.<sup>2</sup>

### 3. *Algarotti and his Newtonianismo per le dame (1737)*

Algarotti attended the Bologna Academy of Sciences, where he could access lessons on experimental physics, geometry, astronomy, chemistry, and natural history, thus adding a number of scientific notions to his humanistic background. Moreover, the diffusion of English freemasonry in Italy in the 1730s favoured international contacts and conveyed political, social, and religious values which were proper to the emerging Enlightenment culture (Finodi 2009, 6; Jacob 2019). Algarotti admired these ideals and considered English empiricism and Newtonian science to be the distinctive features of modernity, although he better satisfied his cosmopolitan aspirations through service at various European courts. All this was fundamental for the development of his thought and for his writings, especially *Newtonianismo*.

The treatise was first published in Milan<sup>3</sup> with the false imprint of Naples, without the printer's indications and the ecclesiastical *imprimatur* (see Mazzotti 2004; Gaspari 2018). Therefore, along with the numerous libertine ideas and materialistic elements it encompassed, the ecclesiastical authorities in Rome in 1739 included the treatise in the *Index librorum prohibitorum*. However, its success was already assured with the first translation into French, *Le Newtonianisme pour les dames*, by Louis-Adrien Du Perron de Castera (1705-1752), which Algarotti decried to the point of challenging the translator to a duel (Giovanardi 1988, 91-125), and into English by Carter (1717-1806), which appeared in 1739 for the publisher of the *Gentleman's Magazine*, Edward Cave

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<sup>2</sup> See Hutton 2017, 103-104 and Mazzotti 2004, 131, n. 22 for a description of all such textual genres, their authors, and intended readers.

<sup>3</sup> For more information about Algarotti's life and career, as well as the treatise's publication details and changes in different editions and reprints over time, see Mazzuchelli 1753-63; Michelessi 1770; Bonora 1960-, s.v. ALGAROTTI, 356-360; Arato 1991; and Mazzotti 2004, n. 9ff.

(Arato 1991, 136-155). Only the title of the French translation conforms almost literally to that of the original treatise (*Le newtonianisme pour les dames, ou entretiens sur la lumière, sur les couleurs et sur l'attraction*), while the English translation seems to point to a more didactic rendition: *Sir Isaac Newton's Philosophy Explained for the Use of the Ladies. In Six Dialogues on Light and Colours* (Gaspari 2018, 24).<sup>4</sup>

Algarotti drew heavily upon *Entretiens sur la pluralité des mondes* (1686) by Fontenelle, the most tenacious and well-known champion of Cartesianism and the greatest popularizer of his time, to whom he dedicated his *Newtonianismo* “a richiamar la selvaggia filosofia da’ solitari gabinetti e dalle biblioteche de’ dotti per introdurla ne’ circoli e alle tolette delle dame” (Frigo 2000) in Paris in 1736. Prior to this, Algarotti had already left Bologna and arrived in France, where he began a brilliant career. He was regularly invited to diplomatic circles and salons of *philosophes* and, just as the drafting of his treatise was about to be concluded, he was allowed to join the Royal Society, thanks to his friends John Hervey and Mary Wortley Montagu. Between 1736 and 1737, he met the Newtonian scientists Clairaut and Maupertuis in Paris, as well as Voltaire, who was writing his *Eléments de la philosophie de Newton* (1738), and the mathematician Madame du Châtelet at the Cirey Castle. Cross-references to the author’s retreat at Cirey stand out on the frontispiece of the first edition of *Newtonianismo*, where the figures of the two protagonists, the knight and the lady, are patterned after Algarotti’s and Madame du Châtelet’s appearance (Mazzotti 2004, 9 and n. 13; Gaspari 2018, 27). Further allusions to Maupertuis in *Newtonianismo*’s ensuing edition testify to the author’s strong ties with France and French Newtonian scientists.

The treatise went through a number of changes over the years, beginning with the title, which since the sixth edition of 1746 (Naples, Hertz heirs) does not feature the “per le dame” address any longer. Its definitive form gradually

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<sup>4</sup> Not only did Castera introduce several scientific mistakes, but he also attempted, by adding his comments, to rescue Cartesian doctrines from Algarotti’s criticism (see Mazzotti 2004, 123, n. 7; Gaspari 2018, 109). In particular, on Algarotti’s disapproval of translations, see his letter to Count Mazzuchelli (1751) in Algarotti 1791-1794, 180-184 (cit. in Mazzotti 2004). See also his remarks on the English-language translation by Carter in the “Avvertenza” preface to the 1739 Italian edition of *Newtonianismo*.

emerged in the first Berlin edition (Gio. Goffredo Michaelis 1750), in which the term 'Newtonianismo' disappeared and only the textual genre was specified, *Dialoghi sopra la luce, i colori, e l'attrazione*, and reached its final form as *Dialoghi sopra l'ottica newtoniana* (1764) (Arato 1991). The original female addressee was probably considered, after the great initial success, a limitation; Algarotti was certainly influenced by Voltaire, who preferred for his *Eléments de la philosophie de Newton* (1738) the specification "mise à la portée de tout le monde", which booksellers liked. The dedication to Fontanelle, along with its references to a female public, was replaced by a tribute to Emperor Frederick II, at whose court Algarotti had spent seven years (1746-1752).

### *3.1 The construction of a lay public*

*Newtonianismo's* appeal to a female public actually covered other aims: a) for Miller (2013 and 2018) Algarotti targeted the largest possible lay audience in order to gain and increase potential followers of the new experimental science as devised by Newton, which is also attested to by the choice to write in Italian rather than Latin; b) Mazzotti (2004) argued that, by proposing his treatise under the guise of a seduction manual after the fashion of contemporary poems and novels, Algarotti would also cover potentially subversive political, social, and religious contents, while c) according to Agorni (1998, 12), the manual's address to the ladies was only a "formal, decorative element" which concealed men as its ideal target readership. These three – among the most recent – scholarly perspectives on Algarotti's text agree that through the dissemination of scientific ideas the author could denounce the stagnant condition of 18<sup>th</sup> century Italian society, namely, the pervasive tradition of scholastic, authoritative philosophy, which still dominated at many social and cultural levels.

To construct a lay public and gain followers for Newtonian experimental philosophy, Algarotti could either himself experiment before a restricted public from the Bolognese and Venetian nobility (which he actually did) or write popular texts. He realized that, by presenting Newton's ideas through his writing, he could reach a much greater audience and promote himself as

the champion of Newtonianism on the Continent. Furthermore, he could convince his readers of Newton's definitive triumph over past Platonic, Cartesian, and Leibnizian doctrines, and suggest introducing the methodology of experimental philosophy into the domains of metaphysics, morals, and politics. This is the reason why *Newtonianismo* was actually the only popularization of Newtonian philosophy to be prohibited by the church (see Mazzotti 2004, 138 and De Zan 1984, 133-47).

Thus Algarotti dispersed a number of gendered elements throughout the treatise, associating feelings, imagination, and social skills with women (the marchioness), and abstract thinking and mathematical practice with men (the chevalier). The former features were related to ancient philosophers and contemporary adversaries of Newtonianism, while the latter were related to the intellectual and moral virtues of Newtonian philosophers. Hence the chevalier appeared to be a teacher conducting the marchioness on an intellectual journey which would eventually disclose how the universe actually worked as revealed by Newton and his philosophy.<sup>5</sup> Theatrical patterns were employed to make this new exemplar of the literary genre enjoyable; Newtonian experiments recounted by the chevalier were set on a stage where a spectacle played out, prospective readers becoming spectators. Algarotti's ambition was to make Newtonianism pleasurable and entertaining, and he succeeded, even if many scholars described the work as superficial and not lending itself to research (see Miller 2018; Fara 2004, 66; Valenza 2009, 83).

#### 4. *English-language editions*

There were four 18<sup>th</sup> century English-language editions of *Newtonianismo*, which were published in 1739, 1742, 1765, and 1772. Scholars have different views on their nature and aims. Arato (1991), Agorni (1998, 2002), and Hutton (2017), for instance, argue that the last three were mere reprints of the 1739 translation into English by Carter and, as such, did not add anything new in terms of content or purpose. Miller (2018), instead, claims that they

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<sup>5</sup> See Arato 1991; Agorni 2002; and Mazzotti 2004 for a thorough description of the dialogues.

do display different elements that are crucial to understanding *Newtonianismo*'s complex transmission through the century. While the different Italian editions of the text were meant to conceal a series of subversive political, religious, and moral challenges to the establishment (Mazzotti 2004, Hutton 2017), its English versions should be regarded as several distinct editions whose form and content were manipulated to orient popular Newtonianism to diverse, gendered readerships. This is because in England Newtonian theories were largely accepted, as Newton was considered the nation's greatest national hero. Therefore, didactic or popular texts aimed to help the British understand one of their own cultural champions. When Algarotti published his work in the first half of the 18<sup>th</sup> century, publishers desired to meet the demands of a market requiring "science without numbers" (Hutton 2017). Whilst his work was apparently addressed to women, it did have a broader audience, namely (male and female) inexpert readers, who lacked a mathematical background and could gain some general knowledge from reading it. Both in Italy and England, women were a significant readership for books purchased as pleasurable entertainment, thus publishers took advantage of the opportunity to market them. By analyzing publishing and editorial practices in 18<sup>th</sup> century England, it was possible to reveal the real nature of *Newtonianismo*'s four different English-language editions (i.e. their purposes, diverse readerships, and how they were discursively compiled) (Miller 2018), thus gaining more information on the way Algarotti's translation(s) contributed to the popularization of Newton(ianism) in Britain.

*Sir Isaac Newton's Philosophy Explain'd for the Use of the Ladies* (London, Edward Cave, 1739) was the first translation of the text into English. It was carried out by Elizabeth Carter, who was a member of the Bluestocking Society that surrounded Elizabeth Montagu (Williams 1861). She was conversant in many classical and modern languages, published essays and poetry, and translated Epictetus. Dr Johnson admired her scholarly and literary abilities and commended her proficiency in languages (Ritchie 2018, 73-77).<sup>6</sup> Her translation of *Newtonianismo* was intended to be a major event, as the several

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<sup>6</sup> A number of works focus upon the figure of Carter, among them, see Agorni 1998 and 2002; Hawley 1999; Taylor 1999; and McGeary 2012.



booksellers listed on its title page show. Like the *Gentleman's Magazine* published by Cave, it sought to disseminate and popularize complex ideas to non-specialist readers, both female and male. Carter's rendition is considered conservative, although she intervened in some passages of the source text in order to adapt and reformulate it for a different readership and aims (see paragraph 5 here).

The second English-language edition, *Sir Isaac Newton's Theory of Light and Colours, and His Principle of Attraction, Made Familiar to the Ladies in Several Entertainments. Translated from the Original Italian of Signor Algarotti* (1742), was published in London by George Hawkins. It is based on both Carter's translation, which it roughly adapts, and Louis-Adrien Du Perron de Castera's French translation from 1738. The notions of familiarity, entertainment, and attraction are associated in the title, suggesting the flirtatious manner with which Castera and the 1742 edition's translator elaborated and inflated the source text.<sup>7</sup> In particular, Miller (2018) shows that some of the main body text was translated from French, but the footnotes were plagiarized directly from the 1739 English translation. By adding essential sections from the French text, the publisher could avoid accusations of copyright infringement.<sup>8</sup> Consonant with the storytelling techniques employed in novels and popular prose (which Castera himself used to write), this edition offered a more fully developed female protagonist, i.e. the marchioness, who interacts with the chevalier more than in Algarotti's original text (and in Carter's translation), with additional elements of flirtation and seduction. Moreover, being modelled on a French translation for a French audience, Descartes's profile was raised and appears to be ranked equal to Newton's, so that the English public would have perceived the former and his philosophy differently.

*The Philosophy of Sir Isaac Newton Explained, in Six Dialogues, on Light and Colours, Between a Lady and the Author, by Count Algarotti, F.R.S. F.S.A.* (Glasgow, Robert Urie, 1765) is faithful to the 1739 translation by Carter, but the paratexts were modified to change its market positioning and, consequently,

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<sup>7</sup>See Moretti 2009 (cit. in Miller 2018) for a detailed analysis of how titles in various works are modified over time to cater to new purposes and intended readerships.

<sup>8</sup>See Bently 2010 on the Statute of Anne or Copyright Act (1710).

its implied use from a gendered to a gender-neutral – perhaps even overtly masculine – readership. The title was changed to eliminate the “for the ladies” explicit address, and Algarotti was referred to with his scholarly qualifications, “Count Algarotti, FRS, FSA”, rather than the more general “from the Italian Signor Algarotti” (1739, title page), in order to elevate his status and the text’s general profile for a broader audience of male and female readers with an interest in science and culture. Moreover, in the same vein the title page epigraph “Lycoris herself may read”, which appeared in the 1742 and 1772 editions, was cancelled, again revealing that the text was intended to appeal to a neutral audience. Also, the typographical marks (i.e. italics) used by Algarotti (and Carter) to signal content for women were excised from this edition. Finally, the text was advertised in the Urie catalogue along with other books catering to the self-improvement of men rather than women, hence why its content and form were manipulated.

Finally, *The Lady's Philosophy: or Sir Isaac Newton's Theory of Light and Colours, and His Principle of Attraction, Made Familiar to the Ladies in Several Entertainments. A New Edition. Translated from the Original Italian of Signor Algarotti* (London, Francis Newbery, 1772) is not original either, since it uses as its source text an already pirated version, that of 1742 (see Miller 2018). By the time this new edition was printed, there was a sizeable collection of works meant to popularize and convey science to amateur readers in Britain. As may be inferred from the title, this London edition was marketed far more overtly to women than previous editions. Contrary to what is stated on the title page, it was neither a “new edition” nor a “translation from Italian”. This means that Newbery’s readers heedlessly bought copies of a pirated translation that had been published in 1742. Looking at the diverse titles listed in this editor’s production, one realizes that they addressed various gendered and age-specific readerships, that is children, young men and ladies, adult men and women (i.e. Tom Telescope’s *The Newtonian System of Philosophy Adapted to the Capacity of Young Gentlemen and Ladies* 1761; Charlotte Lennox’s magazine *The Lady's Museum* 1760-1761) (Fissell and Cooter 2003, 138). Therefore, *The Lady's Philosophy* would well complement Newbery’s offer, all the more so as it combined a poetic and a prosaic nature, which was consonant with the

development of early novels that dramatized flirtatious interactions between men and women.

5. *Popularizing and translating scientific contents (Algarotti's Newtonianismo and Carter's English translation)*

Whilst Algarotti's text and its English editions contain less hard science than Newton's own works and other works by Newton, they are nevertheless essential to understanding the popularization of science in Europe, in Italy and England especially, during the 18<sup>th</sup> century. This paragraph examines, from a linguistic perspective, how Algarotti popularized scientific ideas (terminology, in particular) and how Carter was able to render them in the first English translation of the text.

In the source text scientific content is interspersed and blended with courtship discourse, a combination that accords with the author's aims, namely, to simultaneously entertain and teach / instruct his lay audience. Thus, opinions, descriptions of scientific instruments, objections, and vivid episodes follow one another to provide the dialogues with a varied, entertaining structure. These various perspectives are intermingled so that, for instance, the phrase "women's bedroom eyes" is explained scientifically as follows:

Algarotti 1737	Carter 1739
1a) Egli avvien, rispos' io, da ciò, che la notte la pupilla è più aperta e dilatata, onde gli occhi vengono a parer più neri, e più brillanti, che non appariscono il giorno, in cui ella è più ristretta. Quanti occhi ân trionfato la sera, e fatto conquiste, che ân poi perduto il dì seguente al levar del Sole! (126)	1b) In the dark, the pupil is more open and dilated, which makes the eyes look blacker and brighter in the night than in the day when the pupil is more contracted. How many eyes have triumphed in the evening and gained conquests which they lost the very next morning at the sight of the sun! (vol. II, 203).

Excerpt 1a) contains an example of a courtship approach after a detailed explanation of the eye's dilation during the night to refer to a woman's se-

ductive appearance at intimate moments. Those who desired to explore beyond the flirtations or sidestep them completely, thus access Newton's investigation directly, were provided with scientific passages that were marked dramatically by the narrator (i.e. "I will not defer this explication any longer, answered I [...]") (Carter transl. of Algarotti 1739, vol. I, 112). Those who were not interested in the flirtation between the chevalier and the marchioness would thus be warned to skip these passages just as the signal phrase would entice all those who despised romance and sought to delve into Newtonian science (see also Miller 2013, 196-197).

Carter's translation was immediately praised by Algarotti himself, as well as in a poem published in the *Gentleman's Magazine* ("But we, perhaps, these treasures ne'er had known, / had not their worth, contest, to Carter shone; / no pen cou'd better all their charms impart, / Her judgment equal to her happy art". Swan, 9 June 1739, 322). Scholars speculated that the author's address to a female audience and his evident purpose to improve women's education explain why Edward Cave, who commissioned Carter to translate the text, developed an interest in it, especially at a time when scientific subjects were not usually directed at women.<sup>9</sup> Probably for this reason, he decided to embark on this fresh enterprise.

The translation proved to be extremely successful, as it was copied, pirated, or simply referred to (see paragraph 4 here) in the bestselling English-language editions of Algarotti which ensued. The dominant translation method employed is literal translation, although close analysis revealed that Carter made use of accommodating translation strategies, such as reformulation and adaptation (Vinay and Darbelnet 1958; Reiss 1976; Newmark 1988), with the aim of rendering the text more acceptable for her English target readership and new purposes, and as such playing a significant role in the popularization of Newtonian science in Britain in the 18<sup>th</sup> century.

Regarding the source text, the author employs numerous linguistic strategies to popularize scientific concepts, which are rendered literally by Carter.

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<sup>9</sup> In Italy the popularization of science owed much to female scientists, such as Clelia Borromeo, Maria Gaetana Agnesi, and Laura Bassi, who were active in the 16<sup>th</sup> and 17<sup>th</sup> centuries, a fact which accounts for a potential female public interested in scientific subjects (see Cavazza 1997; Serralunga Bardazza 2005; and Gaspari 2018, 17-145).

Through analogy, he associates specialized philosophical notions (“sistemi generali” / “general systems”, 2a) and 2b) – which might have sounded quite vague to a lay person – to concepts that could be more familiar (“Imperi” / “Empires”, 2a) and 2b), at least to a literate public:

Algarotti 1737	Carter 1739, vol. II
2a) Il medesimo immaginatevi pur, che succeda a quanti sistemi generali si son veduti fin’ora intorno alle cagioni delle cose; i quali a grand’Imperi somiglianti, vacillano per la loro medesima mole e grandezza. (146)	2b) And this you may believe has been the Case with all the general Systems that have hitherto appeared, concerning the Causes of Things. They resemble vast Empires, which totter and fall by their own Weight and Greatness. (vol. II, 5)

Definition is the most recurring technique, consonant with the text’s educational purposes:

Algarotti 1737	Carter 1739
3a) Un termometro, che è uno strumento contenete un liquore, che al menomo freddo si restringe, e si dilata al menomo calore, non soffre alterazione alcuna [...]. (149)	3b) A Thermometer, which is an Instrument containing a Liquor that contracts with the least Cold, and dilates with the least Heat, does not suffer any Alteration in [...]. (vol. II, 10)

In 3a) / 3b) above the word “thermometer” is decoded by means of a relative clause and a hyperonymic term (“instrument”) that generalizes the concept.

Exaggeration by means of hyperbole and superlatives is another linguistic device used in the text, and translated literally by Carter, which aims to impress the marchioness / pupil (and the reader) on the one hand, while reflecting the presence of conversational language<sup>10</sup> on the other:

Algarotti 1737	Carter 1739
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<sup>10</sup> See Culpeper and Kytö 2010 for more insights into early modern English dialogues from a historical sociolinguistic, pragmatic, and stylistic perspective.

<p>4a) [La luce <i>settemplici</i>] è degl'infiniti colori, onde quest'Universo si dipinge lussureggiante tesoro [...]. (157)</p>	<p>4b) This sevenfold Light is the inexhaustible Treasury of those innumerable Colours, which form the gay Picture of the Universe [...]. (vol. II, 23)</p>
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In examples 4a) / 4b) the adjectives “lussureggiante” / “inexhaustible” and “infiniti” / “innumerable” associated with the noun “tesoro” / “treasury” aim to amaze the marchioness and the readership, drawing them into the unsurpassed world of Newtonian natural philosophy.

Notably, the scientific / technical passages in which the core of Newtonian experimental methods is described are detailed and precise, with scientific terminology that is sometimes made evident through italics:

Algarotti 1737	Carter 1739
<p>5a) Un raggio di luce, ripigliai io, siccome l'altro giorno avea incominciato a dirvi, per quanto sottile egli sia, altro non è che un fascetto d'infiniti altri raggi, i quali non son già tutti del medesimo colore, benché tutto il raggio ci paja bianco; ma alcuni sono rossi, alcuni altri aranci, altri gialli, altri verdi, altri azzurri, altri indachi, altri violetti, con infiniti gradi di colori intermedj tra gli uni e gli altri di questi sette principali. Questi raggi adunque di differenti colori che si chiamano <i>primitivi</i> ovvero <i>omogenei</i> mescolati insieme compongono un raggio eterogeno, e composto com'è un raggio di sole di color bianco o più tosto di un colore che pende all'aureo [...]. (157)</p>	<p>5b) I observ'd to you the other Day, answer'd I, that every Ray of Light, however slender, is nothing but a Collection of innumerable other Rays, which are not all of the same Colour, notwithstanding the whole Ray appears white: But some of these Rays are red, orange, others yellow, green, blue, indigo, or violet, besides innumerable Degrees of intermediate Colours between each of these seven principal Ones. These Rays of different Colours, which are called <i>primary</i> or <i>homogeneous</i>, blended together form a heterogeneous Compound Ray of a white or golden Colour [...]. (vol. II, 23)</p>
<p>6a) La camera oscura è l'interiore del nostro occhio, ch'è della figura a un dipresso d'una palla; il foro nella finestra è la pupilla, che è nella parte anteriore dell'occhio, e che apparisce in tutti, come un foro nero ora più grande, ed ora più picciolo; la lente è l'umor cristallino, che ne â appunto</p>	<p>6b) The <i>Camera Obscura</i>, represents the Inside of your eye, which is nearly of the Shape of a Ball: The Hole in the Window is the Pupil which is the Fore-part in the eye, and appears in all as a dark Hole, sometimes greater, sometimes less. The</p>

<p>la figura, e che stà in faccia alla pupilla tenuto sospeso da certe fibrille, chiamate processi ciliari, che partendo da una tunica, o sottilissima pelle, che circonda di dentro l'occhio, vanno a piantarsi ne' margini di lui, la carta su cui si riceve l'immagine degli oggetti, è la retina formata da' filamenti e dalla sostanza midollare del nervo ottico, che è dalla parte di dietro attaccato all'occhio, e che è il gran canale di comunicazione tra esso, ed il cervello. Gli spazj, che sono tra la parte anteriore dell'occhio, e l'umor cristallino, e tra questo, e la retina, sono riempiti di due umori men densi dell'umor cristallino, ma più densi dell'aria. Mercè tutto questo apparato, non altrimenti che nella camera di poc'anzi, si dipingono sulla retina in miniatura gli oggetti esteriori, e noi vediamo. (84)</p>	<p><i>Lens</i> is the Crystalline <i>Humour</i> which is exactly of that Figure, and is placed over-against the Pupil, and suspended by certain little Fibres called the Ciliar Processes, which proceeding from a Coat or very thin Skin which encompasses the Inside of the Eye, are fixed in the Edge of it: the Paper on which the Image of Objects is depicted, is the <i>Retina</i>, composed of the Filaments and Medullary Substance of the Optic Nerve, which is fastened to the Eye behind, and is the great Channel of Communication between that and the Brain. The Spaces which are between the Fore-part of the eye and the Crystalline Humour, and between this and the <i>Retina</i> are filled with two Humours less dense than the Crystalline, but denser than the Air. By the Help of all this <i>Apparatus</i>, external Objects are pictured upon the <i>Retina</i> in Miniature just as in the <i>Camera Obscura</i>, and thus we see. (vol. I, 136-137)</p>
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Excerpts 5a) and 6a) show how knowledgeable Algarotti was; he possessed a sound understanding of natural philosophy and aimed at transmitting it precisely to his readership, leaving nothing unexplained, making it accessible and understandable, however necessarily simplified. Exemplification through enumeration is quite frequent, contributing to the text's overall cohesion. Typographic devices (italics in this case: “*primitivi* ovvero *omogenei*”, 5a) / “*primary* or *homogeneous*”, 5b) are employed to underline the semantic load of some technical words the reader should notice. Carter employs such devices even when they are not present in the source text (“*camera obscura*”, “*lens*”, “*humor*”, “*retina*”, “*apparatus*”, 6b), indicating that she might have wanted to signal to her readers that they are specialized words.

Furthermore, various examples show that such specialized terms are associated with general terms from the same semantic field, which may facilitate comprehension by association:

Algarotti 1737	Carter 1739
7a) La visione si spiegherà sempre dai Filosofi nella medesima maniera, dacché si è osservato l'occhio rassomigliarsi affatto alla camera oscura artificiale. (145-146)	7b) As the Eye is now discovered to have an entire Resemblance to the artificial <i>Camera obscura</i> , all philosophers will hereafter explain the Nature of Vision after the same Manner. (vol. II, 4)
8a) [...] e l'Ottica, i suoi Cannocchiali, i suoi Microscopj, le sue Camere Oscure, le sue Lanterne Magiche, e le tante maraviglie, con cui si perfeziona, o si lusinga questo senso del vedere. (150)	8b) [...] and Optics owe their Telescopes, Microscopes, Magic [Lanterns], and an infinite Number of other Wonders that perfect or flatter the Sense of Seeing. (vol. II, 12)

Example 7a) highlights that a popular tool such as “camera oscura” was included to associate a concept that might have been more familiar to the target readership. Notably, Carter switches the two clauses and moves the theme in the first position (7b), which changes the focus of attention and, again, may simplify comprehension. In examples 8a) / 8b) the terms “lanterne” / “lanterns” are juxtaposed with two technical terms (“telescopi” / “telescopes”, “microscopi” / “microscopes”) and connoted by the adjective “magico” / “magic”, then connected to the following plural nouns “maraviglie” / “wonders”, which attest to hybridization between scientific and imaginative discourse as the core popularizing strategy employed by Algarotti.

As we see in all previous examples, most of the scientific and technical terms in the source text are Latin derivatives, which probably facilitated the translator's task, since much English scientific terminology was coined after Latin starting from the 16<sup>th</sup> century. Indeed, advances in science, even after old scholastic thinking began to be rejected, were still discussed in Latin in universities. Therefore, books for the small English scientific elite and an international readership were written in Latin until well into the 17<sup>th</sup> century. By the time Carter started translating *Newtonianismo*, most technical lexicons had already been “forged or expanded in the interests of precision, and the polysemy of natural language [...] was being rejected” (Campbell 2006, 760, in Iamartino 2014, 64), although the new natural philosophy and scientific



method required continuous creation of new terminology. Furthermore, almost 80 years had passed since the foundation of the Royal Society and its promotion of a clear, concise, and unambiguous language for scientific dissemination and popularization.<sup>11</sup> English could by then be seen as a language suitable for scientific communication at various specialist levels and translators could avail themselves of lexicographic tools to tackle the lexical problems posed by texts they had to render into English. Moreover, Carter was conversant with diverse classical and modern languages, among them Latin and Italian (Dorr 1986, 138). Finally, Algarotti's source text for his *Newtonianismo* was Newton's *Opticks* (1704), which was written in English and could be consulted by the translator herself, along with other scientific texts written in vernacular. For instance, "moto" / "motion", "attrazione" / "attraction", "gravità" / "gravitation", "rifrazione" / "refraction", "riflesso" / "reflection", but also "ottica" / "optics", "telescopio" / "telescope", "microscopio" / "microscope", etc., terms the text is obviously full of, were borrowings from Latin or French or Italian (see OED online 2019, under each of these entries), therefore accessible to Carter.

More significantly, the translator often adapts the source text through elision of entire clauses or phrases:

Algarotti 1737	Carter 1739
9a) [...] e quante Belle in Inghilterra, che comandar ponno in que' liberi maschi petti il forgere, e il variar delle passioni, non debbon'elleno la lor signoria, e le lor armi alla felice, ed ardita sperienza, fatta ne' lor primi anni da industrie mano dell'Inserzione in una tenera, e dilicata pelle d'un benigno Vajolo? (153)	9b) [...] and how many Beauties in England, the Mistresses of free born Hearts, owe their Empires and their Arms to an early Inoculation of the Small Pox? (vol. II, 16)
10a) Non così tosto la seguente mattina forse dal letto la Marchesa, che contro l'uso del bel Mondo mi fece entrare nel	10b) The next Morning, as soon as the Marchioness was up, she sent for me into her Closet, not concealing that agreeable

<sup>11</sup> For a detailed analysis of the development of specialized discourse and scientific language in 17<sup>th</sup> century Britain, see Gotti 1992, 2011, 2013. On the Royal Society and its interest in 17<sup>th</sup> century scientific writing, see Moessner 2007.

<p>suo Gabinetto, non ascondendo quel disordine, da cui ella ben sapeva nulla dover la sua bellezza temere. [...] Io posso dirvi aver dormito questa notte molto meno delle altre. Se ella ne sia la cagione, o nò, io non lo so, ma so bene che la Filosofia, e il non dormire vanno insieme. (195)</p>	<p>Disorder which she knew her Beauty could receive no injury from. [...] I can assure you, I have slept much less this Night than before. I cannot tell whether this be the Reason of it, but I find that Philosophy and sound Sleep do not agree very well together. (vol II, 83)</p>
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In 9b) she cancels all erotic allusions and sexist ambiguities (“maschi petti”, “il variar delle passioni”, “tenera e delicate pelle”), as in excerpt 10b) in which she eliminates “contro l’uso del bel Mondo” from the source text, which might imply unbecoming behaviour on the part of the narrator, as well as “se ella ne sia la cagione”, which is rendered with a more impersonal (thus neutral) “I cannot tell whether this be the Reason of it”. These are a few examples of a procedure she applies systematically that could be listed under the rubric of a “gender-induced strategy” (Agorni 1998, 192), implying that if the address to English-speaking women was to succeed, then radical changes had to be made in the way women’s bodies were represented by Algarotti. Hence misogynistic allusions were not included in the translated text and, in so doing, Carter’s rendering appeared to be more scientific than the source she referred to. In the same vein, she intervened on the source text to better clarify contents for her English audience. For instance, she adds a note to explain that, whilst Algarotti claimed that “Ed egli è mirabile essersi trovato in questo secolo, e molto più in Inghilterra, chi accieendosi al lume delle cose, siasi un’altra volta voluto immerger nella notte delle parole dicendo la vision farsi per via de’ differenti gradi delle forze espansive [...]” (Algarotti 1737, 87), English philosophers such as Robert Green showed “the insufficiency of the present Systems to give us just account of that Science, and the Necessity there is of some new Principles in order to furnish us with a true and real Knowledge of Nature” (Carter’s transl. of Algarotti 1739, I vol., 141-142, n. a). Again, she clarifies some realia proper to Italian culture through explicative notes. For instance, “*Mandragora* or *Mandragola*, an *Italian Comedy* written by the famous Nicholas Machiavel” (Carter’s transl. of Algarotti 1739, I vol., 6, n. a).

Finally, to alter a radically socio-political text (see Mazzotti 2004) into a popularization of scientific issues specifically targeted at women, she eliminates all hints of political and social change referring to 18<sup>th</sup> century Italian society, as in the following extract (see Agorni 1998, 193-194): “Let the Age of Realities once more arise among us [...]” (Carter’s transl. of Algarotti 1739, I vol., xvi), rather than “Il secolo delle cose venga una volta anco per noi” (Algarotti 1737, xi). Although this manipulation could be ascribed to a lack of command of the Italian language, her rendering resulted to be utterly opposed to Algarotti’s main intent, thus giving the impression of being aware that the experimental method devised by the new Newtonian philosophy had already wrought a new epistemological paradigm in England, which Algarotti wished for Italy as well.

## 5. *Conclusions*

Algarotti’s *Newtonianismo* may have seemed to be a frivolous book aimed at entertaining 18<sup>th</sup> century women while teaching them notions of Newtonian science, yet this small contribution on the way it was transmitted both in Italy and in England has returned significant results for the investigation of the dissemination of Newton(ianism).

Firstly, the text was far from being a mere popularization. Apart from (hidden) mathematical content, in fact there was its (concealed) Lockean background, which did not escape the Holy Inquisition’s condemnation. Penetration of Locke’s thought in Italy was one of the principal effects (and in turn a cause) of the new opening up of Italian culture throughout Europe. It is clear that Algarotti and other Italian men of letters and science had joined in efforts to create a more open society.

Secondly, all over Europe enlightened ladies (and lay audiences in general) could read no less than 31 editions of the text, which had been translated into English, French, German, Dutch, Swedish, and Portuguese (Gavroglu 2001, 107). If popularity is measured in terms of translations and reprints, one of the most popular embodiments of Newtonian science was, as a matter of fact, *Newtonianismo*. Furthermore, unlike most popularizations of Newton,

Algarotti's book satisfies several aspects of Newton's European reception – in Italy, France, and England (Hutton 2017), and is therefore quite interesting to peruse.

Thirdly, discussion of the text's English editions revealed how one Italian book became three entirely different English books (1739, 1742, 1772) and one Scottish book (1765). These addressed diverse gendered and age-specific lay audiences in a market where, unlike in Italy, Newtonian theories were already accepted and Newton was liked and admired by many people, which reflects the sense of the term 'popularization' as making popular (OED online 2019, s.v. POPULAR) rather than its more neutral sense of 'dissemination'. It also highlights how fuzzy distinctions between science and literature were across one single title, and how complex its transmission was, as popularizations of scientific ideas in Britain implied the presence of Newtonian natural philosophy along with popular science (Miller 2018).

Fourthly, linguistic examination of the source text shows that Algarotti employed several popularizing strategies to make it accessible to, therefore empowering (Fairclough 2013; Gee 2014) a lay public for his ultimate aim of gaining advocates for the new scientific method. The core strategy he used consisted in interspersing scientific content into a work of light-hearted literature, where scientific discourse coexists with courtship discourse. He did so in the spirit of great scholars and science popularizers such as Fontenelle, Voltaire and, last but not least, Galileo, as testified to by his choice of the dialogue textual genre. Thus Algarotti was able to make his work accessible to a range of reading levels, attracting even inexpert readers to complex ideas presented with clarity and levity.

Finally, the linguistic analysis of *Newtonianismo's* first English translation by Carter observed that, whilst she apparently translated the text as faithfully as possible (i.e. literally), which Algarotti praised, in fact she intervened in some passages to make it suitable to English women – and to a lay public – eliminating misogynistic or overtly sexual elements which, rather, fitted well Algarotti's original aims. She also used domesticating translation strategies to bring the text closer to an English audience, which was already acquainted with Newtonianism and desired to understand it better. Scientific terminol-

ogy, in particular, deriving mainly from Latin, is explained by means of reformulation strategies such as definition, analogy, etc., which Carter maintains and renders accurately into English (Vinay and Darbelnet 1958; Reiss 1976; and Newmark 1988. See also Baker and Saldanha 2011), sometimes further clarifying certain passages by means of syntactic cohesive devices and typographical signals. In so doing, she was able to transform the prescriptive, rhetorical discourse of femininity of the source text into a text explaining science to women (see Agorni 1998 and 2002).

In conclusion, Algarotti's *Newtonianismo* and its translation(s) testify to a crucial moment in the complex and intriguing history of linguistic, literary, and cultural relations between England and Italy, as well as contributing to a decisive turn in the development and spread of scientific ideas in Europe. They also show that English could by then be used as a language suitable for scientific communication at both specialist (i.e. Newton's *Opticks*) and popular levels (i.e. Algarotti's text and its various English-language editions), and that translation played a fundamental role in catering to the diverse and multifaceted needs of different European readerships (Bergs and Brinton 2012).

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