UNIVERSIDADE FEDERAL DE SANTA CATARINA
CENTRO DE COMUNICAÇÃO E EXPRESSÃO
DEPARTAMENTO DE LÍNGUA E LITERATURA ESTRANGEIRAS
GRADUAÇÃO EM LETRAS ESTRANGEIRAS – LÍNGUA INGLESA E LITERATURAS

THE NOTION OF AUTHORSHIP IN MATHEMATICAL TEXTS

Rafael Descovi Galelli

Florianópolis
2015

THE NOTION OF AUTHORSHIP IN MATHEMATICAL TEXTS

Trabalho de Conclusão de Curso (TCC) para a disciplina LLE7462 do Departamento de Língua e Literatura Estrangeira do Centro de Comunicação e Expressão da Universidade Federal de Santa Catarina – Curso de Letras – Língua Inglesa e Literaturas, como requisito parcial para obtenção do título de Bacharel em Letras – Língua Inglesa e Literaturas.

Orientador: Prof. Dr. Lincoln P. Fernandes.

Banca Examinadora:

Prof. Dr. Lincoln P. Fernandes.

Orientador

Profa. Dr.ª Maria Lúcia Vasconcellos.

Prof. Dr. Marcos Antônio Morgado de Oliveira

Florianópolis

2015

Abstract

This study intends to discuss the concept of authorship within the translation studies framework and its interface with scientific texts, in particular, mathematical texts. This discussion will be an exploratory argument among the different understandings of authorship within these different perspectives. There are two main arguments at the center: the relationship between authorship and originality and its consequences to translations. These two arguments find its foundations in the works of Lawrence Venuti and Sundar Sarukkai, from the Translation Studies and Hard Sciences points of view respectively. The main objective is to perceive that although the understanding of originality is intrinsically related to that of authorship, any change in the conception of this original can cause different understandings on writing and on translation alike even in more strict scientific contexts.

Key words: Translation Studies; Mathematics; Philosophy of Language; Calculus; Authorship; Authorship as a Fluctuant Concept.

Number of pages: 30
Number of words: 9582

Resumo

Este estudo tem como objetivo discutir o conceito de autoria no âmbito dos Estudos da Tradução e de sua interface com textos científicos, nomeadamente, os textos matemáticos. Esta discussão será um argumento exploratório entre os diferentes entendimentos sobre autoria dentro dessas diferentes perspectivas. Existem dois principais argumentos no centro: a relação entre autoria e originalidade e suas consequências para as traduções. Esses dois argumentos encontram seus fundamentos nos trabalhos de Lawrence Venuti e Sundar Sarukkai, dos pontos de vista dos Estudos da Tradução e das ciências duras, respectivamente. O objetivo principal é argumentar que embora a compreensão da originalidade esteja intrinsecamente relacionada com a de autoria, uma mudança na concepção sobre a originalidade pode ocasionar diferentes interpretações sobre a escrita e sobre a tradução, mesmo em contextos científicos mais rigorosos.

Palavras-chave: Estudos da Tradução; Matemática; Filosofia da Linguagem; Cálculo; Autoria; Autoria como um Conceito Flutuante.

Número de páginas: 30
Número de palavras: 9582

Table of Contents

The notion of authorship in mathematical texts

Although the concept of authorship appears marginally in a large variety of academic discussions, it has rarely appeared at the center of any specific discussion. This seems to be particularly true in Translation Studies (TS). Historically, this concept has been overlooked throughout the centuries as a key notion in TS, especially until the 18th century. Translation was then viewed either as an exercise to learn languages or, from a more politically grounded point of view, as a means of strengthening and consolidating cultural aspects in a particular region or even reinforcing government dominance[1]. With Romanticism, the author's image begins to change and starts to capture different aspects of intellectual production. This particular change in perspective also places the discussion of authorship in a different light.

In the 1990's, the italo-american writer and translator Lawrence Venuti highlighted the authorship issue within a TS framework in two of his books. In his 1995 book, *The Translator's Invisibility*, Venuti argues that much of what he calls *invisibility* is due to the current concept of authorship and especially to what this particular concept implies to the understanding of translation itself. He argues that the current view on authorship is widely connected with a post-romantic view on the author, a view that praises the intrinsic relationship between the author and its creation; consequently, it overlooks a deeper understanding of the problem. As a result, the translator is regarded only as a means of recoding and transmitting[2] the text from one language to another, a type of passive *machine*, only submitted to the subjectivity of language and specific parameters for each genre; or, in the case of technical translations, the only adjustment to this notion would be that the translator should be not only aware but well-versed in the specific terminology practiced in each specific field. Sarukkai (2002) calls this very familiar and common notion of a translator a "naïve view on translation".

Moreover, this romanticized concept of authorship is broadly understood nowadays as a fundamental part of intellectual production but it also carries alongside a very particular notion for the author itself (i.e., a personalized image for the work embedded in the author's

[1] Deslile & Woodsworth, 1998.

[2] Possible multiple meanings: (re)coding and (re)transmitting the text from on language to another implies, without a doubt, some sort of choice. Venuti will argue that every choice is a political one. I will argue that there can also be naïve choices, often related to lack of knowledge of the subject matter, conversely, when technical skills are in play, there are naïve choices in relation to language.

consciousness). Thus, the notion of authorship is often related to that of ownership; or in more elegant terms to the notion of intellectual property.

Yet, this relationship becomes challenging when placed in different contexts, for instance, that of scientific or technical texts, specifically within the hard sciences[3] and mathematics[4]. This difficulty of stablishing the relationship between author and text arises from two main reasons: first, because there is a philosophical controversy involving the concepts of discovery and creation in mathematics; second, even if this philosophical issue is set aside, there still is a problem in identifying actual authorship from purely repetition or simply new applications. Furthermore, there is an open statement that any mathematical concept cannot be granted any sort of ownership[5]. It follows that translations within these fields suffer from the same kind of definition uncertainty, a type of suspension of authorship.

In a very simple statement: what makes a mathematical text have an author when mathematics itself cannot "belong" to anyone?

As it was indicated above, there is a very profound philosophical argument to be made in this matter, but it is not the objective of this study to discuss it at length. However, books are written and textbooks are organized and oriented to teaching and learning and all texts do come with a corresponding author. There are circumstances, however, that draw some attention: Stewart's Calculus, for instance, a two volumes 1300 pages long textbook has no bibliographical references whatsoever. Does that entail that there is no need for referring or is it something else entirely?

If that were a single example, we would indicate it as just a particular flaw. However, there are others. Michael Spivak's 1967 textbook, also entitled Calculus does not have any references either; George B. Thomas three volume textbook, in its 12th edition, same feature. Is that just a coincidence or is there something behind this incongruence?

---

[3] Although the classification in hard or soft sciences is not a formal one, it only intends to roughly distinguish those in natural sciences from social sciences. The terms natural and social were not used due to the problematic distinction of mathematics as either natural or social.

[4] Mathematics is not generally considered a hard science or even a natural science per se. Popper (2000), e.g., states that since mathematics cannot be properly falsified thus it cannot be considered a science. His solution to this problem often creates a division between pure and applied mathematics, with the first not being classified as science and the second being a science. Thomas Kuhn (1962) argued that mathematics does not work in paradigm changes but only with additions, therefore, it also has a problem with its definition; also, the lack of empirical procedures places mathematics as a formal science.

[5] In Brazilian Law, for instance, it is clearly stated in the 9.160 law, in the Brazilian Civil Code, article eight, first incise.

A first attempt to answer this question would takes us back to Calculus origins in the late 17th century. As history tells, Isaac Newton and Friedrich Leibniz developed Calculus almost simultaneously with no apparent contact between the two. A controversy was installed when Leibniz first published his works. After a few years, it would seem that Leibniz' work was the same as Newton's final mathematical remarks in his masterpiece *Principia Mathematica*. Using different notational systems, it took a few years for the mathematical community to realize that they not only had the same subject but also had the same content. After years of controversy, Newton was awarded the authorship of Calculus. But if that is true, how can Stewart, Spivak, Thomas and so many others simply dismiss this fact? Are they not plagiarizing? Is calculus a closed subject?

This brief digression raises more questions than it answers. A definitive answer is far from trivial and it requires a great deal of philosophical axioms and conjectures. Nevertheless, going back to those modern Calculus texts, how can they be so similar and yet not considered a copy?

What we can notice from one text to the other is that there are tangible differences, even though the subject matter and the results are mainly the same. Yet, if one considers these differences as indicatives of some type of authorship, one is led to the following question: are these hints of authorship present or apparent (not to say considered) in the translated texts? If so, does that mean that the translator, consciously or not, considers these features as "watermarks" of authorship?

In order to look into these hints, one needs a notion of authorship that could account for these aspects. A more fundamental question then arises: are there any definitions of authorship broad enough to account for the different contexts of text production; specifically, is there any definition that can account for the production of mathematical texts and its translations alike?

At first glance, the answer is straightforward: no. It appears that mathematics requires a different starting point (expressly from literary texts) in order for it to have some stability in terms of authorship. Sarukkai (2001; 2002) will argue that the very nature of mathematical texts does not allow them to be granted any kind of authorship because they are already translations of sorts of an already written world[6]. Yet, mathematical texts are translated. But how are they translated? What is the treatment given to authorship in these cases?

---

[6] Sarukkai's arguments will be explained in the following section.

With this last question in mind, the central purpose of this study can be divided in two main parts: the first is to discuss three aspects on authorship: 1) the conceptualization of the original; 2) authorship in translation studies and 3) authorship in hard sciences, particularly the field of *Calculus* in Mathematics. The second part will be firstly to point out how authorship can be identified in these Calculus texts and how the concept of authorship is being managed both in original works in Calculus and its translations in order to indicate some sort of possible future analysis.

Apart from this introduction and the final remarks, this TCC is divided into three sections. The first section will present a discussion on authorship divided into another four parts. The first focuses on the concept of original; the second part is to situate the concept of authorship as indicated by Venuti (1995; 1998) in relation to TS; the third will situate authorship in scientific texts, particularly that of hard sciences, contrasting the more literary perspective with Sarukkai's (2001; 2002) point of view on authorship. Finally, a brief discussion joins these ideas.

The second section presents a more focused approach on the identification of authorship in mathematical texts, i.e. the means to interpret hints of authorship and the theoretical translation background to look for them in the translated texts.

The third section presents the object: Calculus texts. The focus here is on James Stewart's Calculus textbook and its translation to Brazilian Portuguese. Stewart's book is one of the most famous textbooks with the intention of both to present the theoretical mathematics behind and also to serve as a learning-teaching textbook. Excerpts from this textbook are highlighted and discussed with the intention of looking at how authorship has been managed in the translation. The main purpose is to point out that even though the mathematical content is not cited or related to a particular source, each text production has its own particular style, which depends upon both the designated author and the relative language chosen in each instance.

In the fourth and final section, there is a discussion of the outcomes and possible ways to continue with this research.

Authorship in question

The main idea here is to give a starting point for the discussion and to create a brief contextualization of each point of view (Translation Studies and Mathematics), in order to create some common ground for this discussion. The first step will be to present some aspects on the concept of originality and on authorship. In addition, with the following discussion, one expects to create a large enough background to account for the differences in authorship views throughout these fields.

Originality

Most common (mis)conceptions about authorship are intrinsically connected with the notion of originality. Although this connection appears to be obvious, one should keep in mind that it is also misleading and opened to a great deal of interpretations. Moreover, since "[…] The notion of 'original' is central to both: translation and science" (Sarukkai, 2001, p.648), it is necessary to try to define a starting point for this "original" among this different contexts.

At this initial attempt to find a working definition of authorship, another common idea associated with the notion of originality is needed: the notion of a primary idea, particularly when it is related to origins; or even an invention, when it is owned by an entity. This bounding concept of timeframe (i.e., what was done by who in the first place) is particularly connected with the concepts of Historical Materialism and the current view of Information Era.

Within these views and accounting for the relations among these notions, the connections between original-authorship-author agreeably create a strict relationship between the concepts of "original" and that of "author" in the background. Authorship, according to these constraints, presents itself as an inseparable intersection between the two: the author and the original.

In these terms, authorship is consequently recognized and defined as this intersection. Conversely, when the concept of authorship is broken, or when the definition is not clear, the easier and most common outset in order to distinguish it from anything else is to point out what is not original, that is, to point out what is a copy, a reproduction or even a translation. Although simplistic in essence, this restriction is sufficient for most cases wherever the concept of original reveals itself as necessary to distinguish authorship from plagiarism, for example.

While crucial to the understanding of authorship, this simple relation lacks the proper insight to recognize the very nature of the original in a more practical way. Venuti (1995; 1998), however, pinpoints that this simplistic definition is insufficient for a more precise conceptualization of original (and therefore of authorship) when it is placed next to a TS framework. According to Venuti (1998), when translation is associated to the definition of authorship, the entire concept needs to be reevaluated and deliberated with some distinction. Hence, another requirement is to discuss authorship within a TS framework.

Authorship in Translation Studies

With a well-defined political agenda behind the surface, Lawrence Venuti (1995; 1998) poses the main arguments for a discussion of authorship. The author focuses his discussion on authorship by arguing in favor of a translator as a writer of sorts.

In order to inform on his defense for the translator's need of recognition, he devises and develops the concepts of *domestication* and *foreignization*[7] by creating a background hypothesis for the author in view. This background hypothesis is the focus of the discussion surrounding the Translation Studies point of view in this argument.

In his 1998 book *The Scandals of Translation*, Venuti stresses the socially consummated view on authorship and originality; furthermore, at the same time, he opens up a discussion on the significance of the translator when he states:

> Whereas authorship is generally defined as originality, self-expression in a unique text, translation is derivative, neither self-expression nor unique: it imitates another text (Venuti, 1998, p.31);
>
> [...] what distinguishes translation from original composition is mainly the closeness of the mimetic relation to the other text; translation is governed by the goal of imitation, whereas composition is free, relatively speaking, to cultivate a more variable relation to the cultural materials it assimilates (Venuti, 1998, p.44);
>
> A translation, then, can never be more than a second-order representation: only the foreign text can be original, authentic, true to the author's psychology or intention, whereas the translation is forever imitative, not genuine or simply false (Venuti, 1998, p.50).

It is necessary to signal once again that the focus of this investigation is only on two aspects of his argument: the understanding of original and its relationship with the author. It is not the focus here to discuss it at length neither the basis, nor further implications of Venuti's work.

In his understanding, Venuti argues that in addition to the fact that translation authorship is secondary because it presupposes the existence of an original, translations

[7] It should be noted that Venuti is greatly influenced by the ideas of the 18th century philosopher Friedrich Schleiermacher.

also relate to the original in an imitative form, sometimes interpreted as a text imitation and sometimes to the ideas that this original contains. Then, he moves the argument towards the connection between the author and the text itself. This argument is strongly related to that notion of post-romantic authors, i.e., the text becomes the embodiment of the author's intention and psychological state: a paper-image for the author's sole imagination. It follows that this paper-image is regarded as unique and irreplaceable by any other forms of neither interpretation nor translations alike[8]. This view would always place translation in second, disregarding any and all creativity involved in the whole process of translation.

On the other hand, by adding the author's personality to its modern constructed legal context, Venuti also states that:

> Copyright law reserves an exclusive right in derivative works for the author because it assumes that literary form expresses a distinct authorial personality – despite the decisive formal change wrought by works like translations (Venuti, 1998, p.50).
>
> What copyright law protects is a concept of authorship that is really not inscribed in a material form, but rather is immaterial, a god-like essence of individuality that lacks cultural specificity and permeates various forms and media (Venuti, 1998, p.51).

Although the relations between legal protection and dependency are equally important to the argument here, the focus, at least at this moment, lies on the intuitive relationship between the original and the author.

Therefore, it seems reasonable to argue that originality is a fluctuating concept that depends upon outer factors; also, that these factors are not always of material essence; namely, they are social constructs and views at a particular period in history.

Venuti (1995; 1998) also understands that the same concept of authorship is grounded in both philosophical and social (mis)understandings. Most importantly, he believes that authorship is socially constructed upon fluctuant social values; therefore, they can be reassigned in order to credit the translator, at least as the author of the translated text, that is, the translator is in essence the author of that particular form in that particular language[9], not a completely new text, but not only a transcription into another language.

---

[8] One could argue that since every translation is in itself an interpretation, there will be no need to distinguish between interpretation and translation. Yet, there is a more profound implication, especially when it is related to that of mathematics translation: the recognition of translation as interpretation would damage the basis for most mathematician's arguments that mathematics translation does not necessarily require any interpretation since the core of any mathematical text is always symbolized and therefore, it does not presuppose interpretation.

[9] It is important to point out that Venuti's claim is firmly grounded in literary translation. The intention here is to extrapolate his ideas on authorship and translation to other areas.

Ultimately, in Venuti's view, this process of rethinking the concept of authorship in TS would reframe the translator's fundamental value, not only in terms of recoding a text into different languages, but in terms of also crediting the translation as a new creation.

However, if Venuti's argument is accepted and if it is combined with the different understanding of authorship that derives from hard sciences (especially from the mathematics' point of view on authorship) it will provide us with the possibility of looking at the problem yet from another perspective: what if this primary author himself did not have any credit? What would happen with translations then?

As Montgomery (2000) have already noted, another important factor that needs to be considered is that:

> Translation means the possibility of many texts, multiple versions, an ever expanding array of works, both among and within languages. This returns us to the idea of the 'original'; the primal source text, whose importance - or even existence - has been an object of epistemological debate in recent years (Montgomery, 2000, p.286, highlight by the author).

Although pointed to translations in general, Montgomery`s remarks appear to be especially true in the case of mathematical translations. The fact that "original" mathematical texts are already regularly constructed upon layers of multiple texts reassures a belief that there must be a variation in both directions: authorship and originality. It would not be far off to assume, therefore, that its translations could even be considered a third shift: to translate something that it is already a translation.

Authorship in Mathematics

The Indian physicist and philosopher Sundar Sarukkai, in his 2002 book entitled *Translating the World*, widely discusses both the concept of authorship in hard sciences and the translation of its texts. He argues that science texts, especially mathematical ones, presuppose a different understanding of originality and consequently of authorship itself.

Sarukkai's understanding is also based in philosophical interpretations but on different directions from those of Venuti (1995; 1998) as he argues that the post-romantic view on the author did not really influence the view on scientific creations. The author argues that within sciences, although scientific creations/inventions do present an author/inventor, they show an equally intuitive shift in the positioning of the original. His view is well emphasized when he states:

> Even at the foundational level, science is possible only because it sees the world as the given original. The world is the original, the touchstone around which scientific discourse emanates and by which it is sustained (Sarukkai, 2002, p.128)

Although not particularly aimed towards scientific texts, Roland Barthes, in his controversial 1967 work entitled *The death of the author,* displays a similar reasoning as he argues:

> […] the writer can only imitate a gesture forever anterior, never original; his only power is to combine the different kinds of writing, to oppose some by others, so as never to sustain himself by just one of them; if he wants to express himself, at least he should know that the internal 'thing' he claims to 'translate' is itself only a readymade dictionary whose words can be explained (defined) only by other words, and so on ad infinitum (Barthes, 1967, pp.4-5).

It seems clear that there are philosophical premises to be accounted for in both statements. One of these premises is clearly to place the world as the original, that is, to attribute the scientists' role as only writers of this already conceived and amalgamated world. Sarukkai's main argument implies that one must follow one of two directions: one either considers the world as the original (consequently, it makes any particular text a translated text in the first place); or one can consider the first text written as the original (likewise, making it possess a concept of author similar to that of a novel or a poetry, which does not work completely in mathematics or physics for instance).

However, by following the first direction, his main discussion points toward ascertaining that in Mathematics and Physics, actual texts can only work because authors interpret the world as the original; therefore, any written text is, in fact, already a human-like translation of sorts of the world itself. In a way, it is a similar reasoning from that of Barthes, which indicates that any writer is always the involuntary consequence of what and of who came before him.

However controversial these views may seem, they both present a new factor to the equation: both indicate that there is a change in the positioning of the author; a variation that culminates, for better or worse, in the repositioning of that traditional dual connection between original-authorship-author. This is the main point of reflection at this point, mainly because, according to Sarukkai (2001), this rearrangement infers that:

> The scientists are never the original authors. They can only write, rewrite and translate the world as original. The first authorship, the one who holds the copyright over the translation, is the world. Scientific discourse only opens up the text of the world, one that is already 'written' (Sarukkai, 2001, p.654).

Thus, Sarukkai (2001; 2002) not only specifies a movement for the understanding of original, but also in the primary positioning of the author[10]. One could even indicate that the distancing between the authorship concepts in Mathematics and in Literature are imposed mainly due to the supposed impartiality of mathematical constructions; furthermore, that this impartiality is often related to the concept of validating a text, i.e., its content must be independent from the authorial figure within the mathematical domains. By this account, one could also infer that authorship receives a secondary role even within what could be commonly understood as an original production.

If this argument is accepted, one could extrapolate that the authorship role, at the moment of a mathematical translation, would also be conceived as marginal, but even farther from that of the first author or even compared to a literary translation for example.

Evidently, there are differences between the literary and the scientific understandings of authorship. Nonetheless, if one takes the original as primary creation that has never been seen or heard before, in opposition to the notion of secondary or derivative, one must first take into consideration that within a mathematical framework the same notion presents itself in an opposing manner. This feature is only apparent because mathematics has the peculiar characteristic of being in continuous and always-growing construction. The mathematical knowledge always depends upon past definitions, arguments, conclusions and especially upon a strict argumentative model, never quite fully invalidating past constructs. Mathematical authorship, in this sense, can only be construed as an implementation, an addition for what is already been done. The adding sum of all is entitled mathematical knowledge.

By these parameters alone, almost all mathematical texts are derivative, in the sense that they are all dependent on a previous "version". This last argument bears some resemblance to Venuti's argument in which literature is also always dependent upon cultural aspects but it also resonates that of Roland Barthes with a slight twist: the order is not to try to be different but to universalize.

This line of argument would inevitably lead us to stretch the importance of terminology amongst different technical texts. Although commented briefly, Montgomery (2000) once again gives us some insight into the problem that arises when he proposes:

> It would seem justified to propose that mathematical works, due to the nature of the symbolic systems involved, represent the extreme case of universal expression in

---

[10] One must recognize that Sarukkai's views on translations itself also differ from the common understanding of translation in TS. Nevertheless, his view on authorship does not invalidate the following argument.

> science (and perhaps in any field). Such texts, that is, appear invulnerable to significant change between languages. Mathematical discourse is the purest form of scientific logic, occupying a space above the more troubled topology of normal human speech. In reality, however, such is not the case. Even the most densely mathematical research takes place within a linguistic context. This can easily be confirmed by a glance through journals, monographs, and text-books in such fields as theoretical physics, biostatistics, physical chemistry, and cosmology, as well as any branch of mathematics itself. Equations, formulas, propositions, measurements, and alphanumerical or geometrical expressions of all kinds are to be found nested within written explanation and discussion. This is inevitable: as yet, mathematical articulation does not approach a fully self-sufficient system of communication (among human beings, at least) (Montgomery, 2000, p.255, author`s additions).

Montgomery pinpoints, with some humor, that mathematical texts cannot escape the same conditions as any other text: they are, after all, texts as any other human creation.

I have previously stated and discussed this problem in Galelli (2015) by arguing that even mathematical texts can be analyzed with literary (and consequently Translation Studies) frameworks if we consider its aesthetics as main conditions for a translation. In that instance, I have argued that Bicudo`s Portuguese translation for Euclid`s Elements offers a main shift in mathematical translations simply because he infers that the language aesthetics was not only considered in his translation, but placed first in any translator`s choice he would have during its translation process.

That possibility alone could account for many differences in Bicudo’s translation, but the important aspect is that there is the possibility of operating in another approach. In simple words, Bicudo has made it clear that it is a choice, like any language choice. The mathematical component of the text does play its part, but it does not have to be necessarily the most important one.

Nonetheless, beyond Venuti and Barthes’ reasoning, one could also understand (as Sarukkai does) that even what could usually be understood as an original work is actually merely a restatement of what is already written in nature. Therefore, overall, there would be no original: two different texts on the same subject, even in different languages, are consequently the same. This would give us an answer to why can there be so many Calculus texts.

However, this last argument is not easily accepted (and it should not), even though it is just a stretch for the detachment element of mathematical texts. But then again, it appears to be too detached. To claim absolutely no relationship between the writer and the text would be to deconstruct the very nature of creativity and therefore to defy any sort of human invention.

What one can notice nowadays in mathematics is a mixed understanding: the first author is recognized to some extent, in a reference to the names[11] or to a particular field[12], although the knowledge, the content itself remains detached from any particular author, that is, it does not depend upon any authorial figure. There is a sense of respect among practitioners, especially at top advanced research, but there is not a consensus about what should be given authorship[13]. This model is even reinforced by copyright laws in several countries, which clearly state that mathematical concepts are not subject to ownership[14]; hence, since mathematical texts are essentially made out of mathematical concepts, they are, on the whole, not subjected to the same standards as literature, for instance.

Venuti's view on authorship now could be contrasted with a hard science's point of view. While keeping Venuti's relationship between author and translation in mind, one can approach this issue from a different perspective. One could see mathematical translations either as merely a codification of nature itself as Sarukkai puts it, or one could look for authorial concept, as Venuti states. In both choices, however, there is a need to establish a starting point: either the recognized author or the recognized discoverer. In this direction, there is one particular instance in mathematics history that is noteworthy: Calculus authorship.

The *Calculus* Wars

There is no doubt that mathematicians enjoy a singular authorial freedom. There is, however, some cases of dispute about the origin of some mathematical ideas. *Calculus* is the most famous example about this particularity. It is no surprise that it is remarked in history books as *The Calculus Wars*.

With a difference of only a few years, Isaac Newton, working in England, and Gottfried Leibniz in Germany, came up with what is known as *Calculus*[15]. Jason Socrates Bardi wrote a book entitled *The Calculus Wars*. It is a complete account of that period of time when Newton and Leibniz disputed the authorship of Calculus. Throughout the book, Bardi (2008) reminds us several times that there were two main arguments at stake: who

[11] For example: The Cauchy-Schwarz Theorem.
[12] Cartesian Geometry, in reference to Renè Descartes Latin last name, Cartezius.
[13] Philosophically, the problem of establishing whether mathematics is created or invented.
[14] For instance, the 9.160 law, in the Brazilian Civil Code, first incise of the eighth article clearly states it.
[15] It is important to point out that it was the 17th century; communications were not at the stage they are today.

was the first to come up with the idea of Calculus, regardless of the invention or discovery issue, and who was the first to publish it. At the end, he concludes that Newton was the first to come up with the idea, but it was Leibniz the first to publish.

Their terminology was different, their objectives were different and especially their notation system was very different, but there was no doubt whatsoever that the mathematical concepts were the same.

After Leibniz's publication, Newton, who was the Royal Society's president at the time, soon launched a dispute for the credit Calculus was having among peers. This dispute lasted more than 10 years and only ended with Leibniz's death in in 1716. Although Newton was awarded the authorship of Calculus, the debate on whether mathematical concepts were the intellectual property spread throughout the academic circles and brought back the argument on whether mathematics is invented or simply discovered.

Throughout the 1870's until the 1920's, Frege, Russell and Wittgenstein made significant progress towards demonstrating that mathematics was only a series of consequences of logic itself. Working in the interface between language and mathematics, they aimed at proving that language and mathematics were different manifestations of the same logical system behind. Thus, mathematics would have to stand in the same category as languages. Kurt Godel's incompleteness theorems, published in 1931 ended this series of attempts and logic, mathematics and language are again enjoying a period of disconnection.

With this new suspension in the discussion, it follows that there is not much attention being given to developments from either areas. Mathematics is not paying attention to language and Language studies are not focusing on the production of technical texts. Olohan (2007), in his paper entitled *The State of Scientific Translation* had already argue that:

> Underlying this paper is the claim that translation studies and translation theory have paid more attention to the translation of literary, religious and philosophical texts than to non-literary translation. An example of this imbalance can be seen in the *Routledge Encyclopedia of Translation Studies* (Baker 1998), the first major reference work for translation studies. The traditional focus on literary translation is reflected in the inclusion of several entries on the practices of literary translation, research issues in literary translation, poetry translation, Shakespeare translation, drama translation, publishing strategies, etc., while there are no entries on scientific, technical, medical or commercial translation (Olohan, 2007, pp.131-132)[16].

[16] As Olohan (2007) herself had noted, the forthcoming edition would remediate this.

A possible conjecture at this point is that if these different academic contexts would to resume an interchange of developments, maybe both areas would benefit.

In short

What one can take from this discussion is that authorship is a fluctuant concept that relates directly to the time and place of its understanding, i.e., the historical period and the subject framework. In view of post-modern translation theories and the growing movement towards a more founded appreciation for the translator, especially in a work related context, one should find it of great importance to discuss the idea of authorship within the discipline of Translation Studies.

It would appear that the different points of view on authorship would eventually culminate in a different perspective on translation itself. This difference is already perceptible in the lack of material about mathematical translations, but it spreads throughout the whole spectrum of technical translation. Although this observation could be a result of the misguided understanding that mathematical translations do not (and cannot) reflect the same problems as literary translations, or even in the unfounded tradition of looking at mathematical texts as only carriers of content, without any appeal to aesthetics or style, it appears to me that the notion of original and authorship is invariably right at the center of the discussion.

This last argument, however, must be carried out with caution. There is a naïve sense that mathematical texts are mainly carriers of content. However, that does not necessarily entail that this is all they carry, neither that texts are carriers of meaning at all: they are first and far most realizers of meaning. In that sense, novels and poems also "carry" some content, in the same way that mathematical texts "carry" content, though their aesthetic beauty and style can often be placed in front of other features in the moment of a translation.

From this same perspective, but in a reverse view, one must only search for aesthetic and stylistic values as integrant features of mathematical texts, but not as its primary features. Nevertheless, if they are considered, one can finally rearrange the argument on authorship in order to reevaluate their importance to mathematical translations. This will certainly give a better understanding of yet another aspect of mathematical translations and it could even enrich the argument for other types of translation. In Montgomery's words:

> The precise roles of verbal expression in mathematical reports, the contours of rhetoric and organization, may well define a unique precinct in scientific discourse, one that has not yet been probed very deeply (Montgomery, 2000, p.255).

Both of Montgomery`s relations, this literary perspective on mathematical texts and its self-sufficiency as a system of independent language have been discussed in Galelli (2015) in relation to Euclid`s Elements and its translation to Brazilian Portuguese by Irineu Bicudo. However, the focus of that particular study was only on that particular translation and its relation to Venuti’s translation theory of *domestication* and *foreignization* coupled with Antoine Berman’s system of *deforming tendencies* in translations.

This attempt here, however, focuses mainly on the authorship issue around mathematical texts and its consequences to its translations. Is there a language pattern to identify authorship in Calculus texts? With that question in mind, we can approach the subject from a more practical tactic.

A way to show

Throughout the variety of Calculus texts, although one expects hints of authorship embedded in the choices an author makes (or does not make), it is unclear what is just repetition of this four century old theory and what really comes from the designated author of each book.

By searching for these hints of authorship in both the original and the translated text, the intention here is only to show how this fluctuating concept of authorship is managed (or not managed) in this particular *Calculus* translation.

As for the choice of text, the focus will be mainly around one example: James Stewart's book entitled *Calculus* and its translations to Brazilian Portuguese by Cyro C. Patarra, Ana Flora Humes e Márcia Tamanaha.

Stewart's *Calculus*

The choice of subject is straightforward: Calculus [17] is one of the most utilized/renowned mathematical tools/frameworks nowadays. Its applications spread throughout physics, engineering, statistics, chemistry, biology and even medicine. This means that there are a variety of theoretical books and textbooks on Calculus (directed or not at a particular field).

The Canadian mathematician James Stewart (1941-2014) is mostly famous for his calculus textbooks. His two volumes of basic Calculus are two of the most employed textbooks in universities around the globe.

Since they are textbooks, they are mainly intended for teaching and learning. Thus, there are expected features in order for a text to be classified as such. In mathematics, they are often a mixture of mathematical specialized texts and learning-teaching-oriented examples and exercises. This setting opens up the possibility of mixing well-established mathematical content with applications to specific fields, such as Engineering and Biology for example, as well as the composition of suggested exercises. In fact, most modern Calculus textbooks have the same structure: an explanation of the content followed by an example and (sometimes) a specific application.

[17] Newton and Leibniz invented/discovered Calculus in the 17th century. It is mainly a mathematical framework to work with movement and change. It is not unusual to find definitions such as: Calculus is the mathematical study of change or Calculus is the mathematical set of tools to analyze change or movement.

Our focus of analysis here must be direct to what is problematic in mathematical books: demonstrations. The mathematical content itself, has to be same from one book to another (even textbooks), since it is supposedly universal knowledge. That supposition leads to a different problem: Stewart's 1300 pages have no citations whatsoever. There are neither direct references nor any bibliographical references. What would call the attention of any student in any academic field causes no surprises to a math student, which is accustomed with this arrangement.

The focus, however, is that Calculus, as already stated, is a late 17th century mathematical construct. There were some modifications and improvements made to the model proposed by Newton-Leibniz, but it remains essentially the same construct. Yet, as stated, in Stewart's book, there are no citations, no bibliographical references; there is not a single direct reference to original works neither by Newton nor by Leibniz or any other academic article or book. In addition, as previously mentioned, this is not an isolated case[18].

With this possibility in mind, one can ask two different questions: how can one identify and separate authorship from the mathematical content and how is authorship being managed in its translations?

Hints of authorship?

There are two main movements that need to show here: one is to show the different aspects in mathematical writing and its relation with the concept of authorship. This will be shown by analyzing the use of citations, bibliographical content (or lack thereof it), and mainly by extracting excerpts of text and indicating personal pronouns uses (1st plural or third singular for example), verbal tenses (conjugations), essentially, the use of passive voice. The second and simultaneous step will be to analyze and compare how those aspects were dealt in the respective translation.

The excerpts and the book features are analyzed individually and in context in a qualitative perspective. It should be noted that to inform on the exact quantity of first person versus passive voice use does not appear to present much insight into the question of how authorship is dealt with in translations at this point. This quantitative approach would serve much better to a corpus-oriented study. The intention here is only to indicate and to triangulate it with different qualitative analysis.

[18] See page 8.

A first look at the initial pages and we can already encounter some disparities. The chart below relates the 'original' on the left and the Portuguese translation on the right.

Another way to picture a function is by an **arrow diagram** as in Figure 3. Each arrow connects an element of A to an element of B. The arrow indicates that $f(x)$ is associated with x, $f(a)$ is associated with a, and so on. The most common method for visualizing a function is its graph. If f is a function with domain A, then its **graph** is the set of ordered pairs $\{(x, f(x))\,\vert x \in A\}$ (Notice that these are input-output pairs.) In other words, the graph of f consists of all points (x, y) in the coordinate plane such that $y = f(x)$ and x is in the domain of f (Stewart, 2006a, p.12).	Outra forma de ver a função é como um **diagrama de flechas**, como na Figura 3. Cada flecha conecta um elemento de A com um elemento de B. A flecha indica que $f(x)$ está associado a $x, f(a)$ a a, etc. O método mais comum de visualizar uma função consiste em fazer seu gráfico. Se f for uma função com domínio A, então seu gráfico será o conjunto de pares ordenados $\{(x, f(x))\,\vert x \in A\}$ (Observe que eles são os pares *input-output.*) Em outras palavras, o gráfico de f consiste em todos os pontos (x, y) do plano coordenado tais que $y = f(x)$ e x está no domínio de f. (Stewart, 2006b, p.12)

One important aspect from this excerpt is that when choosing a gender for the word "associado" in the translation, the translator is providing, in fact, a meaning. Its meaning can be misinterpreted since the relation established in the text is from the function (a função) and its value (o valor). By choosing the masculine, the connection is interpreted as the value $f(x)$ and its relation to $x, f(a)$ and its relation to a as elements of two different sets. Another aspect is the non-translation of *input-output,* which would already indicate some language difficulty for a 'plain' translation. Nevertheless, the main concern is the use of the passive voice, which indicates some distance from the writer to the reader.

Nevertheless, in the following line, once the "hard math" appears to be fully specified, the subject goes to the first person, indicating a more conversational tone. There are even metaphors involved in order to explain what the previous math was intended:

The graph of a function f gives us a useful picture of the behavior or "life history" of a function. Since the y-coordinate of any point (x, y) on the graph is $y = f(x)$, we can read the value of $f(x)$ from the graph as being the height of the graph above the point x (see Figure 4). The graph of f also allows us to picture the domain of f on the x-axis and its range on the y-axis as in Figure 5 (Stewart, 2006a, p.12).	O gráfico de uma função f nos dá uma imagem proveitosa do comportamento ou da "história de vida" de uma função. Uma vez que a coordenada y de qualquer ponto (x, y) sobre o gráfico é $y = f(x)$, podemos entender o valor de $f(x)$ como a altura do ponto no gráfico acima de x (veja a Figura 4). O gráfico de f também nos permite visualizar o domínio sobre o eixo x e a imagem sobre o eixo y, como na Figura 5 (Stewart, 2006b, p.12).

At the very beginning of the next section, we already have some insight into both features:

If a single function can be represented in all four ways, it is often useful to go from one representation to another to gain additional insight into the function. (In Example 2, for instance, we started with algebraic formulas and then obtained the graphs.) But certain functions are described more naturally by one method than by another. With this in mind, let's reexamine the four situations that we considered at the beginning of this section (Stewart, 2006a, p.14).	Se uma função puder ser representada das quarto maneiras, então é proveitoso ir de uma representação para a outra, a fim de ganhar um *insight* adicional sobre a função. (No caso do Exemplo 2, partimos de fórmulas algébricas para obter os gráficos.) Porém, certas funções são descritas mais naturalmente por um método que por outro. Tendo isso em mente, vamos reexaminar as quatro situações consideradas no começo desta seção (Stewart, 2006b, p.14).

We should note that once again the word 'insight' was not translated to Portuguese. However, the important aspect is the tone, which resembles that of a conversation. However, the next paragraph reveals again a change.

The most useful representation of the area of a circle as a function of its radius is probably the algebraic formula $A(r) = \pi r^2$, though it is possible to compile a table of values or to sketch a graph (half a parabola). Because a circle has to have a positive radius, the domain is $\{r \mid r > 0\} = (0, \infty)$, and the range is also $(0, \infty)$ (Stewart, 2006a, p.14).	A mais útil dentre as representações da área de um círculo em função do seu raio é provavelmente a fórmula $A(r) = \pi r^2$, apesar de ser possível elaborar uma tabela de valores, bem como esboçar um gráfico (meia parábola). Como o raio do círculo deve ser positivo, o domínio da função é $\{r \mid r > 0\} = (0, \infty)$, e a imagem é $(0, \infty)$ (Stewart, 2006b, p.14).

The conversational tone gives way to a sequence of definitions and the apparent formulae brings the natural mathematical tone to the statements. However, the most important factor is the shift to the passive voice, striking as almost completely neutral.

In page 536 original and page 529 of the translation, we can find the following:

Sometimes it is impossible to find the exact value of an improper integral and yet it is important to know whether it is convergent or divergent. In such cases the following theorem is useful. Although we state it for Type 1 integrals, a similar theorem is true for Type 2 integrals.	Algumas vezes é impossível encontrar um valor exato de uma integral imprópria, mas ainda assim é importante saber se ela é convergente ou divergente. Em tais casos o seguinte teorema é útil. Apesar de afirmarmos isso para integrais do Tipo 1, um teorema similar é verdadeiro para integrais do Tipo 2.
We omit the proof of the Comparison Theorem, but Figure 12 makes it seem plausible. If the area under the top curve $y = f(x)$ is finite, then so is the area under the bottom curve $y = g(x)$. And if the area under $y = g(x)$ is infinite, then so is the area under $y = f(x)$. [Note that the reverse is not necessarily true: If $\int_a^\infty g(x)dx$ is convergent, $\int_a^\infty f(x)dx$ may or may not be convergent, and if $\int_a^\infty f(x)dx$ is divergent, $\int_a^\infty g(x)dx$ may or may not be divergent.]	Omitimos a prova do Teorema da Comparação, mas a Figura 12 o faz parecer plausível. Se a área sob a curva superior $y = f(x)$ for finita, então a área sob a curva inferior $y = g(x)$ também é finita. E se a área sob $y = g(x)$ é infinita, então a área sob $y = f(x)$ também é infinita. [Note que o inverso não é necessariamente verdadeiro: se $\int_a^\infty g(x)dx$ é convergente, $\int_a^\infty f(x)dx$ pode ou não ser convergente, e se $\int_a^\infty f(x)dx$ é divergente, $\int_a^\infty g(x)dx$ pode ser ou não divergente.]

From the chart, we can again reckon two different aspects of the text: the first is that even in explanations, the tone can change from neutral to first person plural and this change can be related to the very thin difference between mathematical definitions and actual explanations.

Overall, this shift in the subject of each clause could be a starting point for a more stable definition of authorship in mathematical texts. Such outset could be a good enough tool for analyzing differences between translations for instance and perhaps a quantitative analysis of this aspect could show some insight into the problematic definition of authorship in both original and translated works.

Final remarks

The main objectives of this work were to look at mathematical translations with an especial attention towards authorship; the relations between scientific and mathematical translations and finally the relations between one specific *Calculus* translation: Stewart`s textbook.

With that in mind, we first discussed the subject of originality and later we were able to discuss the concept of authorship in TS, particularly from Lawrence Venuti's point of view. Additionally, we discussed the concept of authorship from the hard sciences and mathematics points of view supported mainly by the ideas of Sundar Sarukkai.

From Stewart`s textbook, we underlined some changes in the voice of the author in order to investigate two different aspects: can we imply that they are traces of authorship and if so, how are they treated in the Portuguese translation. From that, we were able to signal that some changes in the voice of the author appear to be directly related to what Sarukkai points out as a fluctuating concept of authorship. However, the treatment given by the Portuguese translators to that fluctuation appears to mark the differences in Portuguese.

One possible continuation for this piece of research is to make a quantitative analysis of the same characteristics as pointed here in both Stewart's book and its Portuguese translation. This number-oriented approach would possibly give some insight into the choice making mechanisms used by the translators. Another possible addition would be to analyze Stewart's text with a more powerful critical tool, such as Halliday's systemic functional grammar. This approach would almost certainly give some insight into the meaning-making machinery of Calculus as textual representative of mathematics as a whole.

Finally, "there is plenty of room at the bottom". In direct allusion to Richard Feynman`s famous 1959 lecture on the miniaturization of Physics, the metaphor here is that if one looks closely enough, one is bound to find some connections that were previously disregarded. There is plenty of language at the bottom of any mathematical text and that simply cannot be neglected.

Mathematical translations are, with no doubt, being disregarded as a translated text to be analyzed from a TS framework. Historically, from a Mathematical framework, they are also not subjected to any sort of deep analysis due to the naïve and unfounded notion that mathematical texts are only carriers of content.

Up until now, this negligence should be looked at as an opportunity, for it opens up many possibilities for both: Translation Studies expands and obtain a new source material; Mathematics acquires a new parameter of analysis for its texts. What could (and should) be highlighted is that this omission to account for different types of texts infers into TS theorizations a narrow range of possibilities. Not only would the field of Mathematics benefit from other types of analysis to its texts, but also in this particular case, TS would benefit to have a different sort of example to its range of analysis.

It does not come as a surprise that mathematical texts are not being treated as an object in TS. The content specificity and a culturally amalgamated detachment suggest a greater distance between the two areas than what actually exists. In fact, what keeps them apart is only the difficulty in approaching the subject matter in a more practical way. It is true that at least some specific knowledge of the subject is required. However, the very nature of TS as an interdisciplinary field entails some intertextuality and consequently some exchange between at least two different academic universes.

Bibliography

Aixelá, J. F. (2004, January). The Study of Technical and Scientific Translation: an examination of its Historical Development. *JoSTrans - The Journal of Specialized Translation*(01), pp. 29-49. Retrieved from http://www.jostrans.org/issue01/art_aixela.pdf

Baker, M. (1998) (ed.). *Routledge Encyclopedia of Translation Studies*. London and New York: Routledge.

Bardi, J. S. (2008). *A guerra do Cálculo* (1ª ed.). (A. P. Costa, Trad.) Rio de Janeiro: Record.

Barthes, R. (1967). The death of the author. *Aspen*, 1-7.

Berman, A. (2007). *A tradução e a letra, ou, o albergue do longínquo.* (M.-H. C. Torres, M. Furlan, & A. Guerini, Trans.) Rio de Janeiro: 7Letras/PGET.

Byrne, Jody (2006). *Technical Translation: Usability Strategies for Translating Technical Documentation*. Dordrecht: Springer.

Deslile, J., & Woodsworth, J. (1998). *Os tradutores na história.* (S. Bath, Trans.) São Paulo: Ática.

Eco, U. (2003). *Dire quasi la stessa cosa. Esperienze di traduzione*, Milano: Bompiani.

Euclid. (1956). *The thirteen books of Euclid's elements*. Trad. Sir. Thomas Little Heath. New York: Dover.

Kuhn, T. S. (2011). *A estrutura das revoluções científicas*. Trad. Beatriz Vianna Boeira e Nelson Boeira. 10ª Edição. São Paulo: Perspectiva.

Galelli, R.D. (2015). *Entre a Tradução e a Matemática*. Curitiba: Appris.

Montgomery, Scott L. (2000). *Science in Translation*. Chicago: University of Chicago Press.

Olohan, M. (2007). The Status of Scientific Translation. *Journal of Translation Studies, 10*(1), 134-144.

Popper, K. R. (2000). *A lógica da pesquisa científica*. Trad. Leonidas Hegenberg e Octanny Silveira da Mota. SP: Editora Cultrix.

Russell, B. (2007). *Introdução à filosofia matemática.* Trad. de Maria Luiza X. De A. Borges. Rio de Janeiro: Jorge Zahar.

Sarukkai, S. (2001). Mathematics, Language and Translation. *Érudit, 46*(4). doi:10.7202/004032ar

Sarukkai, S. (2001). Translation and Science. *Érudit, 46*(4), pp. 646-663. doi:10.7202/004031ar

Sarukkai, S. (2002). *Translating The World.* University Press of America, Inc.

Stewart, J. (2006a) Calculus. 5th edition. Boston: Thomson Learning.

Stewart, J. (2006b) Cálculo, 5ª edição. Translation: Cyro C. Patarra, Ana Flora Humes & Márcia Tamanaha. São Paulo: Thomson Learning.

Venuti, L. (1995). *The translator's invisibility: a history of translation.* London & New York: Routhledge.

Venuti, L. (1998). *The Scandals of Translation: towards an ethics of difference.* London & New York: Routledge.