The framing of science and religion in seven children's books about Christopher Columbus and Galileo Galilei

Análise e enquadramento teórico da ciência e da religião em sete livros infantis que abordam Cristovão Colombo e Galileo Galilei

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Abstract

As part of my graduate diploma in Science Communication at Laurentian University, I explored how seven children's books about the life of Galileo and Columbus framed science and religion. Using a rhetorical approach, I examined the text and images of the books to see if the books framed known or perceived conflicts between science and religion in a balanced frame, or if they were framed in an unbalanced opposition or non-oppositional way. Using Janis and Fadner's coefficient of imbalance, I was able to quantify the results and found that the books tend to frame science and religion in a balanced way. However, the images in the sections of the books that dealt with known or perceived conflict between the Catholic Church and Galileo or Columbus strayed from a balanced view and framed science and religion as either oppositional or non-oppositional.

Keywords

Children's literature, history of science, science communication, science education, science/faith dialogue

Resumo
Como parte de meu curso de Comunicação Científica desenvolvido na Laurentian University (Sudbury, ON.), explorei como a ciência e a religião são abordados em sete livros infantis canadenses que abordam a vida de Cristovão Colombo e Galileu Galilei. Utilizando uma abordagem retórica, foram examinados os textos e as imagens desses livros a fim de compreender se possíveis conflitos entre ciência e religião são abordados e se esses conflitos aparecem de maneira balanceada, se pendem para um dos lados ou se aparecem de maneira não oposta. Utilizando o coeficiente de desequilíbrio (coefficient of imbalance) proposto por Janis e Fadner, foi possível quantificar os resultados e apontar que os livros analisados tendem a tratar a ciência e a religião de maneira equilibrada. Entretanto, quando analisadas as imagens nas sessões que apresentam conflitos conhecidos entre a igreja católica e Galileu ou Colombo, os livros se afastam de uma visão equilibrada da ciência e da religião e adotam uma posição de oposição, em alguns casos, e de não oposição, em outros.

Palavras-chave
Literatura infantil; história da ciência; comunicação científica; educação científica; diálogo ciência/religião.

Introduction
Science and religion are often seen in a dichotomy: they are seen as either in opposition to each other, or they are seen as having found some common ground. Debates between young earth creationists and evolutionists are a common example of where the two are at extreme odds. On the other hand, Pope Francis's encyclical letter, Laudato Si', which highlights the anthropogenic nature of current climate change and invites both the secular and religious worlds to work towards solutions to this critical issue (Francis, 2015), is a great example of science and religion finding common ground by agreeing on the evidence and a sharing of values.

Despite examples of science and religion finding consensus (Consolmagno, 2000; Gould, 1999), or that there are scientists who declare themselves as people of faith (Ecklund, Johnson, Mamshari, Matthews, & Lewis, 2015), an oppositional image between science and religion persists in western culture. Such perceptions of opposition can be harmful both to science and religion, especially when a voice like Pope Francis's comes to support the anthropogenic nature of modern climate change.

How then do these perceptions of opposition get into and come to be reinforced in western culture? One possible avenue I wanted to explore is children's literature, where this opposition may be presented to individuals at a young age. It is also possible that parents who are reading these books with or to their children may also have these oppositional views reaffirmed, further entrenching them in the general culture.

Through a research project for my graduate diploma course in Science Communication at Laurentian University, I examined whether the opposition between science and religion was or was not being portrayed in a balanced way in seven children's books that talk about the life and history of Galileo Galilei or Christopher Columbus. I chose these two figures not only because they are historical hallmarks of discovery, innovation and adventure, but also because they are two historical points where science and religion are often framed as being in opposition.

Two questions guided my analysis of the books. The first was, how do these seven children's books from the last three decades frame Galileo and Columbus's relationships and their discoveries with respect to the Catholic Church? The second question was, are any known historical myths upheld in the literature?

The perceived opposition between science and religion is a topic that has been explored by both the religious and scientific communities. Most have found this idea of opposition to be inaccurate and not representative of the historical or

modern perceptions of science and religion from within these fields (Consolmagno, 2000; Gould, 1999; Reiss, 2008).

However, in the general public, the oppositional view of science and religion persists and has caused tensions on both sides. This situation of opposition has become known as the science/religion question in some circles of study (Reiss, 2008). With the growing amount of children's literature about science and famous scientists readily available from public libraries or online bookstores, it is unclear if these books are addressing the science/religion question either directly or indirectly – especially with historical books dealing with scientific figures that have had documented conflicts with religious institutions (such as Galileo being on trial for his Copernican views), or historical figures that have had perceived conflicts like Columbus (and the idea of a flat Earth).

At times the conflicts between the church and Galileo, the church and Columbus, and certain other myths about science and religion have been held up as straw men to insight the flames of perceived opposition between science and religion (Gould, 1999). Several of these myths come out of the late 18th and early 19th century, around the time when the groups and individuals studying nature started to call their studies science and no longer use the terms natural philosophy or natural history (Numbers, 2009). (A note, when using the term myth, like Numbers (2009), I am using it in its more colloquial sense to point out a claim that is false.)

During the early 19th century, strong voices from the scientific and religious fields went to great lengths to undermine the other and show that the opposing group had undermine their work or that the other group had hindered or hurt their respective domains. In this back and forth, some authors suggest, the groundwork for the dichotomy we see today was laid through parables, hyperboles, over simplifications and even fabricated histories that ended up rewriting actual historical accounts (Consolmagno, 2000; Gould, 1999; Numbers, 2009).

The stories of Galileo and Columbus are often cited as times where science and religion have been in direct opposition. In the case of Galileo this opposition is well documented, but nuances in the history don't often make their way into stories consumed by the general public.

In Galileo's trial, it is often understood that he was imprisoned in jail and suffered physical tortured at the Roman Inquisition for upholding a Copernican view of the universe. However, it is now known that he was not imprisoned in jail or a cell. Instead he stayed at the Tuscan embassy before the trial and then was put up at the inquisitor's apartments during his trial. During the trial itself he was never physically tortured, though he was threatened with torture (Consolmagno, 2000; Finocchiaro, 2009; Gould, 1999).

When it comes to Columbus, there is a perception that he argued for the idea of a round Earth, a "novel" concept that would allow him to sail west to Asia, while church and state officials clung to a medieval view of a flat Earth. The truth is that, barring two obscure medieval scholars (Lactantius and Cosmas Indicopleustes) who did hold to the idea of a flat Earth based on scripture, the Greek concept of a round Earth, attributed to the Greek scholar Eratosthenes, was not lost to the educated populations of medieval Europe. What was debated was the circumference of the Earth. Columbus had miscalculated and was arguing for a much smaller circumference, while church and state officials correctly argued that the distance was significantly longer than Columbus's calculations (Cormack, 2009; Gould, 1999; Singham, 2007).

If a rhetorical look at children's books about Columbus or Galileo finds that certain myths about science and religion are present, or that there are instances of oppositional frames for science and religion, it is possible that the authors and illustrators may be unknowingly introducing or reinforcing myths about science and religion that contribute to the oppositional views held by the general public in western society.

Methods

For my project I used a mix of both qualitative and quantitative methods. By doing so, I hoped to reveal more accurate and valid results while also helping to eliminate my own biases as a researcher.

As a researcher, I come from a religious (Roman Catholic) background, but also hold an appreciation for and understanding of the scientific methods and subscribe fully to modern cosmology, evolutionary theory, etc. As such, I tend not to see opposition between religion and science, and when I do, it tends to be filtered through a lens of science on the attack against religion – in large part due to outspoken individuals like Richard Dawkins. To help keep these views in check, I used a framework, discussed below, for qualitative coding. I also used the coefficient of imbalance, discussed below, for my quantitative analysis.

Sampling

In choosing my sample of books, I wanted to use books that would be available to the general Canadian public through various means. I chose Amazon.ca and the Winnipeg and Toronto Public Libraries as sources for my book selection. I first searched "Columbus children's books" and "Galileo children's books" in Amazon.ca and created a list of books that were published between 1990 and 2015. I then cross-referenced that list to see which of the books would also be available at either the Toronto or Winnipeg Libraries. I also required that the books have images or pictures.

I do acknowledge that there is debate about whether pictures help or hinder children's ability to read (Samuels, Biesbrock, & Terry, 1974), but images do add to the understanding and enjoyment of books (Zhihui Fang, 1996) and younger children do have a preference for books with pictures (Samuels et al., 1974). The main reason for including books with images is that "images are an important means through which ideologies are produced and onto which ideologies are projected" (Sturken & Cartwright, 2009: p.23). That is to say that images

influence how we see and navigate our cultural world, but they can also reflect back to us our cultural views and perceptions.

Including images also allowed me to examine the interplay between the text and images through their denotation and connotation, leaving room a richer analysis than text alone. "[D]enotation concerns what the image shows, connotation concerns how it is shown. The connotation of words and image can reinforce each other," (Mellor, 2009: p. 210).

Based on these criteria, I chose seven books. Those about Galileo were:

CHRISTENSEN, Bonnie. (2012). *I, Galileo*. New York: Alfred A. Knopf.
DEMUTH, Patricia Brennan. (2015). *Who Was Galileo?* New York: Grosset & Dunlap.
SIS, Peter. (1996). *Starry Messenger*. New York: Square Fish.

And those about Columbus were:

BADER, Bonnie. (2013). *Who Was Christopher Columbus?* New York: Grosset & Dunlap.
SIS, Peter. (1991). *Follow the Dream: The Story of Christopher Columbus*. New York: Alfred A. Knopf.
WADE, Mary Dodson. (2007). *Christopher Columbus: Famous Explorer*. Mankato, Minnesota: Capstone Press.
WEST, David, & GAFF, Jackie. *Christopher Columbus: The Life of a Master Navigator and Explorer*. New York: Rosen Classroom Books & Materials.

I was unable to find a fourth book on Galileo that fit my selection criteria, but I did not want to discard one of the four books on Columbus, because it assured that I had at least two of each type of book (picture book, chapter book and graphic novel).

Only *Who was Galileo?* was not available at the public libraries because it was published in February 2015. I included it because it is part of the same series of books as *Who Was Christopher Columbus*?

and I felt its inclusion might reveal some interesting trends between the two books.

The books I chose are available in Canada through Amazon.ca and other local Canadian book retailers. The two graphic novels *Christopher Columbus: Famous Explorer and Christopher Columbus: The Life of a Master Navigator and Explorer* ranked in the top 10% of the list for 10,000,000 books sold on Amazon.ca according to the website's bestseller book ratings (as of January, 2016). All the other books ranked in the top 5% for the same list. This gives a rough idea how accessible these books are to the Canadian public.

The "Who Was/Who is" is a biography series published by Gross and Dunlap and is created with early years educators and families in mind. These books often have one author and a different individual doing the illustrations. Both of the graphic novels, *Christopher Columbus: Life of a Master Navigator and Explorer and Christopher Columbus: Famous Explorer*, come from publishers who tend to focus on children's literature and the writing and illustrations are done by different individuals.

For the picture books, Peter Sis is both author and illustrator for *Starry Messenger* and *Follow the Dream*; while Bonnie Christensen is both author and illustrator for *I, Galileo*. This makes the picture books slightly different from the rest of the sample as the text and images and being created by the same individual. Knopf, publisher for both *I, Galileo* and *Follow the Dream*, is a more generic publisher that publishes a variety of fiction and non-fiction books. Square Fish, publisher for Starry Messenger, is a children's book publisher under MacMillan publishers.

Qualitative Methods

To create the coding framework that I used to code the books, I applied a rhetorical (or discourse analysis) approach, specifically a deductive approach (O'Leary, 2010: p. 262). With the framework, I wanted to code the instances in the books where science and religion were paired together and

then assign to them one of four themes based on the four terms of the coefficient of imbalance (see quantitative methods below). These four themes based on the coefficient were: oppositional, non-oppositional, neutral, and irrelevant.

First, I established some preliminary criteria for each of the four themes and then created specific criteria for the analysis of the text and the analysis of the images. With this initial framework, I read through the book while looking for new criteria that could be added to the themes of the framework for the test analysis. This new criteria could come from the various levels of information of text analysis such as words, concepts and linguistic devices (O'Leary, 2010: p. 265). I then examined the visual elements of the books paying attention to points of view, colour schemes, line angles, and orientation in space (e.g. foreground, background). Like the text analysis, I added new criteria to the themes of the framework as they appeared. After the analysis, the occurrence of any of the criteria was used to create a total count for each of the four themes. These counts were then used with the coefficient of imbalance for the qualitative analysis.

My rhetorical analysis of the text and images was largely influenced by modern rhetorical analysis methods outlined by Crowley and Hawhee (2012) and supplemented by some of the qualitative data analysis methods outlined by O'Leary (2010) and Krippendorff (2013). My image analysis was supplemented by research that examined how certain shapes and angles can elicit emotional responses (Armbruster, Suchert, Gärtner, & Strobel, 2014; Aronoff, 2006; Bar & Neta, 2006; Larson, Aronoff, Sarinopoulos, & Zhu, 2009; Watson, Blagrove, Evans, & Moore, 2012). I also pulled from other aspects of visual rhetorical analysis (Crowley & Hawhee, 2012; Foss, 2005; Mellor, 2009).

Quantitative Methods

To analyse the results, I used Janis and Fadner's coefficient of imbalance (C.O.I.) that is "intended to be applicable to all types of communication [...]

except those in which the communication is arbitrarily restricted to specific symbols, as in multiple-choice or yes-no answers to questionnaires" (Janis & Fadner, 1943: p. 107), and is designed to help make a quantitative evaluation of qualitative information that can be divided into four types of content. The formula for the C.O.I. is:

$$C=\begin{cases} f^2-fu/rt & \text{when } f\geq u \\ fu-u^2/rt & \text{when } f<u \end{cases}$$

Where:
f = the number of favourable units
u = the number of unfavourable units
r = the number of relevant units = f + u + the number of neutral units
t = the total number of units = r + the number of irrelevant units
(Janis & Fadner, 1965 as cited in Krippendorff, 2013: pp. 59-60)

When establishing the themes of my framework, I expanded the formula to see all its terms. This allowed me to see which four themes I would have to develop.

$$C=\begin{cases} f^2-fu/(f+u+n)(f+u+n+i) & \text{when } f\geq u \\ fu-u^2/(f+u+n)(f+u+n+i) & \text{when } f<u \end{cases}$$

Where:
f = the number of occurrences where science and religion are framed together with a non-oppositional frame, as well as the occurrence of when a historical myth, is dispelled.
u = the number of occurrences where science and religion are framed together with an oppositional frame, as well as the occurrence of any historical myths.
n = the number of occurrences where science and religion are framed together with a neutral frame, as well as points of historical conflict that are not exaggerated and hold to the general consensus of historical events.

i = the number of occurrences of irrelevant instances and instances where science or religion are framed independent of the other.

The C.O.I. gives a result between 1 and -1, and although Janis and Fadner (1943) did not give separators for where the values of imbalance shift from unfavourable to neutral to favourable, Jeffery Greenhaus et al. (2003) set the values at even thirds. Between 1 and 0.33 a book would frame science and religion as non-oppositional. Between 0.32 and

-0.32 a book would frame them as neutral and between -0.33 and -1 a book would frame science and religion as oppositional.

To supplement the C.O.I., I also did a count of the occurrences of when a myth was upheld or dispelled. The two myths that I considered for Columbus were:
1. That the idea of a flat Earth was held by educated individuals at the time.
2. That the point of disagreement between Columbus and the church or state officials was that the Earth was flat and not a disagreement about the circumference of the Earth.

The historical myths that I considered for Galileo were:
1. That he was physically tortured.
2. That he was imprisoned in jail.
3. That he had no visitors during his house arrest.

As will be outlined in the analysis section, the irrelevant instances in the books greatly outweighed any other instances (non-oppositional, oppositional and neutral). As the irrelevant terms are part of the denominator, they outpaced the values of the numerator and resulted in a neutral result for all the books. This is an important finding, as will be discussed later, but I was curious to see what would happen to the values if I was able to limit or restrict the occurrences of the irrelevant cases and focus in on the other three terms of the equation.

To do this, I modified the C.O.I in two different ways. The first was to remove the irrelevant terms from the denominator.

$$C=\begin{cases} f^2-fu/(f+u+n)(f+u+n+i) & \text{when } f\geq u \\ fu-u^2/(f+u+n)(f+u+n+i) & \text{when } f<u \end{cases}$$

By removing the irrelevant terms, I was left with the term r repeated twice and the C.O.I could be simplified to:

$$C=\begin{cases} f^2-fu/(f+u+n)^2 & \text{when } f\geq u \\ fu-u^2/(f+u+n)^2 & \text{when } f<u \end{cases}$$

or

$$C=\begin{cases} f^2-fu/r^2 & \text{when } f\geq u \\ fu-u^2/r^2 & \text{when } f<u \end{cases}$$

With this modification, the new C.O.I. (hereafter referred to as C.O.I. without *t* or C.O.I.W.t) would still return a value between 1 and -1, but would ignore the irrelevant occurrences. Similar modifications to the C.O.I. have been made in other research (Deephouse, 1996; Greenhaus et al., 2003). It should be noted that in both cases the C.O.I. was modified by removing the term *r* and squaring the term *t*.

The second modification I made was to restrict the unmodified C.O.I. to look at only the values of the terms *f*, *u*, *r*, and *t* on pages that dealt with Columbus proposing his voyage westwards in the Spanish court and the trial of Galileo. These pages are summarized in the table below. I chose these two instances because they are the points in history where the myths about Columbus's and Galileo's history take place. This restricted C.O.I. will be hereafter referred to as the C.O.I. pages (C.O.I.P.).

Table 1: Pages that were selected for use with the C.O.I.P.

Book	Pages
I, Galileo	27-28
Starry Messenger	28-32
Who Was Galileo	87-95
Christopher Columbus: Famous Explorer	8-9
Christopher Columbus: The life of a Master Navigator And Explorer	13-15
Follow the Dream: The Story of Christopher Columbus	20-24
Who was Christopher Columbus?	22-23 and 26-27

After calculating the various coefficients of imbalance and doing a count of when a historical myth was upheld or dispelled, I compared these values to the year of publication, the central character, the type of books and the ATOS reader level that I found on the AR BookFinder website ("AR BookFinder," 2014). To explore these comparisons, I used the Pearson correlation coefficient and a one-way ANOVA calculation (Salkind, 2010). I defined my independent and dependant variables as follows:

Table 2: Selection of variables for analysis

Dependent Variables	Independent Variables
C.O.I.	Year of publication
C.O.I.W.t	Central Character
C.O.I.P.	Type of Book
Counts of dispelled myths	ATOS reader level
Counts of upheld myths	

Results

After calculating the C.O.I., C.O.I.W.t and C.O.I.P. for each book, I was able to see how the values differed when looking at the occurrences for the text and imagery together, when looking at the occurrences for the text alone, and when looking at the occurrences for the imagery alone. Tables 3 through 9 summarize these results for each of the seven books.

Table 3: Follow the Dream (1991)

	C.O.I.	C.O.I.W.t	C.O.I.P.
Text and Imagery	-0.06	-0.16	-0.43
Text	0.00	0.00	-0.50
Imagery	-0.12	-0.22	-0.42

Legend	
Non-oppositional	1 to 0.33
Neutral	0.32 to -0.32
Oppositional	-0.33 to -1

Table 4: Starry Messenger (1996)

	C.O.I.	C.O.I.W.t	C.O.I.P.
Text and Imagery	-0.07	-0.13	-0.44
Text	-0.01	-0.03	-0.14
Imagery	-0.13	-0.19	-0.65

Table 5: Christopher Columbus: The Life of a Master Navigator (2005)

	C.O.I.	C.O.I.W.t	C.O.I.P.
Text and Imagery	0.05	0.29	0.25
Text	0.03	0.28	0.15
Imagery	0.06	0.30	0.37

Table 6: Christopher Columbus: Famous Explorer (2007)

	C.O.I.	C.O.I.W.t	C.O.I.P.
Text and Imagery	0.00	0.01	0.03
Text	0.02	0.07	0.17
Imagery	0.00	-0.02	-0.07

Table 7: I, Galileo (2012)

	C.O.I.	C.O.I.W.t	C.O.I.P.
Text and Imagery	-0.03	-0.08	-0.33
Text	-0.05	-0.11	-0.25
Imagery	-0.01	-0.03	-0.38

Table 8: Who Was Christopher Columbus? (2013)

	C.O.I.	C.O.I.W.t	C.O.I.P.
Text and Imagery	0.08	0.38	0.18
Text	0.06	0.49	0.00
Imagery	0.09	0.33	0.45

Table 9: Who Was Galileo? (2015)

	C.O.I.	C.O.I.W.t	C.O.I.P.
Text and Imagery	0.02	0.05	0.06
Text	0.01	0.02	-0.06
Imagery	0.05	0.15	0.45

Table 10 below shows the totals for myths that were upheld and dispelled for each of the seven books.

Table 10: Dispelled and upheld myths

	Follow the Dream	Starry Messenger	CC: The Life of a Master Navigator	CC: Famous Explorer
Dispelled Myths	4	1	9	1
Upheld Myths	2	2	0	0

	I, Galileo	Who Was Christopher Columbus	Who Was Galileo
Dispelled Myths	0	3	4
Upheld Myths	0	0	0

The correlations and one-way ANOVA between the dependent and independent variables are summarized in Table 11 and Table 12 below.

Table 11: Correlation results

	Year of Pub	Central Character	Reader Level
C.O.I. (Text and Imagery)	0.72	0.41	-0.40
C.O.I. (Text)	0.17	0.70	-0.70
C.O.I. (Imagery)	0.86	0.22	-0.21
C.O.I.W.t (Text and Imagery)	0.55	0.47	-0.45
C.O.I.W.t (Text)	0.29	0.64	-0.59
C.O.I.W.t (Imagery)	0.71	0.29	-0.28
C.O.I.P. (Text and Imagery)	0.63	0.45	-0.50
C.O.I.P. (Text)	0.52	0.24	-0.66
C.O.I.P. (Imagery)	0.69	0.32	-0.26
Dispels Myths	-0.07	0.46	-0.16
Upholds Myths	-0.91	-0.09	0.14

Legend
$p > .05$ ≥ 0.75
$p > .10$ 0.67 to 0.74

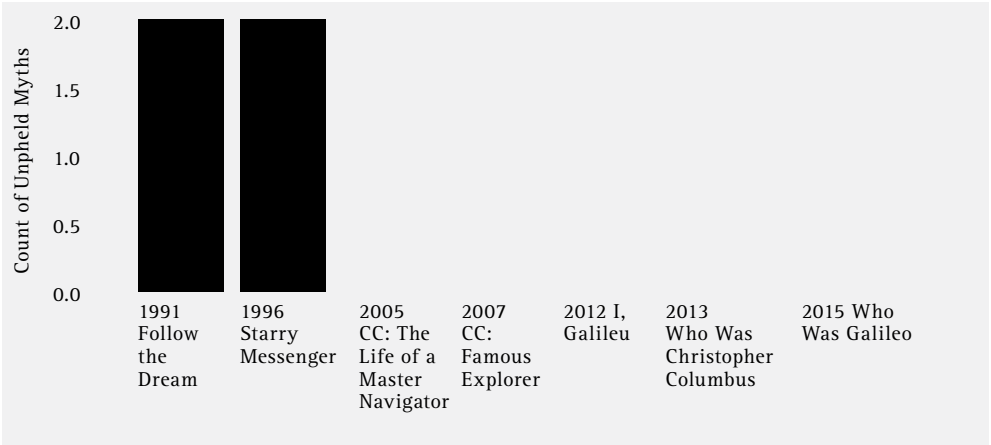
Table 12: One-way ANOVA results

	Type of Book
C.O.I. (Text and Imagery)	10.11
C.O.I. (Text)	2.97
C.O.I. (Imagery)	6.07
C.O.I.W.t (Text and Imagery)	3.56
C.O.I.W.t (Text)	1.78
C.O.I.W.t (Imagery)	4.62
C.O.I.P. (Text and Imagery)	23.97
C.O.I.P. (Text)	7.43
C.O.I.P. (Imagery)	16.40
Dispels Myths	0.67
Upholds Myths	2.19

Legend	
$p > .01$	≥ 18
$p > .05$	6.95 to 17.99
$p > .10$	4.33 to 6.94

Regrettably, because of the small sample size, only two of the correlations were present once they were graphed out. Those two were the relationship between how the year of publication affected the number of myths that were upheld (Figure 1), and how the type of book affected the C.O.I.P. (Text and Imagery) (Figure 2). I will discuss these findings further in the analysis section.

Exploring the two trends above along with the summaries for each of the individual books in more detail revealed some interesting insights.



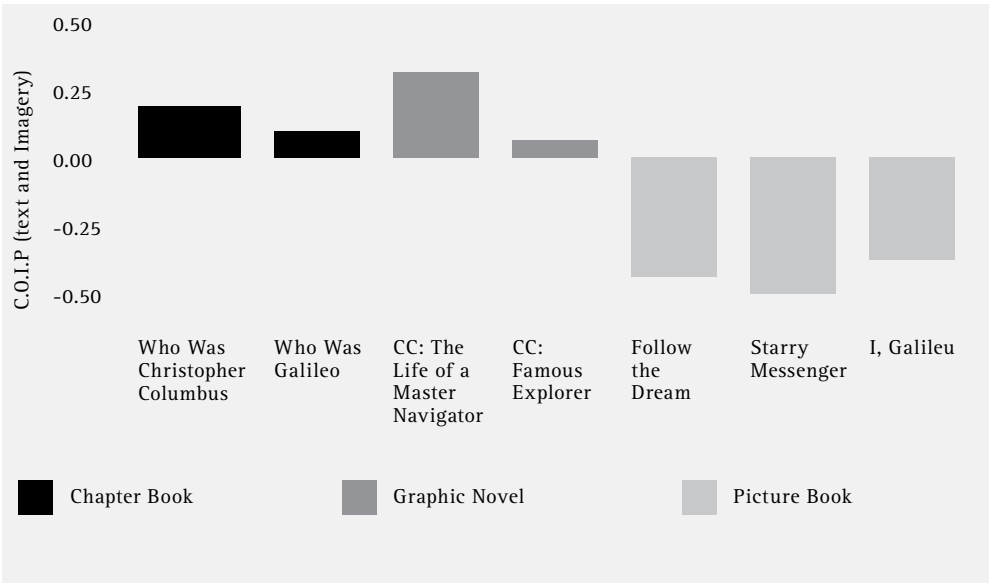


Figure 1.
How the year of publication affects the number of upheld myths

Figure 2.
How the type of book affects the C.O.I.P. (Text and Imagery)

Analysis

Looking at the seven books and their values derived with the C.O.I., it is clear that they all frame science and religion in a neutral way. The results do not exceed a value of ±0.10 except for the values for the imagery of *Follow the Dream* (Table 3) and *Starry Messenger* (Table 4) at -0.12 and -0.13 respectively.

Looking at just the oppositional and non-oppositional values in Table 13 it would appear that some of the books should have larger C.O.I. values. Yet, when I compared the oppositional and

Table 13: Total counts of *f*, *u*, *n* and *i* for each book

Book	Non-oppositional(*f*)	Oppositional (*u*)	Neutral (*n*)	Irrelevant (*i*)
Follow the Dream (1991)	7	17	9	47
Starry Messenger (1996)	7	17	12	27
CC: The Life of a Master Navigator (2005)	42	3	30	408
CC: Famous Explorer (2007)	12	11	9	102
I, Galileo (2012)	6	11	10	35
Who Was Christopher Columbus (2013)	27	1	15	172
Who Was Galileo (2015)	39	25	37	140

non-oppositional to the irrelevant counts, it become clear that irrelevant counts are often dominating the C.O.I. and trending its values towards 0.

When I used the C.O.I.W.t to ignore the irrelevant counts, the values increased, but all the values remain neutral except for one of the books. The exception was *Who Was Christopher Columbus*? whose values for text and imagery, text alone, and imagery alone all cross over into non-opposition (Table 8).

These results support a view that all the books in this sample frame science and religion in neutral terms, except for *Who Was Christopher Columbus*? that frames science and religion as non-oppositional.

This could be because the books deal with the entire lives of Columbus and Galileo and that only a small section of their lives are characterized as being in conflict with the Catholic Church. For Columbus, this was when he asked for funding to sail west. For Galileo, this was when he was taken before the Roman Inquisition - although a case can be made that Galileo had many encounters through his life with the Catholic Church before his trial at the Roman Inquisition.

The C.O.I.P. that focused on those specific periods of history for Columbus and Galileo shows an increase in the values compared to those of the C.O.I.W.t. When looking at the values of the C.O.I.P.

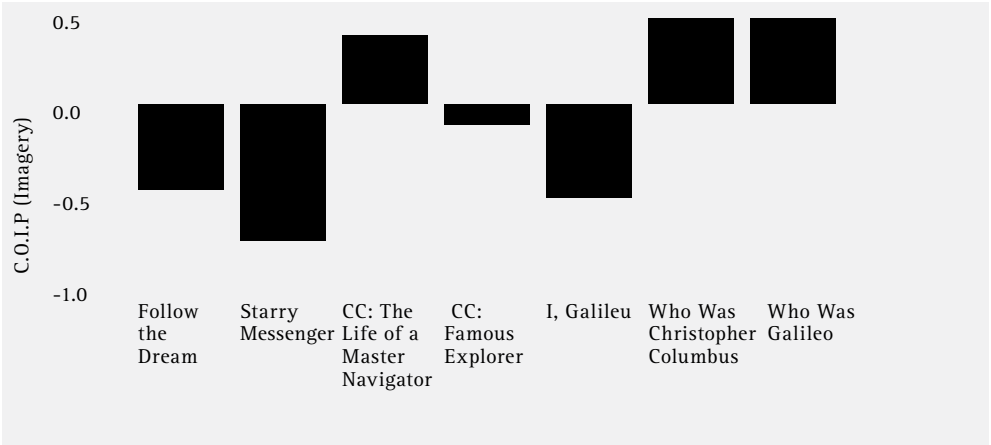


Figure 3.
Values of C.O.I.P. (Imagery)

for text and imagery, three of the books cross over into oppositional views of science and religion: *Follow the Dream*, Starry Messenger, and *I, Galileo* (Figure 2). The rest of the books have values that are neutral.

Looking at the text alone with the C.O.I.P. only one book, *Follow the Dream*, pushes out of the neutral values and frames science and religion as oppositional (Table 3).

Looking at the values of the C.O.I.P. for the imagery alone, all but one of the books, *Christopher Columbus: Famous Explorer*, cross over into either oppositional or non-oppositional values. *Who Was Christopher Columbus?*, *Who Was Galileo?*, and *Christopher Columbus: The Life of a Master Navigator* all have imagery that present these key points in the character's history as non-oppositional (Figure 3). While *Follow the Dream*, *Starry Messenger*, and *I, Galileo* all have imagery that presents science and religion as oppositional at these key points in history (Figure 3).

This is an interesting point. It shows that the imagery that surrounds the subjects of historical conflict in this sample of books is largely polarized, skewing away from a neutral or balanced representation to something more oppositional or non-oppositional.

Moving away from a book-to-book comparison, I would like to talk briefly about the two

correlations. The first of these was how the year of publication affected the number of myths that were upheld in the books (Figure 1). Before 1996, we see that books contain a few myths, but after 1996 there are no myths present in the books. This could be because the corrected versions of the historical myths about Columbus and Galileo have being slowly moving from the academic sphere to more general history books available to authors. Given the small sample size it is more likely a reflection of style, because Peter Sis wrote both *Follow the Dream* and *Starry Messenger* that repeat the historical myths (Figure 1). That said, the fact that there are few to no historical myths in this sample is a positive note. It shows that the myths themselves are not largely being repeated to readers and also that the historical myths are not a contributing factor to the oppositional values in this sample. I would like to note that there was no reverse trend, that is to say that myths were dispelled more frequently in more recently published books.

The second correlation showed that the type of book affected the values for the C.O.I.P. (Text and Imagery). Here the picture books all cross over into values that frame science and religion in opposition, whereas chapter books and graphic novels remain in values that frame the relationship as neutral (Figure 2). At first, given that the C.O.I.P. (Imagery) was polarized (Figure 3), I thought that this might be because picture books rely more on images and that the imagery was pulling the values for text and imagery into values that were oppositional. Graphic novels are also image dependant and we do not see this same trend. To properly explain the trend of picture books having more oppositional values may need a closer analysis of the stylistic differences between the graphic novels and picture books, as well as a larger sample size.

The analysis of the results has highlighted five points. First, that the books have neutral values when using the C.O.I. and that eliminating the irrelevant cases using the C.O.I.W.t confirms these neutral values for all but one of the books, which has

non-oppositional values. Second, that examining the books with the C.O.I.P. (Imagery) revealed that images in the sections of the book that dealt with known or perceived conflict have values that are either oppositional or non-oppositional values, except for one book. Third, the C.O.I.P. (Text and Imagery) revealed that picture books have oppositional values, while graphic novels and chapter books remain neutral. Last, the counts of myths being upheld or dispelled, showed that it is much more common for a myth to be dispelled. The low counts of myths being upheld or dispelled also indicated that how things are written and what the images are showing are having the greatest influence on the values of the C.O.I., C.O.I.W.t. and C.O.I.P.

Discussion

Although the small sample size prevents any firm conclusions, based on the values derived from the C.O.I. and the C.O.I.W.t. the books in this sample frame science and religion in a neutral and balanced way. Added to this is the fact that only two of the books, published in the 1990's, include historical myths related to Galileo and Columbus. Rather than repeat myths, the remaining five books do well at dispelling the historical myths (Table 10). This initial look is promising for the science/religion question and does not support my initial idea that children's literature may be one of the ways that the oppositional view of science and religion gets in the larger public sphere.

As discussed above, the C.O.I.'s and C.O.I.W.t's values deal with the books as a whole and not the specific periods of history where Galileo and Columbus's lives were in conflict with the Catholic Church. The C.O.I.P. explores those key points in history and the values for the C.O.I.P. (Text and Imagery) show that the picture books framed science and religion in oppositional frames, while the graphic novels and chapter books framed science and religion in more neutral frames.

The values for the C.O.I.P. (Text) show that all but one of the values are neutral, and one book,

Follow the Dream, frames science and religion as oppositional. With only one outlier, the text in the books that talks about those points of conflict in history appears to present that history in a neutral and balanced way.

When we look at the values for the C.O.I.P. (Imagery) all but one of the results fall into either oppositional or non-oppositional values. Here *Christopher Columbus: Famous Explorer* is an outlier, giving a neutral value for the images. The rest of the books have unbalanced imagery that present science and religion at these points in history as being either oppositional or non-oppositional. This means that the images could be presenting more conflict than in the historical record, or giving a "rosier" look and glossing over historical conflicts. An unbalanced view in the images is definitely a negative remark when addressing the science/religion question; ideally when addressing this question we want a balanced view that doesn't skew events in one direction or the other. It remains possible that the images from those points in history could impact how a reader interprets the relationship between science and religion, but it is unclear if the images are one of the venues that directly contribute to the general public's perception of conflict between science and religion.

It is important to note that the dichotomy of oppositional or non-oppositional views of science and religion in the imagery is not likely the result of the direct intent on behalf of the illustrators (or authors when it comes to the text), but perhaps more a reflection of the dichotomy that already exists in western society.

It is also important to note that social factors that affect the science/religion question such as religious upbringing, family and community influences were outside the scope of this research project, but are important factors to consider including in future studies that may explore the themes discussed in this paper. It would also be of value to expand the sample size and to have multiple coders using the framework to help assure the framework's reliability

and help identify criteria that were misclassified. It may also be of interest to examine more closely the instances of opposition to see if they have a pro-science or pro-religion tendency.

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