FEATURE

Sentiment Analysis of the Conflict of Ages Series

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Abstract. *There has been much work in assessing and interpreting the writings of Ellen G. White within the Seventh-day Adventist Church. However, there are few studies that have tried to look at her writings using text-mining tools along with the implications for ESL readers. The purpose of this study is to analyze the Conflict of Ages Series by Ellen White using machine learning text-mining tools. The results indicate that the Conflict of Ages Series is written above the reading level of the typical American, moderately formal, and neutral in terms of their sentiment. A description of the most positive and negative sentences in the Conflict of Ages Series is also provided. For ESL readers, the Conflict of Ages Series may be beyond their comprehension due to the high readability and formality of the text devoid of context.*

Keywords: conflict of ages, Ellen G. White, sentiment analysis

Introduction

Ellen White was a co-founder of the Seventh-day Adventist Church. One of her primary roles was in the field of writing and publishing. It is estimated that Ellen White (1827–1915) wrote over 50,000 pages of text in an era before typewriters (White, 2000). With such a huge volume of writing and the global influence of the church she helped to found, Ellen White is also one of the most translated authors of all-time (White, 2000). However, translation of any work can lead to a loss of meaning (Van Nes, Abma, Jonsson, & Deeg, 2010). This has led non-native English speakers to attempt to read White's writings in English and struggle with comprehension.

One of the major works of the Seventh-day Adventist Church has been in understanding or interpreting the books, articles, and letters Ellen White wrote (Knight, 1996). This has led to a large number of primarily qualitative studies that

have sought to organize and understand her writings (Douglas, 2000; Fortin, 2007; General Conference of Seventh-day Adventist, 2015).

Among some of Ellen White's most influential writings is the Conflict of Ages Series. This five-book series deals with the Fall of man to the destruction of the wicked after the millennium. With the emphasis on qualitative measures in assessment of Ellen White's work, there is little quantitatively focused research providing insights into her writings. In addition, there is little formal research in understanding Ellen White's writings in the context of English as a Second Language (ESL) and reading comprehension.

Therefore, the purpose of this study is to use text mining analysis tools to attempt to provide a distinct perspective on the Conflict of Ages Series. In particular, the research questions of this study are as follows.

1. What is the readability of the Conflict of Ages Series written by Ellen White?
2. What is the formality of the Conflict of Ages Series written by Ellen White?
3. What is the polarity (positive/negative feelings) of the books of the Conflict of Ages Series written by Ellen White?

Addressing these questions will help readers and scholars of the writings of Ellen White to capture such characteristics of her writing as the emotional quality and formality from a perspective that encompasses the entire series at once rather than relying on human instinct and organizational capabilities. In addition, educators will have a better understanding of the challenges of reading Ellen White from a quantitative perspective rather than only from anecdotal and qualitative viewpoints.

Text Mining

Text mining is a machine learning technique that became commonly used in the late 1990s for analyzing unstructured data (Grimes, 2007). Unstructured data is data that is not stored in relational databases. Examples of unstructured data include emails, text messages, mp3, and videos. It is estimated that 80-90% of business relevant information comes in the form of unstructured data (Grimes, 2008). This indicates that the majority of business-related decisions were at one time being made without the use of most of the available data.

There are several forms of text mining. Among them includes readability, formality measures, and sentiment analysis. Readability is the ease at which something can be read. Formality measure is how a text relates to an individual (Lesmeister, 2015). Sentiment analysis is the computational process of assessing a writer's attitude towards a subject (Cambria, Schuller, Xia, & Havasi, 2013). These three terms all fall under the umbrella term of text mining.

Readability has been connected with student performance. As readability improves, so too does performance (Peng, 2015). Some of the most critical work in readability is in health care as it is common for patients to misunderstand the technical language that describes their health (Zheng & Yu, 2017). There is also work in developing new readability formulas in several domains such as business and education (Crossley, Skalicky, Dascalu, McNamara, & Kyle, 2017; Loughran & McDonald, 2014).

In the context of ESL, high readability has been found to reduce plagiarism in comparison to text that has low readability or is easy to read (Sun, 2012). In terms of comprehension, there is a strong positive relationship between readability and achievement (Husna, 2016). However, if the reading is considered too easy, it can lead to boredom and difficulty in understanding the content (Aziz, Fook, & Alsree, 2010).

Formality measures have been used in various fields for many purposes. For example, formality analysis has been used in the past to analyze political speeches and even college lectures (Haiying et al., 2016; Medimorec, Pavlik, Olney, Graesser, & Risko, 2015). There has also been work done with formality measures in support of reading comprehension in order to find ways to improve text comprehension (Crossley et al., 2017). Lastly, formality measures have been used to distinguish languages from each other (Heylighen & Dewaele, 2002).

Formal language is devoid of context and often abstract in nature. Informal language is highly context dependent or related to pragmatics (Owens, 2012). Generally, non-native speakers are better at understanding informal language rather than formal due to the contextual nature of informal language (Sousa, 2011). However, if the language becomes too informal, such as in the use of slang and idioms, this can interfere with comprehension (Owens, 2012).

Sentiment analysis is an especially popular analytical tool in analyzing data from social media. It is commonly used to analyze comments on Twitter and Facebook (Ceron, Curini, Iacus, & Porro, 2013; Martinez-Camara, Martin-Valdivia, Urena-Lopez, & Montejo-Raez, 2014; Ortigosa, Martin, & Carro, 2014). In the world of education, sentiment analysis has been used to analyze comments made in massive open online course discussion forums as a way to gauge performance (Wong, Pursel, Divinsky, & Jansen, 2015).

In the business world, sentiment analysis has been used to analyze comments about restaurants and cellphone brands (Mostafa, 2013; He, Zha, & Li, 2013). One study found a relationship with comments on social media and a firm's stock performance (Yu, Duan, & Cao, 2013). Another study examined the development of online communities in response to a terrorist attack (Shaikh, Feldman, Barach, & Marzouki, 2017). In the context of ESL, the use of sentiment analysis is in its infancy yet there is a software currently available that assesses the emotional level of a non-native speaker's messages to ensure smooth communication with native

speakers; however, the focus of this software is for communication and not primarily for educational purposes (Intentex, 2017).

Text Mining in Religious Text

There is little work done so far involving text mining and religious text. McDonald (2014) compared the religious writings of several major world religions to identifying the textual commonalities between themes. Alhawarat, Hegazi, and Hilal (2015) focused on word frequencies specifically in the Koran. One sentiment analysis was conducted in order to identify potential radical jihadist (Bermingham, Conway, McInerney, O'Hare, & Smeaton, 2009). However, Bermingham et al. (2009) were focused on the conversations of potential jihadist on social media and not necessarily on religious text.

In regards to the writing of Ellen White, many studies have organized the major themes of her writing qualitatively (General Conference of Seventh-day Adventist, 2015; Timm, 1996; Knight, 1996; Fortin, 2007). These themes have been mainly theological or by type of book (White, 1948; Knight, 1996). One major problem with organizing text qualitatively is information overload (McDonald, 2014). Trying to organize such a huge volume of writing as Ellen White's is a challenging task to do based solely on human memory organizational capabilities.

The Conflict of Ages Series is a collection of five books written by Ellen White during the 19th century. These books focus on the history of the world from a biblical perspective. The book *Patriarchs and Prophets* deals with the fall of Satan all the way until the death of King David of Israel. *Prophets and Kings* covers the reign of Solomon until the conclusion of the Old Testament. *Desire of Ages* covers the life, ministry, and death of Christ. *Acts of the Apostles* begins in the Book of Acts and concludes with John writing the Book of Revelation. Lastly, *Great Controversy* deals with the history of the church after the death of the Apostles until the destruction of the wicked at the end of the Millennium.

The use of text mining tools in the domain of religious text is rare. In addition, the use of these tools in the writings of Ellen White is nearly non-existent. As such, this paper provides a quantitative insight in the readability, formality, and sentiment of the writings of Ellen White.

Methodology

Sample and Research Design

Purposive sampling was used in the selection of the books that were included in the analysis. The five books are all a part of the Conflict of Ages Series written by Ellen White. The research design was primarily exploratory.

The primary purpose was to develop descriptive statistics to explain the characteristics of the Conflict of Ages Series quantitatively.

Data Collection and Data Analysis

The Conflict of Ages books were downloaded from the Ellen White Estates website. Each Book was converted to a text file that could be analyzed using R. The files were then split placing each sentence in its own row for analysis purposes. Lastly, a data frame was created.

The readability of the text was calculated based on the number of characters, words, and sentences. The scores produced provided the grade level at which the text was estimated to be at. Formality measure classified every word in the text as a formal or contextual word. The classification was based on word type. Formal words were nouns, adjectives, prepositions, and articles. Contextual words were pronouns, verbs, adverbs, and interjections. Conjunctions were not a part of the Formality index but were used as part of counting the total number of words.

The sentiment analysis uses a polarity dictionary, which is used to assign words as positive, negative, or neutral. A score is then given to each sentence and ultimately to each book based on the number of positive and negative words as predetermined by the polarity dictionary.

Results

Table 1 provides the readability statistics. The readability of the books within the Conflict of Ages Series is generally at the 9th to 10th grade level. The exception being that the *Desire of Ages* is written at a 7th grade reading level. *Desire of Ages* is also the longest book in terms of words and sentences with *Acts of the Apostles* being the shortest based on the same criteria.

Table 1

Readability

Book	Words	Sentences	Readability
Patriarch & Prophets	276987	14336	9.28
Prophets & Kings	175214	9135	9.11
Desire of Ages	286905	17952	7.38
Acts of the Apostles	156082	7759	9.88
Great Controversy	235922	13415	9.02
Average	226222	12519.4	8.93

Table 2 provides the overview of the formality measure. The books are mainly similar in the level of formality. This indicates that there are the same proportions of formal and contextual words in each book. This is confirmed by Table 3, which provides a breakdown of the various types of words used in each book as a proportion.

Table 2

Formality Measure

Book	Formality
Patriarch & Prophets	63.57
Prophets & Kings	64.96
Desire of Ages	61.18
Acts of the Apostles	63.97
Great Controversy	66.11
Average	63.96

Table 3

Proportions of Word Forms (Each row sums to 100)

Book	Noun	Adj	Prep	Articles	Pro-noun	Verb	Adverb	Interj	Other
Patriarch & Prophets	24.83	8.04	18.23	9.92	9.92	19.46	4.5	0.01	5.09
Prophets & Kings	25.71	7.79	18.68	10.15	9.3	18.99	4.09	0.01	5.28
Desire of Ages	24.28	7.54	17.65	9.58	11.47	20.78	4.42	0.01	4.29
Acts of the Apostles	24.81	8.05	19.03	9.78	10.11	19.27	4.34	0	4.61
Great Controversy	26	8.92	18.11	10.72	8.47	18.69	4.35	0.02	4.72
Average	25.12	8.06	18.34	10.03	9.85	19.43	4.34	0.01	4.80

Table 4 provides the results for the sentiment analysis. Based on the standardized mean of polarity the *Conflict of Ages Series* as a whole is mostly written with a neutral sentiment ($M = .11$). *Acts of the Apostles* is the slightly more positive than the other books in the series ($M = .21$). The other four books have essentially the same value.

Table 4

Sentiment Analysis Results

Book	Average Polarity	SD Polarity	Standardized Mean of Polarity
Patriarch & Prophets	.02	.34	.07
Prophets & Kings	.04	.32	.11
Desire of Ages	.02	.32	.06
Acts of the Apostles	.07	.34	.21
Great Controversy	.03	.34	.08
Average	.03	.33	.11

A closer look at the results of the sentiment analysis revealed the three most negative and the three most positive sentences in the *Conflict of Ages Series*. The third most negative sentence (polarity = -1.63) was found in *Great Controversy* chapter 11 page 203. This quote comes from Ellen Whites description of the Diet of Spires in 1529 where the German Princes reject a measure passed at the Diet that forbade the spreading of Protestantism. Due to the brief nature of the sentence, the entire paragraph is quoted below. The actual negative sentence is in italics. Negative words are in bold and positive words are underlined

> A deep impression was made upon the Diet. The majority were filled with amazement and alarm at the boldness of the protesters. The future appeared to them stormy and uncertain. ***Dissension*, *strife*, *and* *bloodshed* *seemed* *inevitable*.** But the Reformers, assured of the justice of their cause, and relying upon the arm of Omnipotence, were 'full of courage and firmness.' (GC 203; emphasis added)

The second most negative sentence (polarity = -1.66) was found in *Desire of Ages* chapter 2 page 28. The context of this sentence is the description of the cycle of apostasy of Israel as the awaited the coming of the Messiah. Due to the brief nature of the sentence, the entire paragraph is quoted below. The actual negative sentence is in italics. Negative words are in bold and positive words are underlined.

> But the Israelites fixed their hopes upon worldly greatness. From the time of their entrance to the land of Canaan, they departed from the commandments of God, and followed the ways of the heathen. It was in vain that God sent them warning by His prophets. *In **vain** they **suffered** the **chastisement** of **heathen** **oppression***. Every reformation was followed by deeper apostasy. (DA 28; emphasis added)

The most negative sentence (*polarity* = -1.85) was found in *Prophets and Kings* chapter 23 page 282 which speaks of the reasons for the Assyrian Captivity of Israel. The bold words were identified as negative while the underlined words were identified as positive by the sentiment dictionary.

> Against the marked **oppression**, the **flagrant injustice**, the unwonted **luxury** and **extravagance**, the **shameless** feasting and drunkenness, the **gross licentiousness** and **debauchery**, of their age, the prophets lifted their voices; but in **vain** were their **protests**, in **vain** their **denunciation** of **sin**. (PK 282; emphasis added)

In terms of positive sentences, the third most positive sentence (polarity = 1.94) was found in *Great Controversy* chapter 19 page 343. The context is man's inability to understand the plan of redemption that God has created to save the human race.

> But no man, however **honored** of **Heaven**, has ever attained to a full understanding of the **great** plan of **redemption**, or even to a **perfect** appreciation of the **divine** purpose in the **work** for his own time. (GC 343; emphasis added)

The second most positive sentence (polarity = 2.04) was found in *Patriarch and Prophets* chapter 15 page 176. The context is Abraham seeking a wife for his son Isaac with an emphasis on a parent's responsibility to guide their children. Due to the brief nature of the sentence, the entire paragraph is quoted below. The actual positive sentence is in italics.

> They [parents] should feel it a duty, by their own teaching and example, with the assisting grace of God, to so mold the character of the children from their earliest years that they will be pure and noble and will be attracted to the good and true. **Like** attracts **like**; **like appreciates like**. Let the love for truth and purity and goodness be early implanted in the soul, and the youth will seek the society of those who possess these characteristics. (PP 176; emphasis added)

The most positive sentence in the Conflict of Ages Series was found in Patriarch and Prophets Chapter 1 page 41and in Great Controversy Chapter 29 page 497. In both passages, the context is God allowing Lucifer to begin the process of setting up his own government by using his influence as the highest ranked angel of Heaven.

> Lucifer, as the anointed **cherub**, had been highly **exalted**; he was greatly **loved** by the **heavenly** beings, and his influence over them was **strong**. (PP, 41 & GC, 49; emphasis added)

Discussion and Conclusions

This study has led to several major findings. First, the readability of the books within the *Conflict of Ages Series* is probably too difficult for the average native English reader. With an average grade level of 9th grade, the books of the series are beyond the 7th or 8th grade reading level of the typical college freshman in America (Mass, 2015). This does not take into account those who do not pursue higher education. Nor does it consider people who do not speak English as their first language. The majority of Adventist church members do not use English as their first language, which explains the push to publish Ellen White's writings in so many other languages besides English (Office of Archives, Statistics, and Research, 2016; White, 2000). In addition, there have been several adaptations of Ellen White's writings over time to help those who are not able to appreciate the original writings (EGW Writings, 2017).

Second, the books of the *Conflict of Ages Series* are primarily formal in nature. Generally; writing is often much more formal than speaking (Elbow, 2012). Given that the purpose of these writings was for the entire church it should be expected that Ellen White's writing would be more formal since she did not know who would read her books. What this means for ESL students is that Ellen White's letters may be easier to understand as they are letters to individuals. Personal communication is generally more informal in nature than public addresses (Holmes, 2013). This leads to the conclusion that the letters of Ellen White may be easier for ESL students to understand in comparison to the books that were written for mass audiences.

Third, based on the polarity results, at least in the *Conflict of Ages Series*, the writing style is primarily neutral. This is in contrast to accusations that Ellen White's writings have such negative sentiments attached to them as legalistic or works oriented (Knight, 1996; Fortin & Moon, 2014). The contrast is also true in that the writings are not overwhelmingly uplifting and positive as well. However, the emotional quality of language is culturally dependent (Holmes, 2013; Owens, 2012). In spite of this, the results here provide a baseline in which cultural variation can be accommodated.

It would be beneficial if a deeper exploration of the positive and negative sentences was conducted qualitatively. For example, human intuition may uncover relationship among the positive and negatives sentences in a way that is not possible for a computer algorithm to do. In addition, additional exploration of the *Spirit of Prophecy* with any form of text mining analysis would provide insight that can be used as a basis for deeper theological study. Lastly, in terms of formality, it would be useful to know if there is a difference in the formality of the letters of Ellen White when compared to the books of Ellen White as this may play a role in suggesting reading for ESL students.

Despite the use of quantitative measures, there is still a degree of subjectivity to the analysis. The results may change based on the polarity dictionary that is used. In addition, sentences are not often taken alone but are usually related to their context when deciding on their emotional quality. Therefore, this study only attempts to provide insights rather than making sweeping conclusions about the characteristics of the writing style of Ellen White in the *Conflict of Ages Series*. For the ESL context, the benchmarks of the readability, formality, and sentiments has been set in terms knowing at what level a student needs to be in order to understand the books of the *Conflict of Ages Series*.

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