# Analyzing conversion narratives with a naive sentimental analysis algorithm

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## Introduction

We as human beings are uniquely intelligent in that we're symbolic. Being symbolic means that we can form "complex, highly nested symbolic descriptions of classes, properties, relations, actions and events" (Winston and Holmes) (Bandler). Another important ability of ours is the ability to merge, which is the ability to take two concepts A and B, and combine them to create a third concept C without destroying A or B. We can continue this infinitely (Berwick and Chomsky). Through both of these abilities, we are able to form inner-stories, which is a collection of complex, highly nested symbolic descriptions of properties, relations, actions, and events, usefully connected with, for example, causal, means-ends, enablement, and time constraints (Winston and Holmes). We can infer inner-stories from what we perceive, and we can externalize our inner-stories through media such as books and speeches, which is a positive feedback loop. The strong story hypothesis says that this positive feedback loop is what makes our intelligence unique from the other primates. In this paper, I am going to explore whether common inner-stories were externalized in the works of Epiphanius' Panarion.

Epiphanius of Salamis (c. 310–320 – 403) was a bishop known for his defense of orthodoxy. One of his works defending orthodoxy is the *Panarion*, in which he rebuts the beliefs of about 80 sects ( $\alpha \ddot{\imath} \rho \varepsilon \sigma \iota \varsigma$, from which the English word "heresy" was derived, but in *Panarion* Epiphanius mostly used it to mean "sect" or "faction") (Williams). For which reason this work was given the name *Contra Omnes Haereses* (Latin for "Against all Heresies") by Saint Irenaeus (Williams).

It is said Epiphanius did not use any one classical author as a source, and, for the most part, the heresiologist simply drew upon ideas that had become part of the intellectual and cultural koine of the Greco-Roman world long before he began writing the Panarion (Schott). With all the stories being passed on by ear, it is very possible that the stories Epiphanius had heard and wrote down were all unintentionally edited to the inner-stories of the people who talked about them while they were passed on from person to person (i.e. each person that talked about the story would misremember or distort the story slightly to their inner beliefs).

If the people who passed on the stories were largely homogenous in their way of thinking, the narratives in the books would eventually all end up with the same inner-story. One common way I suppose that the common inner-story can be observed is that all the stories might follow the same overarching progression in mood. For example, if a listener were to have a preceding belief that conversion is an effective way of elevating social status, this listener would have a mental model that a person, before converting, had a miserable life, and gained status and social stability through conversion and lived a happy life after it. When this listener hears a conversion narrative, he or she would unintentionally try to align the inner-story of the conversion narrative to the model he has in mind and retell the narrative with a hint of his/her inner-story layered on the bottom. Therefore, when a population who all have similar inner-stories are the listeners and reteller of the all the narratives, the narratives would share an inner-story, and that's what I am trying to detect in this project.

# Software tools used

## AFINN

AFINN is a list of common words rated for valence with an integer between minus five (negative) and plus five (positive) (Nielson).

```
amusement        3
amusements       3
anger   -3
angers  -3
angry   -3
anguish -3
anguished        -3
animosity        -2
annoy   -2
annoyance        -2
annoyed -2
```

A few lines from the AFINN lexicon,

with the word on the left and its AFINN score on the right


The simplest sentimental analysis algorithm can be written to simply calculate the sum of AFINN scores in a passage, which is what is commonly used for analyzing the positivity of Twitter tweets or movie reviews. This is naive in the sense that it is a "word-in-a-bag" algorithm, which isn't concerned with the particular order of the words, but for the scope of this project, I am not going to use the more advanced algorithms, for the data is too large, and I am only getting started with sentimental analysis. Using this algorithm on Panarion, however, poses the problem that the translation of such ancient text probably contains words that are not indexed in the AFINN lexicon, for example, "sin." To tackle this problem, a second tool is brought in.

## WordNet

WordNet is a large lexical database of English grouped into sets of cognitive synonyms (synsets), each expressing a distinct concept. Synsets are interlinked by means of conceptual-semantic and lexical relations (Miller).

For example, when the word "dog" is inputted into WordNet (which you can do online at wordnet.princeton.edu), it returns a list of synsets that contains "dog."

**Noun**

S: (n) **dog**, domestic dog, Canis familiaris (a member of the genus Canis (probably descended from the common wolf) that has been domesticated by man since prehistoric times; occurs in many breeds) *"the dog barked all night"*
S: (n) frump, **dog** (a dull unattractive unpleasant girl or woman) *"she got a reputation as a frump"; "she's a real dog"*
S: (n) **dog** (informal term for a man) *"you lucky dog"*
S: (n) cad, bounder, blackguard, **dog**, hound, heel (someone who is morally reprehensible) *"you dirty dog"*
S: (n) frank, frankfurter, hotdog, hot dog, **dog**, wiener, wienerwurst, weenie (a smooth-textured sausage of minced beef or pork usually smoked; often served on a bread roll)
S: (n) pawl, detent, click, **dog** (a hinged catch that fits into a notch of a ratchet to move a wheel forward or prevent it from moving backward)
S: (n) andiron, firedog, **dog**, dog-iron (metal supports for logs in a fireplace) *"the andirons were too hot to touch"*

**Verb**

S: (v) chase, chase after, trail, tail, tag, give chase, **dog**, go after, track (go after with the intent to catch) *"The policeman chased the mugger down the alley"; "the dog chased the rabbit"*

Contained in each of these synsets are synonyms, and each synset has a distinct meaning. WordNet also stores the relations between synsets. For example, below are the hypernyms of the first meaning of "dog," which are sets that are one step up the hierarchy, i.e. a superset of "dog."

S: (n) **dog**, domestic dog, Canis familiaris (a member of the genus Canis (probably descended from the common wolf) that has been domesticated by man since prehistoric times; occurs in many breeds) *"the dog barked all night"*
○ *direct hyponym* / *full hyponym*
○ *part meronym*
○ *member holonym*
○ **direct hypernym** / *inherited hypernym* / *sister term*
● S: (n) canine, canid (any of various fissiped mammals with nonretractile claws and typically long muzzles)
● S: (n) domestic animal, domesticated animal (any of various animals that have been tamed and made fit for a human environment)

# WordNet enhanced AFINN analysis

My naive algorithm for enhancing the AFINN analysis with WordNet, is the same "word-in-a-bag" idea, but for each word that is not indexed in the AFINN lexicon, we extract all the synonyms of this word by looking up this word in the WordNet database, and finding the

average AFINN score for all its synonyms that are documented in the AFINN lexicon. One potential issue with this method is that the connotations of some words might have changed somewhere along the flow of time (e.g. the aforementioned $\alpha\ddot{\iota}\rho\varepsilon\sigma\iota\varsigma$ in "sect" vs. "heresy"), but since a translation of the *Panarion* by a very serious scholar is used, I assume that the connotations of the words in the text are translated to the best of our knowledge. Here are the enhanced AFINN scores of some rather interesting words in Panarion.

```python
44  ∨ def main():
45        # analyze_text('aquila.txt', 'aquila.csv')
46        # analyze_text('symmachus.txt', 'symmachus.csv')
47        # analyze_text('theodotion.txt', 'theodotion.csv')
48        print(enhanced_afinn('flesh'))
49        print(enhanced_afinn('man'))
50        print(enhanced_afinn('wise'))
51        print(enhanced_afinn('lust'))
52        print(enhanced_afinn('beneficial'))
53        print(enhanced_afinn('sinful'))
54
55    main()
```

```
TERMINAL    PROBLEMS    OUTPUT    DEBUG CONSOLE                                    2: Pytho

exe" "c:/Users/Yuxi Long/OneDrive - Duke University/IC JCA/demensuris_analyze.py"
0.0
0.0
1.0
-2.0
3.0
-1.8
```

## NLTK

The Natural Language ToolKit (NLTK) is a collection of tools commonly used for natural language processing. I used the tokenizer tools from it, which converts the text into a list of sentences, and then converts each sentence into words, which I can then feed into the WordNet enhanced AFINN algorithm.

## Putting it all together: pseudocode of my program

```
sentences = nltk_sentence_tokenizer.tokenize(text)
sentence_count = 0
forEach sentence in sentences:
```

```
        sentence_score = 0
        forEach word in sentence:
            if word in AFINN:
                sentence_score += AFINN_SCORE(word)
            else:
                sentence_score += WORDNET_ENHANCED_AFINN(word)
        write_to_file(sentence_count, sentence_score)
        sentence_count += 1


function WORDNET_ENHANCED_AFINN(word):
    synonyms = WordNet.synset(word).elements
    indexed_word_count = 0
    total_score = 0
    forEach synonym in synonyms:
        if synonym in AFINN:
            total_score += AFINN_SCORE(word)
            indexed_word_count += 1
    return total_score / indexed_word_count
```

# Using the program to analyze certain passages

## How to interpret the graphs

The y-axis of the graphs are **cumulative** AFINN scores, because I believe that the effect of the positivity and negativity created by words are cumulative. Only when a barrage of these words bombard you do they paint a mood. One swallow does not a summer make.

Therefore, a continuously rising graph means that most of the sentences have positive words, and vice versa. The peak of a mountain in the graph is the point where everything turns from positive to negative, and a basin or valley is where the story turns better.

# Choosing the passages:

Andrew Jacobs mentioned five conversion narratives in his journal article, Matters (Un-)Becoming: Conversions in Epiphanius of Salamis. These five conversion narratives are separated into three categories in the article, characterized by the result of these conversions, listed as below:

- "I. Becoming a leader: ascetics and priests"
    - Peter (Panarion 40)
    - Paulinian (epistula 51)
- "II. Becoming a heretic"
    - Origen (Panarion 64)
    - Arius (Panarion 69)
- "III. Becoming a Christian"
    - Josephus of Tiberias (Panarion 30)

(Note: I have changed all the markings that are a number (eg "1.") followed by a period to "," in all of the conversion narratives, so that it would not confuse the sentence tokenizer and makes the tokenizer think that it is starting a new sentence.)

*Panarion 40 Against Archontics: graphed from 1.1 to 1.9, after which Epiphanius elaborates on his rebuttal*
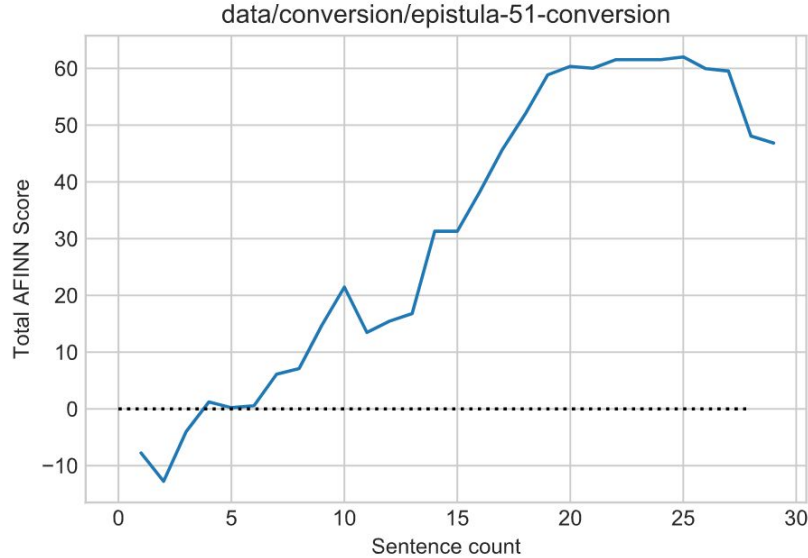


data/conversion/peter-conversion
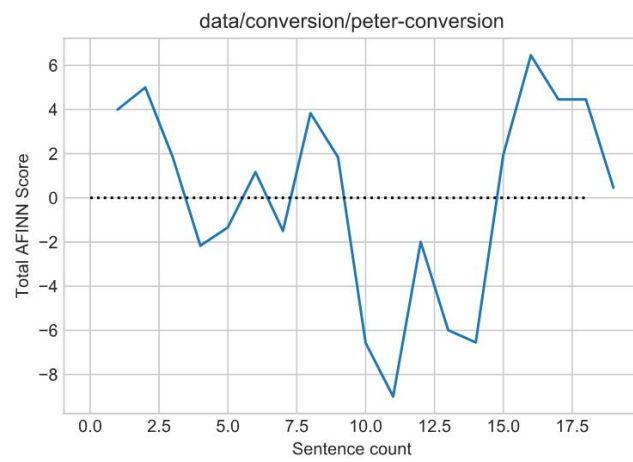
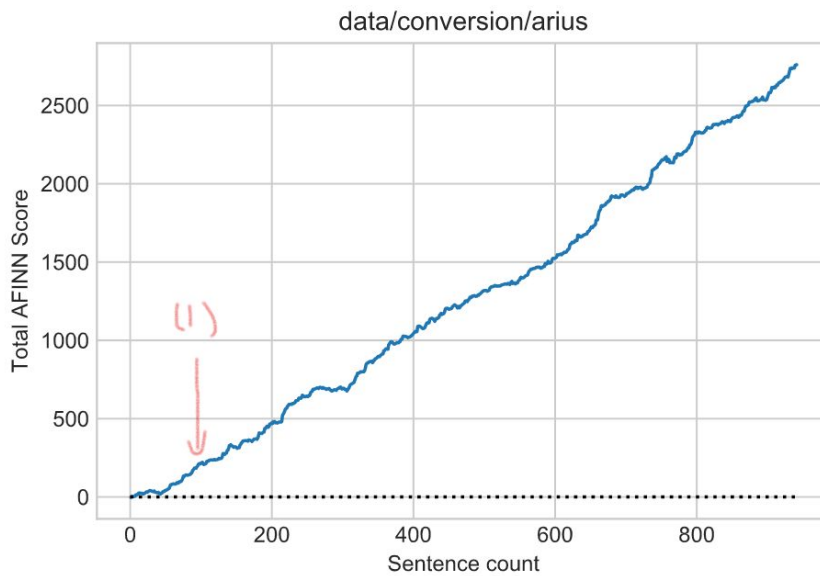*Epistula 51 graphed in full*:



data/conversion/epistula-51
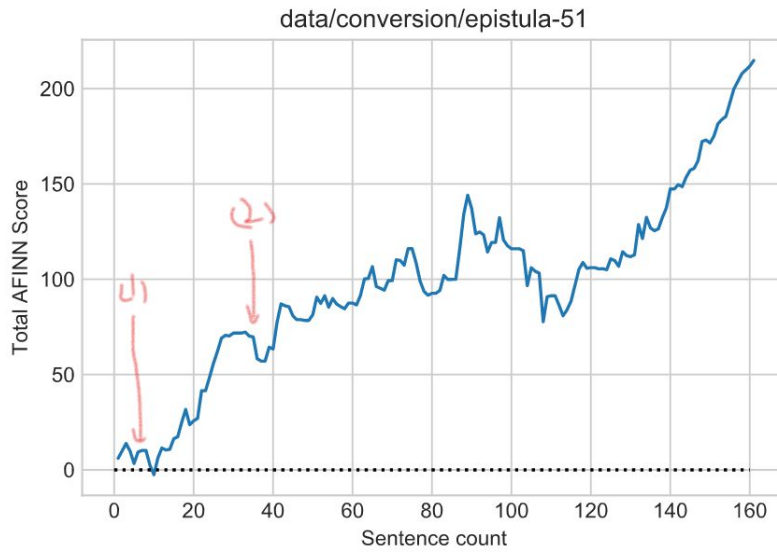
(1) Sentence 6: beginning of Epiphanius' talk on an unusual ordination

(2) Sentence 36: end of Epiphanius talk about the ordination

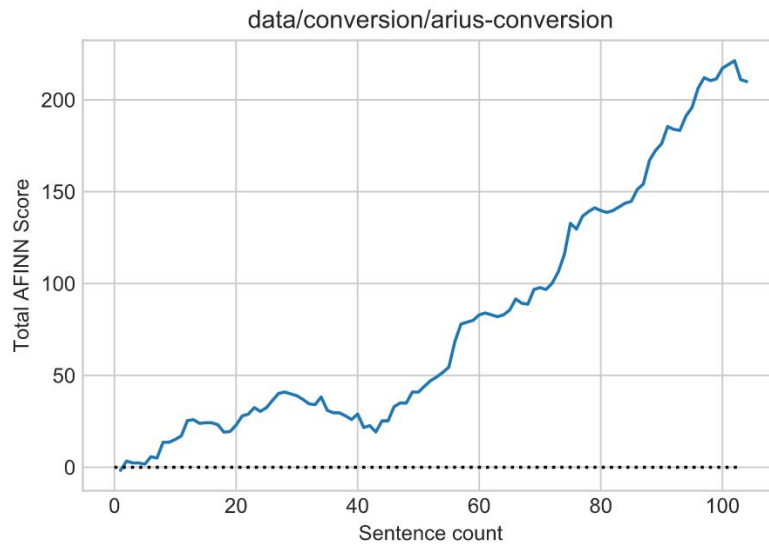*Epiphanius 51 graphed from sentence 6 to 36:*



data/conversion/epistula-51-conversion

*Panarion 69 Against the Arian Nuts: graphed in full:*



data/conversion/arius

Interesting points:

   (1)  Sentence 103: death of Arius on the toilet

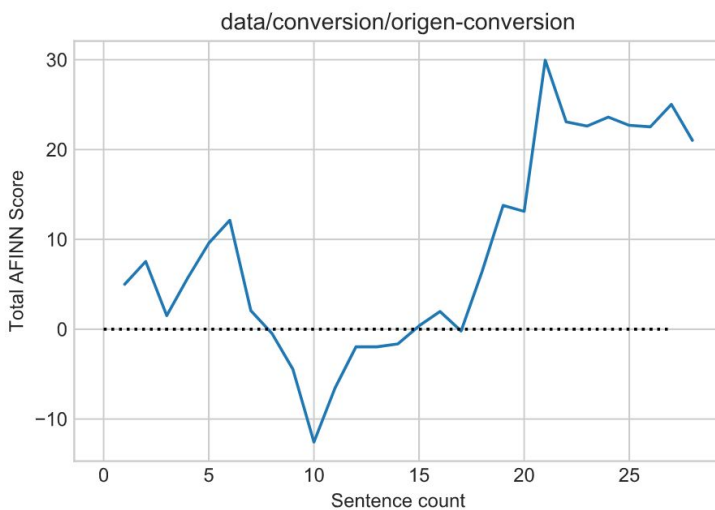*graphed from sentence 1 to 103 (1.1 to 10.2):*



data/conversion/arius-conversion

*Against Origen also called Adamantius graphed in full:*
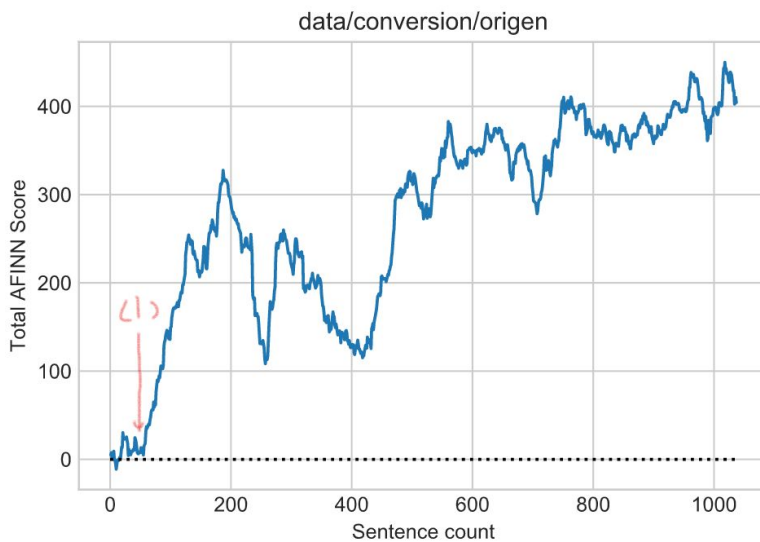


(1) Sentence 27. The end of Epiphanius' narrative on Origen's life. From which point on Epiphanius begins writing about Origen's "subordinationist view of the Trinity" (Williams) and refuting it.

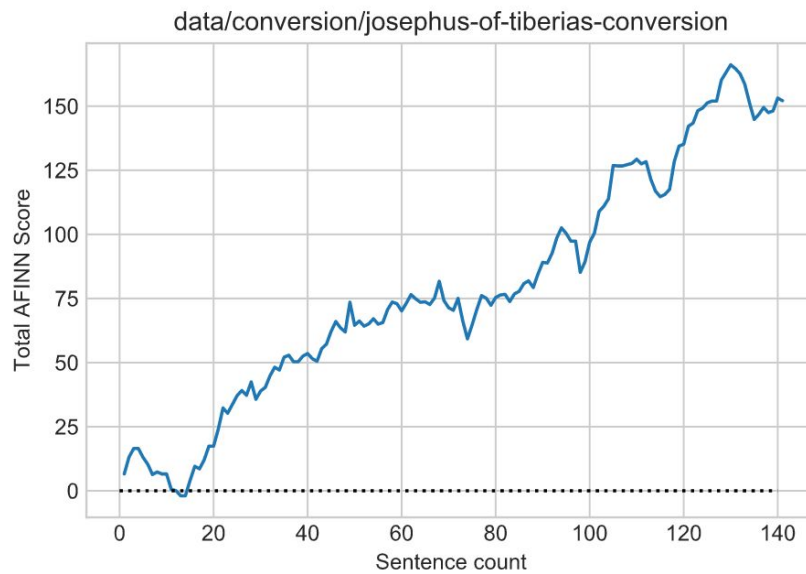*graphed from sentences 1 to 27 (1.1 to 3.13):*

*Panarion 30 Against Ebonites: graphed in full*



data/conversion/josephus-of-tiberias
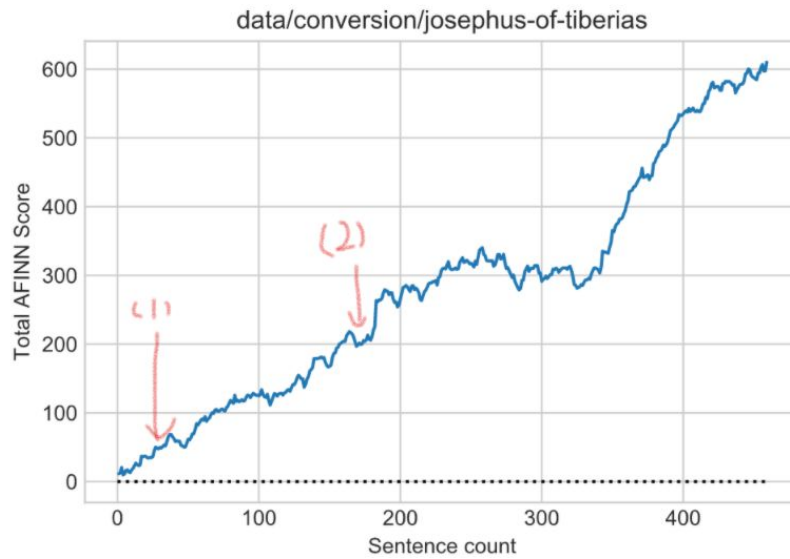
(1) Sentence 34: beginning of Josephus' story

(2) Sentence 174: end of Josephus' story

*Against Ebonites* graphed from sentence 34 to 174 (4.1 to 12.9)



data/conversion/josephus-of-tiberias-conversion

# Discussion on results:

Comparing the output of the program to the analysis by Jacobs, we can see that the program is mostly correct in graphing the contour of the narrative. For example, for Origen's narrative,  Origen was "the pious son of a martyr, himself subject to harassment in Alexandria for his Christianity" (Jacobs). Looking at the graph, we can see a high point to sentence 5 (being pious and well-educated) and then a dip to sentence 10 ("he was expelled from the church" (Epiphanius)). After being expelled, Origen devoted himself to a life of extreme piety, had a patron whose name is Ambrose for his work, and became a zealous scholar of the scripture (Epiphanius), which can be seen on the graph as the peak of a "mountain." But then, Origen became so swallowed up in "learning" that he began to produce his "dangerous exegeses," (Jacobs) and that's his downfall.

Looking at all the graphs, the conversion stories don't seem to have similar progression of moods. My null hypothesis is rejected. However, one thing I do notice is that the shape of the portion which contains the conversion narratives seems to resemble the shape of the larger section. For example, the positivity in Arius' conversion is steadily increasing and so is the whole *Against the Arian Nuts*. The positivity in Origen's conversion changes drastically between positive and negative quickly, and so is the whole chapter of *Against Origen also called Adamantius*. One explanation for this might be that Epiphanius sets the overarching progression of the mood he is describing a certain sect with the progression of the mood he describes a sample with. Interestingly, Frank Williams, in his introduction to his translation of the Panarion, remarked that the lack of rhetorics in his book showed that Epiphanius did not complete his rhetorical training with a rhetor in the city of Alexandria (Williams). However, this writing style in which the mood progression within a portion of the chapter resembles that of the chapter is somewhat interesting. This might be a uniquely Epiphanius style that is worth further research.

# Reflections

I think my life would have been just fine without knowing that Epiphanius and Arius and Origen existed, but now that I read it, one not-very-useful but very interesting thing I learned is that ancient people trash talked each other just as hard as we do. Epiphanius said so much about Origen that it is somewhat funny. And imagine being Arius, not only suffering a death on a toilet, which was already funny and shameful, but also got his story compiled in a book that would become one of the biggest works on heresiology, and having a copy of his story at every library that is concerned with theology. Following are the excerpts from Panarion about it.

*Panarion 63: Against Origen also called Adamantius*

*4,7 [Origen] smears on texts from the sacred scriptures that suit him, though not as they are or with their real interpretation.*

*5,1 But even now, in the Sect that deals with him, it will do no harm to describe them again for the same reason and purpose, and give his refutation from his own counterfeits. (2) For there is a great deal of his nonsense that came later, and the cultivation of an idea that is false and departs from the truth. (3) For he appeared to speak against every sect before him and refute each one, but later he spat this sect up into the world, one of no little influence. 5,4 So then, first I shall quote his own words in refutation of his false, bogus notion; then I shall show what I, in my mediocrity, intend to say against him.*

*Panarion 69: Against the Arian Nuts.*

*10,2 That most pious and godfearing bishop, Alexander, bishop of the best of cities—(he and the bishop in Alexandria had the same name)— spent the whole day after he heard that, and the night, in groans and mourning, praying and beseeching God either to take his life so that he would not be polluted by communion with Arius, or to work some wonder. And his prayer was answered. (3) Arius went out that night from the need to relieve himself, went to the privy, sat down in the stalls inside, and suddenly*

*burst and expired. Thus, he was overtaken and surrendered his life in a smelly place, just*

*as he had belched out a dirty heresy,*

P.S.: Duke is spending millions of dollars per year on journal subscriptions and I am still pirating from sci-hub and libgen

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