On Death and Emotion: Evaluating the Five Stages of Grief in End-of-Life Memoirs Using AI Deep Learning Models

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Introduction:

Denial, anger, bargaining, depression, acceptance. Commonly referred to as the "Five Stages of Grief," the Kübler-Ross Model was first introduced in 1969 by American psychiatrist Elizabeth Kübler-Ross in her bestselling book, *On Death and Dying*.[1] Kübler-Ross worked to raise awareness regarding the emotions and needs of the dying, calling for better healthcare standards in order to treat the dying with dignity. This model was originally created from a series of case studies of hospice patients as a guideline to help physicians understand the feelings of the dying and how they process their grief.

Arguably the most widely-utilized model for processing grief in hospice and palliative care, the Kübler-Ross Model is often heavily criticized for its strict application and lack of quantitative evidence.[2] The term "stages" is a highly controversial one, as it implies that grief is a linear process, where patients must move through a set of steps in order to achieve a sense of peace. This can influence the views of physicians and healthcare workers, as they may attempt to push a patient through their grief in order to bypass the "difficult" stages, such as anger and depression. Critics also believe that the lack of empirical evidence and over-reliance on qualitative measures weakens the reliability of the model.

The purpose of my project is to examine the relation between the stages of dying and the cruxes of sentiment in end-of-life memoirs. I propose that sentiment analysis could be utilized as a form of quantitative evidence that proves or disproves the reliability of the Kübler-Ross Model.

Methodology:

Sentiment analysis is a multi-faceted tool that utilizes machine learning, natural language processing, and computational linguistics to analyze the valence and intensity of emotion in text.[3] It is a method that can help humans detect emotional inflection points in narrative, especially ones that may be difficult to uncover using only close reading. In my analysis, I used the simplified version of the SentimentArcs software in Google Colabs that included a variety of lexical, heuristic, and state-of-the-art transformer models.[4]
- VADER
- TextBlob
- DistilBERT
- MultiBERT NLPTown
- RoBERTa Lg 15 Datasets

I examined three bestselling end-of-life memoirs, written in first person from the perspective of an author diagnosed with terminal illness:
- *When Breath Becomes Air* by Paul Kalanithi[5]
- *The Unwinding of the Miracle* by Julie Yip-Williams[6]
- *The Bright Hour* by Nina Riggs[7]

After running sentiment analysis code, I analyzed the overall shape of the narrative arcs, seeing if there was a difference before and after terminal diagnosis. Using emotional cruxes detected by SentimentArcs, I was able to find key passages that represented inflection points in the sentiment values. I examined only cruxes that had multimodal agreement. I then conducted a close and middle reading of the cruxes, seeing if I could identify any of the Five Stages.

Kalanithi:

When Breath Becomes Air
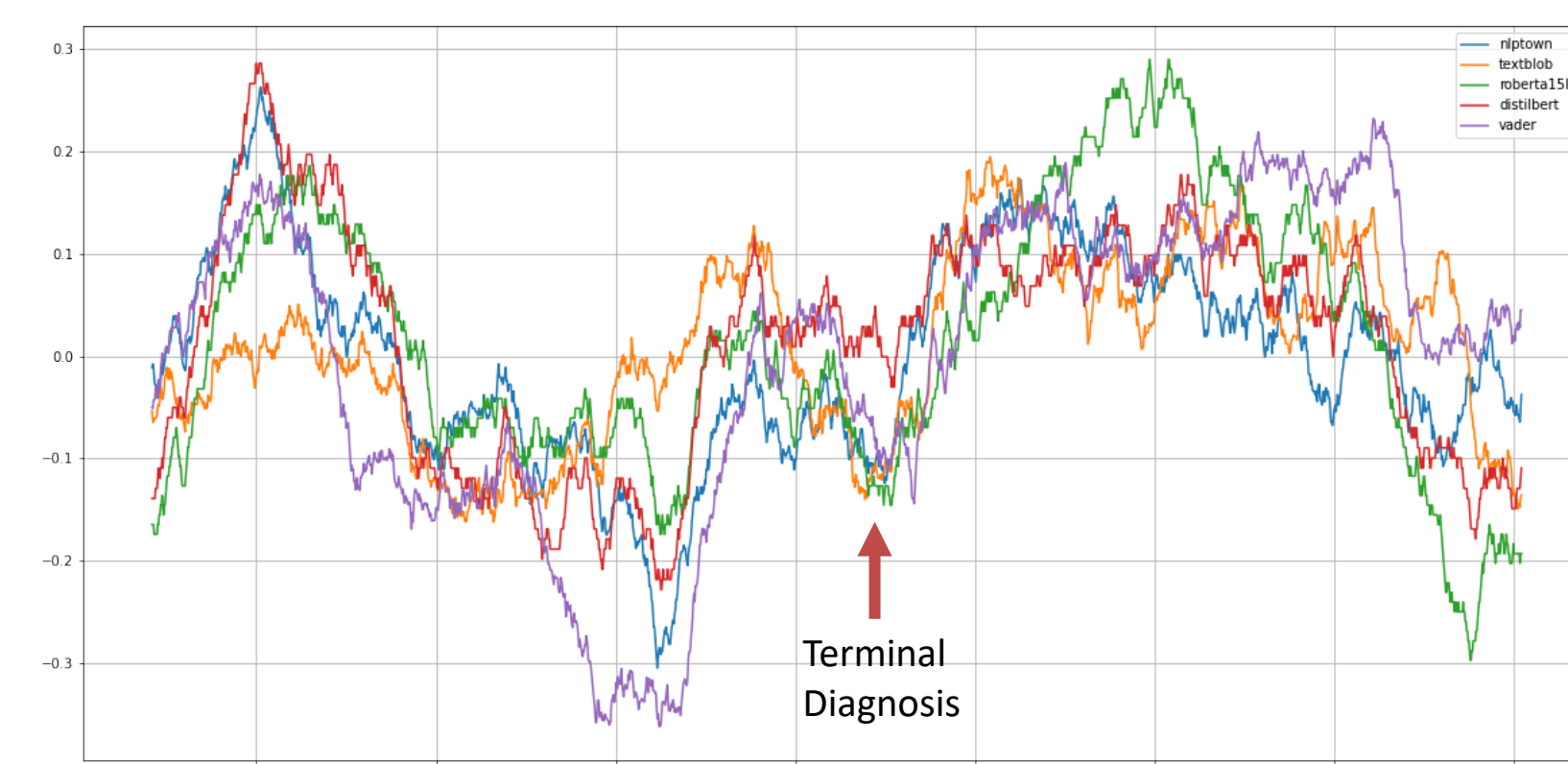
Merged model of Kalanithi, adjusted to standard scalar normalization (SMA 10%). Models begin to show more sudden ups and downs in sentiment valence after diagnosis (1141). There is a notable valley in sentiment at the time of the diagnosis. Roberta disagreed the most with other models.
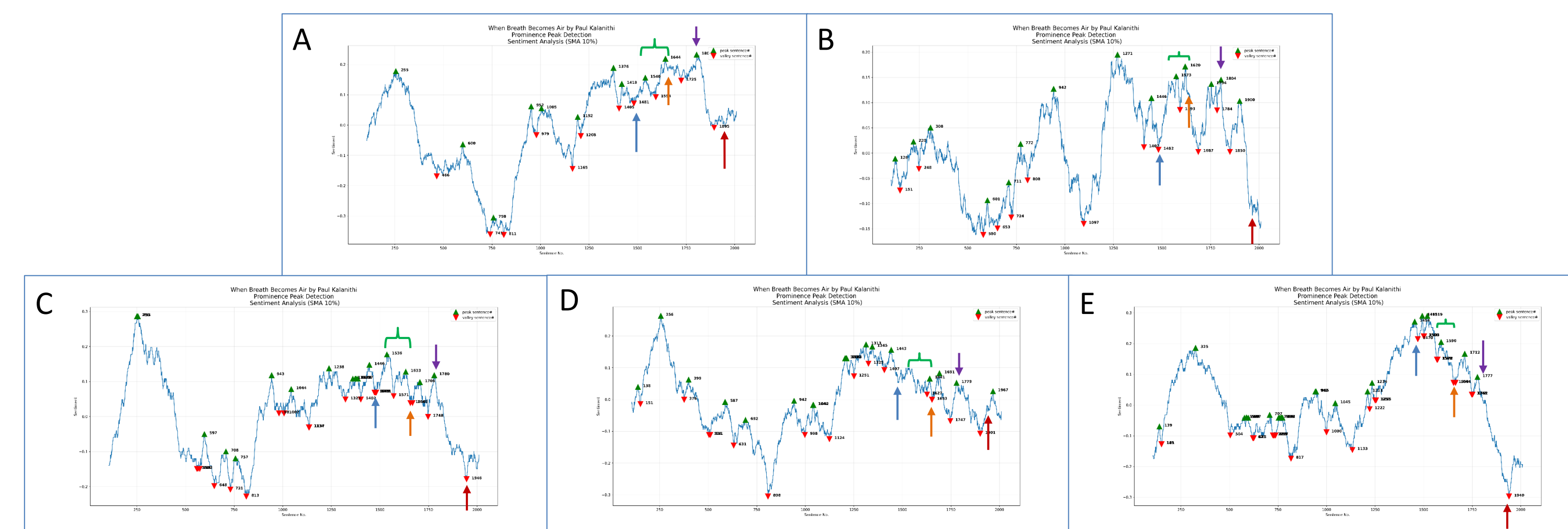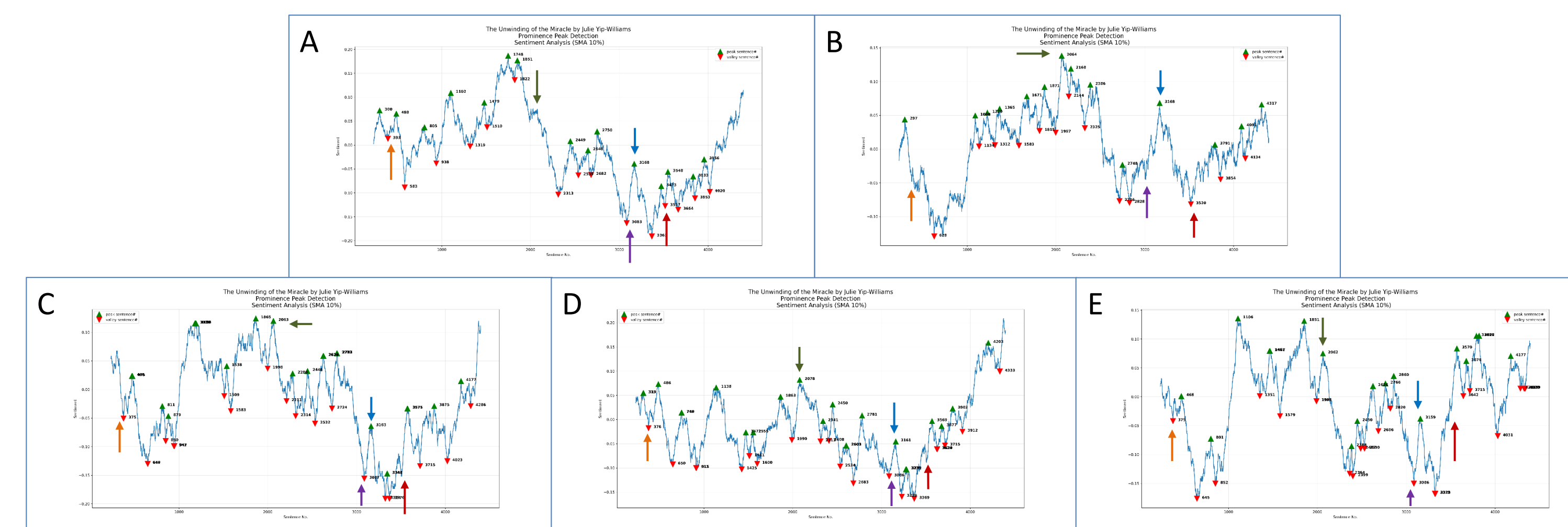

Vader (A), Textblob (B), distilBERT (C), nlptown (D), and roBERTa (E) 0.05 prominence minimum peak detection.
- Denial: Narrator returns to work as normal (~1500-1650); a series of up-down-up cruxes centered around neutral
- Anger: Nasty encounter with resident (~1940-50); extremely negative crux
- Bargaining: Prayer and bargaining with god (1650's), slight negative crux, appears neutral or less positive
- Depression: Narrator reflects on his mortality, death (~1480), downward crux approaching neutral
- Acceptance: A new tumor appears, narrator states "It simply was" (~1782-1800), positive crux

Yip-Williams:

The Unwinding of the Miracle
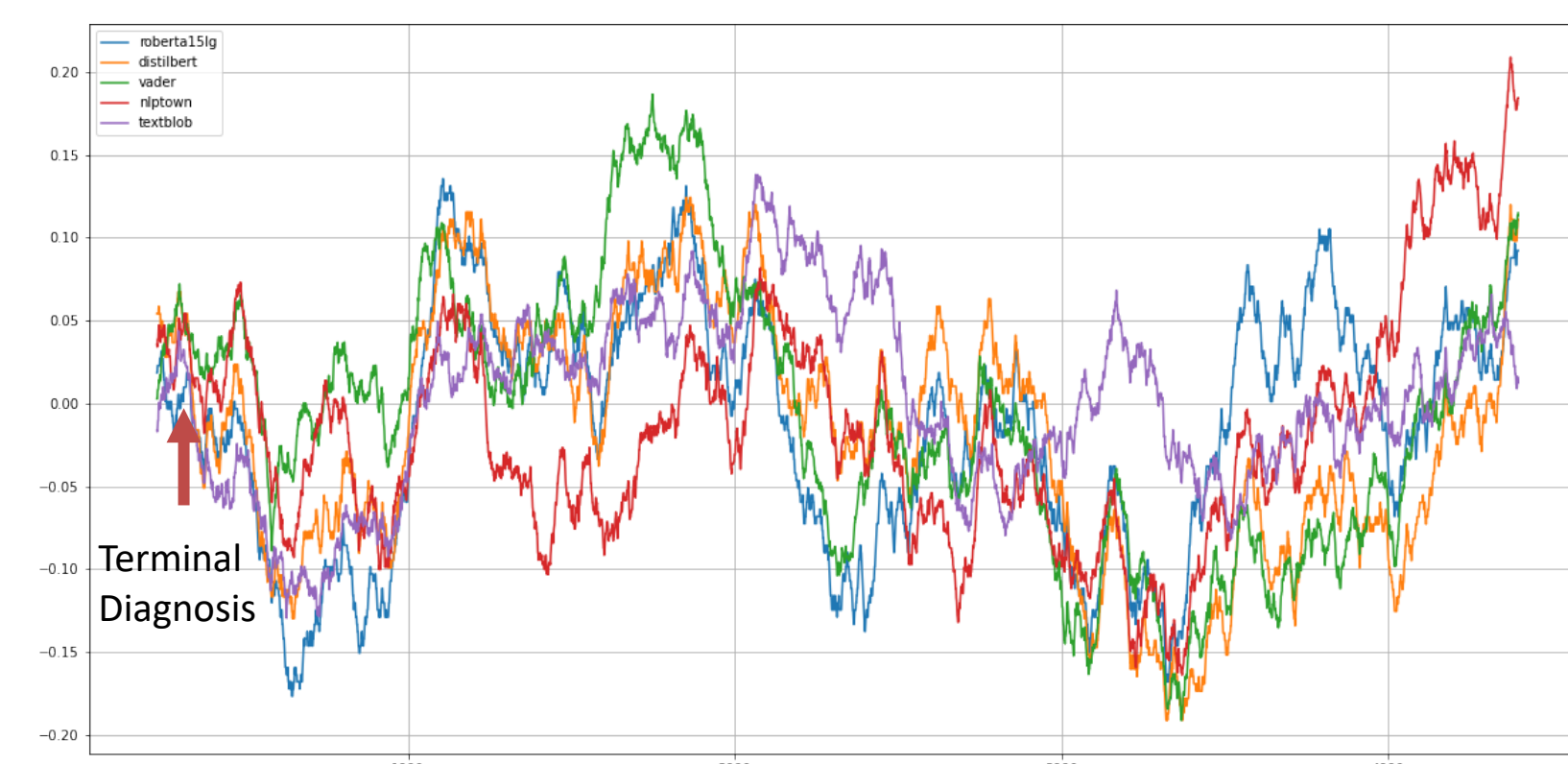
Merged model of Yip-Williams, adjusted to standard scalar normalization (SMA 10%). Terminal diagnosis is given at the very beginning of the memoir; sentiment remains around neutral at the time (145). The greatest peaks and valleys come from passages reflecting on life/past events not related to illness. Out of all models, Textblob varied the most.
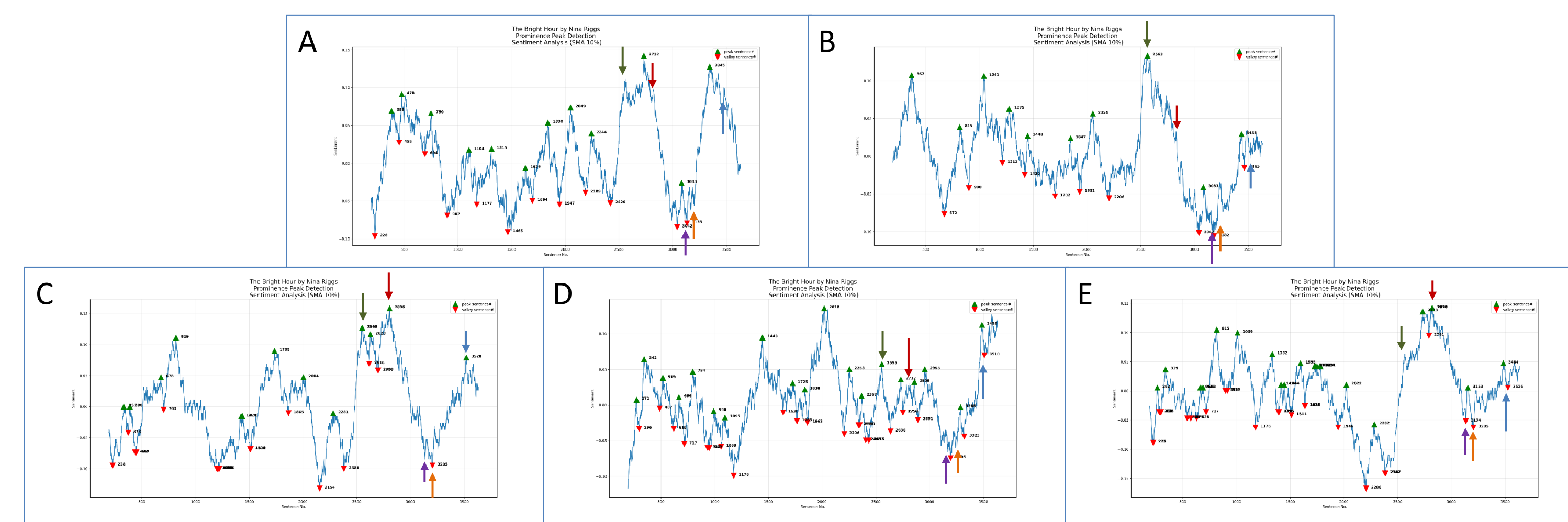

Vader (A), Textblob (B), distilBERT (C), nlptown (D), and roBERTa (E) 0.04 prominence minimum peak detection.
- Denial: Brief moment of denial, celebration of successful surgery (~2060's); positive upward trend
- Anger: Expresses resentment and hatred towards the healthy and living (~3520); negative crux
- Bargaining: "I find myself making another deal with God" (370-95); neutral or slightly negative crux
- Depression: Narrator experiences "most crazed and hysterical crying fit" (~3160's); upward trend, varies
- Acceptance: Narrator makes peace with death (~3085); negative downward crux

Riggs:

The Bright Hour
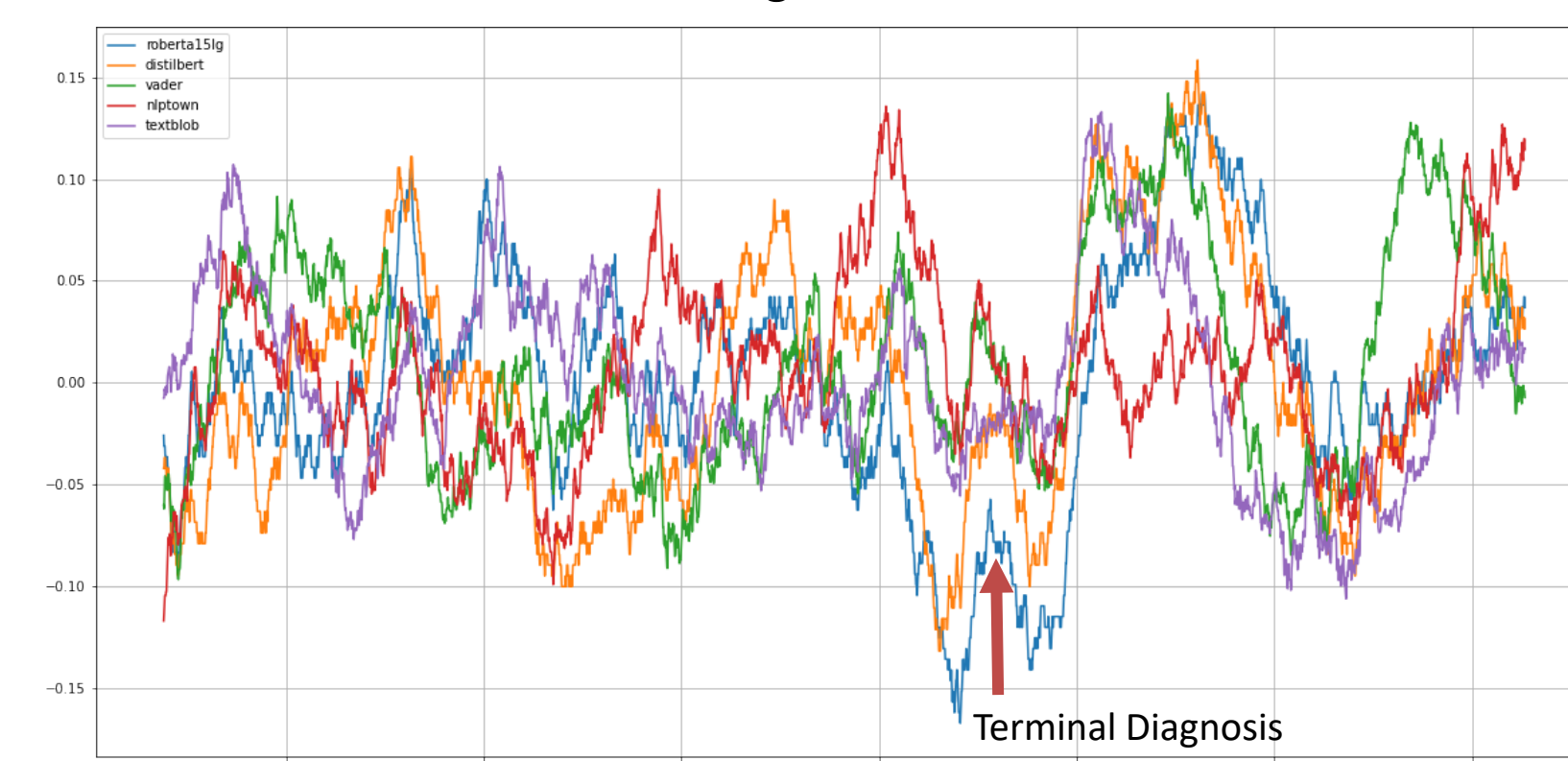
Merged model of Riggs, adjusted to standard scalar normalization (SMA 10%). Extreme disagreement between models, however the arc begins to solidify after terminal diagnosis (2289). Before terminal diagnosis, Riggs described more of her journey with illness and her ailing mother rather than her own mortality. Roberta and nlptown disagreed most with other models.

Vader (A), Textblob (B), distilBERT (C), nlptown (D), and roBERTa (E) 0.04 prominence minimum peak detection.
- Denial: Narrator dreams of life without cancer (2555-60's); positive upward trend
- Anger: Compares sound of sirens to emotions, "Angry tears building" (~2800-50); positive upward trend
- Bargaining: "Can you give me just a few more years?" (~3200); negative downward crux
- Depression: Narrator experiences a panic attack (~3510-30); positive, both peak and valley depending on model
- Acceptance: Discusses mortality, plans after death (~3130's); negative downward crux

Conclusions:

Findings:
- All emotions of the five stages correspond with a sentiment crux
- There is no straightforward pattern or sequential trend in the cruxes of the five stages
- The shape of a narrative is affected by processing grief after a terminal diagnosis
- After terminal diagnosis, sentiment changes so quickly & drastically, overall sentiment remains about neutral

Defining grief and mortality is not a simple quantification. Part of the process of grieving is experiencing emotions with ambiguity and turmoil. We see this turmoil manifest in the sentiment models of end-of-life memoirs, specifically following a terminal diagnosis. Emotion becomes so turbulent, that sentiment value appears neutral. Different people respond in different valences and intensities to the emotions of the five stages. Although there appears to be some quantitative underlying behind the emotions of the Kübler-Ross Model, it is difficult to say if we can hold this model to an indubitable, empirical standard.

Limitations and Future Studies: This study relied greatly on my emotional analysis of the memoirs, which may be faulty or misinterpreted. In addition, crux analysis differed based on peak detection and SMA used; the standards I worked with may have skewed my results. All three case studies were written by young adults with terminal illness-- these findings may not apply to patients of a different age or generation. For future work, I propose researchers work with journals or diaries from terminal patients of all ages. These texts may reveal more about emotional responses to grief than posthumously published memoirs.

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