

Modeling Endangered Language Shifts and Revitalization: Applying the Abrams-Strogatz Model to 'Ōlelo Hawai'i

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Introduction

In 1896, after the Hawaiian monarchy was overthrown by a group of Caucasian businessmen, the indigenous Hawaiian language, 'Ōlelo Hawai'i, was legally banned from use on the island. When the ban was lifted in 1978, the language was in critical danger of extinction, with fewer than 2,000 fluent speakers remaining. However, this crisis sparked an extraordinary resurgence. Through newly enacted governmental policies, Hawaiian immersion preschools and educational programs, and a broadened 'Ōlelo Hawai'i media presence, there are now an estimated 20,000 speakers of the language.

The resurgence of 'Ōlelo Hawai'i exemplifies how language shift models may be of use in predicting the growth and decline of a given language. The Abrams-Strogatz model is a mathematical predictive model that examines how the existence or imposition of a dominant language may threaten the survival of another language. For the purposes of my project, I explored the historical dynamics of 'Ōlelo Hawai'i and English, applying the Abrams-Strogatz model to add a quantitative perspective to the study of language endangerment.

Mathematical Framework

1. Model Used: Abrams-Strogatz Model
2. Purpose: Quantitatively compares the dynamics of language competition between two languages
3. Languages Examined: 'Ōlelo Hawai'i and English
4. Key Parameters:
 - a. Proportion of speakers (p) fluent in 'Ōlelo Hawai'i
 - b. Prestige, or attractiveness (s) of 'Ōlelo Hawai'i $0 \leq s \leq 1$
 - c. Rate of language adoption (a)
5. Assumptions:
 - a. Only two language considered at a time
 - b. Symmetry (the proportions of speakers of 'Ōlelo Hawai'i and English are inversely proportional)
 - c. The prestige factor (a proportion) cannot be equal to 0 or 1
6. Estimating Prestige Factor
Estimated based on the following factors:
 - a. Governmental/legal recognition
 - b. Educational incorporation
 - c. Media Presence
 - d. Community/Daily Use

Historical Background

1896—'Ōlelo Hawai'i is banned by the U.S. government. As this was the first year in which the number of fluent speakers of 'Ōlelo Hawai'i began to dramatically decline, I chose to start my model with the year 1896.

1948—In the year 1948, newspapers written in 'Ōlelo Hawai'i ceased publication.

1978—In the year 1978, the ban on 'Ōlelo Hawai'i was finally lifted and 'Ōlelo Hawai'i was declared a national language of Hawai'i alongside English. This shift in governmental recognition and restrictions marked a change in the population of Hawaiians who wanted to learn their native language.

1986—Nonprofit Aha Pūnana Leo launched first series of Hawaiian immersion preschools. (Interview with Dr. Larry Kimura). This increase in education in 'Ōlelo Hawai'i drove an increase in fluent speakers.

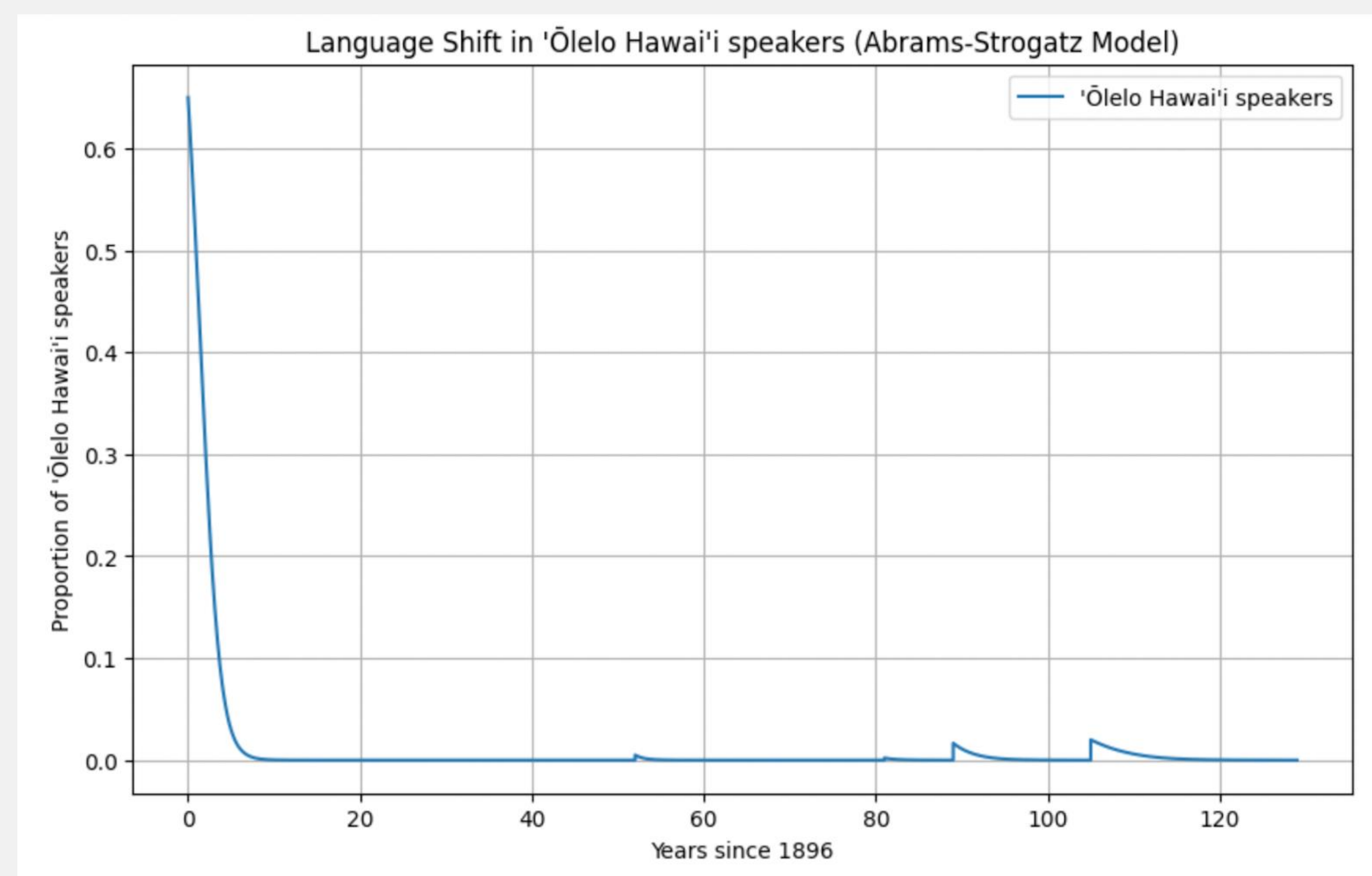
2002—In 2002, education and instruction in 'Ōlelo Hawai'i became available online, as the University of Hawai'i at Hilo launched the first ever Hawaiian online course. By making 'Ōlelo Hawai'i more accessible through the internet, this milestone year also marked an uptick in fluent speakers of 'Ōlelo Hawai'i



The image above is a newspaper in 'Ōlelo Hawai'i published in 1930. The image to the right depicts Queen Liliuokalani, who was overthrown by the coup of 1896, and fought to reinstate the independency of her people, as indicated by the accompanying newspaper clipping.



Results



As seen in the graph above of the Abrams-Strogatz model, the various time periods studied were grouped to develop one continuous graph. The slight increases in proportion of 'Ōlelo Hawai'i speakers can be attributed to increases in the prestige value, s , and an increase in the proportion of 'Ōlelo Hawai'i speakers. It is notable, however, that no matter the increase in prestige of a language, if the initial proportion of fluent speakers remains low, the Abrams-Strogatz model constantly predicts that the proportion of fluent speakers of the language will approach zero, which is reflected in the exponential decreasing nature of the graph.

Conclusion

In graphing the decline of 'Ōlelo Hawai'i, different mathematical parameters can be analyzed to better understand the future of 'Ōlelo Hawai'i. Once the proportion of fluent speakers declined after 1896, it never rose to the same level again, despite revitalization efforts. What did change, however, was the societal prestige of the language, through the publication of newspapers, immersion preschools, and online courses. Despite this, the projection of the future proportion of fluent speakers of 'Ōlelo Hawai'i remains relatively low, approaching a plateau in the graph. Although revitalization efforts can enhance the prestige of a language, if its initial proportion of speakers remains relatively low, it is unlikely that the language will be revitalized past a certain proportion of fluent speakers. The Abrams-Strogatz model's projection certainly oversimplifies this, however, as it neglects the evolution of 'Ōlelo Hawai'i over time, especially as the language may be used in colloquial forms, such as through Pidgin.

Future Studies

In the future, I am interested in pursuing a career in data science and in further exploring computational linguistics, such as through Natural Language Processing. This project exemplified how math may be applied to my personal areas of interest. Having taught in a Spanish immersion preschool and having grown up in the Pacific Northwest, both the study of language acquisition and the study of endangered languages have always intrigued me. Moving forward, I hope to continue exploring how quantitative fields interact with linguistics and anthropological studies.

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- As this is an ongoing project, an ongoing list of references can be found at the QR code here

