Executive Summary

Problem: A
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Statement of Problem: Examine the propensity of a person to alter their appearance and conform to particular social expectations.

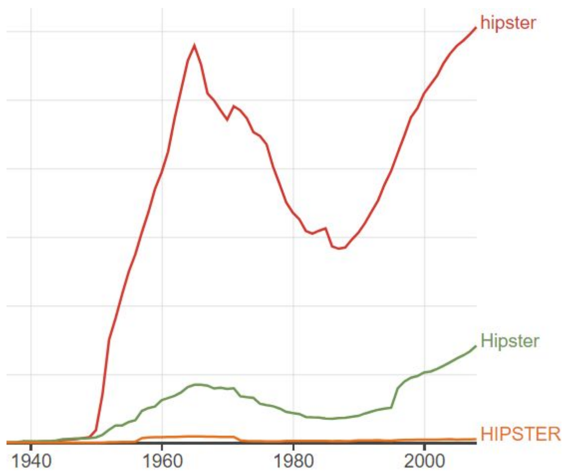
We start by creating a system of coupled differential equations based on the SIR model. Our model contained three groups — Susceptible, Recovered, and Hipster. Susceptible is the portion of the population that is assumed to be receptive to adopting a stereotypically hipster lifestyle as evidenced by their clothing choices. This susceptible portion is assumed to be 19-34 years old, or approximately 21% of the US population based on population distribution of age statistics, or 68.7 Million people. Hipster is the portion of the population that has adopted said stereotypical hipster lifestyle, and are recognizable as a part of the culture by their fashion choices. To simplify the model, we assume that this characterization is binary, being either hipster or susceptible, again, with the qualifier for hipster being that they would be seen as being a hipster based on their appearance. Recovered is a group within the system that is no longer susceptible nor hipster. There are three possibilities for people entering the recovered group. The first possibility is that they enter into the recovered category within the 15 year observation span without ever becoming hipster, likely after becoming disenchanted with the hipsterisms. The second possibility is that a person remains a hipster for the entirety of the observation span and then ages out. The third possibility is that become hipster within the age range and then "recover" from hipsterism before the observation period is completed.

$$\begin{aligned}\frac{dS}{dt} &= -a \cdot S(t) \cdot H(t) - c \cdot S(t) + 817 \\ \frac{dH}{dt} &= a \cdot S(t) \cdot H(t) - b \cdot H(t) \\ \frac{dR}{dt} &= b \cdot H(t) + c \cdot S(t)\end{aligned}$$

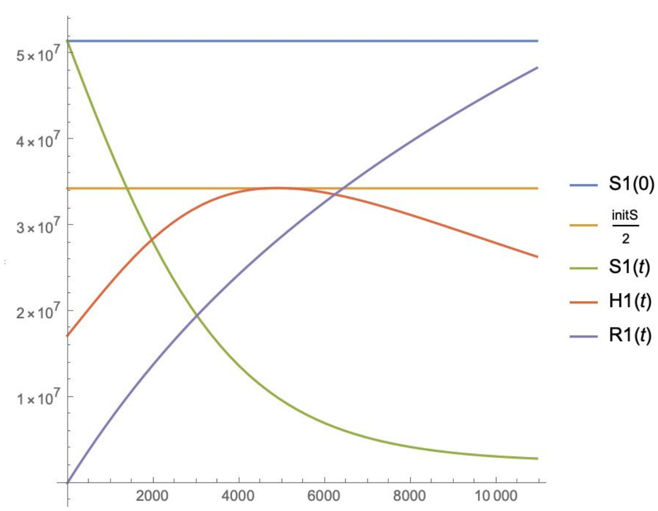
The above equations govern the system of linear ODEs. In the first equation, $\frac{dS}{dt}$, the product of S(t) and H(t) accounts for the direct interaction of susceptibles and hipsters. This is multiplied by the negative of our influence constant — denoted by ***'a'*** — analogous to the transmission coefficient in the SIR model. It is the rate at which the susceptible population becomes hipsterized. This product is furthermore reduced by $-c \cdot S(t)$ where c is a percentage of the susceptible population that is skipping the hipster group and entering directly into recovered per day. To account for a growing population, the average birth rates from the endpoints of our observation span were averaged, converted to a daily value, and the found 817 people per day is added to our susceptible.
The equation $\frac{dH}{dt}$ is growing from the people directly removed from the susceptible population and will grow continually as long as the population of susceptible is sufficient. This growth is given be $a \cdot S(t) \cdot H(t)$. where *a* is the influence constant. A certain percentage of the hipster population is recovering per day, given by $-b \cdot H(t)$ where *b* is a recovery constant — comparable to that of the SIR model.
Therefore, $\frac{dR}{dt}$ grows as the susceptibles skip to recovered through the $-c \cdot S(t)$ term and the recovered population of H(t) enters via the $-b \cdot H(t)$ term.

The values of the constants are defined in the following manner. The variable b — which governs the loss of hipsters — is assumed to be dependent on significant life changes. In our age bracket, the most influential life changes were assumed to be the transition from college into the workfield, and the transition between employments. Assuming the majority of our population would graduate by age 22, and consider research showing that most jobs are left within two years, we divided our age range into the corresponding ages and used these values to find the weighted average. Additionally, we assumed that only 7.5% would cease to be hipsters during the timeframe, resulting in b = 0.0000868.

(fig. 1) - Prevalence of term "hipster"
(people vs days)



(*fig.* 2) -Estimated continuation hipster population
(uses vs year)



With *b* as a fixed variable, we wrote a Mathematica script for our system of coupled differential equations. The variables *a* and *c* are then determined from a base expectation of growth rate multiplied by another constant that describes the probability that person will become a hipster. This is a relative number that defines how "contagious" a specific trend or aspects of a group are. We found these values through multiple iterations of the model (fig. 2) in order to make them correspond to the found values the historical prevalence of the term "hipster" (fig. 1) under the assumption that their trends will correspond. Additionally, we made three assumptions in the fitting of this graph based on real-world observations. (1) We assumed that the most recent value in fig. 1 is at a maximum that is declining. (2) We assumed that as the number of hipsters increases, the change in hipsters declines, having a roughly sinusoidal fluctuation. (3) We assumed that the hipster population would never surpass more than half of the susceptible group. With all of these constraints, we found these values to be $a = 8.68 \cdot 10^{-12}$, and $c = .000125$.

In conclusion we found a constant stating that the rate of growth in persons per day is given by $a = 8.68 \cdot 10^{-12}$. We were able to observe a single oscillation of "the hipster cycle" and predict that the number of self-proclaimed hipster at the bottom of the cycle, in the year 2028, should be $2.63 \cdot 10^{7}$ or 38% of the total population.

(*Note: Two page format was unable to be kept when converting to requested PDF format.)