

Executive Summary GSST PM

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1 Problem Statement

We were asked to predict and assess the spreading of a trend within a population group: everything from similarity of members, number of people affected, methods of communication between members, and pace of spreading.

We make a few assumptions when creating the predictive model:

Firstly, we assume that the trend within our group involves physical products or articles of clothing that are deemed either desired or fashionable/chic.

Secondly, we assume only two possible states for each individual: either a participant in the trend or a bystander. This was done by Touboul in his hipster-behavior model. We can comfortably make our classification a binary one as though socioeconomic barriers may bar individuals from perfectly replicating the set trends, a myriad of cheaper alternatives exist for each “trendy” product or fashion that are almost indistinguishable from the more expensive products. For example, one can buy a counterfeit Chanel or other designer bag in the place of a more expensive one. We can therefore assume a low or no barrier to enter or exit a certain trend.

Thirdly, with the development of the internet and the ubiquity of mobile devices, communication has become both instantaneous and global. We now have a unitary global culture that is propagated by means such as Facebook and Twitter. A trend that starts in a remote part of the internet can be spread like wildfire across the globe and go viral, starting the next whip. This creates a single group that is influenced by a given trend. FOMO, or the fear of missing out, is another principle that exacerbates the peer pressures already felt by individuals, contributing to the instantaneousness at which these individuals adapt to the trends. This eliminates the need for time-delays to be a component of the model.

2 Model

With our model, the origin of a trend is a singular individual. This individual influences a few people; however, they will soon propagate the trend at an increasing rate. This rate of change, however, soon reaches a maximum when the majority of individuals have either already joined or rejected the trend. We modeled our function through the use of trigonometric equations in order to get the desired peak in rate of change that we seek. The constants in the equations are dependent on the virality of the trend as well as the population size. This ensures that the results for the equation are varied based upon the type of trend.

$$\frac{dp}{dt} = p \frac{\cos(t - \frac{\pi}{2})}{[\sin(t - \frac{\pi}{2})]^{\frac{2}{3}}}$$

Solve using the separation of variables method:

$$\int \frac{1}{p} dp = \int \frac{\cos(t - \frac{\pi}{2})}{[\sin(t - \frac{\pi}{2})]^{\frac{2}{3}}} dx$$

Integrate the right side using u-substitution, $u = \sin(t - \frac{\pi}{2})$, such that $du = \cos(t - \frac{\pi}{2})dx$:

$$\ln(p) + c_1 = \int u^{-\frac{2}{3}} du$$

$$\ln(p) + c_1 = \left(3[\sin(t - \frac{\pi}{2})]^{\frac{1}{3}}\right) + c_2$$

$$\ln(p) = \left(3[\sin(t - \frac{\pi}{2})]^{\frac{1}{3}}\right) + c$$

$$p = e^{\left(3[\sin(t - \frac{\pi}{2})]^{\frac{1}{3}}\right) + c}$$

Using the initial values $p(\pi) = k$, where k is the total population:

$$p(\pi) = k = ce^{\left(-3[\sin(-\frac{\pi}{2})]^{\frac{1}{3}}\right)}$$

$$p(\pi) = k = ce^3$$

$$c = ke^{-3}$$

$$p(t) = ke^{-3[\sin(t - \frac{\pi}{2})]^{\frac{1}{3}} - 3}$$

In order to account for an initial condition of $p(0) = 1$, representing the initial person to start a trend, we add a constant at the end of the equation:

$$p(t) = ke^{-3[\cos(t)]^{\frac{1}{3}} - 3} + 1 - \frac{k}{e^6}$$

3 Limitations

Since the model is oscillatory, utilizing a sinusoidal function, the peaks in trend interest are not realistic to an actual trend. Since the frequency is connected to the growth of one peak, it is not possible to account for both, and as a result, the limitations in frequency must be considered. Thus, we propose the first peak of the function, from $t = 0$ to $t = \frac{\pi}{2}$, to model the initial involvement in one trend, and we leave the frequency subject to change based on trend as each trend will come back in different intervals of time.