Fashion Trends: How They Come and Go

Conformists, Non-Conformists, and Influence

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What is our goal?

Our goal is to create a mathematical model that describes how people belonging to a certain fashion trend influence people who do not belong to this fashion trend, and how fashion trends change from one to the next over time.

Some Definitions

Interactions

People interact through social media and word of mouth

Influence

The influence of a person is the number of people they interact with

Our Assumptions

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- People move forward in fashion trends, never backwards
- Both the number of people wearing shoe X and their combined influence affects how many people decide what shoe to wear
- The total influence of a group is the the combined influence of each individual in that trend

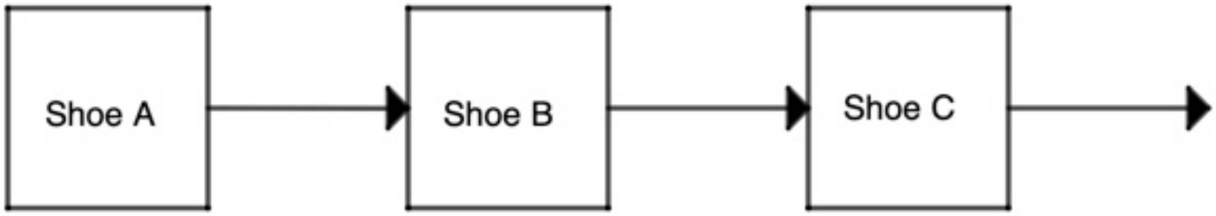
Variables

Variable	Definition	Range
X_+	The number of conformists who wear shoe X (e.g. A_+)	$[0, \infty)$
X_-	The number of non-conformists who wear shoe X (e.g. A_-)	$[0, \infty)$
I_{X_+}	The combined influence of conformists who wear shoe X (e.g. I_{A_+})	$[0, \infty)$
I_{X_-}	The combined influence of non-conformists who wear shoe X, (e.g. I_{A_-})	$[0, \infty)$
t	time (in weeks)	$[o, \infty)$

Constants

Constant	Definition	Range
n	The rate at which people who wear shoe C start wearing an entirely new shoe	[0,1]
k_1	The maximum chance a conformist has of switching to a different shoe in a week	[0,1]
k_2	The maximum chance a non-conformist has of switching to a different shoe in a week	[0,1]

Figure for System



Shoe A is the original popular trend. People go from shoe A, to shoe B, to shoe C. There is no path directly from shoe A to shoe C.

Equations for Initial Trend

$$\frac{dA_+}{dt} = k_1 \cdot (-\frac{I_B}{I_B + I_A} \cdot A_+)$$

$$\frac{dI_{A_+}}{dt} = \frac{dA_+}{dt} \cdot \frac{I_{A_+}}{A_+}$$

$$\frac{dA_-}{dt} = k_2 \cdot (-\frac{I_A}{I_B + I_A} \cdot A_-)$$

$$\frac{dI_{A_-}}{dt} = \frac{dA_-}{dt} \cdot \frac{I_{A_-}}{A_-}$$

Equations for Main Trend

$$\frac{dB_+}{dt} = -\frac{dA_+}{dt} - k_1 \cdot \left(\frac{I_C}{I_B + I_C} \cdot B_+\right)$$

$$\frac{dI_{B_+}}{dt} = -\frac{dI_{A_+}}{dt} - k_1 \cdot \left(\frac{I_{B_+} \cdot I_C}{I_B + I_C}\right)$$

$$\frac{dB_-}{dt} = -\frac{dA_-}{dt} - k_2 \cdot \left(\frac{I_B}{I_B + I_C} \cdot B_-\right)$$

$$\frac{dI_{B_-}}{dt} = -\frac{dI_{A_-}}{dt} - k_2 \cdot \left(\frac{I_B \cdot I_{B_-}}{I_B + I_C}\right)$$

Equations for Final Trend

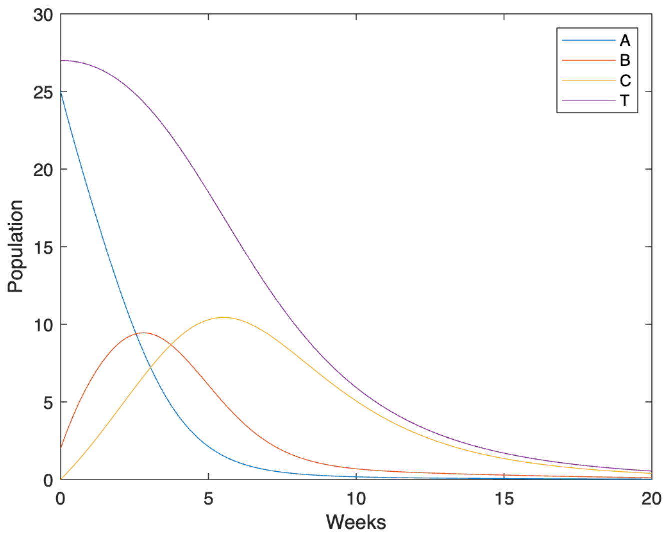
$$\frac{dC_+}{dt} = \frac{I_C}{I_B + I_C} \cdot B_+ \cdot k_1 - n \cdot C_+$$

$$\frac{dI_{C_+}}{dt} = \frac{I_{B_+} \cdot I_C}{I_B + I_C} \cdot k_1 - n \cdot I_{C_+}$$

$$\frac{dC_-}{dt} = \frac{I_B}{I_B + I_C} \cdot B_- \cdot k_2 - n \cdot C_-$$

$$\frac{dI_{C_-}}{dt} = \frac{I_{B_+} \cdot I_B}{I_B + I_C} \cdot k_2 - n \cdot I_{C_-}$$

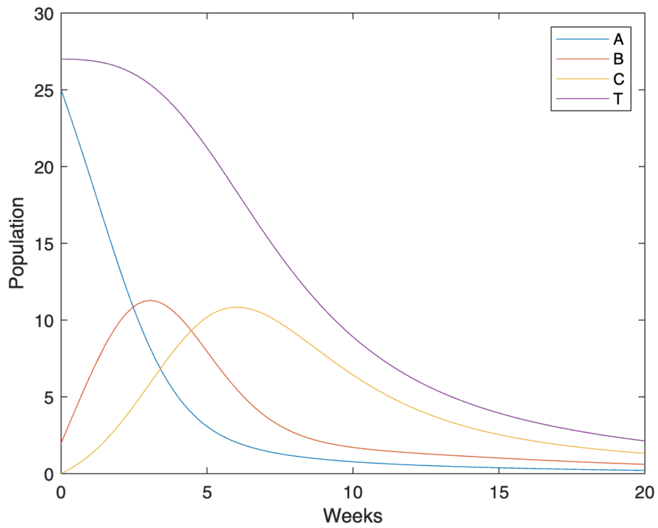
Results



$A_+ = 20$	$I_{A_+} = 20$
$A_- = 5$	$I_{A_-} = 5$
$B_+ = 0$	$I_{B_+} = 0$
$B_- = 2$	$I_{B_-} = 5$
$C_+ = 0$	$I_{C_+} = 0$
$C_- = 0$	$I_{C_-} = 0$
$n = 0.3$	$k_1 = k_2 = 1$

$Max(A)$ at $(0, 25)$
$Max(B)$ at $(2.8, 9.5)$
$Max(C)$ at $(5.5, 10.4)$

Results



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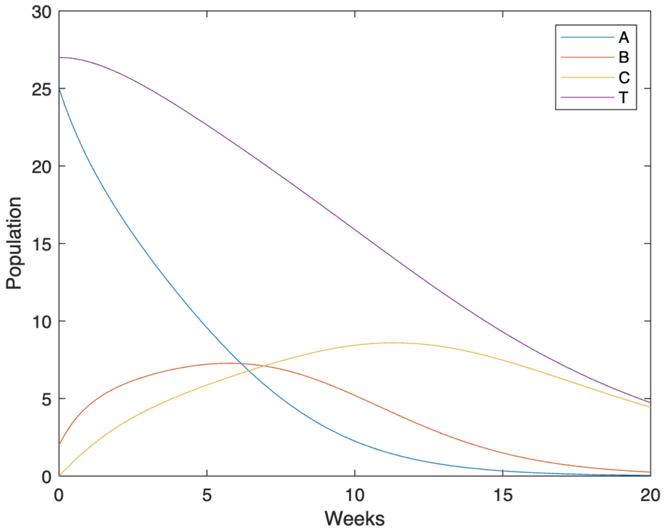
$B_- = 2$	$I_{B_-} = 5$
$C_+ = 0$	$I_{C_+} = 0$
$C_- = 0$	$I_{C_-} = 0$
$n = 0.3$	$k_1 = 1, k_2 = 0.5$

$Max(A)$ at $(0, 25)$
$Max(B)$ at $(2.8, 11.2)$
$Max(C)$ at $(6.1, 10.8)$

Results



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$B_- = 2$	$I_{B_-} = 5$
$C_+ = 0$	$I_{C_+} = 0$
$C_- = 0$	$I_{C_-} = 0$
$n = 0.3$	$k_1 = 0.5, k_2 = 1$

$Max(A)$ at $(0, 25)$
$Max(B)$ at $(5.7, 7.3)$
$Max(C)$ at $(11.5, 8.6)$

How Would Our Model Change if We Have to Model TWO aspects of fashion? (Question 2)