

# Behaviour Dynamics in Social Networks - Assignment 1

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## Abstract

After Jenny has entered Mark's door, her presence clearly makes that Mark becomes happy. Liking Mark a lot, his happiness makes her nervous, which makes that she breaks one of the two nice vases near the door. Seeing this, Mark becomes angry on her. This makes Jenny sad. Jenny's sadness makes Mark's anger disappear, and he gives Jenny a hug. Seeing this, Mark's partner Dion becomes jealous, upon which she breaks the other vase.

Use the concepts and formats introduced in Chapter 2 to analyse and model this scenario by a temporal-causal network by the following steps.

## 1 Graphical conceptual representation

States describing the scenario:

1. Jenny's presence ( $X_1$ );
2. Mark becomes happy ( $X_2$ );
3. Jenny likes Mark ( $X_3$ );
4. Jenny becomes nervous ( $X_4$ );
5. Jenny breaks a vase ( $X_5$ );
6. Mark becomes angry ( $X_6$ );
7. Jenny becomes sad ( $X_7$ );
8. Mark gives Jenny a hug ( $X_8$ );
9. Dion become jealous ( $X_9$ );
10. Dion breaks a vase ( $X_{10}$ ).

In Figure 1, there is a connection that model a negative impact in order to make the level of the affected state lower, the one going from  $X_7$  to  $X_6$  (i.e. Mark anger decreases due to Jenny sadness). There is also a loop that contains  $X_6$  and  $X_7$ .

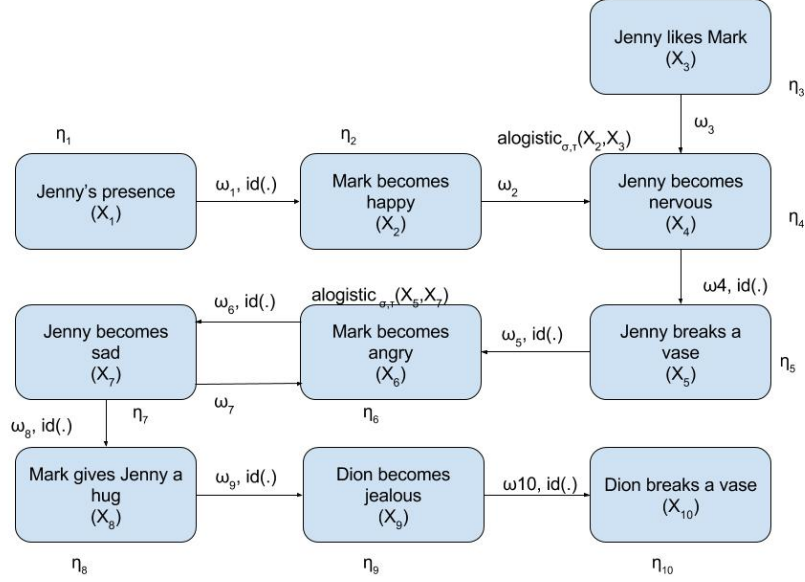


Figure 1: Conceptual representation of the scenario.

## 2 Conceptual representation in matrix format

We now move to the matrix representation of the graph in Figure 1. Rows represent nodes from which an edge is starting, while columns represent nodes to which edge are ending.

## 3 Numerical representation

Numerical representation for the scenario represented in Figure 2.

### 3.1 Difference equation

$$X_1(t + \Delta t) = X_1(t) + \eta_1 \cdot (id(X_1(t)) - X_1(t))\Delta t = X_1(t) \quad (1)$$

$$X_3(t + \Delta t) = X_3(t) + \eta_3 \cdot (id(X_3(t)) - X_3(t))\Delta t = X_3(t) \quad (2)$$

### 3.2 Differential equation

$$\frac{\delta X_1(t)}{\delta t} = X_1(t) + \eta_1 \cdot (id(X_1(t)) - X_1(t)) \quad (3)$$

## 4 Expected behaviour

## 5 Simulation

		states and connections									
		$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$	$X_8$	$X_9$	$X_{10}$
$X_1$			$\omega_1$								
$X_2$					$\omega_2$						
$X_3$					$\omega_3$						
$X_4$						$\omega_4$					
$X_5$							$\omega_5$				
$X_6$								$\omega_6$			
$X_7$									$\omega_7$		
$X_8$										$\omega_8$	
$X_9$											$\omega_9$
$X_{10}$											$\omega_{10}$
		speed factors									
		$\eta_1$	$\eta_2$	$\eta_3$	$\eta_4$	$\eta_5$	$\eta_6$	$\eta_7$	$\eta_8$	$\eta_9$	$\eta_{10}$
combination functions											
identity function	<b>id(.)</b>		id( $X_1$ )	id( $X_2$ )		id( $X_3$ )		id( $X_4$ )	id( $X_5$ )	id( $X_6$ )	id( $X_7$ )
sum function	<b>sum(...)</b>										
scaled sum	<b>ssum(...)</b>										
scale factor $\lambda$											
simple logistic	<b>slogistic<sub><math>\alpha</math></sub>(...)</b>										
advanced logistic	<b>alogistic<sub><math>\alpha</math></sub>(...)</b>				alogistic <sub><math>\alpha</math></sub> ( $X_2, X_3$ )		alogistic <sub><math>\alpha</math></sub> ( $X_5, X_6$ )				
steepness $\sigma$					$\sigma_1$		$\sigma_2$				
threshold $\tau$					$\tau_1$		$\tau_2$				

Figure 2: Matrix format of the conceptual representation

