

again represents the importance of relative rather than absolute measures. If opposition develops slowly, the government will develop defenses to neutralize its effects. In addition, it is unlikely that strong opposition to government or executive policies could be maintained by the populace for an extended period of time. Finally, it is the comparison of current values of opposition to traditional values that yield the normalized climate of opposition (Cli_Opp_Leg, Cli_Opp_Exec, Cli_Opp) which is used throughout the model.

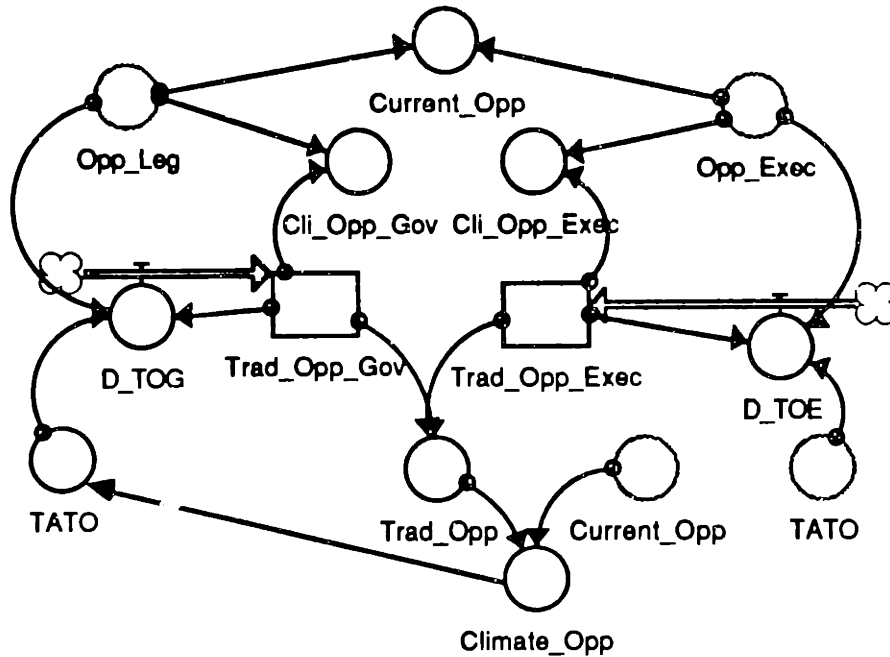


Figure B.5.5: Traditional Opposition

Traditional levels of opposition are assumed to adjust with the time constant TATO (Time to Adjust Traditional Opposition), however, this time constant is in fact variable. In the model it is a function of the current climate of opposition. This reflects the fact that people are much quicker to accept a higher level of government opposition than they are to forget past events. This assumption is admittedly debatable.

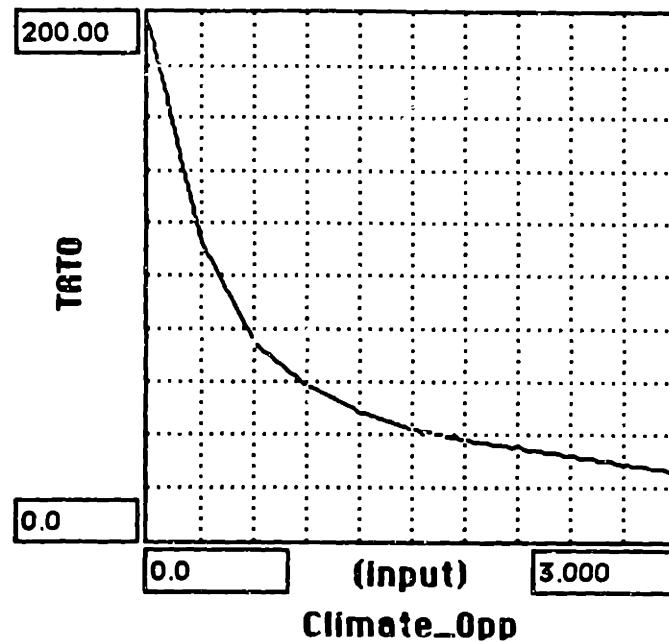


Figure B.5.6: Time to Adjust Traditional Opposition (TATO)

Unhappiness (Unhappiness)

This variable is simply the sum of societal discontent (not including the executive--he's just one man). Ideally, the political system should try to minimize this quantity. It can be an interesting variable to observe in order to determine whether the system is stable in a classical sense. That is to say, does the level of unhappiness decrease or increase after a disturbance?

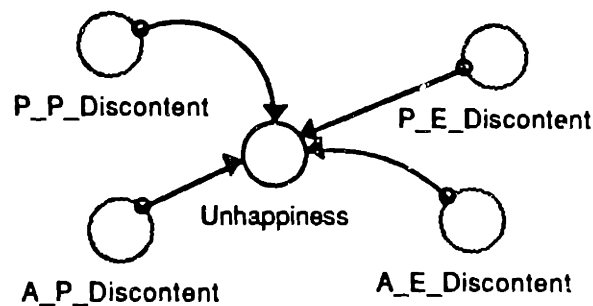


Figure B.5.7: Unhappiness

B.6 Noise Inputs

Pink Noise (Pink_Noise)

In order to test the response of the system to imperfect information flows, indecision, and other assumptions of bounded rationality, pink noise is generated using a structure outlined in Richardson and Pugh's Introduction to System Dynamics Modeling with DYNAMO (p. 371).

Pink_Noise is added to the executive desired levels of freedom and economic welfare (Exec_Des_Free, Exec_Des_Eco_Wel) and has a standard deviation of 3 with a correlation time of 6 months. Pink_Noise2 serves as an input to normal production (Norm_Prod) and has a standard deviation of 6 with a correlation time of 12.

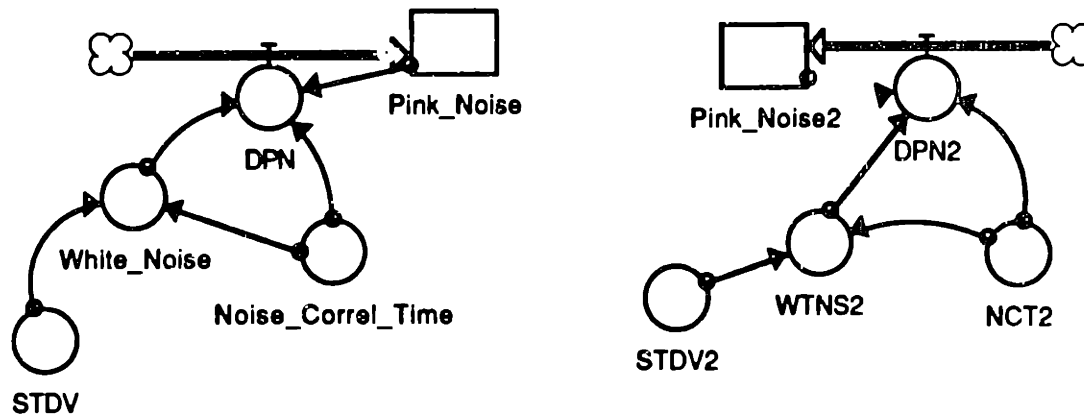


Figure B.6.1: Pink Noise

Appendix C: Listing of Model Equations

State Variables

$\text{Aris_Des_Eco_Wel} = \text{Aris_Des_Eco_Wel}$
 $\text{INIT}(\text{Aris_Des_Eco_Wel}) = 65$
 {Aristocrat's Desired Economic Welfare (Produce/Month)}
 $\text{Aris_Des_Free} = \text{Aris_Des_Free} + dt * (C_A_Des_Free)$
 $\text{INIT}(\text{Aris_Des_Free}) = 35$
 {Aristocrat's Desired Freedom for Populace (Freedom)}
 $\text{Aris_Leg_Infl} = \text{Aris_Leg_Infl} + dt * (-D_AELI + D_PALI)$
 $\text{INIT}(\text{Aris_Leg_Infl}) = .333$
 {Aristocratic Legislative Influence (fraction)}
 $\text{Ave_Eco_Unrest} = \text{Ave_Eco_Unrest} + dt * (D_AEU)$
 $\text{INIT}(\text{Ave_Eco_Unrest}) = 30$
 {Average Economic Unrest among populace (output)}
 $\text{Ave_Pol_Unrest} = \text{Ave_Pol_Unrest} + dt * (D_APU)$
 $\text{INIT}(\text{Ave_Pol_Unrest}) = 30$
 {Average Political Unrest among populace (freedom)}
 $\text{Economic_Law} = \text{Economic_Law} + dt * (Eco_Legislation)$
 $\text{INIT}(\text{Economic_Law}) = 50$
 {Economic Law (output/person/month)}
 $\text{Eco_Welfare} = \text{Eco_Welfare} + dt * (d_EW)$
 $\text{INIT}(\text{Eco_Welfare}) = 50$
 {Economic Welfare of the populace (output/person/month)}
 $\text{Exec_Power} = \text{Exec_Power} + dt * (C_Exec_Power)$
 $\text{INIT}(\text{Exec_Power}) = .4$
 {Executive Power (fraction)}
 $\text{Exe_Leg_Infl} = \text{Exe_Leg_Infl} + dt * (D_AELI + D_PELI)$
 $\text{INIT}(\text{Exe_Leg_Infl}) = .333$
 {Executive Legislative Influence (fraction)}
 $\text{Gov_Pol_Free} = \text{Gov_Pol_Free} + dt * (C_GPF)$
 $\text{INIT}(\text{Gov_Pol_Free}) = 50$
 {Government Policy concerning Freedom (freedom)}
 $\text{OF_Aris} = \text{OF_Aris} + dt * (a_OF - c_OF)$
 $\text{INIT}(\text{OF_Aris}) = (1 - \text{OF_Exec})/2$
 {Output Fraction for Aristocrats (fraction)}
 $\text{OF_Exec} = \text{OF_Exec} + dt * (c_OF + b_OF)$
 $\text{INIT}(\text{OF_Exec}) = \text{Exec_Power} * .1$
 {Output Fraction for Executive (fraction)}
 $\text{OF_Pop} = \text{OF_Pop} + dt * (-a_OF - b_OF)$

```

INIT(OF_Pop) =(1-OF_Exec)/2
{Output Fraction for Populace (fraction)}
Perc_Out_Aris = Perc_Out_Aris + dt * ( d_POA )
INIT(Perc_Out_Aris) = 50
Perc_Out_Pop = Perc_Out_Pop + dt * ( D_POP )
INIT(Perc_Out_Pop) =50
{Output to Populace perceived by Populace (output/person/month)}
Pink_Noise = Pink_Noise + dt * ( DPN )
INIT(Pink_Noise) = 0
{Pink Noise generated for testing (non-dimensional)}
Pink_Noise2 = Pink_Noise2 + dt * ( DPN2 )
INIT(Pink_Noise2) = 0
{Pink Noise (non-dimensional)}
Pol_Freedom = Pol_Freedom + dt * ( Incr_Pol_Free )
INIT(Pol_Freedom) = 50
{Political Freedom for populace (freedom)}
Pol_Law = Pol_Law + dt * ( Political_Legislat )
INIT(Pol_Law) = 50
{Political Law concerning freedom (freedom)}
Pop_Des_Eco_Wel = Pop_Des_Eco_Wel + dt * ( C_PDEW )
INIT(Pop_Des_Eco_Wel) = 65
{Popular Desired Economic Welfare (output/person/month)}
Pop_Des_Free = Pop_Des_Free + dt * ( Inc_Pop_Des_Free )
INIT(Pop_Des_Free) = 65
{Popular Desired Freedom (freedom)}
Pop_Leg_Infl = Pop_Leg_Infl + dt * ( -D_PELI - D_PALI )
INIT(Pop_Leg_Infl) = .333
{Popular Legislative Influence (fraction)}
Propaganda = Propaganda + dt * ( C_Prop )
INIT(Propaganda) = -22
{Propaganda (freedom or output/person/month)}
Rel_Des_Eco_Wel = Rel_Des_Eco_Wel
INIT(Rel_Des_Eco_Wel) = 50
{Religious Desired Economic Welfare for populace
(output/person/month)}
Rel_Des_Free = Rel_Des_Free
INIT(Rel_Des_Free) = 50
{Religious Desired Freedom for populace (freedom)}
Rel_Effort = Rel_Effort + dt * ( Inc_Rel_Eff - Dec_Rel_Eff )
INIT(Rel_Effort) = 1.5
{Religious Effort to influence populace (weighting fraction)}

```