Predator Prey Model in Cognition

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The PP Model is projected in 2 dimensions and set by 4 parameters, α, β, σ, γ. Here are the ODE for the system:

$$\frac{dx}{dt} = x(\alpha - \beta y)$$
$$\frac{dy}{dt} = -y(\gamma - \sigma x)$$

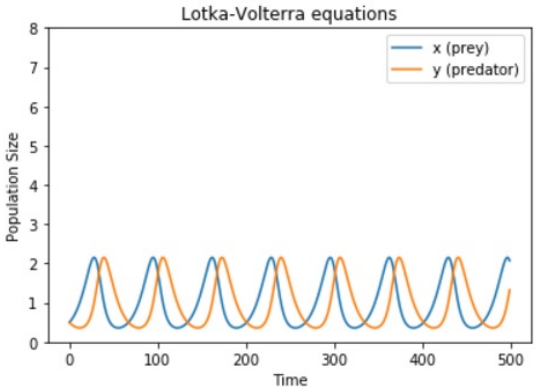

Figure 1: Predator Prey Model 1.
Figure 1)

Figure 1 This is the standard setting of the parameters demonstrating a healthy Predator and Prey relationship. In cognition one can think of this as a basic reward feedback dynamic. For example, one can take the classic need to eat ad the food resource to drug addiction. One can think of the prey as being a drug (e.g.,caffeine, amphetamines...) and the predator as the addictive need for it. In this figure the relationship is stable and doesn't show extreme tug and pull effects.

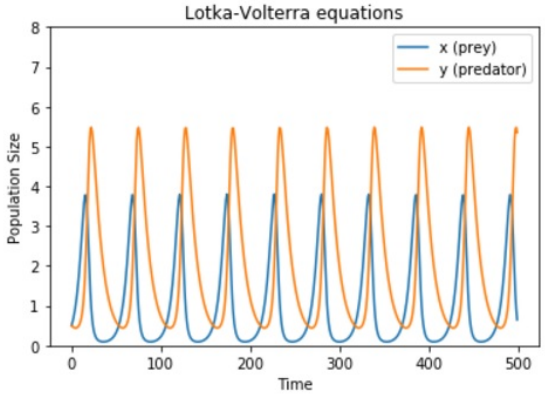

Figure 2: Predator Prey Model 2.
Figure 2)

Figure 2 shows an example of the addiction going past an unhealthy relationship. Eventually the need for the addictive resource will be more than the available resource. This lack of sedation can lead to a rash need for an unhealthy amount that may cause overdose.

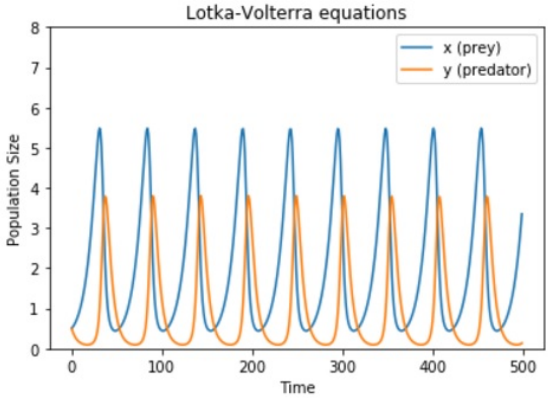

Figure 3: Predator Prey Model 3.
Figure 3)

Figure 3 can be interpreted as the relationship either before or after the state describes in Figure 2. The individual is sedated and does not have the need to intake more than the size of the resource.