

April 21, 2016

## Exercise 1

In the lecture we saw how to generate movement by generating a time course of vehicle heading,  $\phi(t)$  from a dynamical system defined over  $\phi$ . The contribution of a single obstacle to this dynamics is given by

$$\dot{\phi} = \alpha(\phi - \psi) \exp\left[-\frac{(\phi - \psi)^2}{2\sigma^2}\right]$$

where  $\psi$  is the direction in which an obstacle lies.

1. Plot the first factor and describe the geometrical meaning of the two parameters,  $\psi$  and  $\alpha$ .
2. Plot the second factor and describe the geometrical meaning of the two parameters,  $\psi$  and  $\sigma$ .
3. Plot the product. Is the slope of the dynamics at  $\phi = \psi$  affected by the second factor? Why or why not?
4. Plot the time course of heading direction that results from this dynamics when the initial heading direction,  $\phi(0)$  is (a)  $< \psi$ , (b)  $> \psi$ , (c)  $= \psi$ . These plots are qualitative based on your mental "simulation" of the dynamics.
5. Plot the same time courses when  $\alpha$  is larger.
6. State what happens when the initial heading,  $\phi(0)$  is far from  $\psi$ :  $|\phi(0) - \psi| \gg \sigma$