Review questions:

Do these questions in addition to your Homework 5, in preparation for the final exam.

1. What are the two problems of motor control? What’s Bernstein’s solution to them? How does a horse’s gait transition illustrate the idea of synergy (coordination and control)?

2. What does it mean by open-loop control? What kind of motor control theories are open-loop theories? What are some advantages and disadvantages?

What does it mean by closed-loop control? What kind of motor control theories are closed-loop theories? What are some advantages and disadvantages?

When you simply add a feedback (of motor outcome) into the motor control loop (so to close the loop), is it going to correct errors in the motor system or lead to accurate movement? Why or why not?

3. What is motor program? What are some results or evidence that may support the motor program hypothesis of movement control?

4.What are Kelso’s criticisms to the computational approach to motor control? What are some differences between the dynamical approach and the computational approach to motor control?

5. To efficiently control a complex system, we take advantage of the self-organization of the system. What does it mean by “self-organizing”? what does it mean by “embodied”? How does “self-organizing” support the idea of “embodiment”?

6. What is a point attractor of a dynamical system? What is a limit cycle attractor? Give examples of human movements that exhibit a point attractor and a limit cycle attractor.

7. How was the “double-step targeting” experiments done? What are some important interpretations of the main results?

8. What is bifurcation? Explain with examples.

9. Discrete arm reaching can be modeled as damped mass spring. What does it mean by “damped”? Why is damping important?

10. What is the higher-order variable that characterizes limb movement?

11. Rhythmic limb movement may be modeled as hybrid oscillators, phase driven oscillators, or force driven oscillators. Which one exemplifies Gibson’s philosophy? Which one exemplifies a disembodied unit that exerts explicit control on the movement system? Explain your answers.

12. Define relative phase. What are the two stable states of human rhythmic movement? What happens if you keep moving faster?

13. How did Raibert (Raibert, 1986) engineer his running robots? What principles did he use to guide his design? What were the three parts of his control structure?

14. What dynamics do human walking and running resemble? What is a key feature that differentiates running from walking?

15. Write down Warren’s control law for running over irregular terrain. How does this control law exemplify the central ideas of ecological psychology, such as perception and action are inseparable, perception and action are embodied and perception and action use higher-order variables?

16. After the whole course, now how do you understand the phrase “perception/action form one system; they are two sides of the same coin”?