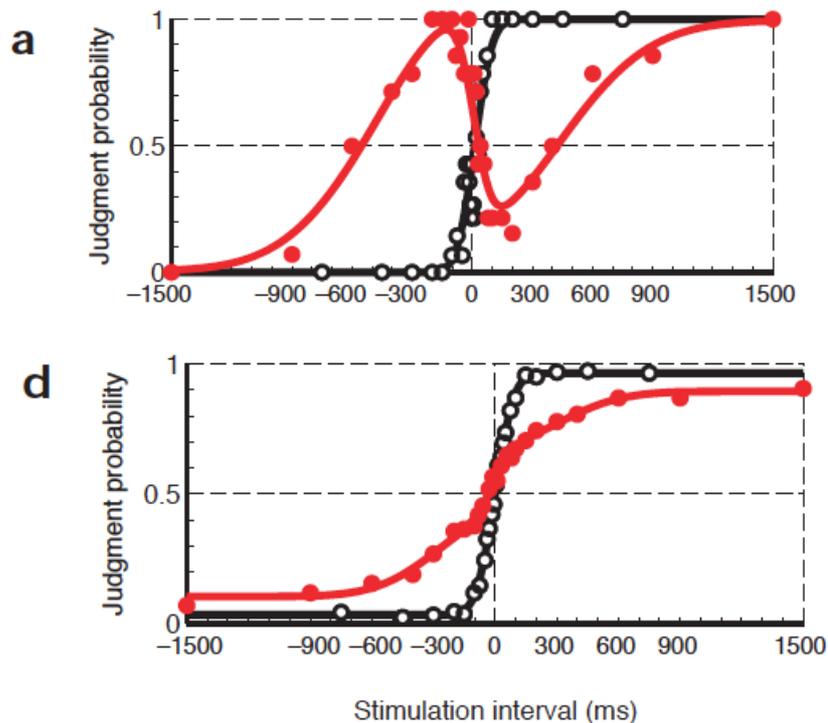


Concepts in Human Movement Sciences

Exam October 20th, 2015

Part Behavioural

- 1) Is ecological psychology a theory or an approach? Explain why.
- 2) According to Fitts, which parameter in his law should change during skill acquisition? What aspect of skill learning cannot be explained by this change?
- 3)

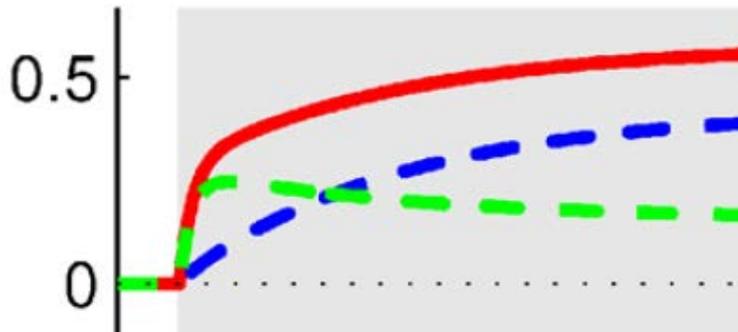


The two panels plotted above are from figure 1 of Yamamoto & Kitazawa. Panel **a** shows data from subject K.K. and panel **d** shows the data averaged over all subjects. Although the red curves (crossed-hand condition) differ considerably between subject KK and the average subjects, one can argue that both red curves are being caused by the same mechanism. Give an argument.

- 4) Discuss whether Harris & Wolpert assume in their theory the existence of a motor program according to the definition of Keele.
- 5) According to Wing & Kristofferson, there are two places where variability (noise) is introduced in repetitive timing: in the central clock and in the peripheral delays. Argue which of these two locations is responsible for the predicted negative autocorrelation between subsequent intervals.
- 6) Explain what synergies are according to Ting & Macpherson, and how they are solving the redundancy problem.

7) The variability in task performance can be split in a task-relevant and a task-irrelevant component. What predictions do van Beers et al. make for the lag-1 autocorrelation of the two components of variability?

8) The figure is taken from a figure in the paper by Smith et al., and indicates the mechanism of motor adaptation that they propose. Explain what is on the axes, what the three curves indicate, and what their relation is.



Part Biophysical-Stability

9) A device is developed to assess the ability of subjects to deal with perturbations of their trunk. The device applies horizontal forces at the shoulder level in the right direction, by a motor pulling on a cable. The subject does not know when the perturbation will occur and cannot predict it based on visual or auditory information. The test is performed with the subject initially sitting upright and the pelvis is rigidly fixed to a frame. Orientation of the trunk in the frontal plane, the force in the cable and EMG, the electrical activity, of left and right trunk muscles are continuously measured.

- a) The force applied is a pulse perturbation with a peak force of 100 N. Describe the kinematic response that will occur when testing a healthy adult subject.
- b) Describe how the kinematic response in low-back pain patients will differ from that in healthy controls and describe which mechanism(s) determine these differences.
- c) To test the effects of taping on trunk stability, subjects are tested before and after application of an elastic tape on their trunk on the left side. Do you expect a change in the kinematic response after the application of the tape? Motivate your answer.
- d) A 20-kg mass is placed in a weight vest and applied over the shoulders of a healthy subject. What changes do you expect in the EMG signals before the perturbation and in the kinematic responses after the perturbation compared to the unloaded situation? Motivate your answer.

10) Variability and local dynamic stability of trunk kinematics in running are compared between running on an athletics track and cross-country running (on unpaved and uneven terrain).

- a) The trunk kinematics are less variable and at the same time show decreased local dynamic stability (Lyapunov exponents also called local divergence exponents are larger) in running on the track. Explain these findings.
- b) It is found that the step width, i.e. the mediolateral distance between the heels at consecutive heel strikes, is larger during cross-country running than during running on an athletics track. Explain, using the theory of Hof, why runners increase step width on the uneven terrain.

Part Biophysical-Intensity

- 11) Using the session TRIMP method, a coach can estimate the training load of his athletes. Discuss this method, including the concepts of monotony and strain, and discuss the advantages and disadvantages of using heart rate versus RPE.
- 12) Heart rate is often used to estimate or prescribe exercise intensity. Discuss the potential problems and limitations of using the heart rate to do this.
- 13) The critical power (CP), based on the relation between exercise intensity and the duration of the performance, is a fundamental concept defining the limits of physical performance. Explain the difference between the lactate threshold and the CP and discuss which one should preferably be used.
- 14) Morton (2006) describes the CP model as a hydraulic 2-vessel model, which is based on several assumptions. One of the assumptions is “CP and AWC are constants, independent of P (and/or of t).” Discuss to what extent this assumption is valid.
- 15) There are basically 2 primary mechanisms by which a muscle can increase its absolute CP (Walsh 2000). Describe these two physiological mechanisms.
- 16) A coach has two handcycling athletes who will perform in a 10-km road race. The coach has learned about the CP model and decides to do some tests, which indicate that one of the athletes (A) has a relatively high W' but a relatively low CP, whereas the other (B) has a relatively high CP but a relatively low W' . The coach asks your advice about the optimal race tactics. What do you advise him?