

B. Synchronization

2013/4/21

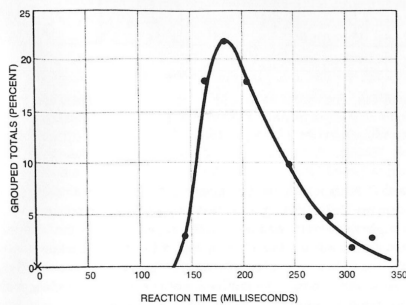
1

Demonstration: Human Synchronization

2013/4/21

2

Reaction Time

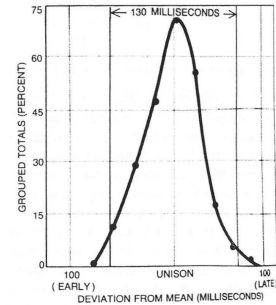


2013/4/21

Fig. from Buck & Buck (1976)

3

Synchronization



2013/4/21

Fig. from Buck & Buck (1976)

4

Flashing Among Fireflies

2013/4/21

5

Synchronous Flashing

- In only two places enormous numbers of fireflies gather in trees and flash in synchrony
 - SE Asia (India, Philippines, New Guinea)
 - Elkmont in the Smoky Mountains!
- A group of trees spread over 1/10 mile may flash in synchrony
- Only males do synchronous flashing
- Had been unexplained for 300 years
- Early 1900s: claimed to be an illusion because no explanation could be imagined

2013/4/21

6

Why Do They Do It?

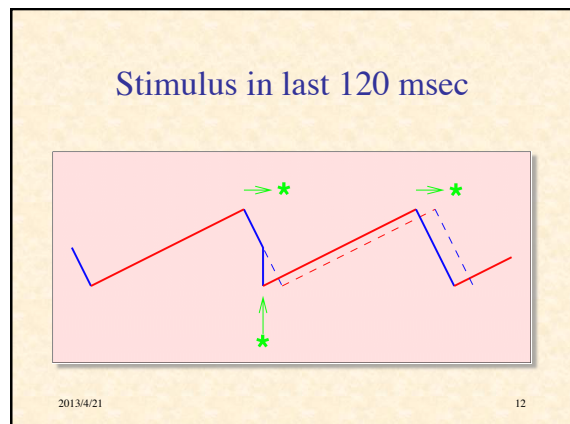
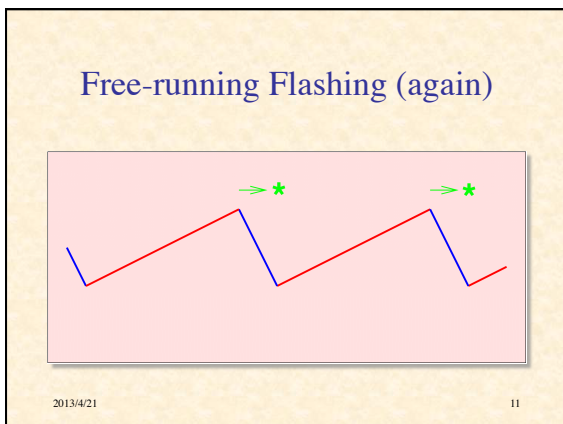
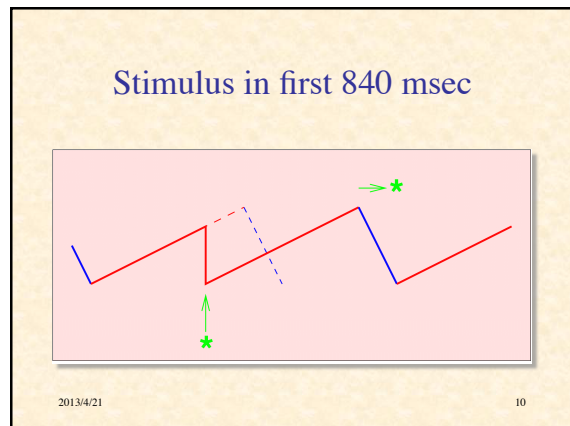
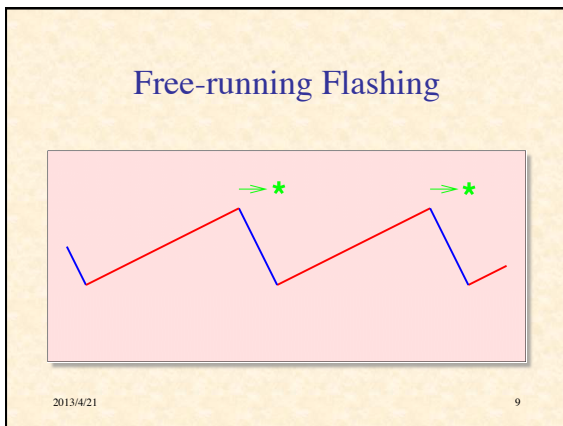
- Females identify males of their own species by flashing rate
 - difficult to do if they flash chaotically
 - i.e., enhanced discrimination
- Allows males to detect (unsynchronized flashing of nearby females)
 - i.e., enhanced detection
- Allows small groups of males to attract larger numbers of females
 - i.e., signal enhancement

2013/4/21 7

How Do They Do It?

- “innate individual rhythmicity with phase-dependent sensitivity to mutual influences”
- Natural flashing period: 965 ± 90 msec (≈ 1 sec)
- Flash from firefly *A* will reset the clock of nearby firefly *B*
 - thereby shifting the *phase* of *B*'s clock
- If *A* flashes in first 840 ms of *B*'s cycle, will inhibit *B*'s next flash & delay until 1 sec after stimulus (i.e. retarded so it is in sync with *A*)
- If *A* flashes in last 160 ms, *B*'s next flash occurs normally, but subsequent flash will be advanced to be in sync with *A*

2013/4/21 8



Camazine's Model of
Firefly Synchronization

[Run Firefly.nlogo Simulation](#)

2013/4/21 13

Wilensky's Model of
Firefly Synchronization

[Run Fireflies-mobile.nlogo Simulation](#)

2013/4/21  14