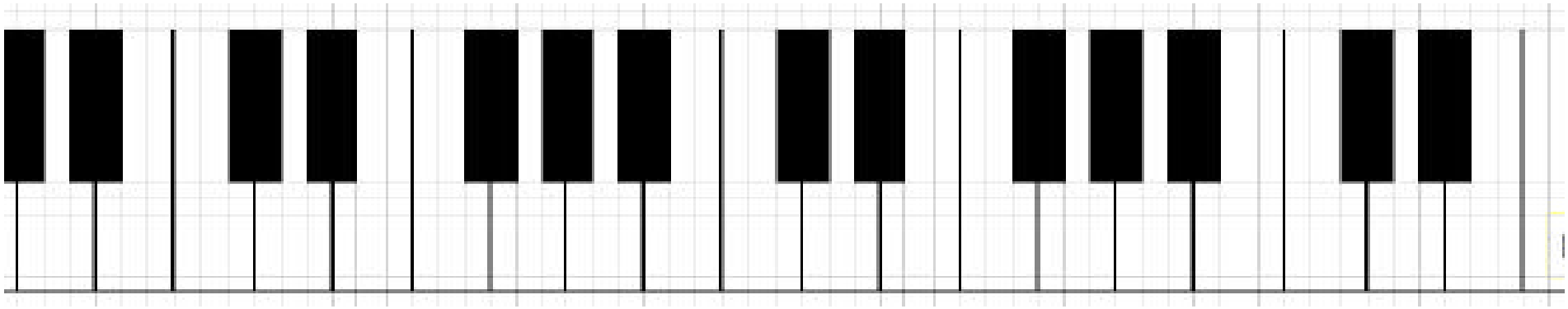
PH109 Monday 10/15/01

Musical Intervals - Musical Scales



1. Musical Interval:

a tune consists of a sequence of frequency changes, called "intervals".

We perceive the intervals as being the same if the RATIO of the frequencies is the same:

example: 1:2 ratio (octave) 200Hz → 400Hz
same as 300Hz → 600Hz
2:3 ratio (“fifth”) 200Hz → 300Hz
same as 300Hz → 450Hz

divide or multiply all frequencies of a tune by same number -> same tune (called “transposition”)

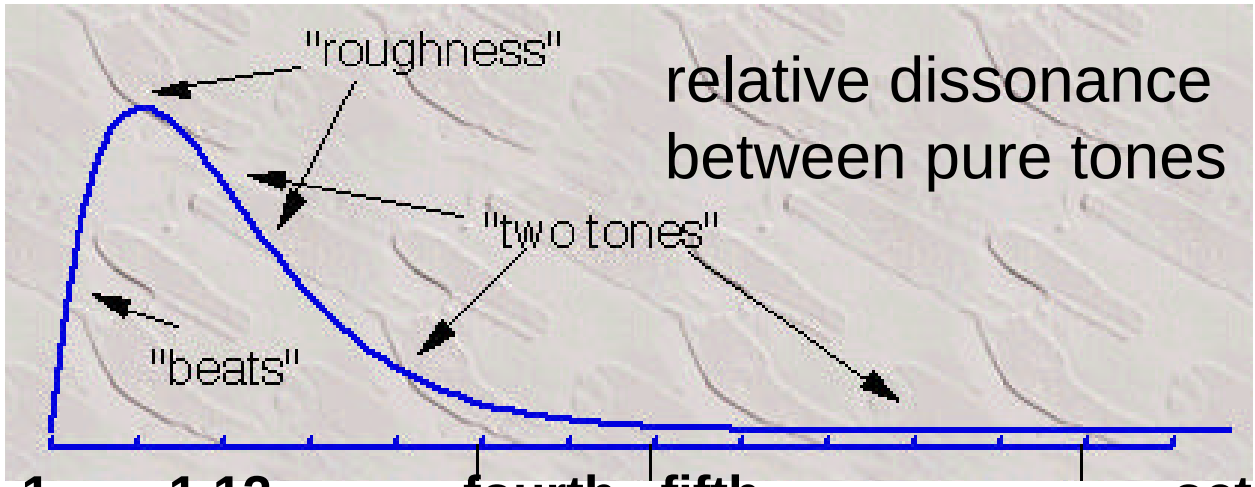
a musical interval is a given frequency RATIO

2. Consonance (harmony) = “simple” number ratios

e.g. 2:1 ("octave");
3:2 ("fifth”)
5/4 ("major third”)

where do names of intervals come from?

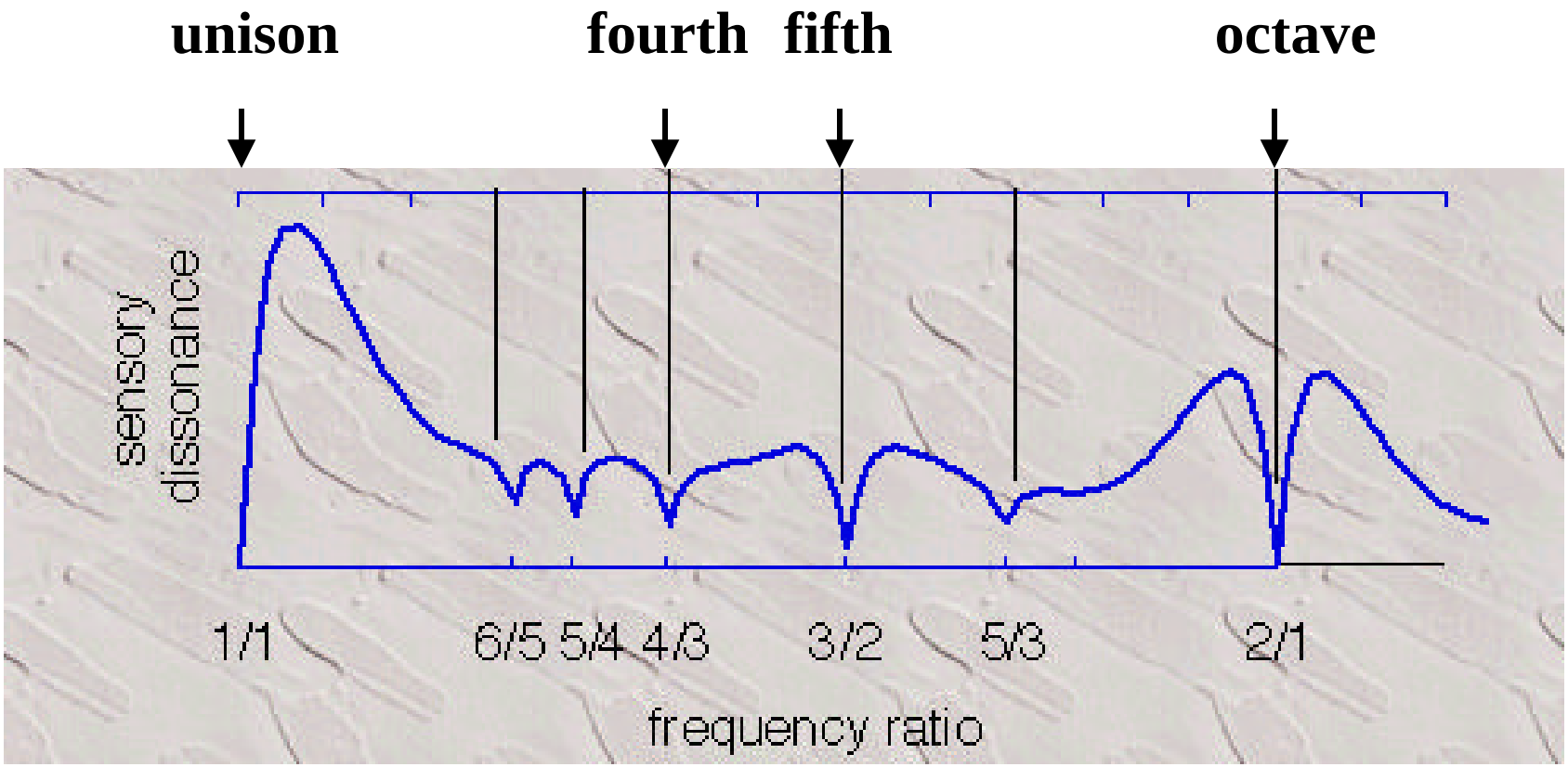
Physical basis (conjecture): no beats between overtones (overtones either agree exactly or not at all).



frequency ratio between tones

Dissonance Curve

Sethares, UW EEC



example: 4/3 = “fourth”. Assume 200 Hz and 150 Hz:

tone 1: 200 400 600 800 1000

tone 2: 150 300 450 600 750 900

3. Constructing a scale ("just" scale)

freq. ratio of the THE TRIAD:

(major triad) **4 -> 5 -> 6 (-> 8)**

or divide by 4: **1 5/4 3/2 2**

C E G C

call first tone of scale C and assign to it a frequency of 1unit (1 unit can be any number of Hz)

to get Hz, you could multiply by any number you like, e.g. multiply by 240:

240Hz -> 300Hz -> 360Hz -> 480Hz

why choose these intervals? CONSONANCE!

tune the white keys of the piano……

C D E F G A B C D

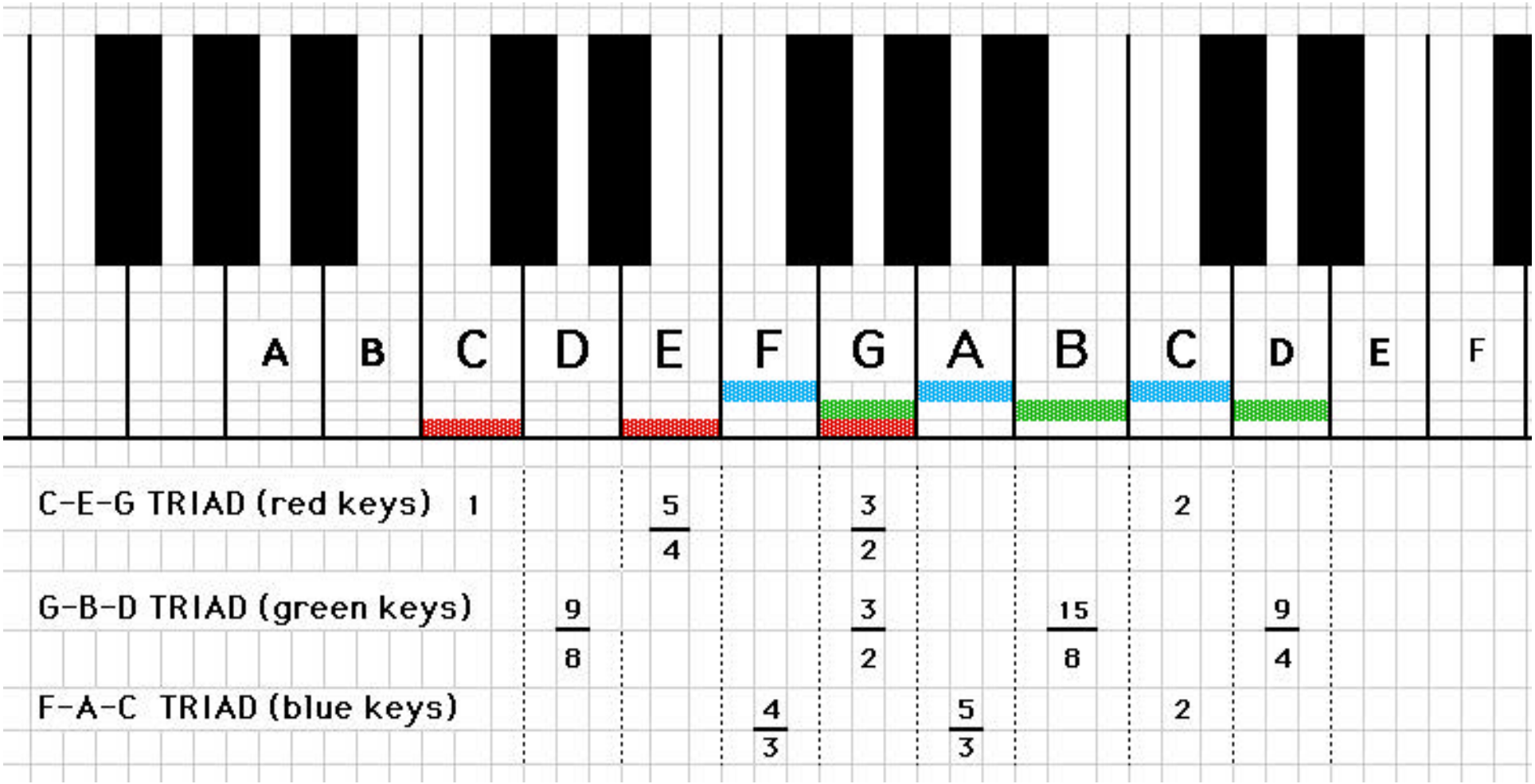
…..to three triads:

C-E-G: **C D E F G A B C D**

G-B-D: C **D** E F **G** A **B** C **D**

F-A-C: C D E **F** G **A** B **C** D

Now calculate the required frequencies:
they must be in the proportions 1 - 5/4 - 3/2

Just Scale:

white keys of the piano