

# Introduction to Statistics

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1/9/07

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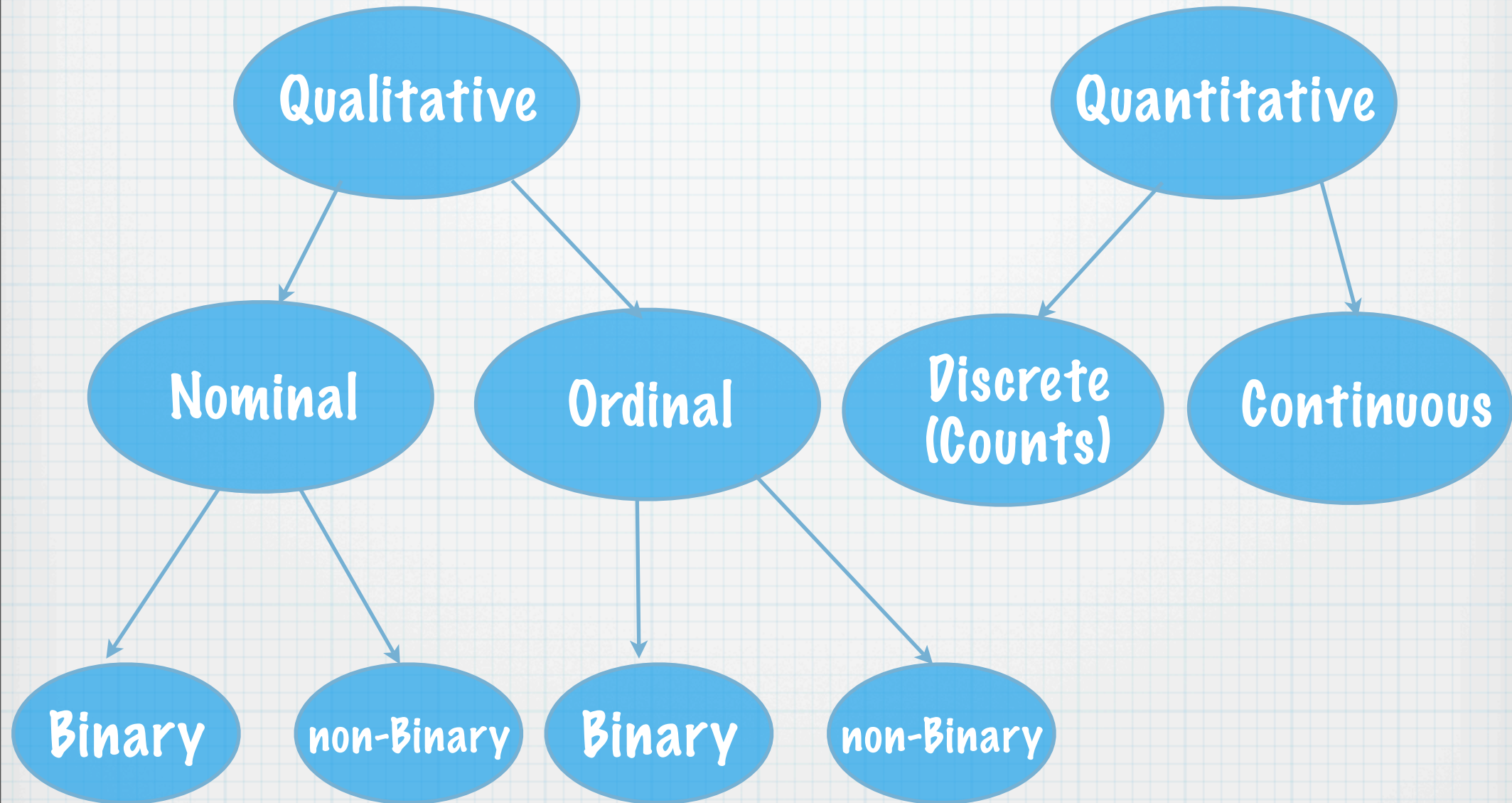
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- \* “The French counted criminals and the English counted paupers.”
- \* Age, sex, education, health, income: How to draw useful information from these data?

# Need theory to:

- \* Describe, summarize data
- \* Understand how the data might have been different
- \* Extrapolate and predict
- \* Infer the source of the data

# Types of data



# Descriptive statistics

- \* Categorical data summarized with percentages
- \* Measurements summarized with averages
- \* Why do we need summaries?

# Compact disk



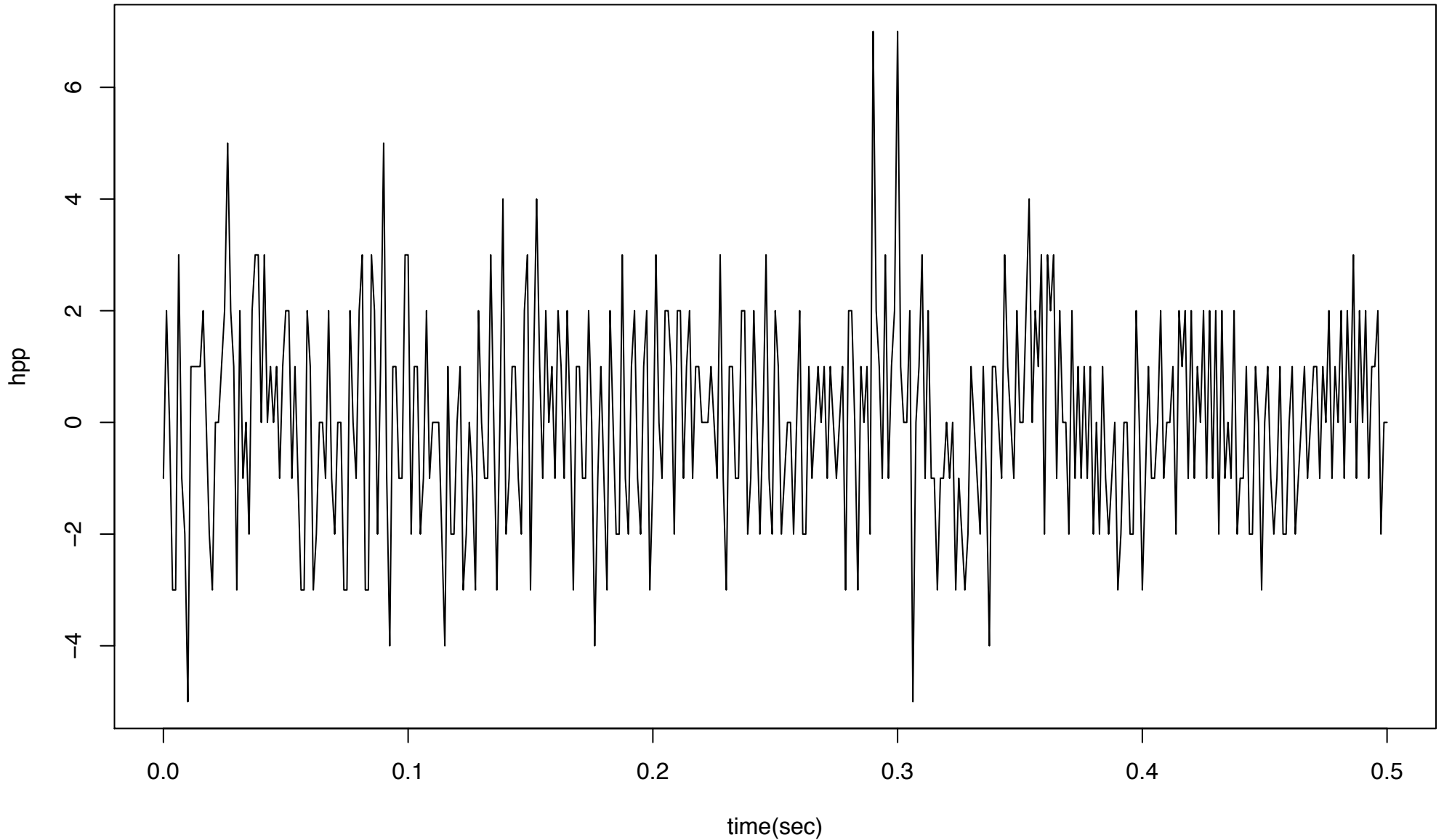
44,100 16-bit numbers/sec

5 msec of "Here Comes the Sun"

-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	
1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	-1	-1	-1	-1	-1	
-1	-1	0	0	0	0	0	0	1	2	1	-2	-3	0	1	0	0	0	-2	-1	0	1	0	-3	-2	0	-2	-2
0	0	-1	-1	-1	0	1	0	-2	-2	-3	-2	0	0	-2	-1	-1	1	1	-2	-1	1	0	-1	0	0	0	
0	0	0	1	1	1	-1	-2	-1	-1	0	1	1	1	1	0	-1	0	1	1	-1	-1	0	1	2	0	0	1

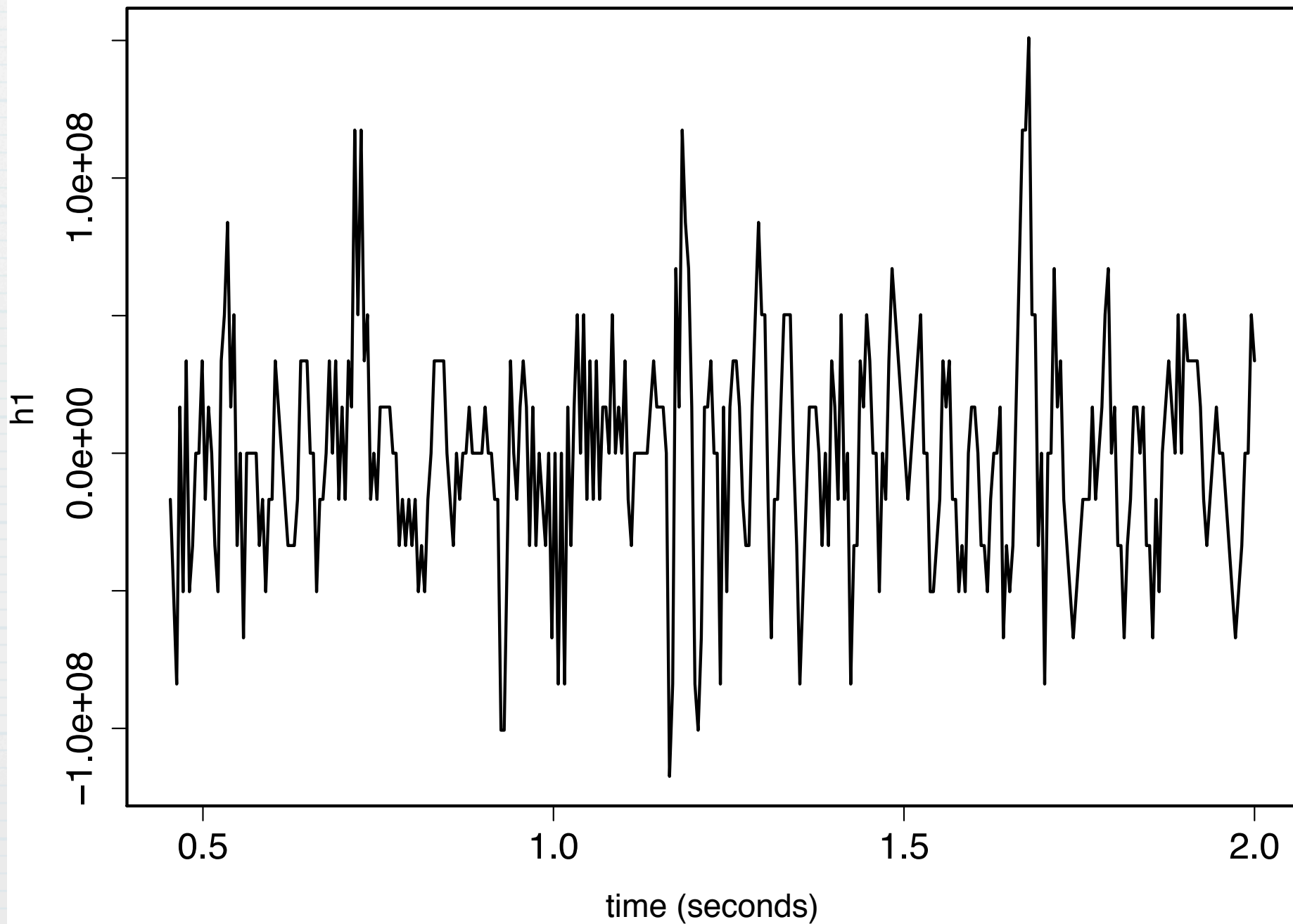
# Plotting the data

Here Comes the Sun (first 1/2 second)

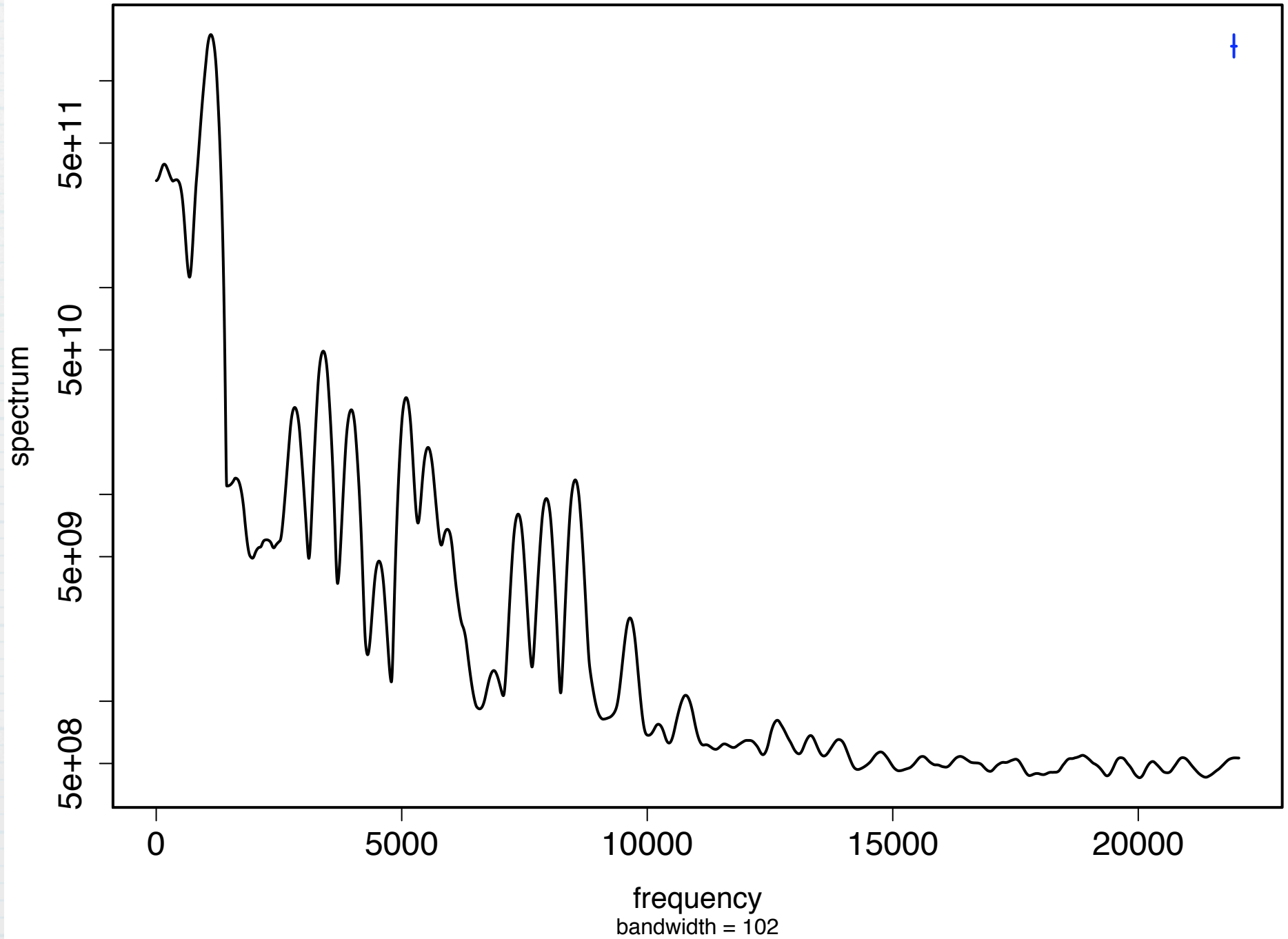




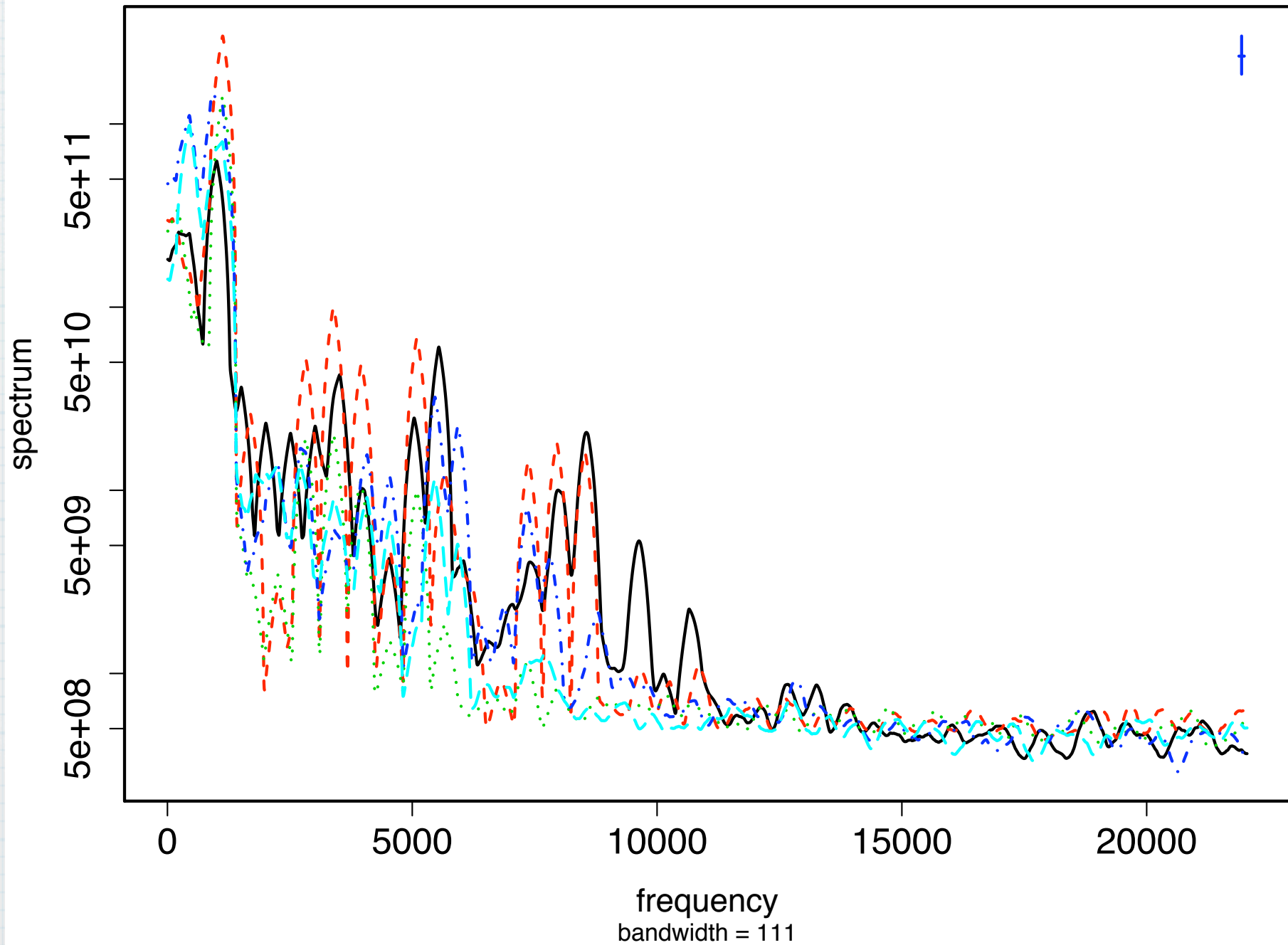
# Beginning of Here Comes the Sun



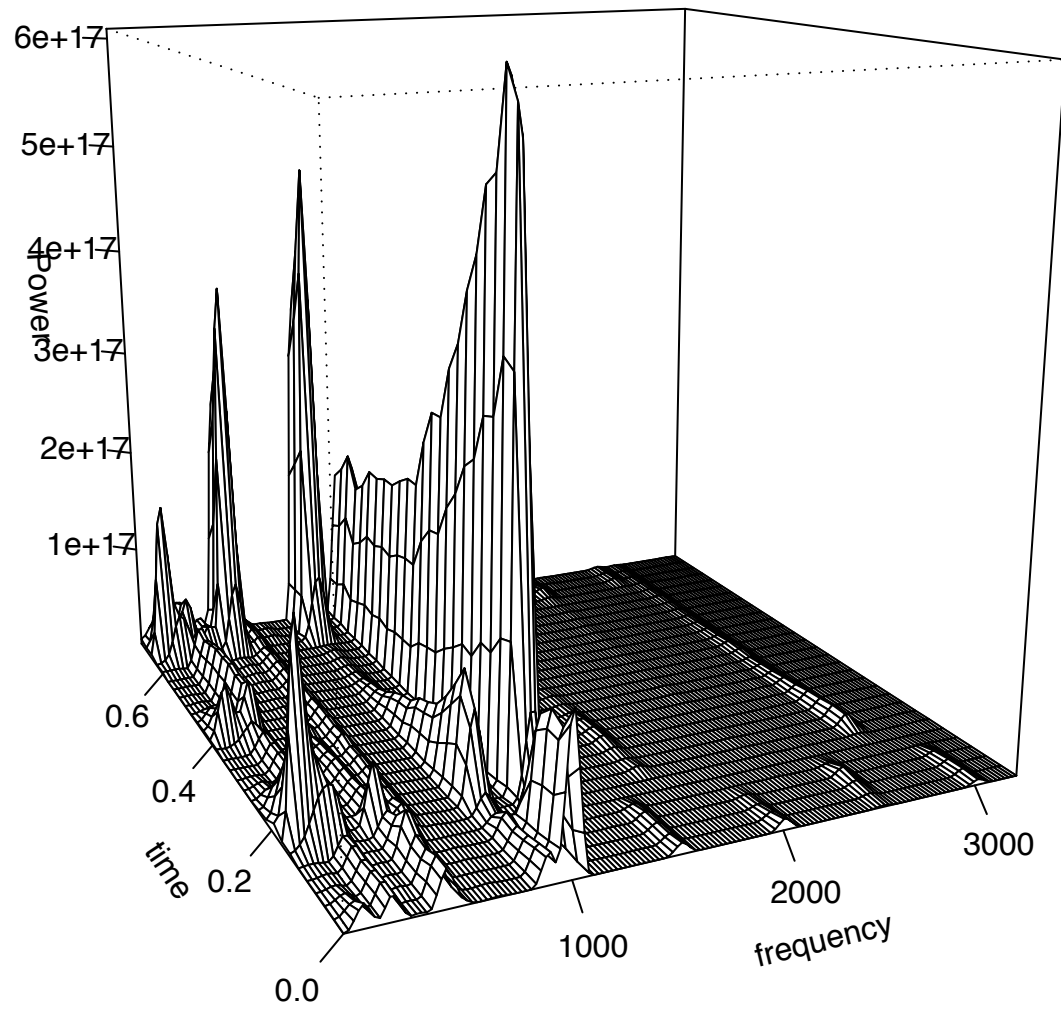
# Spectrum of 1 second of Here Comes the Sun



Spectrum of 5 successive 1/5 sec samples of Here Comes the Sun

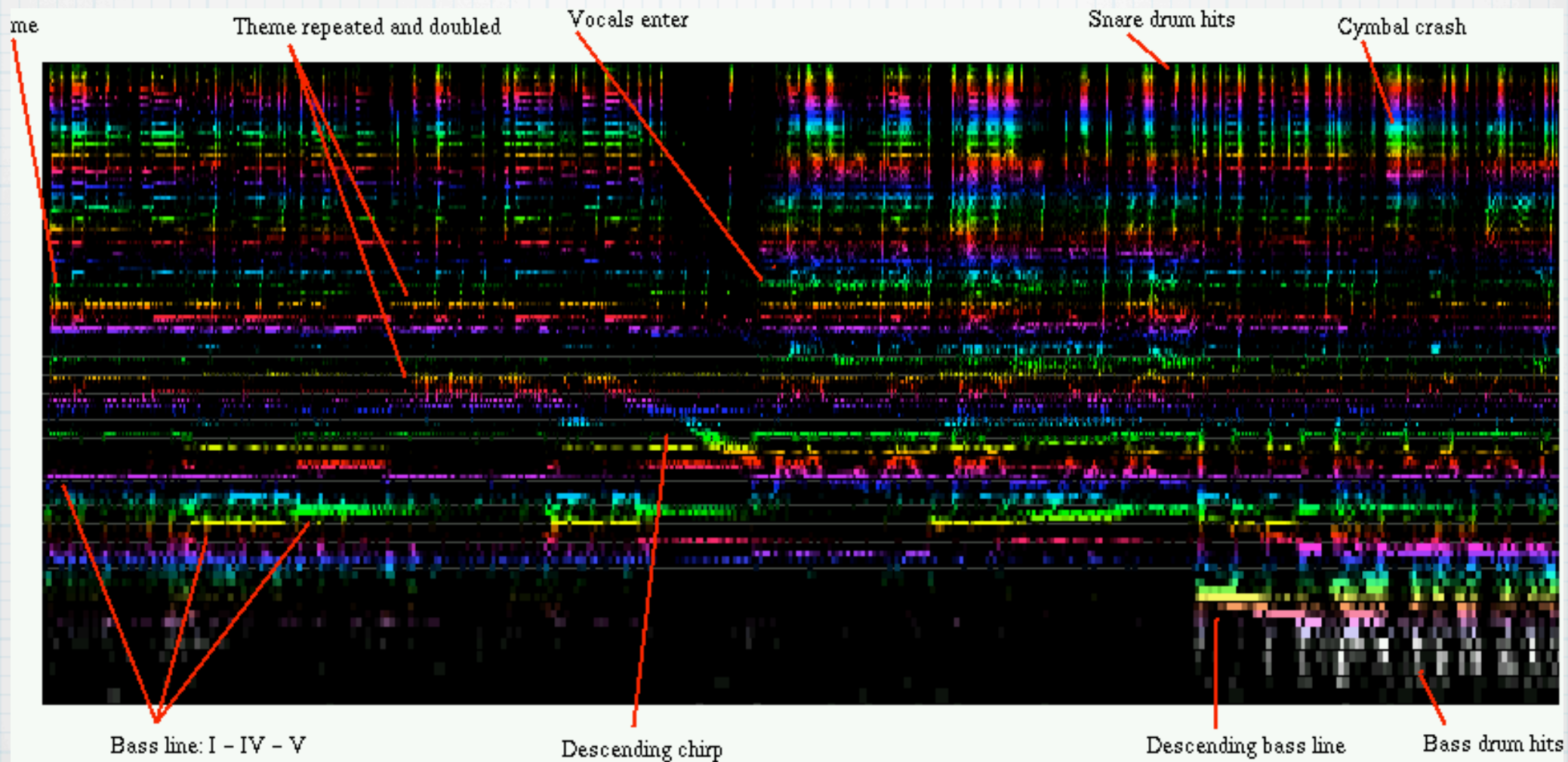


# Windowed spectrum of 1 second of Here Comes the Sun

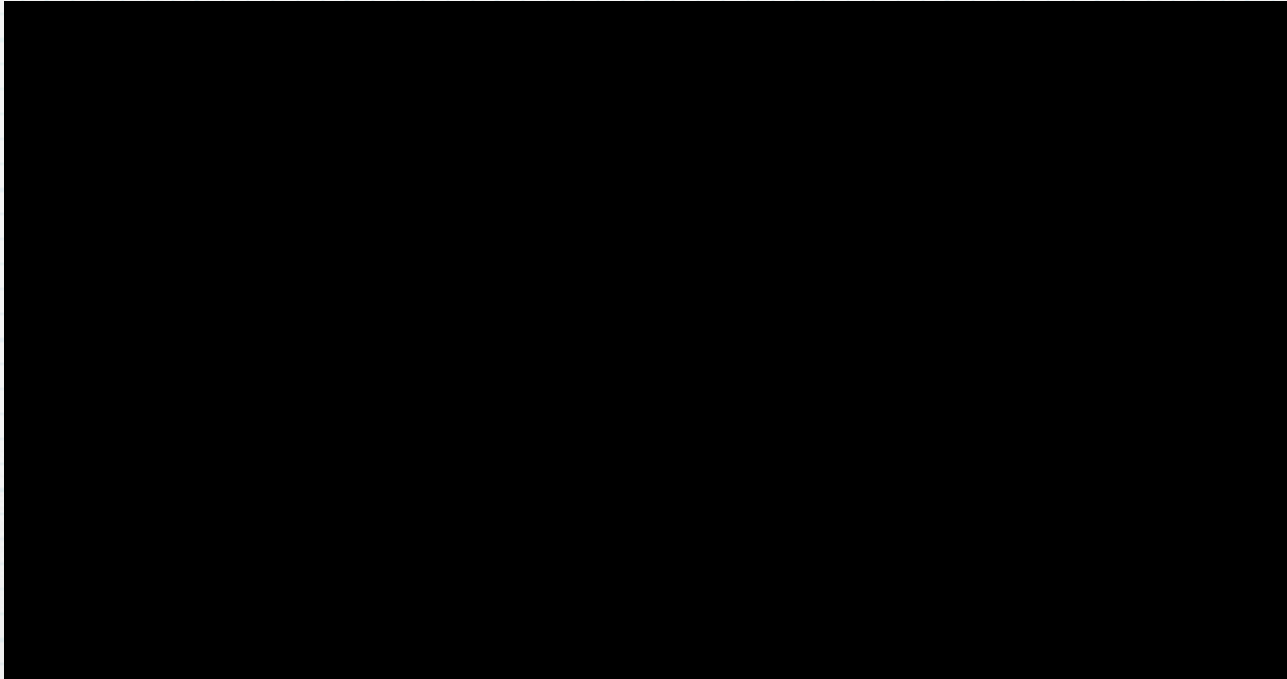


# The Beatles - "Here Comes the Sun"

# The Beatles - "Here Comes the Sun"



# Winter Wren



# Bach violin sonata



# Statistical theory

- \* A lot of mathematics
- \* A lot that's not mathematical: Need to think about where the data came from

# Averages

Given data  $x_1, \dots, x_n$

- \* **Mean:**  $(x_1 + \dots + x_n) / n$
- \* **Median:** The number such that half the data are higher and half lower.
- \* **Mode:** The most common value of the data.

# Histogram

- \* Represent the distribution of the data
- \* Divide the range of the data into bins
- \* Turns the measurement data into categories (which bin?)
- \* Graphically represent categories by bars

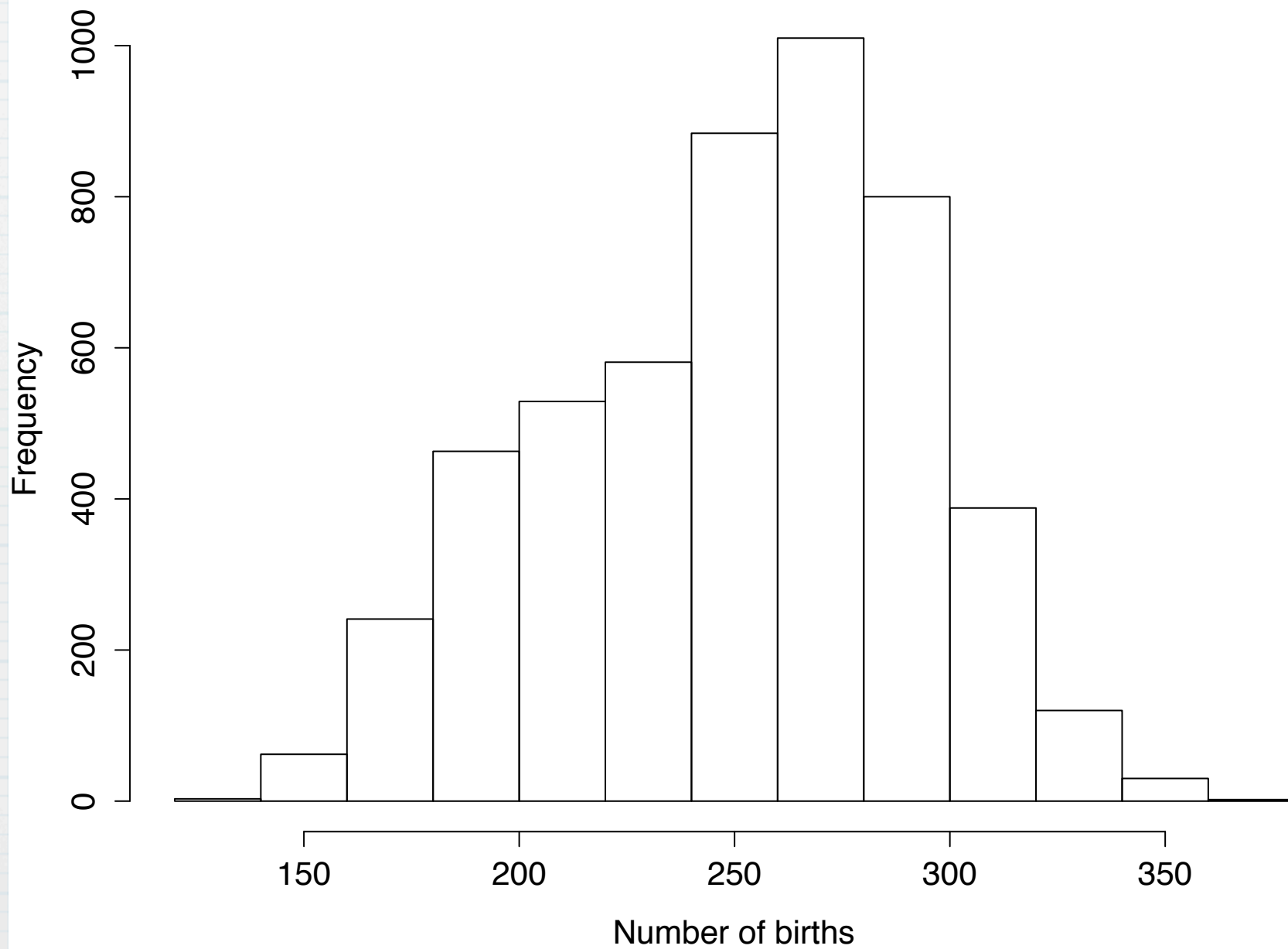
# Daily Quebec births (1/1/77-12/31/90)

[1,]	241	274	256	294	281	251	230
[2,]	240	249	272	270	281	295	213
[3,]	205	263	270	266	312	294	243
[4,]	187	284	274	311	270	264	220
[5,]	219	263	271	305	283	269	229
[6,]	222	281	277	265	282	271	242
[7,]	212	268	279	272	252	294	235
[8,]	202	268	295	314	279	314	239
[9,]	236	290	307	303	300	275	253
[10,]	204	294	305	318	281	295	251
[11,]	226	286	309	319	311	294	266
[12,]	221	294	301	288	301	289	258
[13,]	217	237	311	260	308	316	258
[14,]	229	290	326	313	302	270	249
[15,]	194	252	214	208	242	210	244

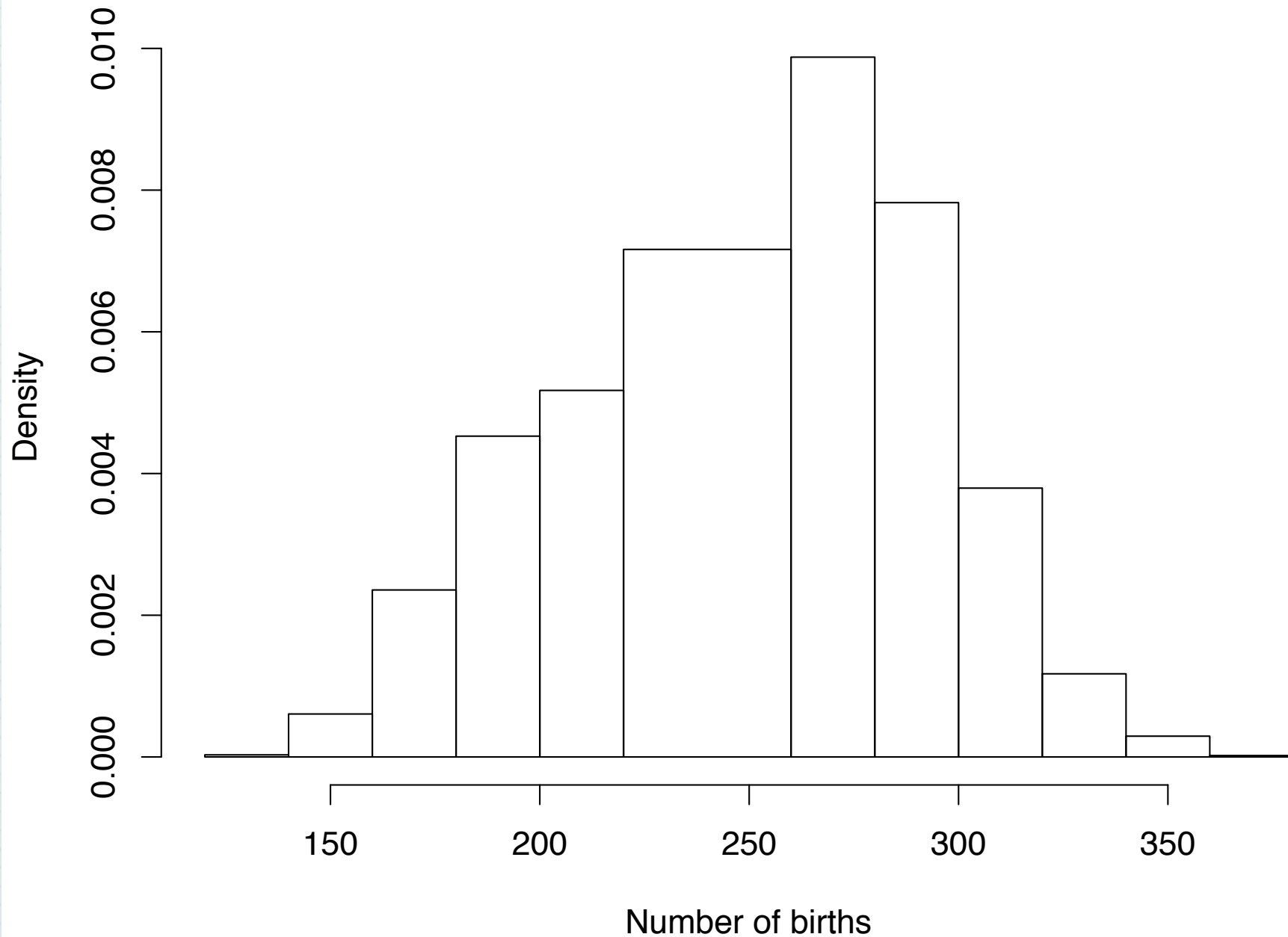
Total 5113  
numbers

[http://www-  
personal.buseco.monash.edu.au/  
hyndman/TSDL/demography.html](http://www-personal.buseco.monash.edu.au/hyndman/TSDL/demography.html)

# Histogram of daily births in Quebec 1977-90



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# Music's Charms May Lengthen Life

New York Times December 5, 1978

Music may have charms little considered even by the poets who write so much about it or the musicians who create it. Under the right circumstances, a life devoted to music may be a prescription for longevity.

This is the conclusion of an associate professor of medicine at the University of California at San Diego who is also a lifelong symphony devotee and amateur musician. Struck by the fact that Leopold Stokowski died in his 96th year, the professor, Dr. Donald H. Atlas, did a little epidemiological research on the longevity of symphony conductors[...]

From several source books and his own experience, Dr. Atlas compiled a list of 35 deceased major symphony leaders and found their mean length of life to be 73.4 years. The life expectancy of American men in general is 68.5 years, he said, and the difference is statistically significant.

"I am aware that a comparison of the current survival expectancy of American men to that of European-born conductors from the last century may be open to question," said Dr. Atlas.

"Nevertheless, since I have not been able to find a single death in this group at an age younger than 58, I firmly believe that these men were protected by some undetermined factors from the modern scourge of early fatal ischemic vascular disease," disease of the heart and circulatory system.

# Canada 1953 height, weight

22,000 individuals weighed and measured

Male

Female

Years	Average Height (Inches)	Average Weight (Pounds)	Average Height (Inches)	Average Weight (Pounds)
2	34.7	30	33.6	28
3	36.6	32	36.0	31
4	39.2	37	39.2	36
5	41.9	40	41.8	41
6	44.6	46	44.2	44
7	47.0	50	46.5	49
8	49.1	57	48.9	57
9	51.3	63	51.0	62
10	53.5	70	53.3	69
11	55.4	77	55.3	77
12	57.4	84	58.2	92
13	59.3	94	60.4	102
14	62.2	108	61.3	107
15	64.7	119	62.2	112
16-17	66.7	136	62.5	120
18-19	68.0	144	62.6	124
20-24	67.9	154	62.8	124
25-29	68.3	160	62.7	126
30-34	68.0	167	62.8	130
35-44	67.5	167	62.4	135
45-54	66.9	164	61.8	144
55-64	66.0	161	61.3	147
65 and over	65.5	155	60.6	138

### CANADIAN AVERAGE HEIGHTS AND WEIGHTS FOR AGE

