

1
00:00:01,610 --> 00:00:07,410
is it on okay now time okay okay good

2
00:00:06,000 --> 00:00:09,000
morning everyone I am going to talk

3
00:00:07,410 --> 00:00:11,250
about an EEG experiment with Bill

4
00:00:09,000 --> 00:00:15,539
Bankston and I'm going to jump right

5
00:00:11,250 --> 00:00:17,009
into the data there's a lot to say I'm

6
00:00:15,539 --> 00:00:19,710
going to skip right through here here's

7
00:00:17,010 --> 00:00:21,900
the basic design of the experiment early

8
00:00:19,710 --> 00:00:24,150
on I took a look at the data and I

9
00:00:21,899 --> 00:00:26,909
started taking interest in this one

10
00:00:24,149 --> 00:00:28,829
right here I started digging into it and

11
00:00:26,910 --> 00:00:30,809
even though there are a lot of different

12
00:00:28,829 --> 00:00:33,629
interesting aspects of the data I took a

13
00:00:30,809 --> 00:00:34,799
look at one aspect and so that's what

14
00:00:33,630 --> 00:00:36,270
we're gonna be looking at today that's

15
00:00:34,799 --> 00:00:37,979
that's what's been done so far and if

16
00:00:36,270 --> 00:00:42,510
that seems a little incomplete to you

17
00:00:37,979 --> 00:00:44,279
that's because it is but that's but

18
00:00:42,509 --> 00:00:45,719
that's what we have so far and so I'm

19
00:00:44,280 --> 00:00:47,789
going to tell you what's been done how

20
00:00:45,719 --> 00:00:53,308
it's been done and some of the curious

21
00:00:47,789 --> 00:00:55,320
data that's resulted from it here is the

22
00:00:53,308 --> 00:00:57,718
montage for those who know and care

23
00:00:55,320 --> 00:00:59,340
about such things for the rest of you

24
00:00:57,719 --> 00:01:01,710
just take a look at the placement of

25
00:00:59,340 --> 00:01:03,840
those electrodes are going to be the

26
00:01:01,710 --> 00:01:07,650
same placements as when we look at a

27
00:01:03,840 --> 00:01:10,740
spectral display and here's bills

28
00:01:07,650 --> 00:01:12,330
baseline of his eyes open right before

29

00:01:10,739 --> 00:01:15,298
he is doing the healing sessions and

30
00:01:12,329 --> 00:01:16,739
just just just glanced at it we're going

31
00:01:15,299 --> 00:01:17,970
to be looking at the back of the head

32
00:01:16,739 --> 00:01:19,829
primarily and we're going to be looking

33
00:01:17,969 --> 00:01:22,739
around eight Hertz and that would be

34
00:01:19,829 --> 00:01:24,780
right here if there's only one spectral

35
00:01:22,739 --> 00:01:26,728
display or only one box showing it's

36
00:01:24,780 --> 00:01:31,140
going to be this P Z location in the

37
00:01:26,728 --> 00:01:33,179
back of the head in the center so that's

38
00:01:31,140 --> 00:01:35,299
eyes open and that's relevant because he

39
00:01:33,180 --> 00:01:37,860
did his healings with his eyes open and

40
00:01:35,299 --> 00:01:41,460
yet it looks a lot more like eyes closed

41
00:01:37,859 --> 00:01:44,219
and here here's a session that we're

42
00:01:41,459 --> 00:01:45,780
going to be focusing on and that's a lot

43
00:01:44,219 --> 00:01:49,140

more like eyes closed and that has very

44

00:01:45,780 --> 00:01:51,509

big waves in the back of his head the

45

00:01:49,140 --> 00:01:55,069

difference being that the frequency is

46

00:01:51,509 --> 00:01:57,239

lower and the amplitude is higher

47

00:01:55,069 --> 00:01:59,819

another thing that's interesting to note

48

00:01:57,239 --> 00:02:02,099

is that this peak right here is the same

49

00:01:59,819 --> 00:02:04,139

and is reflected on the right back side

50

00:02:02,099 --> 00:02:06,269

of the head whereas the other peak is

51

00:02:04,140 --> 00:02:07,590

more reflected on the left and this is a

52

00:02:06,269 --> 00:02:10,769

little deceptive here

53

00:02:07,590 --> 00:02:15,450

this does Twin Peaks because in most of

54

00:02:10,769 --> 00:02:17,129

the time the left is dominating on the

55

00:02:15,449 --> 00:02:18,988

higher frequency and it's just the

56

00:02:17,128 --> 00:02:22,709

occasional bursts that bring up that

57

00:02:18,989 --> 00:02:26,549

second lower peak okay here's the data

58
00:02:22,709 --> 00:02:27,870
set itself this blue right here

59
00:02:26,549 --> 00:02:32,040
indicates that we're going to we're

60
00:02:27,870 --> 00:02:33,480
going to erase this section of data from

61
00:02:32,039 --> 00:02:35,669
a spectral analysis if we were going to

62
00:02:33,479 --> 00:02:38,789
analyze this whole this whole set here

63
00:02:35,669 --> 00:02:40,169
and these waves right here correspond to

64
00:02:38,789 --> 00:02:42,150
those big spikes were looking at earlier

65
00:02:40,169 --> 00:02:45,419
so these are these big waves in the back

66
00:02:42,150 --> 00:02:47,039
of the head so here would be a selection

67
00:02:45,419 --> 00:02:48,738
of data and this is how I started

68
00:02:47,039 --> 00:02:51,449
looking at it I just started looking at

69
00:02:48,739 --> 00:02:54,090
snapshots like this here's a second and

70
00:02:51,449 --> 00:02:56,250
a half of data and then when I bring up

71
00:02:54,090 --> 00:02:59,159
a spectral analysis I'll see a peak like

72
00:02:56,250 --> 00:03:01,739
this and did this many times just just

73
00:02:59,159 --> 00:03:03,329
looking around and when I went up with

74
00:03:01,739 --> 00:03:05,819
my mouse over the top of that peak the

75
00:03:03,329 --> 00:03:08,939
software will tell me what frequency it

76
00:03:05,818 --> 00:03:11,849
is and here comes up 7.81 and I did this

77
00:03:08,939 --> 00:03:14,729
many times I would see I would see a

78
00:03:11,849 --> 00:03:16,409
little one second bursts of these or

79
00:03:14,729 --> 00:03:18,479
even half second verse of these and then

80
00:03:16,409 --> 00:03:23,430
I would surround it and it would keep

81
00:03:18,479 --> 00:03:25,078
coming up 7.81 and that number seemed

82
00:03:23,430 --> 00:03:27,629
familiar to me and I just like what is

83
00:03:25,079 --> 00:03:29,340
going on with that number and then and

84
00:03:27,629 --> 00:03:31,590
then I stopped looking at the power

85
00:03:29,340 --> 00:03:32,909
spectra which which squares all the

86

00:03:31,590 --> 00:03:34,829
amplitudes and just started looking at

87
00:03:32,909 --> 00:03:36,299
straight amplitude then it started

88
00:03:34,829 --> 00:03:39,329
seeing secondary peaks and started

89
00:03:36,299 --> 00:03:40,799
measuring what those were and so then

90
00:03:39,329 --> 00:03:45,840
the pattern emerged that it would be

91
00:03:40,799 --> 00:03:47,609
7.81 and 15.6 too and it didn't take me

92
00:03:45,840 --> 00:03:52,509
long to realize that was an exact double

93
00:03:47,609 --> 00:03:56,140
and so yeah thnkx my math fantastic

94
00:03:52,509 --> 00:03:58,539
so so I kept seeing that pattern and and

95
00:03:56,139 --> 00:04:00,399
I I couldn't remember from years ago

96
00:03:58,539 --> 00:04:02,919
when I worked at a biofeedback clinic I

97
00:04:00,400 --> 00:04:04,480
could remember anything about EEG

98
00:04:02,919 --> 00:04:07,059
harmonics I couldn't remember anything

99
00:04:04,479 --> 00:04:08,649
about alpha harmonics I googled it I

100
00:04:07,060 --> 00:04:10,900

looked in books I hope I picked up the

101

00:04:08,650 --> 00:04:12,340

phone I didn't see anything but i just

102

00:04:10,900 --> 00:04:14,590

thought i took a note of it and i kept

103

00:04:12,340 --> 00:04:20,350

looking for it until i saw this one

104

00:04:14,590 --> 00:04:23,889

there's one double triple okay i think

105

00:04:20,350 --> 00:04:26,199

there's something here so i looked at

106

00:04:23,889 --> 00:04:28,360

this and and I got a little bit excited

107

00:04:26,199 --> 00:04:31,240

and then I said you know I think I know

108

00:04:28,360 --> 00:04:33,910

what 7.81 reminds me of it it's a

109

00:04:31,240 --> 00:04:37,030

Schumann frequency it's the it's the

110

00:04:33,910 --> 00:04:40,000

frequency of the earth so here it looks

111

00:04:37,029 --> 00:04:42,788

like bill is doing harmonics on the

112

00:04:40,000 --> 00:04:47,079

frequency of Earth that might be

113

00:04:42,788 --> 00:04:48,759

important so so ever since that day

114

00:04:47,079 --> 00:04:50,019

there's it's almost as if there's this

115
00:04:48,759 --> 00:04:51,459
guy named Schumann that's kind of

116
00:04:50,019 --> 00:04:57,250
hanging over my shoulder watching me

117
00:04:51,459 --> 00:04:59,769
work and saying is this about me so I

118
00:04:57,250 --> 00:05:00,819
knew I needed more data oh and and I

119
00:04:59,769 --> 00:05:02,228
didn't really get that excited

120
00:05:00,819 --> 00:05:03,848
intelligent the by spectra because

121
00:05:02,228 --> 00:05:05,319
that's what that's the tool Jay said

122
00:05:03,848 --> 00:05:06,879
well you're going to look at the by

123
00:05:05,319 --> 00:05:08,639
Spector and I didn't know what he had in

124
00:05:06,879 --> 00:05:10,839
mind but this is what he had in mind and

125
00:05:08,639 --> 00:05:12,550
so I wanted to know if those frequencies

126
00:05:10,839 --> 00:05:15,939
were really happening at the same time

127
00:05:12,550 --> 00:05:19,900
is it really like a bell and and here it

128
00:05:15,939 --> 00:05:22,899
is you can see 7.81 15.6 three I think

129
00:05:19,899 --> 00:05:25,959
it's 23.4 for you can see one two three

130
00:05:22,899 --> 00:05:28,060
lines there and then I think then I

131
00:05:25,959 --> 00:05:30,098
started to wonder well are they really

132
00:05:28,060 --> 00:05:32,740
happening in the same place or is this

133
00:05:30,098 --> 00:05:35,408
being reflected from somewhere else so I

134
00:05:32,740 --> 00:05:37,780
map that out and then they are right on

135
00:05:35,408 --> 00:05:41,199
top of each other and the highest

136
00:05:37,779 --> 00:05:42,698
amplitude in the same place so then I'm

137
00:05:41,199 --> 00:05:44,379
really wanting to get back to the data

138
00:05:42,699 --> 00:05:47,860
and I'm going to want to isolate all

139
00:05:44,379 --> 00:05:50,379
those little bits and and get at that

140
00:05:47,860 --> 00:05:54,098
and the software doesn't really allow me

141
00:05:50,379 --> 00:05:55,899
to do that in any sensible way and I

142
00:05:54,098 --> 00:05:58,269
keep banging at it and have them all

143

00:05:55,899 --> 00:06:01,620
kinds of bad ideas and then I start

144
00:05:58,269 --> 00:06:05,149
staring into space on this question and

145
00:06:01,620 --> 00:06:07,310
two days later I come up with an answer

146
00:06:05,149 --> 00:06:12,829
and I realize there's an export button I

147
00:06:07,310 --> 00:06:14,300
can put it into Excel and you know so

148
00:06:12,829 --> 00:06:18,050
what if it's a half a million rows I've

149
00:06:14,300 --> 00:06:20,569
got a newish computer and I can put my

150
00:06:18,050 --> 00:06:23,629
funny little formulas here and ask pz

151
00:06:20,569 --> 00:06:26,199
what kind of how big these waves are and

152
00:06:23,629 --> 00:06:29,990
then assign values in these columns and

153
00:06:26,199 --> 00:06:32,569
then pour that data back into my EEG

154
00:06:29,990 --> 00:06:34,220
software and tell the EEG software that

155
00:06:32,569 --> 00:06:37,279
these are a couple anonymous electrodes

156
00:06:34,220 --> 00:06:38,810
and then on that basis I can select the

157
00:06:37,279 --> 00:06:42,439

data that i want to see here the big

158

00:06:38,810 --> 00:06:45,470

waves are passing through and I can also

159

00:06:42,439 --> 00:06:47,389

do the inverse and see the contrast and

160

00:06:45,470 --> 00:06:51,170

I was pretty excited about myself at

161

00:06:47,389 --> 00:06:52,550

that point and then I look at the data

162

00:06:51,170 --> 00:06:54,500

and sure enough it looks really good

163

00:06:52,550 --> 00:06:57,199

really nice contrast where everything's

164

00:06:54,500 --> 00:06:59,149

great until i realized that it's only

165

00:06:57,199 --> 00:07:01,670

analyzing the really big chunks of data

166

00:06:59,149 --> 00:07:03,709

and its really skipping over most of

167

00:07:01,670 --> 00:07:07,280

most of the sample most of the things

168

00:07:03,709 --> 00:07:09,109

that i want to see so at that point i

169

00:07:07,279 --> 00:07:15,079

stare into space and ask myself a

170

00:07:09,110 --> 00:07:17,389

brand-new question and i come up with an

171

00:07:15,079 --> 00:07:19,789

answer that i was basically almost there

172
00:07:17,389 --> 00:07:23,810
I just needed to do a little bit more

173
00:07:19,790 --> 00:07:25,640
work in Excel and select just the just

174
00:07:23,810 --> 00:07:28,269
the data that I wanted to see or pass in

175
00:07:25,639 --> 00:07:31,399
a zero and from that point I could

176
00:07:28,269 --> 00:07:34,250
create create a file for the EEG that I

177
00:07:31,399 --> 00:07:35,509
could analyze each of these bursts that

178
00:07:34,250 --> 00:07:38,870
comes through individually and

179
00:07:35,509 --> 00:07:42,649
collectively so here I've got 15 of the

180
00:07:38,870 --> 00:07:45,920
most the longest lasting burst let's say

181
00:07:42,649 --> 00:07:49,189
each quarter second was greater than 20

182
00:07:45,920 --> 00:07:50,930
micro volts or something in and so these

183
00:07:49,189 --> 00:07:52,310
15 I took a look at individually and

184
00:07:50,930 --> 00:07:57,370
here we're going to have three views of

185
00:07:52,310 --> 00:08:00,740
all of them so and here's a trade off

186
00:07:57,370 --> 00:08:02,750
the spectral analysis will allow you to

187
00:08:00,740 --> 00:08:05,660
look at one second of data but it will

188
00:08:02,750 --> 00:08:07,879
give you a very poor resolution so I

189
00:08:05,660 --> 00:08:09,529
wanted to know because I've got this

190
00:08:07,879 --> 00:08:11,538
human guy looking over my shoulder I

191
00:08:09,528 --> 00:08:14,449
want to know what that frequency really

192
00:08:11,538 --> 00:08:16,459
is so my trade off is I'm going to have

193
00:08:14,449 --> 00:08:18,379
three seconds of zeros in here to get a

194
00:08:16,459 --> 00:08:21,288
four second analysis to get quarter

195
00:08:18,379 --> 00:08:23,389
second resolution and with that

196
00:08:21,288 --> 00:08:25,759
trade-off is some error so I'm going to

197
00:08:23,389 --> 00:08:28,489
expect some error but i do that knowing

198
00:08:25,759 --> 00:08:29,959
that I've got 15 samples and out of

199
00:08:28,488 --> 00:08:31,728
those at the end I'm going to tell them

200

00:08:29,959 --> 00:08:34,219
up and maybe I'll learn something about

201
00:08:31,728 --> 00:08:37,870
what this frequency is again the

202
00:08:34,219 --> 00:08:41,389
alternative is just always again 7.81

203
00:08:37,870 --> 00:08:44,659
15.6 three so here's one and it comes up

204
00:08:41,389 --> 00:08:47,480
eight point 06 a little higher and this

205
00:08:44,659 --> 00:08:51,230
one has a rounded harmonic and that's

206
00:08:47,480 --> 00:08:53,990
one quarter step quarter hurts away from

207
00:08:51,230 --> 00:08:55,938
a double and given the expected error I

208
00:08:53,990 --> 00:08:58,759
think that is a double and when you look

209
00:08:55,938 --> 00:09:02,599
at the by spectra you can see two nice

210
00:08:58,759 --> 00:09:07,459
lines coming up hey that's the first one

211
00:09:02,600 --> 00:09:10,850
second one is a little bit longer and

212
00:09:07,458 --> 00:09:14,619
again eight point 06 and again nearly on

213
00:09:10,850 --> 00:09:18,110
the double and a nice second line third

214
00:09:14,620 --> 00:09:24,649

one is a seven point eight one and a

215

00:09:18,110 --> 00:09:25,818

nice second line fourth one surprised me

216

00:09:24,649 --> 00:09:27,828

because there's one thing I didn't tell

217

00:09:25,818 --> 00:09:29,750

you about this sample I tried to filter

218

00:09:27,828 --> 00:09:33,649

out anything above 8.3 hurts because

219

00:09:29,750 --> 00:09:35,269

again i had schumann on my mind but but

220

00:09:33,649 --> 00:09:39,110

i tried to filter them out but he was so

221

00:09:35,269 --> 00:09:41,058

strong he came through anyway and he did

222

00:09:39,110 --> 00:09:45,889

have a he does have a little bit of a

223

00:09:41,058 --> 00:09:48,588

second line there this one can't quite

224

00:09:45,889 --> 00:09:54,438

make up his mind on the peak but on the

225

00:09:48,589 --> 00:09:55,970

double it splits the difference and the

226

00:09:54,438 --> 00:10:01,389

sixth one is by far the longest

227

00:09:55,970 --> 00:10:01,389

continuous burst and is very specific