Methods Overview

- From the raw data, we first remove circadian variations.

- For each HRV measure, for each participant, at each time offset, we do a multivariate regression analysis with all twelve environment variables.

- We calculate a weighted mean of the results across participants to get population-averaged values of the regression parameters: 10 HRV x 12 environment x 81 lags.

- Applying a Bonferroni correction for the number of lags we get a statistical summary for all HRV measures compared with all environment measures.

1
00:00:10,970 --> 00:00:05,090
Rolla McCrady has been at previous sse

2
00:00:14,060 --> 00:00:10,980
meetings michael act atkinson is his

3
00:00:19,010 --> 00:00:14,070
main on-site technical assistance at the

4
00:00:20,599 --> 00:00:19,020
heart math Institute the the arabic

5
00:00:23,029 --> 00:00:20,609
physician whose name I will not attempt

6
00:00:26,300 --> 00:00:23,039
to pronounce ah was their co-worker on

7
00:00:32,269 --> 00:00:26,310
data gathering for this study and I was

8
00:00:34,610 --> 00:00:32,279
brought into it as a hired consultant to

9
00:00:37,040 --> 00:00:34,620
do some analyses for them and I end up

10
00:00:44,389 --> 00:00:37,050
being the presenter because I'm the one

11
00:00:46,819 --> 00:00:44,399
who's an SSC member so one of the things

12
00:00:50,779 --> 00:00:46,829
that the hard math institute among

13
00:00:52,580 --> 00:00:50,789

others has has demonstrated is that the

14
00:00:54,920 --> 00:00:52,590
heart is actually the most powerful

15
00:01:01,069 --> 00:00:54,930
source of electromagnetic signals in the

16
00:01:03,200 --> 00:01:01,079
body and additional findings from

17
00:01:07,910 --> 00:01:03,210
previous heart math Institute research

18
00:01:09,590 --> 00:01:07,920
are that the the electromagnetic fields

19
00:01:11,660 --> 00:01:09,600
at least it's generally presumed that

20
00:01:14,210 --> 00:01:11,670
it's the electromagnetic fields produced

21
00:01:17,899 --> 00:01:14,220
by the heart have measurable effects on

22
00:01:22,940 --> 00:01:17,909
other organisms and people near a given

23
00:01:24,560 --> 00:01:22,950
person ah now this this raises the

24
00:01:28,670 --> 00:01:24,570
question of what about other

25
00:01:32,719 --> 00:01:28,680
electromagnetic magnetic fields the sort

26
00:01:35,270 --> 00:01:32,729
of Art Deco image here is showing some

27
00:01:37,069 --> 00:01:35,280
of the frequencies or rather wavelengths

28
00:01:40,429 --> 00:01:37,079
involved in the Schumann resonances

29
00:01:42,819 --> 00:01:40,439
which are the natural resonances of the

30
00:01:45,410 --> 00:01:42,829
earth as a whole for electromagnetic

31
00:01:48,499 --> 00:01:45,420
radiation propagating between the

32
00:01:51,020 --> 00:01:48,509
surface and the ionosphere those are by

33
00:01:52,490 --> 00:01:51,030
no means the only electromagnetic

34
00:01:55,010 --> 00:01:52,500
effects associated with the Earth's

35
00:01:58,310 --> 00:01:55,020
environment and some of them have been

36
00:02:01,700 --> 00:01:58,320
shown to have effects on human

37
00:02:04,789 --> 00:02:01,710
physiology and psychology in studies

38
00:02:09,859 --> 00:02:04,799

that I'm not going to cite here because

39
00:02:12,250 --> 00:02:09,869
there's a lot of them so since the heart

40
00:02:15,369 --> 00:02:12,260
both generates in response to electro

41
00:02:17,289 --> 00:02:15,379
magnetic signals it seems natural to

42
00:02:19,479 --> 00:02:17,299
look at heart function as an indicator

43
00:02:23,470 --> 00:02:19,489
of the body's reaction to external

44
00:02:26,920 --> 00:02:23,480
fields and the aspect that the heart

45
00:02:28,690 --> 00:02:26,930
math people thought was best suited for

46
00:02:31,180 --> 00:02:28,700
this kind of analysis was heart rate

47
00:02:38,789 --> 00:02:31,190
variability which Julie mentioned in her

48
00:02:41,410 --> 00:02:38,799
talk so the experimental program here

49
00:02:43,599 --> 00:02:41,420
HRV data was collected from 16

50
00:02:46,899 --> 00:02:43,609
volunteers in Saudi Arabia over a

51
00:02:50,020 --> 00:02:46,909
six-month period the participants wore

52
00:02:52,649 --> 00:02:50,030
monitors for extended periods not all

53
00:02:55,030 --> 00:02:52,659
the time usually not 24/7 but for

54
00:02:58,750 --> 00:02:55,040
extended slices out of this six-month

55
00:03:00,729 --> 00:02:58,760
period 10 different HRV measures were

56
00:03:03,729 --> 00:03:00,739
calculated from the raw heartbeat data

57
00:03:06,970 --> 00:03:03,739
on an hourly basis and during this same

58
00:03:09,220 --> 00:03:06,980
period 12 measurements of geomagnetic or

59
00:03:10,890 --> 00:03:09,230
cosmic variables were recorded on an

60
00:03:15,369 --> 00:03:10,900
hourly basis

61
00:03:19,869 --> 00:03:15,379
so the 10 HRV measures don't worry there

62
00:03:21,909 --> 00:03:19,879
will not be a quiz on this that this is

63
00:03:26,800 --> 00:03:21,919

just so that you can get a a glance at

64
00:03:30,849 --> 00:03:26,810
the names of what they are and we had 12

65
00:03:34,140 --> 00:03:30,859
environment variables including several

66
00:03:37,960 --> 00:03:34,150
G several standard published geomagnetic

67
00:03:40,900 --> 00:03:37,970
indices PC n stands for the polar cap

68
00:03:44,349 --> 00:03:40,910
North index a measure of magnetic flux

69
00:03:46,890 --> 00:03:44,359
literally on the north polar cap the

70
00:03:49,990 --> 00:03:46,900
Schumann resonance appears again and

71
00:03:53,460 --> 00:03:50,000
there were four sets of GCI magnetometer

72
00:03:56,699 --> 00:03:53,470
readings then there are cosmological

73
00:03:59,170 --> 00:03:56,709
parameters not directly connected to

74
00:04:02,920 --> 00:03:59,180
geomagnetism there's the solar wind

75
00:04:06,280 --> 00:04:02,930
speed the sunspot number the F 10.7

76
00:04:09,610 --> 00:04:06,290
index is a measure of how much radio

77
00:04:11,860 --> 00:04:09,620
emission the Sun is putting out at a

78
00:04:15,309 --> 00:04:11,870
frequent at by the wavelength of ten

79
00:04:17,939 --> 00:04:15,319
point seven centimeters and the cosmic

80
00:04:22,240 --> 00:04:17,949
ray incidence counts

81
00:04:24,730 --> 00:04:22,250
so we've just designed a tremendously

82
00:04:25,000 --> 00:04:24,740
complicated data structure we've got ten

83
00:05:52,570 --> 00:04:25,010
a

84
00:05:55,690 --> 00:05:52,580
the effect of multiple contributing

85
00:05:58,540 --> 00:05:55,700
variables simultaneously and sort them

86
00:06:00,370 --> 00:05:58,550
out from each other and I have a

87
00:06:02,500 --> 00:06:00,380
detailed explanation of how that works

88
00:06:09,100 --> 00:06:02,510

which I will reserve for an appendix if

89
00:06:12,250 --> 00:06:09,110
we have the time hello now there we go

90
00:06:13,840 --> 00:06:12,260
so just as a quick overview from the raw

91
00:06:16,540 --> 00:06:13,850
data we first remove circadian

92
00:06:18,610 --> 00:06:16,550
variations and then for each HR v

93
00:06:21,310 --> 00:06:18,620
measure for each participant at each

94
00:06:23,410 --> 00:06:21,320
time offset we do a multivariate

95
00:06:26,410 --> 00:06:23,420
regression analysis on all 12

96
00:06:28,240 --> 00:06:26,420
environment variables we calculate the

97
00:06:32,770 --> 00:06:28,250
weighted mean across participants to get

98
00:06:35,140 --> 00:06:32,780
the population averages then we apply a

99
00:06:38,440 --> 00:06:35,150
bonferroni correction for the number of

100
00:06:38,740 --> 00:06:38,450
lags and take the moat and apply that to

101
00:06:47,560 --> 00:06:38,750
the

102
00:06:50,140 --> 00:06:47,570
significance bonferroni correction is

103
00:06:52,750 --> 00:06:50,150
basically a technique you apply to

104
00:06:54,700 --> 00:06:52,760
compensate for the inherent bias of I've

105
00:06:57,550 --> 00:06:54,710
got a bunch of tests and I'm taking the

106
00:07:00,610 --> 00:06:57,560
one that looks best how much do I need

107
00:07:04,350 --> 00:07:00,620
to dilute my p-value to reflect the

108
00:07:07,330 --> 00:07:04,360
effect of cherry-picking the best result

109
00:07:14,880 --> 00:07:07,340
and here's the summary of the overall

110
00:07:19,330 --> 00:07:14,890
results 12:12 environment variables vs.

111
00:07:23,010 --> 00:07:19,340
10 HRV measures and the legend of

112
00:07:26,620 --> 00:07:23,020
rainbow colors running around the side

113
00:07:29,920 --> 00:07:26,630

this violet shade at the top corresponds

114
00:07:36,070 --> 00:07:29,930
to a p-value of 10 to the minus 15 power

115
00:07:39,150 --> 00:07:36,080
or less in fact this 1 square here

116
00:07:43,120 --> 00:07:39,160
showing up in deep violet sorry I'm

117
00:07:47,620 --> 00:07:43,130
ignoring one side of the room actually

118
00:07:49,930 --> 00:07:47,630
has a p-value of 1.6 times ten to the

119
00:07:53,020 --> 00:07:49,940
minus sixteen power that's after

120
00:07:57,070 --> 00:07:53,030
correcting for the fact that it's the

121
00:07:59,740 --> 00:07:57,080
best lag out of 81 lags and of course

122
00:08:02,350 --> 00:07:59,750
we've got 120 separate tests here so we

123
00:08:06,580 --> 00:08:02,360
can do a separate bonferroni correction

124
00:08:10,120 --> 00:08:06,590
for that and that dilutes our p-value

125
00:08:15,730 --> 00:08:10,130
all the way to 1.9 times 10 to the minus

126
00:08:19,830 --> 00:08:15,740
14th power how disappointing and as you

127
00:08:22,750 --> 00:08:19,840
can see there are quite a few other

128
00:08:27,100 --> 00:08:22,760
significant results in fact and I

129
00:08:32,230 --> 00:08:27,110
apologize for the fine print of these

130
00:08:34,990 --> 00:08:32,240
120 tests 74% of them are significant at

131
00:08:37,450 --> 00:08:35,000
0.05 level or better at basically

132
00:08:41,589 --> 00:08:37,460
anything that's not black if this were a

133
00:08:43,270 --> 00:08:41,599
chance phenomenon only about 5% of that

134
00:08:45,610 --> 00:08:43,280
hundred-and-twenty or in other words

135
00:08:49,470 --> 00:08:45,620
about 6 of those squares should be

136
00:08:57,240 --> 00:08:53,730
um looking at that things in a little

137
00:09:00,540 --> 00:08:57,250
more detail but still the same overview

138
00:09:05,340 --> 00:09:00,550

all ten HRV measures are reacting to the

139
00:09:07,050 --> 00:09:05,350
Schumann resonance that's a brief the

140
00:09:12,870 --> 00:09:07,060
buttons are too close to each other on

141
00:09:15,360 --> 00:09:12,880
this control SFI here is the mnemonic

142
00:09:17,699 --> 00:09:15,370
for Schumann fundamental integral it's

143
00:09:20,699 --> 00:09:17,709
the integrated strength of the lowest

144
00:09:23,939 --> 00:09:20,709
Schumann resonance frequency and every

145
00:09:26,819 --> 00:09:23,949
measure is reacting to it ah nine out of

146
00:09:29,400 --> 00:09:26,829
ten are reacting to the ten point seven

147
00:09:33,319 --> 00:09:29,410
centimeter solar emissions eight out of

148
00:09:36,710 --> 00:09:33,329
ten are reacting to cosmic-ray counts

149
00:09:39,560 --> 00:09:36,720
only seven of the ten react to

150
00:09:46,259 --> 00:09:39,570
significantly to the solar wind speed

151
00:09:50,340 --> 00:09:46,269
but look at this stretch of green we've

152
00:09:52,410 --> 00:09:50,350
got five out of the ten are reacting

153
00:09:55,860 --> 00:09:52,420
with P less than ten to the minus fifth

154
00:09:58,559 --> 00:09:55,870
to the solar wind on the other hand not

155
00:10:00,329 --> 00:09:58,569
much is reacting to the polar cap North

156
00:10:02,639 --> 00:10:00,339
flux and there are a couple of other

157
00:10:09,290 --> 00:10:02,649
environmental measures that don't seem

158
00:10:11,819 --> 00:10:09,300
to be having much impact as as for the

159
00:10:13,079 --> 00:10:11,829
measures there are several measures that

160
00:10:16,439 --> 00:10:13,089
are reacting to ten out of twelve

161
00:10:19,019 --> 00:10:16,449
environment measure variables and there

162
00:10:22,949 --> 00:10:19,029
are other HRV measures that show very

163
00:10:24,960 --> 00:10:22,959

few significant reactions now how

164
00:10:27,030 --> 00:10:24,970
significant is significant I've been

165
00:10:29,309 --> 00:10:27,040
talking about statistical significance

166
00:10:31,050 --> 00:10:29,319
which just means we can assert with

167
00:10:34,379 --> 00:10:31,060
confidence that something is happening

168
00:10:36,269 --> 00:10:34,389
that is not a statistical fluke ah the

169
00:10:38,009 --> 00:10:36,279
everyday sense of significance on the

170
00:10:42,960 --> 00:10:38,019
other hand means that something is big

171
00:10:46,110 --> 00:10:42,970
enough to matter so just to get an idea

172
00:10:48,720 --> 00:10:46,120
of the range here the most statistically

173
00:10:51,689 --> 00:10:48,730
significant response is the reaction of

174
00:10:55,199 --> 00:10:51,699
high frequency HRV spectral power to the

175
00:10:57,120 --> 00:10:55,209
Schumann resonance intensity multiplying

176
00:10:59,130 --> 00:10:57,130
the regression coefficient by the full

177
00:11:02,910 --> 00:10:59,140
range of variation in the Schumann

178
00:11:06,509 --> 00:11:02,920
resonance produces 7.8 percent

179
00:11:11,310 --> 00:11:06,519
of the full range of variation in HRV so

180
00:11:14,819 --> 00:11:11,320
in in terms of the pragmatic effect on

181
00:11:16,440 --> 00:11:14,829
physiology we're talking about between

182
00:11:21,150 --> 00:11:16,450
five and ten percent of the natural

183
00:11:24,329 --> 00:11:21,160
range of variation now this overall

184
00:11:26,730 --> 00:11:24,339
evaluation ignores most of the models at

185
00:11:29,069 --> 00:11:26,740
different time delays as I said we're

186
00:11:31,710 --> 00:11:29,079
looking at the most significant one and

187
00:11:33,480 --> 00:11:31,720
applying a bonferroni correction so that

188
00:11:36,840 --> 00:11:33,490

we don't fool ourselves into making a

189
00:11:38,790 --> 00:11:36,850
type 1 error however there's a great

190
00:11:42,810 --> 00:11:38,800
deal more information in those time

191
00:11:44,550 --> 00:11:42,820
sequences and with with numbers like 10

192
00:11:49,350 --> 00:11:44,560
to the minus 16th and 10 to the minus

193
00:11:52,439 --> 00:11:49,360
14th flying around we can afford to look

194
00:11:54,930 --> 00:11:52,449
at a few more variables without too much

195
00:11:57,860 --> 00:11:54,940
risk of fooling ourselves into over

196
00:12:01,530 --> 00:11:57,870
interpreting a statistical fluke

197
00:12:03,870 --> 00:12:01,540
so here's five of the variables we

198
00:12:05,790 --> 00:12:03,880
picked five partly for visibility partly

199
00:12:09,120 --> 00:12:05,800
because the other five were strongly

200
00:12:13,620 --> 00:12:09,130
correlating with them for the strongest

201
00:12:16,910 --> 00:12:13,630
response the Schumann resonance and you

202
00:12:20,639 --> 00:12:16,920
can see that all of these variables are

203
00:12:28,160 --> 00:12:20,649
reacting in a similar way there's a sort

204
00:12:33,150 --> 00:12:28,170
of quasi periodic behavior here which is

205
00:12:35,550 --> 00:12:33,160
not at 24 hour intervals so it's not a

206
00:12:39,600 --> 00:12:35,560
circadian influence that somehow escaped

207
00:12:41,939 --> 00:12:39,610
our removal of circadian effects we

208
00:12:46,019 --> 00:12:41,949
don't know what it is it's its

209
00:12:48,870 --> 00:12:46,029
periodicity is about 18 to 20 hours we

210
00:12:51,449 --> 00:12:48,880
we're not aware of anything particularly

211
00:12:54,480 --> 00:12:51,459
significant that oscillates on that time

212
00:12:58,199 --> 00:12:54,490
scale another interesting feature of

213
00:13:03,269 --> 00:12:58,209

that graph is that nothing is reacting

214
00:13:06,090 --> 00:13:03,279
in real time you look at HRV at the same

215
00:13:09,660 --> 00:13:06,100
time as a particular burst of activity

216
00:13:11,970 --> 00:13:09,670
in the Schumann resonance no reaction

217
00:13:16,430 --> 00:13:11,980
the reaction is showing up most strongly

218
00:13:20,870 --> 00:13:16,440
30 hours later then there's also

219
00:13:22,790 --> 00:13:20,880
this this thing down here which is a

220
00:13:25,670 --> 00:13:22,800
puzzle it looks like there's an

221
00:13:28,700 --> 00:13:25,680
anticipatory response about 34 hours

222
00:13:31,430 --> 00:13:28,710
ahead of time here's the variable that

223
00:13:36,620 --> 00:13:31,440
had multiple things reacting to it very

224
00:13:39,740 --> 00:13:36,630
significantly the solar wind here we

225
00:13:43,340 --> 00:13:39,750
don't see quasi-periodic structure we've

226
00:13:47,240 --> 00:13:43,350
just got one big peak which again is

227
00:13:54,020 --> 00:13:47,250
showing up in multiple variables that is

228
00:13:56,750 --> 00:13:54,030
10 hours after the stimulus now an

229
00:14:00,110 --> 00:13:56,760
interesting feature about this is that

230
00:14:01,690 --> 00:14:00,120
the solar wind doesn't reach Earth's

231
00:14:04,250 --> 00:14:01,700
surface

232
00:14:05,900 --> 00:14:04,260
supposedly it affects earth because it

233
00:14:08,360 --> 00:14:05,910
changes the shape of the magnetosphere

234
00:14:09,130 --> 00:14:08,370
and so distorts the Earth's magnetic

235
00:14:12,830 --> 00:14:09,140
field

236
00:14:16,250 --> 00:14:12,840
but the HRV response to the solar wind

237
00:14:23,270 --> 00:14:16,260
is stronger than the response to most of

238
00:14:25,430 --> 00:14:23,280

the geomagnetic indices how is how is

239
00:14:27,740 --> 00:14:25,440
that happening if the solar wind should

240
00:14:31,190 --> 00:14:27,750
be mediating its effect through the

241
00:14:35,200 --> 00:14:31,200
Earth's magnetic field again we we don't

242
00:14:39,110 --> 00:14:35,210
know as with the previous one there's

243
00:14:43,100 --> 00:14:39,120
nothing much visible in in real time at

244
00:14:47,570 --> 00:14:43,110
a time lag of 0 and there is once again

245
00:14:53,030 --> 00:14:47,580
not as strong but a rather puzzling hint

246
00:14:53,600 --> 00:14:53,040
of an anticipatory reaction about 34

247
00:14:57,920 --> 00:14:53,610
hours

248
00:15:00,620 --> 00:14:57,930
brought prior to the stimulus and I just

249
00:15:04,780 --> 00:15:00,630
sorry 30 hours on this one I went the

250
00:15:05,900 --> 00:15:04,790
wrong way getting to my discussion so

251
00:15:08,840 --> 00:15:05,910
conclusions

252
00:15:11,720 --> 00:15:08,850
the search for HRV responses to

253
00:15:13,910 --> 00:15:11,730
geomagnetic and cosmic variables returns

254
00:15:17,350 --> 00:15:13,920
a strong yes despite the number of

255
00:15:19,700 --> 00:15:17,360
individual tests made the strongest

256
00:15:21,620 --> 00:15:19,710
physiological responses are delayed by

257
00:15:24,410 --> 00:15:21,630
10 to 30 hours depending on what

258
00:15:26,870 --> 00:15:24,420
variable we're looking at some of the

259
00:15:29,220 --> 00:15:26,880
strongest responses to cosmic variables

260
00:15:32,670 --> 00:15:29,230
do not seem to be mediated by

261
00:15:35,190 --> 00:15:32,680
the geomagnetic field and these results

262
00:15:38,040 --> 00:15:35,200
provide some indications of which

263
00:15:40,110 --> 00:15:38,050

environmental variables and which HRV

264
00:15:43,550 --> 00:15:40,120
measures will be most useful to track in

265
00:15:50,430 --> 00:15:46,590
speaking of future studies things that

266
00:15:52,920 --> 00:15:50,440
could bear more invit investigation we

267
00:15:55,500 --> 00:15:52,930
ignored individual variations here for

268
00:15:58,620 --> 00:15:55,510
the sake of simplicity what could we

269
00:16:00,840 --> 00:15:58,630
learn by actually looking at them do

270
00:16:03,060 --> 00:16:00,850
individual patterns of HRV response

271
00:16:07,170 --> 00:16:03,070
correlate usefully with a person's

272
00:16:09,450 --> 00:16:07,180
physical condition or health needs will

273
00:16:11,520 --> 00:16:09,460
a larger study population show the same

274
00:16:13,770 --> 00:16:11,530
or similar effects we've got a

275
00:16:15,600 --> 00:16:13,780
tremendous number of data points but one

276
00:16:19,380 --> 00:16:15,610
weakness of this study is that we only

277
00:16:21,900 --> 00:16:19,390
have 16 volunteers and they're all from

278
00:16:24,120 --> 00:16:21,910
the same culture same geographical

279
00:16:27,300 --> 00:16:24,130
region they could very easily be a

280
00:16:32,220 --> 00:16:27,310
biased sample compared to the general

281
00:16:34,560 --> 00:16:32,230
human population the anticipatory

282
00:16:35,880 --> 00:16:34,570
reactions are a puzzle we still don't

283
00:16:38,940 --> 00:16:35,890
know how we're supposed to interpret

284
00:16:41,910 --> 00:16:38,950
them and then there's the question I

285
00:16:44,070 --> 00:16:41,920
already mentioned that the the solar

286
00:16:47,880 --> 00:16:44,080
wind doesn't seem to be working through

287
00:16:49,410 --> 00:16:47,890
the magnetospheric effects so how does

288
00:16:51,150 --> 00:16:49,420

it have its effect I first want to

289
00:16:54,360 --> 00:16:51,160
suggest we talk about heart rate

290
00:16:56,250 --> 00:16:54,370
variability and I'm going to argue that

291
00:16:57,390 --> 00:16:56,260
you're really not affecting the heart

292
00:16:59,220 --> 00:16:57,400
and you're affecting the autonomic

293
00:17:01,710 --> 00:16:59,230
nervous system because I don't think

294
00:17:04,110 --> 00:17:01,720
you're actually capturing the heart beat

295
00:17:06,060 --> 00:17:04,120
like with pacemakers so you're dealing

296
00:17:08,430 --> 00:17:06,070
with autonomic nervous system so what

297
00:17:11,850 --> 00:17:08,440
you deal with that you even got to talk

298
00:17:15,120 --> 00:17:11,860
about seat sleep you got to talk about

299
00:17:17,160 --> 00:17:15,130
REM you got to talk about you know diet

300
00:17:19,860 --> 00:17:17,170
now I don't know I was involved in a

301
00:17:21,460 --> 00:17:19,870
study with Ramadan with people in Saudi

302
00:17:24,640 --> 00:17:21,470
Arabia I don't know if that was going

303
00:17:26,199 --> 00:17:24,650
when you did your study but there's all

304
00:17:28,720 --> 00:17:26,209
these other factors that are really

305
00:17:30,909 --> 00:17:28,730
important it's good data and exciting

306
00:17:32,260 --> 00:17:30,919
but you know we got to talk about the

307
00:17:34,450 --> 00:17:32,270
nervous system which we're talking about

308
00:17:39,750 --> 00:17:34,460
the brain really and the autonomic

309
00:17:43,890 --> 00:17:39,760
nervous system not stimulating the heart

310
00:17:47,260 --> 00:17:43,900
those are all very good points and I

311
00:17:50,169 --> 00:17:47,270
suspect that this has a lot to do with

312
00:17:53,770 --> 00:17:50,179
why the effects we're seeing only

313
00:17:57,940 --> 00:17:53,780

explain a small portion of the natural

314
00:17:59,830 --> 00:17:57,950
variability that that natural variation

315
00:18:02,950 --> 00:17:59,840
comes from somewhere and all of the

316
00:18:07,990 --> 00:18:02,960
factors that you listed are relevant to

317
00:18:10,360 --> 00:18:08,000
it yes the the the autonomic nervous

318
00:18:12,820 --> 00:18:10,370
system is tremendously important to

319
00:18:18,700 --> 00:18:12,830
heart function and does regulate it in a

320
00:18:22,299 --> 00:18:18,710
healthy individual but the the the heart

321
00:18:25,570 --> 00:18:22,309
rate variability was the physiological

322
00:18:29,320 --> 00:18:25,580
measure that the the heart math people

323
00:18:32,710 --> 00:18:29,330
chose to work with for a a variety of

324
00:18:37,210 --> 00:18:32,720
reasons including the ones that I

325
00:18:40,180 --> 00:18:37,220
mentioned early on York I was I think

326
00:18:43,270 --> 00:18:40,190
this is a terrific presentation and I

327
00:18:46,409 --> 00:18:43,280
must admit that it provides very sort of

328
00:18:49,750 --> 00:18:46,419
powerful evidence of sort of a

329
00:18:52,419 --> 00:18:49,760
relationship of individual physiological

330
00:18:55,270 --> 00:18:52,429
variables to the cosmic environment well

331
00:18:59,350 --> 00:18:55,280
the obvious question to me is well if

332
00:19:02,020 --> 00:18:59,360
this is what the Sun can do to people do

333
00:19:03,850 --> 00:19:02,030
the planets also have an effect because

334
00:19:06,399 --> 00:19:03,860
one thinks about the Mars effect for

335
00:19:08,950 --> 00:19:06,409
instance as an example and I must admit

336
00:19:12,220 --> 00:19:08,960
that when that go cleanse stuff on the

337
00:19:14,169 --> 00:19:12,230
Mars effect came out most of us were

338
00:19:17,200 --> 00:19:14,179

saying well how could that how could

339
00:19:20,350 --> 00:19:17,210
that be okay but everybody was thinking

340
00:19:21,820 --> 00:19:20,360
about gravitational pull and so forth

341
00:19:25,000 --> 00:19:21,830
nobody thought about these other

342
00:19:27,570 --> 00:19:25,010
variables so the obvious question again

343
00:19:30,239 --> 00:19:27,580
in my mind is do the planets have any of

344
00:19:31,769 --> 00:19:30,249
and might that influence things like the

345
00:19:32,549 --> 00:19:31,779
Mars effect I assume you know what that

346
00:19:35,220 --> 00:19:32,559
is

347
00:19:38,070 --> 00:19:35,230
yes I'm familiar with the Gokul on Mars

348
00:19:43,139 --> 00:19:38,080
effect and the thing with that is that

349
00:19:46,580 --> 00:19:43,149
it is a a purely empirical statistical

350
00:19:50,820 --> 00:19:46,590
correlation that was found that has no

351
00:19:55,970 --> 00:19:50,830
no underlying mechanism that anybody has

352
00:19:58,979 --> 00:19:55,980
been able to suggest exactly these

353
00:20:02,690 --> 00:19:58,989
environmental variables that I mentioned

354
00:20:06,359 --> 00:20:02,700
are all literally measurable features of

355
00:20:08,810 --> 00:20:06,369
the physical environment they are things

356
00:20:11,820 --> 00:20:08,820
that can be physically detected at

357
00:20:14,129 --> 00:20:11,830
either at Earth's surface or in the

358
00:20:18,869 --> 00:20:14,139
immediate vicinity with instruments

359
00:20:21,659 --> 00:20:18,879
which I'm sorry yes the planets are out

360
00:20:23,489 --> 00:20:21,669
there they have they have gravitational

361
00:20:26,789 --> 00:20:23,499
effects they have electromagnetic

362
00:20:30,869 --> 00:20:26,799
effects those are all many orders of

363
00:20:33,049 --> 00:20:30,879

magnitude smaller we assume what what

364
00:20:39,810 --> 00:20:33,059
yeah the things we're looking at okay

365
00:20:43,680 --> 00:20:39,820
okay fascinating so a speculative

366
00:20:47,810 --> 00:20:43,690
comment on the anticipatory effect and

367
00:20:51,180 --> 00:20:47,820
perhaps the 18 hour cycle that you see

368
00:20:55,080 --> 00:20:51,190
several years ago Dick Schaap gave an

369
00:20:57,239 --> 00:20:55,090
absolutely mind-blowing talk in which he

370
00:21:01,049 --> 00:20:57,249
showed a correlation between various

371
00:21:04,499 --> 00:21:01,059
human events and solar wind activity

372
00:21:07,349 --> 00:21:04,509
just at the Sun in other words activity

373
00:21:11,310 --> 00:21:07,359
solar wind as it was leaving the Sun not

374
00:21:13,560 --> 00:21:11,320
as it was arriving on earth so as if we

375
00:21:19,859 --> 00:21:13,570
were reacting to something that was

376
00:21:21,989 --> 00:21:19,869
happening out there now and there hasn't

377
00:21:24,029 --> 00:21:21,999
been any follow up on this it was it was

378
00:21:27,119 --> 00:21:24,039
just a series of correlations that he

379
00:21:29,489 --> 00:21:27,129
did but I wonder whether some of these

380
00:21:32,580 --> 00:21:29,499
time effects that you're seeing may be

381
00:21:34,470 --> 00:21:32,590
because the response is not due to

382
00:21:37,470 --> 00:21:34,480
what's hitting the earth but it's due to

383
00:21:38,480 --> 00:21:37,480
the source of perhaps the solar winds

384
00:21:41,300 --> 00:21:38,490
for example

385
00:21:45,630 --> 00:21:41,310
well that is a very interesting

386
00:21:49,440 --> 00:21:45,640
speculation and I have to admit that the

387
00:21:51,830 --> 00:21:49,450
solar wind correlation in particular

388
00:21:54,720 --> 00:21:51,840

looks an awful lot like the proverbial

389
00:21:56,970 --> 00:21:54,730
spooky action at a distance because it

390
00:22:02,940 --> 00:21:56,980
doesn't look like it's being mediated by

391
00:22:05,730 --> 00:22:02,950
anything we know about so if if there's

392
00:22:07,530 --> 00:22:05,740
a reaction to stuff that's happening all

393
00:22:10,430 --> 00:22:07,540
the way out there at the surface of the

394
00:22:13,620 --> 00:22:10,440
Sun yes that that would show up as

395
00:22:15,600 --> 00:22:13,630
anticipatory compared to the

396
00:22:19,080 --> 00:22:15,610
measurements of the solar wind reaching

397
00:22:20,040 --> 00:22:19,090
Earth's magnetosphere thank you very