1
00:00:00.370 --> 00:00:03.060
<v ->We'll turn everything over to Dr. Susan Wright</v>

2
00:00:16.810 --> 00:00:17.643
<v ->Good morning.</v>

3
00:00:17.643 --> 00:00:18.890
And welcome to the second session

4
00:00:18.890 --> 00:00:21.540
of our four-part data science careers seminar series

5
00:00:21.540 --> 00:00:24.440
Bringing Data Science to Addiction Research.

6
00:00:24.440 --> 00:00:25.590
My name is Susan Wright.

7
00:00:25.590 --> 00:00:28.920
I'm from the division of neuroscience and behavior, the DNB

8
00:00:28.920 --> 00:00:29.990
and I'm the program director

9
00:00:29.990 --> 00:00:32.250
for big data and computational science

10
00:00:32.250 --> 00:00:34.880
and leading our data science efforts here at NIDA.

11
00:00:34.880 --> 00:00:37.900
Training and data science is a priority for NIDA

12
00:00:37.900 --> 00:00:40.560
and it's supported by our new office of research training,

13
00:00:40.560 --> 00:00:44.233
diversity and disparities for ORTB.

14
00:00:44.233 --> 00:00:45.950
We have organized a seminar series

15
00:00:45.950 --> 00:00:48.170
with the full support of our NIDA director,

16
00:00:48.170 --> 00:00:50.850
Dr. Nora Volkov, and the organizers include members

17
00:00:50.850 --> 00:00:53.090
of the division of Neuroscience and Behavior

18
00:00:53.090 --> 00:00:54.750
and the office of research training,

19
00:00:54.750 --> 00:00:56.650
diversity and disparities.

20
00:00:56.650 --> 00:00:59.960
The organizers include myself, Dr. Roger Little,

21
00:00:59.960 --> 00:01:01.390
the deputy director of the division

22
00:01:01.390 --> 00:01:04.920
of neuroscience and behavior Dr. Wilson Compton,

23
00:01:04.920 --> 00:01:07.350
the NIDA deputy director and acting director

24
00:01:07.350 --> 00:01:09.070
of the office of research training,

25
00:01:09.070 --> 00:01:11.030

diversity and disparities.

26
00:01:11.030 --> 00:01:13.400
Dr. Albert Avila, the deputy director

27
00:01:13.400 --> 00:01:15.450
of the research office of research training,

28
00:01:15.450 --> 00:01:16.950
diversity and disparities

29
00:01:16.950 --> 00:01:18.790
and the director of the office of disparities

30
00:01:18.790 --> 00:01:21.710
and health disparities, and Dr. Lindsay friend,

31
00:01:21.710 --> 00:01:24.130
the research and career development program officer

32
00:01:24.130 --> 00:01:25.580
in the office of research training,

33
00:01:25.580 --> 00:01:27.950
diversity and disparities.

34
00:01:27.950 --> 00:01:30.160
I want to thank Roger Wilson, Albert and Lindsay

35
00:01:30.160 --> 00:01:32.630
for their help with organizing the seminar series.

36
00:01:32.630 --> 00:01:34.490
And I also want to thank the team who have been helping

37
00:01:34.490 --> 00:01:35.860
with the technical details.

38
00:01:35.860 --> 00:01:38.730
And that includes Usha Charia, Susan Holbrook,

39
00:01:38.730 --> 00:01:40.723
Caitlin Duda, BARR, and David Mazda.

40
00:01:41.610 --> 00:01:43.330
We've organized the seminar series

41
00:01:43.330 --> 00:01:44.510
of future exciting talks

42
00:01:44.510 --> 00:01:46.490
from both data science industry leaders

43
00:01:46.490 --> 00:01:47.930
and NIDA funded scientists

44
00:01:47.930 --> 00:01:50.830
who are incorporating data science into their research.

45
00:01:50.830 --> 00:01:52.410
We're hoping that by doing so

46
00:01:52.410 --> 00:01:54.020
we'll generate some interesting discussion

47
00:01:54.020 --> 00:01:55.600
about how we can further our efforts

48
00:01:55.600 --> 00:01:57.950
to bring data science to addiction research

49
00:01:57.950 --> 00:01:59.530
and hopefully inspire a new generation

50
00:01:59.530 --> 00:02:03.470

of data scientists focused throughout this series.

51
00:02:03.470 --> 00:02:04.600
You'll be hearing from a variety

52
00:02:04.600 --> 00:02:06.550
of interesting data science careers

53
00:02:06.550 --> 00:02:07.880
and learn about the different paths

54
00:02:07.880 --> 00:02:09.220
the speakers took to get there,

55
00:02:09.220 --> 00:02:11.220
the skills needed, et cetera.

56
00:02:11.220 --> 00:02:13.360
The format for this session includes presentations

57
00:02:13.360 --> 00:02:17.180
from two speakers, Dr. Kirk borne and Dr. Martin Paulus.

58
00:02:17.180 --> 00:02:19.050
There'll be time for questions from the audience

59
00:02:19.050 --> 00:02:21.310
after both of them have finished their presentations.

60
00:02:21.310 --> 00:02:23.810
So please use the chat box to submit your questions

61
00:02:23.810 --> 00:02:25.960
and we'll get to as many of them as we can.

62
00:02:27.560 --> 00:02:29.680
Our first speaker is Dr. Kirk

63
00:02:30.520 --> 00:02:33.980
who is the principal data scientist, data science fellow

64
00:02:33.980 --> 00:02:36.690
and an Executive Advisor at Global Technology

65
00:02:36.690 --> 00:02:38.370
and concerning concern consulting

66
00:02:38.370 --> 00:02:41.430
for Booz Allen Hamilton since 2015.

67
00:02:41.430 --> 00:02:44.320
You provide thought leadership, mentoring, training

68
00:02:44.320 --> 00:02:46.960
and consulting activities and data science machine learning

69
00:02:46.960 --> 00:02:49.410
and AI across multiple disciplines.

70
00:02:49.410 --> 00:02:50.920
Previously, he was professor

71
00:02:50.920 --> 00:02:53.060
of astrophysics and computational science

72
00:02:53.060 --> 00:02:55.610
at George Mason university for 12 years

73
00:02:55.610 --> 00:02:59.020
in the graduate and undergraduate data science programs.

74
00:02:59.020 --> 00:03:01.260
Prior to that, he spent nearly 20 years

75
00:03:01.260 --> 00:03:03.270

supporting data systems activities

76
00:03:03.270 --> 00:03:05.480
for NASA space science programs

77
00:03:05.480 --> 00:03:08.760
including a role at NASA as data archive project scientist

78
00:03:08.760 --> 00:03:11.000
for the Hubble space telescope.

79
00:03:11.000 --> 00:03:13.450
Dr.Borne received his bachelor's degree in physics

80
00:03:13.450 --> 00:03:17.310
from LSU and his PhD in astronomy from Caltech.

81
00:03:17.310 --> 00:03:18.340
He is an elected fellow

82
00:03:18.340 --> 00:03:21.200
of the international Astra statistics association

83
00:03:21.200 --> 00:03:24.280
for his contributions to big data research in astronomy.

84
00:03:24.280 --> 00:03:26.100
In 2020, he was elected a fellow

85
00:03:26.100 --> 00:03:28.320
of the American Astronomical Society

86
00:03:28.320 --> 00:03:31.220
for lifelong contributions to the field of astronomy.

87
00:03:31.220 --> 00:03:33.190
As a global speaker, he has given hundreds

88
00:03:33.190 --> 00:03:36.320
of invited talks worldwide, including keynote presentations

89
00:03:36.320 --> 00:03:39.660
that dozens of data science, AI, and analytics conferences.

90
00:03:39.660 --> 00:03:43.140
He has an active contributor social media

91
00:03:43.140 --> 00:03:45.710
where he promotes big data literacy for all

92
00:03:45.710 --> 00:03:47.710
and has been named consistently(audio breaks)

93
00:03:47.710 --> 00:03:49.010
worldwide social influencers

94
00:03:49.010 --> 00:03:51.240
and big data, data science, machine learning

95
00:03:51.240 --> 00:03:53.210
and AI since 2013.

96
00:03:53.210 --> 00:03:55.020
Please join me in welcoming Dr. Kirk one

97
00:03:55.020 --> 00:03:57.353
this morning, virtual applause.

98
00:03:59.090 --> 00:04:01.070
<v ->Thank you very much, Susan.</v>

99
00:04:01.070 --> 00:04:02.710
Thank you Dr. Wright, Dr. Little

100
00:04:02.710 --> 00:04:04.370

and all of your staff for this opportunity.

101
00:04:04.370 --> 00:04:07.600
It's great to be here, thumbs up if you're hearing me.

102
00:04:07.600 --> 00:04:09.580
So this is a great opportunity.

103
00:04:09.580 --> 00:04:13.160
Just speak about what is passionate in my life

104
00:04:13.160 --> 00:04:15.810
which is not just doing data science

105
00:04:15.810 --> 00:04:18.480
but propagating it to the future workforce,

106
00:04:18.480 --> 00:04:21.040
to the current workforce, to the next generation,

107
00:04:21.040 --> 00:04:24.070
the current generation to all basically.

108
00:04:24.070 --> 00:04:27.430
And so this presentation is really about my career journey

109
00:04:28.510 --> 00:04:30.910
summarized as fast as possible in 30 minutes,

110
00:04:30.910 --> 00:04:31.860
it's just kind of hard to do

111
00:04:31.860 --> 00:04:33.310
since it's been quite a while

112
00:04:33.310 --> 00:04:35.080
that I've been doing this stuff.

113
00:04:35.080 --> 00:04:39.370
But as pointed out at Booz Allen Hamilton

114
00:04:39.370 --> 00:04:42.820
where I have multiple roles as a principal data scientist

115
00:04:42.820 --> 00:04:44.020
which primarily means I can work

116
00:04:44.020 --> 00:04:47.110
across many different accounts and disciplines

117
00:04:47.110 --> 00:04:50.460
as executive advisor as towards our own internal executives

118
00:04:50.460 --> 00:04:54.460
as well as our client executives and data science fellow

119
00:04:54.460 --> 00:04:56.220
which basically is that a free pass

120
00:04:56.220 --> 00:04:58.500
for me to talk about data science out there

121
00:04:58.500 --> 00:05:01.123
to the whole world and share the love of data.

122
00:05:02.330 --> 00:05:05.830
So today's presentations is again, my journey.

123
00:05:05.830 --> 00:05:08.120
And so there's a picture of me with my family,

124
00:05:08.120 --> 00:05:10.330
I'm the one with the arrow pointing to him

125
00:05:10.330 --> 00:05:12.150

next to my mother, my two brothers

126
00:05:12.150 --> 00:05:13.330
and my dad on the far right

127
00:05:13.330 --> 00:05:16.210
who is a United States air force officer.

128
00:05:16.210 --> 00:05:17.119
And so that was me.

129
00:05:17.119 --> 00:05:19.620
I started at the beginning of my educational journey.

130
00:05:19.620 --> 00:05:22.650
I think back to those days, I was just finished first grade,

131
00:05:22.650 --> 00:05:23.730
we were just moving to England.

132
00:05:23.730 --> 00:05:25.160
My father was stationed in England.

133
00:05:25.160 --> 00:05:28.510
So two years of my education were in the United Kingdom.

134
00:05:28.510 --> 00:05:30.690
So I feel like I have a very strong affinity

135
00:05:30.690 --> 00:05:33.599
with folks there so if you're from the UK, hello.

136
00:05:33.599 --> 00:05:36.770
I feel like I have part of my being is there.

137
00:05:36.770 --> 00:05:38.820
<v ->Dr. Bonn if you could share your slides</v>

138
00:05:40.900 --> 00:05:42.590
<v ->Awesome, thank you for that.</v>

139
00:05:42.590 --> 00:05:43.423
<v ->No problem.</v>

140
00:05:44.441 --> 00:05:47.191
(mouse clicking)

141
00:05:48.530 --> 00:05:51.550
That's fun how I forgot to do that.

142
00:05:51.550 --> 00:05:53.253
Let me back up to the title slide.

143
00:05:54.690 --> 00:05:56.050
Just so you saw what I was talking about

144
00:05:56.050 --> 00:05:58.253
my fortuitous career in data science,

145
00:05:59.305 --> 00:06:01.930
there was a picture of me with my family,

146
00:06:01.930 --> 00:06:03.680
with the arrow pointing towards me.

147
00:06:05.627 --> 00:06:09.000
So the journey is goes back to sort of early days

148
00:06:09.000 --> 00:06:11.940
of my education as a picture

149
00:06:11.940 --> 00:06:14.800
of me with my college sweetheart there in the upper right.

150
00:06:14.800 --> 00:06:17.380

And I've been married to her now for over 40 years

151
00:06:17.380 --> 00:06:19.110
and in the bottom right is a picture of me

152
00:06:19.110 --> 00:06:20.900
in my first post-doctoral appointment

153
00:06:20.900 --> 00:06:25.680
which that the Carnegie Institution of Washington in DC

154
00:06:25.680 --> 00:06:27.800
and I'm on the far, left upper left

155
00:06:27.800 --> 00:06:30.450
and seated below me is a Dr.John Ward,

156
00:06:30.450 --> 00:06:32.650
one of the greatest drummers of the 20th century

157
00:06:32.650 --> 00:06:36.640
and Dr. Vera Rubin who was my postdoctoral mentor

158
00:06:36.640 --> 00:06:37.790
who was recently been honored

159
00:06:37.790 --> 00:06:40.860
as the first major United States observatory

160
00:06:40.860 --> 00:06:42.290
named after her.

161
00:06:42.290 --> 00:06:44.890
And so it was quite an honor to have those experiences

162
00:06:44.890 --> 00:06:47.950
in my career from high school in Nebraska.

163
00:06:47.950 --> 00:06:50.520
Remember my dad was air force, so I was everywhere.

164
00:06:50.520 --> 00:06:54.200
LSU, I am from Baton Rouge and then those places

165
00:06:54.200 --> 00:06:57.110
in between Michigan Carnegie institution.

166
00:06:57.110 --> 00:06:59.800
So it really all starts to met my first love of astronomy

167
00:06:59.800 --> 00:07:01.730
when I was very young.

168
00:07:01.730 --> 00:07:04.270
An uncle gave me a astronomy book

169
00:07:04.270 --> 00:07:06.610
which has just pretty pictures, lots of pretty pictures.

170
00:07:06.610 --> 00:07:08.560
I was nine years old and I fell in love with that.

171
00:07:08.560 --> 00:07:10.170
And I said, I really wanna do this.

172
00:07:10.170 --> 00:07:12.240
I wanna study this, I wanna understand this.

173
00:07:12.240 --> 00:07:13.980
And by the time I got to high school

174
00:07:13.980 --> 00:07:16.320
I started to be seeing more and more of the real meat

175
00:07:16.320 --> 00:07:17.650

of astronomy that it's not just

176
00:07:17.650 --> 00:07:19.500
about pretty pictures and pretty images,

177
00:07:19.500 --> 00:07:20.810
even though that's very attractive.

178
00:07:20.810 --> 00:07:22.520
And it attracts a lot of people

179
00:07:22.520 --> 00:07:23.607
there's really a lot of data behind it.

180
00:07:23.607 --> 00:07:26.670
And so I discovered the astronomical Almanac

181
00:07:26.670 --> 00:07:29.973
it was called the nautical Almanac in those days.

182
00:07:30.850 --> 00:07:33.930
So this particular immature* has a 2018 version.

183
00:07:33.930 --> 00:07:34.870
The one I was looking at

184
00:07:34.870 --> 00:07:38.070
in high school was actually the 1979 version.

185
00:07:38.070 --> 00:07:40.080
So I couldn't find a picture of that.

186
00:07:40.080 --> 00:07:41.120
So it's just filled with data.

187
00:07:41.120 --> 00:07:43.430
And this data just basically talked

188
00:07:43.430 --> 00:07:46.900
about the motions of the planets, the moons of the planets,

189
00:07:46.900 --> 00:07:49.120
the Sun and the moon and the sky.

190
00:07:49.120 --> 00:07:51.070
And then there were equations that described all

191
00:07:51.070 --> 00:07:52.570
that stuff in the explanatory.

192
00:07:53.428 --> 00:07:54.760
So I really began to see

193
00:07:54.760 --> 00:07:58.350
that the astronomy was not just about the pretty pictures.

194
00:07:58.350 --> 00:08:00.340
It was about compilations of data.

195
00:08:00.340 --> 00:08:03.140
And from those data we built explanatory models

196
00:08:03.140 --> 00:08:05.130
to explain all that data.

197
00:08:05.130 --> 00:08:08.750
And that really excited me because I really saw the power

198
00:08:08.750 --> 00:08:11.490
of math for the first time in the sciences

199
00:08:11.490 --> 00:08:14.640
with numbers that is data to actually give insights

200
00:08:14.640 --> 00:08:17.370

and do discoveries, which is what we call science.

201
00:08:17.370 --> 00:08:19.710
And so I had this love of math and love of science

202
00:08:19.710 --> 00:08:21.240
and love of astronomy.

203
00:08:21.240 --> 00:08:24.240
And when I applied for undergraduate school from high school

204
00:08:24.240 --> 00:08:27.830
I put it in my high school and that application to college

205
00:08:27.830 --> 00:08:29.060
I didn't know what degree I wanted.

206
00:08:29.060 --> 00:08:31.890
So I just picked math because I love math so much.

207
00:08:31.890 --> 00:08:33.755
And so even up to the first day of high

208
00:08:33.755 --> 00:08:37.970
of freshmen orientation at LSU in Baton Rouge

209
00:08:37.970 --> 00:08:42.280
in August of 1972, I couldn't I still couldn't really

210
00:08:42.280 --> 00:08:44.950
be sure I want it to do math or I wanted to do science

211
00:08:44.950 --> 00:08:47.980
or I wanted to do physics or I wanted to do astronomy.

212
00:08:47.980 --> 00:08:49.010
So a funny thing happened

213
00:08:49.010 --> 00:08:50.890
on the way to freshmen orientation.

214
00:08:50.890 --> 00:08:51.820
My brother and I were...

215
00:08:51.820 --> 00:08:54.320
Older brother and I were driving in the car to the campus.

216
00:08:54.320 --> 00:08:57.690
This was late August a very, very hot humid day.

217
00:08:57.690 --> 00:08:59.130
If you're from Louisiana or the South,

218
00:08:59.130 --> 00:09:00.508
you know how humid and hot it can be.

219
00:09:00.508 --> 00:09:02.800
And it was one of those atrocious days.

220
00:09:02.800 --> 00:09:05.381
And so I figured out that the shortest walk between

221
00:09:05.381 --> 00:09:08.130
the air conditioned car and an air conditioned building

222
00:09:08.130 --> 00:09:09.970
was the walk to the physics orientation.

223
00:09:09.970 --> 00:09:12.860
So I decided to be a physics major (chuckles)

224
00:09:12.860 --> 00:09:14.930
and which was absolutely perfect because with physics

225
00:09:14.930 --> 00:09:16.840

you get nothing but math for years

226
00:09:16.840 --> 00:09:18.600
and you get of course you get all the physics you want.

227
00:09:18.600 --> 00:09:22.010
But at the same time, I get all the astrophysics

228
00:09:22.010 --> 00:09:24.200
the foundation for astrophysics that I needed when I went

229
00:09:24.200 --> 00:09:25.460
to graduate school.

230
00:09:25.460 --> 00:09:26.810
And so it was really the right place

231
00:09:26.810 --> 00:09:28.620
at the right time in my career to be able

232
00:09:28.620 --> 00:09:32.120
to combine all the things that I loved in one way

233
00:09:32.120 --> 00:09:34.310
which I didn't actually perceive when I was younger

234
00:09:34.310 --> 00:09:37.340
that you could actually combine all these things.

235
00:09:37.340 --> 00:09:38.530
So those years went by

236
00:09:38.530 --> 00:09:40.500
and I want to don't belabor that point.

237
00:09:40.500 --> 00:09:43.220
So after graduate school and postdocs,

238
00:09:43.220 --> 00:09:45.320
I ended up at the Hubble space telescope

239
00:09:45.320 --> 00:09:48.910
in Baltimore, Maryland as the science database guy,

240
00:09:48.910 --> 00:09:51.510
research scientist hired there in late 1985,

241
00:09:52.558 --> 00:09:55.510
started to work in Baltimore at that facility.

242
00:09:55.510 --> 00:09:57.670
And so there's a picture of me from that era.

243
00:09:57.670 --> 00:10:02.238
So all these slides where they have these employment years

244
00:10:02.238 --> 00:10:04.362
you'll see a picture of me from those years.

245
00:10:04.362 --> 00:10:05.810
(chuckles)
So there I am.

246
00:10:05.810 --> 00:10:10.400
So it turned out shortly after I started working there

247
00:10:10.400 --> 00:10:13.470
and in the late 1985,

248
00:10:13.470 --> 00:10:18.100
along came the shuttle challenger disaster in January, 1986.

249
00:10:18.100 --> 00:10:20.620
So it was absolutely the most devastating day

250

00:10:20.620 --> 00:10:22.780
for everyone working at NASA.

251
00:10:22.780 --> 00:10:24.430
And for me, who ever...

252
00:10:24.430 --> 00:10:25.450
Ever since nine years old

253
00:10:25.450 --> 00:10:28.720
I wanted to have a career in astronomy, worked with NASA.

254
00:10:28.720 --> 00:10:31.610
And for this to happen, it is just like a devastating moment

255
00:10:31.610 --> 00:10:35.540
as most of you who've lived through that can share also.

256
00:10:35.540 --> 00:10:39.600
And so what happened for us at the Space Telescope Institute

257
00:10:39.600 --> 00:10:40.583
was also dramatic in a different way

258
00:10:40.583 --> 00:10:42.520
and that's certainly not the tragedy

259
00:10:42.520 --> 00:10:45.910
of human life of course but the telescope

260
00:10:45.910 --> 00:10:49.130
was scheduled to be launched on the shuttle in that same...

261
00:10:49.130 --> 00:10:50.800
In the summer of that same year.

262
00:10:50.800 --> 00:10:52.070
But obviously that wasn't gonna happen

263
00:10:52.070 --> 00:10:54.330
because NASA needed basically to shut down

264
00:10:54.330 --> 00:10:56.860
the shuttle program for several years trying to figure out

265
00:10:56.860 --> 00:10:58.610
what went wrong and how not to have that

266
00:10:58.610 --> 00:10:59.610
ever happened again.

267
00:11:00.860 --> 00:11:03.220
So that period of four years there was a.....

268
00:11:03.220 --> 00:11:05.310
between the scheduled launch date

269
00:11:05.310 --> 00:11:07.700
to when it actually launched in 1990,

270
00:11:07.700 --> 00:11:08.940
there was a lot of reflection

271
00:11:08.940 --> 00:11:10.340
and retooling and improvements.

272
00:11:10.340 --> 00:11:14.870
So we were in a mad rush to get things ready for August 86.

273
00:11:14.870 --> 00:11:17.310
Now we had four years really just to slow down,

274
00:11:17.310 --> 00:11:20.770
take a look back, see what we could fix, do better.

275

00:11:20.770 --> 00:11:22.080
And one of those was taking a look

276
00:11:22.080 --> 00:11:24.560
at Science Data Management.

277
00:11:24.560 --> 00:11:26.590
So the view at the time and again

278
00:11:26.590 --> 00:11:27.960
I was a fairly young guy...

279
00:11:27.960 --> 00:11:31.010
And I've done a lot of data analysis as an astronomer.

280
00:11:31.010 --> 00:11:34.440
Even up to that point, I had done a lot of analysis

281
00:11:34.440 --> 00:11:36.130
never really thought about data management

282
00:11:36.130 --> 00:11:39.020
but the vision I had in my head

283
00:11:39.020 --> 00:11:41.050
of what it looked like then is this scene

284
00:11:41.050 --> 00:11:43.460
from the last scene of the Raiders of the Lost Ark movie.

285
00:11:43.460 --> 00:11:44.800
So maybe you've seen it,

286
00:11:44.800 --> 00:11:46.990
where they find the they find the Arc of the covenant

287
00:11:46.990 --> 00:11:49.273
and you think of this fantastic discovery

288
00:11:49.273 --> 00:11:52.260
is a great opportunity to learn about amazing things

289
00:11:52.260 --> 00:11:55.340
and do discovery from this incredible artifact.

290
00:11:55.340 --> 00:11:56.173
But what do they do with it?

291
00:11:56.173 --> 00:11:58.480
They lock it in a box and put an index number on it

292
00:11:58.480 --> 00:12:01.320
and hide it away in a warehouse.

293
00:12:01.320 --> 00:12:03.140
And data manager was sort of like that.

294
00:12:03.140 --> 00:12:05.510
We collect the data for the telescope,

295
00:12:05.510 --> 00:12:08.167
the scientists who were the principal investigators

296
00:12:08.167 --> 00:12:11.550
of the approach of the particular observational program

297
00:12:11.550 --> 00:12:13.010
would do the research and the data would

298
00:12:13.010 --> 00:12:15.630
then be locked away in the archive.

299
00:12:15.630 --> 00:12:18.380
We managed, the data would be managed (chuckles),

300

00:12:18.380 --> 00:12:20.150
that's the magic word there, okay.

301
00:12:20.150 --> 00:12:21.460
So it would be just locked away.

302
00:12:21.460 --> 00:12:22.360
We have an index number,

303
00:12:22.360 --> 00:12:23.930
we know where to find it if we need it

304
00:12:23.930 --> 00:12:27.030
but really that discovery potential is considered past.

305
00:12:27.030 --> 00:12:30.510
Now we lock it up, we don't need to use it anymore.

306
00:12:30.510 --> 00:12:32.240
Well, if you can imagine that sort of concept

307
00:12:32.240 --> 00:12:33.950
not making much sense for a library, right?

308
00:12:33.950 --> 00:12:35.320
If you put books in the library

309
00:12:35.320 --> 00:12:37.610
and you index it so you can find it, but you lock the doors

310
00:12:37.610 --> 00:12:40.410
and don't let people, what's the point, right?

311
00:12:40.410 --> 00:12:41.707
And so they said, we got to do something different.

312
00:12:41.707 --> 00:12:44.980
And so during those years we had this opportunity

313
00:12:44.980 --> 00:12:47.820
since we were had the piece to think about it,

314
00:12:47.820 --> 00:12:48.653
we said wait a second,

315
00:12:48.653 --> 00:12:50.627
we really need to have more discovery potential

316
00:12:50.627 --> 00:12:52.140
from this data that is we...

317
00:12:52.140 --> 00:12:53.330
In other words we need to open the doors

318
00:12:53.330 --> 00:12:55.610
so to let everyone in to access the data.

319
00:12:55.610 --> 00:12:58.740
So this whole idea of a science data archive was born.

320
00:12:58.740 --> 00:13:01.230
So it's beyond data management is sort of data...

321
00:13:01.230 --> 00:13:02.940
A discovery from data

322
00:13:02.940 --> 00:13:06.300
and so that whole archive system was born.

323
00:13:06.300 --> 00:13:08.440
Or as I like to say, born with it, ether

324
00:13:08.440 --> 00:13:10.070
which is my last name because I ultimately

325

00:13:10.070 --> 00:13:12.870
became NASA's data archive project scientist

326
00:13:12.870 --> 00:13:14.070
for the whole telescope.

327
00:13:15.250 --> 00:13:18.330
So this new data management I put into cap quotes

328
00:13:18.330 --> 00:13:20.920
their data management is more about data we use

329
00:13:20.920 --> 00:13:23.680
for discovery that is allowing people who are not

330
00:13:23.680 --> 00:13:24.830
the principal investigators,

331
00:13:24.830 --> 00:13:27.470
who basically set up the first observations

332
00:13:27.470 --> 00:13:29.930
of a particular object or class of objects.

333
00:13:29.930 --> 00:13:32.930
And this guy, other astronomers could come in to study

334
00:13:32.930 --> 00:13:35.110
that same data that's in the archive.

335
00:13:35.110 --> 00:13:37.390
And so as it turned out as the years went by

336
00:13:37.390 --> 00:13:40.730
it's long ago we passed the milestone

337
00:13:40.730 --> 00:13:43.270
where the number of refereed papers

338
00:13:43.270 --> 00:13:45.120
for Hubble science was exceeded

339
00:13:45.120 --> 00:13:46.810
but from archival research compared

340
00:13:46.810 --> 00:13:49.560
to the primary observation research programs.

341
00:13:49.560 --> 00:13:51.370
And so it's actually proven to be true

342
00:13:51.370 --> 00:13:54.710
that was it's a far greater discovery accelerator

343
00:13:54.710 --> 00:13:57.010
and amplifier to open up those doors

344
00:13:57.010 --> 00:13:59.260
and open the data to the whole community.

345
00:13:59.260 --> 00:14:02.620
So with the focus was then on the big science discovery,

346
00:14:02.620 --> 00:14:05.773
big science data focused on discovery not on management.

347
00:14:06.880 --> 00:14:09.470
And so it really was another sort of chapter

348
00:14:09.470 --> 00:14:14.470
and how I thought about sort of data and science with data.

349
00:14:14.690 --> 00:14:17.450
And that is how do you make this data available

350

00:14:17.450 --> 00:14:19.090
in a better way to people?

351
00:14:19.090 --> 00:14:21.700
How do you think about how users are going to use the data

352
00:14:21.700 --> 00:14:24.920
instead of how did you wanna design the thing?

353
00:14:24.920 --> 00:14:26.380
So this whole concept of design thinking

354
00:14:26.380 --> 00:14:29.773
even though we never called it that sort of was in the air,

355
00:14:29.773 --> 00:14:31.960
even though we didn't use that terminology.

356
00:14:31.960 --> 00:14:34.470
So let's try to design the systems to enable

357
00:14:34.470 --> 00:14:36.910
and improve a data search discovery access

358
00:14:36.910 --> 00:14:38.910
across these massive data collections.

359
00:14:38.910 --> 00:14:41.640
So and all kinds of new questions against

360
00:14:41.640 --> 00:14:45.410
the same existing data sets to answer new questions

361
00:14:45.410 --> 00:14:48.250
allow new diverse use cases and novel projects

362
00:14:48.250 --> 00:14:49.950
that were never thought of before.

363
00:14:49.950 --> 00:14:54.320
So designing systems and net concept of sort of design

364
00:14:54.320 --> 00:14:57.210
around data systems sort of inspired me to move on

365
00:14:57.210 --> 00:14:59.760
when I got an opportunity which I accepted to move

366
00:14:59.760 --> 00:15:01.840
to the NASA Goddard space flight center

367
00:15:01.840 --> 00:15:04.640
in Greenbelt Maryland in an office called

368
00:15:04.640 --> 00:15:07.080
the Space Science Data Operations office

369
00:15:07.080 --> 00:15:09.100
which was managing all of the science data

370
00:15:09.100 --> 00:15:11.890
from all of the NASA space science missions.

371
00:15:11.890 --> 00:15:15.830
So if you think of Hubble as one mission, one experiment

372
00:15:15.830 --> 00:15:18.710
that if they had 15,000 different experiments

373
00:15:18.710 --> 00:15:21.020
that were being managed in this data facility

374
00:15:21.020 --> 00:15:22.160
and when a component of that

375

00:15:22.160 --> 00:15:25.170
the astronomy data facility and astronomy data center

376
00:15:25.170 --> 00:15:28.340
I became the contract group manager of...

377
00:15:28.340 --> 00:15:30.450
On that contract for NASA

378
00:15:30.450 --> 00:15:33.320
and so there were 15,000 experimental data sets

379
00:15:33.320 --> 00:15:35.250
we were managing again, compare to Hubble

380
00:15:35.250 --> 00:15:37.840
which was one data set and that was our role.

381
00:15:37.840 --> 00:15:40.640
Basically, we were the digital library

382
00:15:40.640 --> 00:15:43.250
by order of Congress to be preserved for all time

383
00:15:43.250 --> 00:15:46.060
the data collected from these experiments

384
00:15:46.060 --> 00:15:48.550
which of course the tax payers have paid for.

385
00:15:48.550 --> 00:15:50.173
And so it's there for all time.

386
00:15:51.560 --> 00:15:54.090
So 1997, which I was sort of two years

387
00:15:54.090 --> 00:15:55.405
into that management role

388
00:15:55.405 --> 00:15:57.180
of helping them manage the data system.

389
00:15:57.180 --> 00:15:58.930
So I was managing a team of people

390
00:15:58.930 --> 00:16:02.790
database, data clerks, PhD, Stein, scientists

391
00:16:02.790 --> 00:16:04.613
and many more people like that.

392
00:16:06.190 --> 00:16:10.290
And 1997 sort of a big thing happened in my career path.

393
00:16:10.290 --> 00:16:12.990
And that was like, I called my big aha moment.

394
00:16:12.990 --> 00:16:16.360
So it was very common for the the NASA scientists

395
00:16:16.360 --> 00:16:17.950
where they finished with their experiment,

396
00:16:17.950 --> 00:16:19.820
that the PIs when they finished with their experiment,

397
00:16:19.820 --> 00:16:21.910
the principal investigators would turn

398
00:16:21.910 --> 00:16:24.590
their data over to us and we would provide

399
00:16:24.590 --> 00:16:27.640
that long-term preservation for their dataset.

400

00:16:27.640 --> 00:16:29.240
And so it was very common for me

401
00:16:29.240 --> 00:16:31.280
when I'm at conferences for people to come up to me

402
00:16:31.280 --> 00:16:33.780
and say, Hey we got this, we're finishing our experiment,

403
00:16:33.780 --> 00:16:34.870
we wanna turn your data over

404
00:16:34.870 --> 00:16:36.950
to the data center there at NASA.

405
00:16:36.950 --> 00:16:39.563
And so we had a formal process for doing that.

406
00:16:39.563 --> 00:16:41.750
(coughs)

407
00:16:41.750 --> 00:16:46.100
So in 1987, a colleague of mine, I met at a conference,

408
00:16:46.100 --> 00:16:48.520
having that kind of conversation.

409
00:16:48.520 --> 00:16:49.880
But what he said was quite startling.

410
00:16:49.880 --> 00:16:51.360
He said they were finishing up this project

411
00:16:51.360 --> 00:16:53.790
that had two terabytes of data.

412
00:16:53.790 --> 00:16:56.300
Well, two terabytes of data today is not very much, right?.

413
00:16:56.300 --> 00:16:58.030
You probably have that on your thumb drive

414
00:16:58.030 --> 00:16:59.550
or at least on your laptop.

415
00:16:59.550 --> 00:17:02.190
Over terabytes of data 1997 was enormous.

416
00:17:02.190 --> 00:17:05.380
In fact I didn't realize quite how enormous it was

417
00:17:05.380 --> 00:17:07.070
and absolute since I knew it was a big number,

418
00:17:07.070 --> 00:17:09.990
but I never realized it until I got back to work

419
00:17:09.990 --> 00:17:12.197
after that conference and talked to the managers there

420
00:17:12.197 --> 00:17:14.273
and said, hey we got this opportunity to bring in

421
00:17:14.273 --> 00:17:16.370
a two terabyte dataset.

422
00:17:16.370 --> 00:17:18.315
And they looked at me like I had three heads on it.

423
00:17:18.315 --> 00:17:20.220
(chuckles)
I said, what's up?

424
00:17:20.220 --> 00:17:22.500
And they said, you realize we've archived

425
00:17:22.500 --> 00:17:25.340
every space science experiment, data set.

426
00:17:25.340 --> 00:17:28.560
Since the history of NASA, since NASA began

427
00:17:28.560 --> 00:17:32.190
we have 15,000 experiment data sets here.

428
00:17:32.190 --> 00:17:35.480
And the sum total combined of all 15,000

429
00:17:35.480 --> 00:17:37.783
of those datasets is less than one terabyte.

430
00:17:38.800 --> 00:17:41.170
So you're asking us to bring in one more

431
00:17:41.170 --> 00:17:44.120
on top of the 15,000, which will require us

432
00:17:44.120 --> 00:17:47.173
to triple the capacity of the data center, are you kidding?

433
00:17:48.350 --> 00:17:52.580
So it was like, whoa, okay, that's quite a shock, okay.

434
00:17:52.580 --> 00:17:54.913
So they said to me the, well, they said to me that

435
00:17:54.913 --> 00:17:57.060
well if you can find some way to find funding

436
00:17:57.060 --> 00:17:59.927
to triple our capacity, then maybe we can do this.

437
00:17:59.927 --> 00:18:01.340

And I was thinking to myself,

438
00:18:01.340 --> 00:18:03.240
well how can I find funding to buy hardware?

439
00:18:03.240 --> 00:18:06.190
I know how to write proposals, to study colliding galaxies

440
00:18:06.190 --> 00:18:09.110
and Starburst galaxies and things like that.

441
00:18:09.110 --> 00:18:12.640
How do I run a proposal to buy equipment?

442
00:18:12.640 --> 00:18:14.360
And so a friend of mine, I was talking with,

443
00:18:14.360 --> 00:18:15.940
one of my senior scientists on my staff.

444
00:18:15.940 --> 00:18:18.740
He said, Kirk, have you ever heard of data mining?

445
00:18:18.740 --> 00:18:19.940
I said, no, what's that?

446
00:18:19.940 --> 00:18:22.850
And so I start reading about data mining

447
00:18:22.850 --> 00:18:24.920
and discovered this thing called machine learning

448
00:18:24.920 --> 00:18:25.980
which I had never heard before,

449
00:18:25.980 --> 00:18:28.653
which is an entirely new way of thinking about data,

450
00:18:29.630 --> 00:18:31.740
which is discovering patterns in data

451
00:18:31.740 --> 00:18:33.090
and not just analyzing data

452
00:18:33.090 --> 00:18:34.680
but actually discovering new patterns.

453
00:18:34.680 --> 00:18:37.380
And then in other words, the way I thought about it was

454
00:18:37.380 --> 00:18:40.250
generating new questions from an existing data set

455
00:18:40.250 --> 00:18:41.900
how to find new questions and data.

456
00:18:41.900 --> 00:18:43.330
Like, why is this pattern here?

457
00:18:43.330 --> 00:18:45.360
Why is this emergent phenomenon here?

458
00:18:45.360 --> 00:18:47.210
Why is this correlation changing?

459
00:18:47.210 --> 00:18:48.790
You'll finding the question in the data

460
00:18:48.790 --> 00:18:51.190
a new way of thinking about data.

461
00:18:51.190 --> 00:18:52.360
So as I was reading more and more

462
00:18:52.360 --> 00:18:54.060

about machine learning and data mining,

463
00:18:54.060 --> 00:18:56.300
I was really hooked on it because remember

464
00:18:56.300 --> 00:18:57.600
I'm a math lover, right?

465
00:18:57.600 --> 00:19:00.127
Besides a data lover, I'm a math lover.

466
00:19:00.127 --> 00:19:01.420
So this was right in my wheelhouse,

467
00:19:01.420 --> 00:19:02.580
Oh man data machine learning

468
00:19:02.580 --> 00:19:04.180
is all about mathematical algorithms.

469
00:19:04.180 --> 00:19:07.000
This is exciting, this is new math I never saw in college.

470
00:19:07.000 --> 00:19:10.070
I had umpteen semesters of calculus in college

471
00:19:10.070 --> 00:19:11.690
but I'd never had a course on machine learning.

472
00:19:11.690 --> 00:19:13.860
So I was excited, but I said to myself

473
00:19:13.860 --> 00:19:16.930
there's no way I can go back to my NASA managers and say,

474
00:19:16.930 --> 00:19:19.020
hey this is a lot of sexy math let's do this

475
00:19:19.020 --> 00:19:21.190
and that it wasn't going to sell.

476
00:19:21.190 --> 00:19:23.410
I just couldn't go there and say this is a lot of cool math.

477
00:19:23.410 --> 00:19:24.493
It had to be more to it than that

478
00:19:24.493 --> 00:19:27.980
because they're serving a research community worldwide

479
00:19:27.980 --> 00:19:30.310
who were coming there for data, not for more math.

480
00:19:30.310 --> 00:19:32.060
And so yeah, people want to learn more math

481
00:19:32.060 --> 00:19:34.940
but that's not why we are existence right there, right?

482
00:19:34.940 --> 00:19:36.600
So I said, I got to find some hook.

483
00:19:36.600 --> 00:19:40.050
I gotta find some way to see what the real value

484
00:19:40.050 --> 00:19:44.040
of this is besides it makes Kirk happy, Kirksville cool.

485
00:19:44.040 --> 00:19:47.573
How can I make this sensible to other people?

486
00:19:48.800 --> 00:19:53.510
So in 1997, email came across with an invitation

487
00:19:53.510 --> 00:19:54.950

at NASA Goddard space flight center

488
00:19:54.950 --> 00:19:57.590
for a lunchtime talk, which is not unusual.

489
00:19:57.590 --> 00:19:58.810
There were two or three lunch time talks

490
00:19:58.810 --> 00:20:00.010
every single day there,

491
00:20:00.010 --> 00:20:02.600
a research facility with 20,000 people there

492
00:20:02.600 --> 00:20:04.440
and lots of engineers and scientists

493
00:20:05.669 --> 00:20:06.960
I always getting such invitations

494
00:20:06.960 --> 00:20:07.880
but this one was special.

495
00:20:07.880 --> 00:20:10.390
It was an invitation to hear a talk

496
00:20:10.390 --> 00:20:12.637
from an IBM researcher on data mining.

497
00:20:12.637 --> 00:20:14.360
And I said, okay, I got to go here

498
00:20:14.360 --> 00:20:16.100
and see what this is all about.

499
00:20:16.100 --> 00:20:18.310
So I went to this talk and to this day

500
00:20:18.310 --> 00:20:21.143
I swear at this, okay, that was 24 years ago.

501
00:20:22.010 --> 00:20:24.090
And to this day, I say it was probably one

502
00:20:24.090 --> 00:20:26.180
of the most clever presentations

503
00:20:26.180 --> 00:20:28.730
I'd ever seen this research scientist.

504
00:20:28.730 --> 00:20:31.000
She began by filling the Blackboard

505
00:20:31.000 --> 00:20:32.200
and we didn't have white boards.

506
00:20:32.200 --> 00:20:34.230
She filled the Blackboard with equations.

507
00:20:34.230 --> 00:20:36.410
I mean, she was talking about with the data mining

508
00:20:36.410 --> 00:20:38.750
they were doing at IBM

509
00:20:38.750 --> 00:20:40.930
and filled the Blackboard with equations

510
00:20:40.930 --> 00:20:44.500
for the first 30 minutes of this hour-long lunch talk.

511
00:20:44.500 --> 00:20:47.430
And okay, so like I said, I like math

512
00:20:47.430 --> 00:20:49.110

but that wasn't doing it for me.

513
00:20:49.110 --> 00:20:51.630
This wasn't gonna help me to explain it to anybody.

514
00:20:51.630 --> 00:20:53.010
I get that it's a lot of math,

515
00:20:53.010 --> 00:20:55.000
but why is this important?

516
00:20:55.000 --> 00:20:57.710
What is the fundamental significance of this

517
00:20:57.710 --> 00:21:01.453
for my job, for the data centers role for NASA?

518
00:21:02.700 --> 00:21:05.290
So I wasn't quite sure until 30 minutes

519
00:21:05.290 --> 00:21:08.480
into her hour long talk, she just stopped, like that.

520
00:21:10.846 --> 00:21:11.679
(chuckles)

521
00:21:11.679 --> 00:21:12.620
She just stopped.

522
00:21:12.620 --> 00:21:13.820
(laughing)

523
00:21:13.820 --> 00:21:15.280
And she said," I'm now gonna to tell you

524
00:21:15.280 --> 00:21:17.367
about our summer intern program."

525
00:21:19.090 --> 00:21:20.983
And she stopped again.

526
00:21:21.840 --> 00:21:25.010
And I swear she was playing with this great speaker

527
00:21:25.010 --> 00:21:28.780
because she just had filled this Blackboard with equations.

528
00:21:28.780 --> 00:21:32.090
Now she's gonna talk about the summer intern program.

529
00:21:32.090 --> 00:21:34.237
And so she probably read our minds and she said

530
00:21:34.237 --> 00:21:35.070
"I know what you're thinking.

531
00:21:35.070 --> 00:21:36.990
"You said, what does this have to do with that?"

532
00:21:36.990 --> 00:21:40.000
And I said, "it's because we teach this stuff

533
00:21:40.840 --> 00:21:44.237
to high school students in inner city, New York."

534
00:21:46.070 --> 00:21:47.450
And I see some of your eyes rolling.

535
00:21:47.450 --> 00:21:48.881
And that's what happened to me.

536
00:21:48.881 --> 00:21:53.030
I as well and I said, right, you teach all this math stuff

537
00:21:53.030 --> 00:21:55.540

to high school students and interested in New York

538
00:21:55.540 --> 00:21:58.060
at the IBM Watson Research Center, I get it.

539
00:21:58.060 --> 00:21:58.893
No, I don't get it.

540
00:21:58.893 --> 00:22:00.190
I don't understand what you're talking about.

541
00:22:00.190 --> 00:22:01.670
So she knew we were probably thinking that.

542
00:22:01.670 --> 00:22:04.490
So she said, yeah, we teach this subject

543
00:22:04.490 --> 00:22:06.550
and the context of the thing that matters most

544
00:22:06.550 --> 00:22:07.383
in their life.

545
00:22:08.960 --> 00:22:11.780
So I'm saying, okay, I've never lived in a big city.

546
00:22:11.780 --> 00:22:13.320
My father was US air force,

547
00:22:13.320 --> 00:22:16.660
he worked in the Minuteman missile nuclear defense program.

548
00:22:16.660 --> 00:22:18.780
He would never have lived near a large city

549
00:22:18.780 --> 00:22:20.070
'cause you don't put missile bases

550
00:22:20.070 --> 00:22:21.990
near large cities on purpose.

551
00:22:21.990 --> 00:22:23.120
So I said,

552
00:22:23.120 --> 00:22:25.480
I don't know what is the most important thing in the life

553
00:22:25.480 --> 00:22:28.460
of a big city, inner city, high school student.

554
00:22:28.460 --> 00:22:30.410
I just didn't know the answer to that.

555
00:22:30.410 --> 00:22:32.250
But she said, she teaches it in that context

556
00:22:32.250 --> 00:22:33.830
and she said, the context is basketball.

557
00:22:33.830 --> 00:22:36.960
They love basketball, street basketball.

558
00:22:36.960 --> 00:22:39.490
They play it after school, during school, before school

559
00:22:39.490 --> 00:22:41.300
they love it, their whole life is basketball.

560
00:22:41.300 --> 00:22:45.070
And so IBM created this program called IBM scout

561
00:22:45.070 --> 00:22:48.160
which every NBA, National Basketball Association team

562
00:22:48.160 --> 00:22:51.730

uses to predict next best play in all their games.

563
00:22:51.730 --> 00:22:54.320
They do data mining of all the play histories

564
00:22:54.320 --> 00:22:55.280
of all the games.

565
00:22:55.280 --> 00:22:56.320
And when they play an opponent,

566
00:22:56.320 --> 00:22:58.530
they understand based upon the time

567
00:22:58.530 --> 00:22:59.800
on the clock the number...

568
00:22:59.800 --> 00:23:01.090
The particular players on the field

569
00:23:01.090 --> 00:23:04.120
the particular score on the game, et cetera,

570
00:23:04.120 --> 00:23:06.030
what the next play is likely to be.

571
00:23:06.030 --> 00:23:08.930
So they use this IBM data mining software

572
00:23:08.930 --> 00:23:11.024
to help coaches win national championships

573
00:23:11.024 --> 00:23:13.200
and there's a story that they could tell

574
00:23:13.200 --> 00:23:15.180
about how that did happen once.

575
00:23:15.180 --> 00:23:17.590
Anyway, so when the students heard about this

576
00:23:17.590 --> 00:23:18.663
they were just excited to learn it,

577
00:23:18.663 --> 00:23:20.840
they were excited to learn the science and math

578
00:23:20.840 --> 00:23:22.680
because it was relevant to something

579
00:23:22.680 --> 00:23:24.530
that was extremely important in their life,

580
00:23:24.530 --> 00:23:25.580
which was basketball.

581
00:23:26.880 --> 00:23:29.120
So at this point, I'm getting the vibe now,

582
00:23:29.120 --> 00:23:30.361
I'm getting the vibe, this is pretty cool,

583
00:23:30.361 --> 00:23:33.210
this is touching the lives of people

584
00:23:33.210 --> 00:23:34.750
and inner city environment

585
00:23:34.750 --> 00:23:36.180
where really there's a lot of pressures

586
00:23:36.180 --> 00:23:39.460
against sort of academic achievement, academic performance.

587
00:23:39.460 --> 00:23:40.420

Remember what they wanna do,

588
00:23:40.420 --> 00:23:41.580
they wanna get out of the classroom

589
00:23:41.580 --> 00:23:43.750
and go play their street basketball.

590
00:23:43.750 --> 00:23:45.077
So this probably would have been enough

591
00:23:45.077 --> 00:23:48.090
but what she said next completely changed my life.

592
00:23:48.090 --> 00:23:50.160
And I swear to that, this is true.

593
00:23:50.160 --> 00:23:52.490
I don't know exactly how she said it, but I know exactly

594
00:23:52.490 --> 00:23:54.720
what my thoughts were after she said it.

595
00:23:54.720 --> 00:23:56.240
So I'll tell you what the gist of what she said was

596
00:23:56.240 --> 00:23:58.983
and then I'll tell you exactly what I thought after.

597
00:24:00.170 --> 00:24:02.280
What she said, this is the...

598
00:24:02.280 --> 00:24:04.480
We measure the impact and the success

599
00:24:04.480 --> 00:24:07.680
of our intern program by the graduation rate

600
00:24:07.680 --> 00:24:11.100
of the students, the interns that come through our program.

601
00:24:11.100 --> 00:24:12.520
And you have to realize the students that come

602
00:24:12.520 --> 00:24:14.150
through our program, their inner city students

603
00:24:14.150 --> 00:24:17.233
with no very little academic pressure to succeed,

604
00:24:17.233 --> 00:24:19.646
very little pressure in their family

605
00:24:19.646 --> 00:24:21.560
and in their circles and their peer groups

606
00:24:21.560 --> 00:24:24.033
to achieve academically successful.

607
00:24:25.140 --> 00:24:28.430
So it's important to us that we see how well they do

608
00:24:28.430 --> 00:24:30.580
after they come through our program.

609
00:24:30.580 --> 00:24:32.360
And these students come from high schools

610
00:24:32.360 --> 00:24:35.420
where the traditional graduation rate is about 50%,

611
00:24:35.420 --> 00:24:38.400
about 50% of the students in those high schools graduate.

612
00:24:38.400 --> 00:24:40.330

But the students who come through our program,

613
00:24:40.330 --> 00:24:45.093
our intern program, their graduation rate is 97%.

614
00:24:46.160 --> 00:24:49.280
97% out of a population where it's typically 50

615
00:24:50.730 --> 00:24:53.373
and my jaw dropped virtually.

616
00:24:54.400 --> 00:24:55.380
And I said to myself

617
00:24:55.380 --> 00:24:57.240
and this is exactly what I said 24 years ago.

618
00:24:57.240 --> 00:24:59.470
I'll never forget even the words in my own head.

619
00:24:59.470 --> 00:25:01.160
I said, if this data mining thing,

620
00:25:01.160 --> 00:25:02.800
which we now call data science,

621
00:25:02.800 --> 00:25:04.970
I said, if this data mining thing

622
00:25:04.970 --> 00:25:08.120
has this much power to change people's lives

623
00:25:08.120 --> 00:25:10.293
I have to do this for the rest of my life.

624
00:25:11.430 --> 00:25:12.400
And I have been.

625
00:25:12.400 --> 00:25:16.530
I mean, it's just touched me so deeply that way.

626
00:25:16.530 --> 00:25:21.530
So at that point, I had a mission to find the applications

627
00:25:22.210 --> 00:25:23.890
of what we now call it, data science

628
00:25:23.890 --> 00:25:25.450
and everything I did at NASA

629
00:25:25.450 --> 00:25:27.800
so much so that my friends gave me a little plastic camera.

630
00:25:27.800 --> 00:25:29.560
That was Kirks data mining hammer

631
00:25:29.560 --> 00:25:30.900
cause to a child with a hammer.

632
00:25:30.900 --> 00:25:32.533
All the world is a nail, of course.

633
00:25:32.533 --> 00:25:33.520
(laughing)

634
00:25:33.520 --> 00:25:36.420
So to a Kirk with data mining knowledge

635
00:25:36.420 --> 00:25:38.420
every problem is a data science problem.

636
00:25:39.500 --> 00:25:41.840
So I built this a website at NASA

637
00:25:41.840 --> 00:25:45.440

to be able to share resources, links to talks

638
00:25:45.440 --> 00:25:49.130
and conferences and papers, projects, software

639
00:25:49.130 --> 00:25:49.963
anything I could find.

640
00:25:49.963 --> 00:25:52.880
I created this tool to help sort of build

641
00:25:52.880 --> 00:25:55.380
sort of NASA's presence around data mining.

642
00:25:55.380 --> 00:25:57.870
Again, data mining the phrase we used in those days

643
00:25:57.870 --> 00:25:59.720
which is just the application of machine learning

644
00:25:59.720 --> 00:26:01.423
which we call data science today.

645
00:26:02.730 --> 00:26:04.240
So what I didn't realize was

646
00:26:04.240 --> 00:26:05.460
how much attention this was getting,

647
00:26:05.460 --> 00:26:07.630
and, oh, by the way there's a little shout out there.

648
00:26:07.630 --> 00:26:11.240
This is sort of the first top of that website

649
00:26:11.240 --> 00:26:14.530
which you can now find on the archive or a back machine,

650
00:26:14.530 --> 00:26:15.950
a little shout out down there to the basketball play

651
00:26:15.950 --> 00:26:19.480
by play histories to that talk that I heard

652
00:26:19.480 --> 00:26:21.633
for that net IBM researcher.

653
00:26:23.500 --> 00:26:26.690
So this was taking place or putting this together

654
00:26:26.690 --> 00:26:29.280
sort of during 1998 and onward.

655
00:26:29.280 --> 00:26:31.820
And then a funny thing happened.

656
00:26:31.820 --> 00:26:32.720
Another funny thing happened,

657
00:26:32.720 --> 00:26:34.260
my whole life was about funny things happening.

658
00:26:34.260 --> 00:26:35.093
(laughing)

659
00:26:35.093 --> 00:26:37.710
A funny thing happened in October, 2000.

660
00:26:37.710 --> 00:26:41.133
October, 2000, roughly one month after 911,

661
00:26:42.536 --> 00:26:44.270
(coughs)
excuse me.

662

00:26:44.270 --> 00:26:47.050
That morning in my NASA office, my phone rang

663
00:26:47.050 --> 00:26:49.417
and the voice on the other end of the phone said

664
00:26:49.417 --> 00:26:51.647
"can you brief the president tomorrow morning

665
00:26:51.647 --> 00:26:52.547
"on data mining?"

666
00:26:54.010 --> 00:26:57.660
And I just freeze, I said," you mean the president?"

667
00:26:57.660 --> 00:26:59.867
They said, "yes the president of the United States

668
00:26:59.867 --> 00:27:03.290
"would like to brief you tomorrow morning on data mining."

669
00:27:03.290 --> 00:27:05.310
So I said, " well, how the heck did you ever find me?"

670
00:27:05.310 --> 00:27:08.507
And they said," well, we realized we needed data mining

671
00:27:08.507 --> 00:27:10.793
"to mine, the different databases out there

672
00:27:10.793 --> 00:27:13.267
"and the national security realm to make sure this

673
00:27:13.267 --> 00:27:15.567
"something like nine 11 doesn't happen again."

674
00:27:16.420 --> 00:27:17.253
I said, "well, how'd you find me?"

675
00:27:17.253 --> 00:27:18.987
And they said, "well, we called around the various agencies

676
00:27:18.987 --> 00:27:21.847
"including science agencies to see who the experts were

677
00:27:21.847 --> 00:27:23.497
"and the people at NASA headquarters said

678
00:27:23.497 --> 00:27:25.160
"you're the NASA expert."

679
00:27:25.160 --> 00:27:28.050
So two things happened in that conversation.

680
00:27:28.050 --> 00:27:29.360
Two thoughts to that conversation.

681
00:27:29.360 --> 00:27:30.870
I still remember was first of all

682
00:27:30.870 --> 00:27:32.670
the teeny little bit I knew,

683
00:27:32.670 --> 00:27:34.960
which believe me though it was a teeny little bit

684
00:27:34.960 --> 00:27:36.590
that I knew in those days

685
00:27:36.590 --> 00:27:39.190
cause I was just here publishing other people's work

686
00:27:40.180 --> 00:27:41.760
on this webpage.

687

00:27:41.760 --> 00:27:42.630
The teeny bit I knew

688
00:27:42.630 --> 00:27:45.280
was already considered expert, wow, okay.

689
00:27:45.280 --> 00:27:47.830
And the other thing that really struck me was that

690
00:27:47.830 --> 00:27:49.920
this stuff that I do is not just impactful

691
00:27:49.920 --> 00:27:52.860
in the sciences, but at world serious event

692
00:27:52.860 --> 00:27:54.330
and world series applications.

693
00:27:54.330 --> 00:27:55.420
I mean every everywhere

694
00:27:55.420 --> 00:27:57.503
not just in the sciences but everywhere.

695
00:27:58.550 --> 00:28:00.207
So that inspired me to look more deeply

696
00:28:00.207 --> 00:28:01.910
and to start to all of a sudden

697
00:28:01.910 --> 00:28:03.640
I started seeing all these national reports

698
00:28:03.640 --> 00:28:04.610
and over the years went by

699
00:28:04.610 --> 00:28:06.930
I started compiling a list of national reports

700
00:28:06.930 --> 00:28:08.370
about this national imperative

701
00:28:08.370 --> 00:28:10.450
for big data and data science.

702
00:28:10.450 --> 00:28:11.360
And there's a list there.

703
00:28:11.360 --> 00:28:12.460
I'm not gonna read this obviously

704
00:28:12.460 --> 00:28:13.860
but these slides will be available later.

705
00:28:13.860 --> 00:28:15.390
So you can look through those,

706
00:28:15.390 --> 00:28:17.050
those that are in red there are ones

707
00:28:17.050 --> 00:28:18.970
that I was on actually on those panels

708
00:28:18.970 --> 00:28:20.620
and contributed to those reports.

709
00:28:21.750 --> 00:28:23.930
So it really became clear to me that data literacy matters

710
00:28:23.930 --> 00:28:27.520
because it's gonna touch even in early two thousands,

711
00:28:27.520 --> 00:28:29.220
it was clear this digital revolution

712

00:28:29.220 --> 00:28:30.630
was gonna touch every organization

713
00:28:30.630 --> 00:28:33.680
every industry, every job, everything.

714
00:28:33.680 --> 00:28:35.610
So then I moved on and I said

715
00:28:35.610 --> 00:28:36.880
I got to do something about this.

716
00:28:36.880 --> 00:28:40.340
So I left that my 20 years, almost 20 years at NASA

717
00:28:40.340 --> 00:28:43.910
became professor of astrophysics at George Mason university.

718
00:28:43.910 --> 00:28:45.780
I got tenured full professorship there.

719
00:28:45.780 --> 00:28:47.640
And we started the world's first data science

720
00:28:47.640 --> 00:28:51.160
undergraduate degree program about 15 years ago

721
00:28:51.160 --> 00:28:52.700
I actually never taught an astrophysics course

722
00:28:52.700 --> 00:28:55.010
which is I to take that data science.

723
00:28:55.010 --> 00:28:57.570
And so it was all about teaching students

724
00:28:57.570 --> 00:29:00.910
how to use data correctly and how to use data ethically.

725
00:29:00.910 --> 00:29:02.510
And when you come back to these slides

726
00:29:02.510 --> 00:29:04.470
you can read these cartoons here.

727
00:29:04.470 --> 00:29:06.150
But I really found

728
00:29:06.150 --> 00:29:08.010
what I believe was sort of my passionate life

729
00:29:08.010 --> 00:29:10.410
teaching data science to the next generation,

730
00:29:10.410 --> 00:29:11.550
data literacy for all

731
00:29:11.550 --> 00:29:13.920
I put together this list on my blog site

732
00:29:13.920 --> 00:29:14.753
which you can check out

733
00:29:14.753 --> 00:29:17.340
which is appropriately named Rocket data Science.

734
00:29:17.340 --> 00:29:19.110
It has nothing to do with rockets

735
00:29:19.110 --> 00:29:21.460
but just shout out to my pastor.

736
00:29:21.460 --> 00:29:25.260
I got this passion, which led me to join Twitter in 2012.

737

00:29:25.260 --> 00:29:26.880
So guess what?

738
00:29:26.880 --> 00:29:30.950
Tomorrow is my ninth anniversary, my ninth Twitter-versary

739
00:29:30.950 --> 00:29:32.720
actually started at a conference.

740
00:29:32.720 --> 00:29:34.300
Someone challenged me at a conference

741
00:29:34.300 --> 00:29:36.080
they said to me you need to be on Twitter

742
00:29:36.080 --> 00:29:37.260
to share the love of this stuff.

743
00:29:37.260 --> 00:29:38.093
And I said, Twitter

744
00:29:38.093 --> 00:29:39.350
why would I want to tell people what I had

745
00:29:39.350 --> 00:29:42.310
for breakfast and what clothes wearing?

746
00:29:42.310 --> 00:29:43.157
And he said, why would you say that?

747
00:29:43.157 --> 00:29:45.370
And I said, isn't Twitter all about Justin Bieber?

748
00:29:45.370 --> 00:29:47.160
(laughing)

749
00:29:47.160 --> 00:29:49.070
He said," no, there's a real science community there."

750
00:29:49.070 --> 00:29:51.730
So I joined Twitter, started sharing my love there

751
00:29:51.730 --> 00:29:54.627
and just doing what I love, just sharing the love of data,

752
00:29:54.627 --> 00:29:58.280
trying to build literacy, 140 characters at a time.

753
00:29:58.280 --> 00:30:00.430
Eventually I grew a huge population

754
00:30:00.430 --> 00:30:02.660
and I became this thing called top influencer.

755
00:30:02.660 --> 00:30:05.030
And I didn't even know what that meant,

756
00:30:05.030 --> 00:30:07.490
but anyway so certainly after that, this company

757
00:30:07.490 --> 00:30:09.390
Booz Allen Hamilton called me,

758
00:30:09.390 --> 00:30:10.467
they said, "how would you like to do this

759
00:30:10.467 --> 00:30:12.910
"across all disciplines, not just in the sciences?"

760
00:30:12.910 --> 00:30:14.730
And I said, yes,

761
00:30:14.730 --> 00:30:16.520
who became their first principal data scientist,

762

00:30:16.520 --> 00:30:19.120
first data science fellow and executive advisor.

763
00:30:19.120 --> 00:30:20.150
Here's a picture of me at the top.

764
00:30:20.150 --> 00:30:22.120
And here's another picture of me when another president

765
00:30:22.120 --> 00:30:24.630
called and asked me to represent the United States

766
00:30:24.630 --> 00:30:29.067
and the G7 Summit and tour in Italy in 2017, years fly by.

767
00:30:32.310 --> 00:30:35.883
So another amazing opportunity, so it's actually been.

768
00:30:36.760 --> 00:30:38.110
I'm waiting for the current president,

769
00:30:38.110 --> 00:30:39.350
but now three presidents in a row

770
00:30:39.350 --> 00:30:42.210
have invited me to things in the executive office

771
00:30:42.210 --> 00:30:43.043
of the white house.

772
00:30:43.043 --> 00:30:44.851
And so that I'm waiting for that next call.

773
00:30:44.851 --> 00:30:45.970
(laughing)
So they

774
00:30:45.970 --> 00:30:47.030

were watching out there.

775
00:30:47.030 --> 00:30:48.980
So I started doing this and I was really attracted

776
00:30:48.980 --> 00:30:50.850
to Booz Allen because they were creating all kinds

777
00:30:50.850 --> 00:30:52.050
of cool things.

778
00:30:52.050 --> 00:30:54.580
The field guide to data science, the data science bowl

779
00:30:54.580 --> 00:30:57.060
which is actually a using data for social good

780
00:30:57.060 --> 00:30:59.280
created this data science 5k program

781
00:30:59.280 --> 00:31:01.530
with actually training 5,000 data scientists

782
00:31:01.530 --> 00:31:03.460
in our organization which I understand.

783
00:31:03.460 --> 00:31:05.938
I learned that our data science 5k team

784
00:31:05.938 --> 00:31:07.480
brought that training program

785
00:31:07.480 --> 00:31:09.639
to the NIH National Library of medicine

786
00:31:09.639 --> 00:31:13.140
to boost the skills of the staff there building

787
00:31:13.140 --> 00:31:15.360
what I would call building data literacy, data fluency,

788
00:31:15.360 --> 00:31:19.490
data science, data literacy, and data joy.

789
00:31:19.490 --> 00:31:20.730
So there's some links to articles here,

790
00:31:20.730 --> 00:31:22.320
which I found really fascinating,

791
00:31:22.320 --> 00:31:24.680
but I love what the director said, Patricia,

792
00:31:24.680 --> 00:31:26.040
Brendan doctor read

793
00:31:26.040 --> 00:31:29.180
and said that originally folks thought about data science

794
00:31:29.180 --> 00:31:31.770
as a research tool but now we can see it as part

795
00:31:31.770 --> 00:31:33.460
of everyday activity.

796
00:31:33.460 --> 00:31:36.210
And I said, that is exactly right.

797
00:31:36.210 --> 00:31:39.220
And so that just the joy of seeing that in the room

798
00:31:39.220 --> 00:31:41.270
and those articles that are written about their experience

799
00:31:41.270 --> 00:31:44.870

I was really proud of Booz Allen being able to assist

800
00:31:44.870 --> 00:31:46.430
in bringing that to the NIH.

801
00:31:48.700 --> 00:31:51.620
So I was able to use my executive advisor role

802
00:31:51.620 --> 00:31:56.170
and my sort of data literacy mission in life

803
00:31:56.170 --> 00:31:57.620
to explain to people many things

804
00:31:57.620 --> 00:31:59.700
about analytics and data science

805
00:31:59.700 --> 00:32:01.613
including this maturity ladder.

806
00:32:01.613 --> 00:32:03.650
So last time as I start that conversation

807
00:32:03.650 --> 00:32:05.220
with executive advising of where are you,

808
00:32:05.220 --> 00:32:07.480
are you doing hindsight to just reporting

809
00:32:07.480 --> 00:32:11.290
descriptive analytics or oversight diagnostic analytics

810
00:32:11.290 --> 00:32:13.150
or are you moving up this ladder of maturity

811
00:32:13.150 --> 00:32:16.070
like predictive modeling and prescriptive modeling

812
00:32:16.070 --> 00:32:17.371
to cognitive analytics, ultimately,

813
00:32:17.371 --> 00:32:18.907
which is finding the right question

814
00:32:18.907 --> 00:32:21.010
and the data you should be asking.

815
00:32:21.010 --> 00:32:21.850
So what's the difference between

816
00:32:21.850 --> 00:32:22.930
prescriptive and predicted?

817
00:32:22.930 --> 00:32:25.100
This I'm gonna be wrapping up here in just a second

818
00:32:25.100 --> 00:32:27.370
and this is important for what my closing comments

819
00:32:27.370 --> 00:32:29.000
are gonna be.

820
00:32:29.000 --> 00:32:31.510
So mathematically what predictive analytics is,

821
00:32:31.510 --> 00:32:34.170
you find a function that basically connects

822
00:32:35.400 --> 00:32:37.960
some historical data to a future outcome, okay?

823
00:32:37.960 --> 00:32:40.210
So consider a D as your data.

824
00:32:40.210 --> 00:32:41.740

So given the data find Y

825
00:32:41.740 --> 00:32:45.343
where Y is some outcome in some future time?

826
00:32:46.408 --> 00:32:48.890
So that's predictive modeling, very common thing we do.

827
00:32:48.890 --> 00:32:50.860
Prescriptive modeling in my mind is the opposite

828
00:32:50.860 --> 00:32:55.400
said if some of those variables are causal variables,

829
00:32:55.400 --> 00:32:58.780
And what we'd call in medical clinical research treatments.

830
00:32:58.780 --> 00:32:59.923
If you can find some of those variables

831
00:32:59.923 --> 00:33:01.590
that are causal variables

832
00:33:01.590 --> 00:33:03.610
some of those things will become, can become treatments

833
00:33:03.610 --> 00:33:05.660
and you can cause a different outcome.

834
00:33:05.660 --> 00:33:08.340
You can move the needle and actually change something.

835
00:33:08.340 --> 00:33:10.270
So if you wanna find a different outcome

836
00:33:10.270 --> 00:33:11.220
that is you don't like the one

837
00:33:11.220 --> 00:33:12.570
that the predictive model tells you

838
00:33:12.570 --> 00:33:15.110
but you wanna find a different, a more optimal outcome.

839
00:33:15.110 --> 00:33:17.470
What are the data that will move it there?

840
00:33:17.470 --> 00:33:18.303
What are the treatments?

841
00:33:18.303 --> 00:33:19.662
What are the variables?

842
00:33:19.662 --> 00:33:21.470
What are the environmental variables

843
00:33:21.470 --> 00:33:22.970
and states you can change?

844
00:33:22.970 --> 00:33:25.870
What are the essentially prescriptions

845
00:33:25.870 --> 00:33:27.560
you can give to change the outcome?

846
00:33:27.560 --> 00:33:29.610
So in medical science, we call it a prescription,

847
00:33:29.610 --> 00:33:32.573
but in every other aspect it's called prescriptive.

848
00:33:33.750 --> 00:33:35.750
So those are long-winded explanations.

849
00:33:35.750 --> 00:33:37.410

There's also shorter description of

850
00:33:37.410 --> 00:33:40.870
how these two things are predictive given X find Y

851
00:33:40.870 --> 00:33:43.560
prescriptive given Y find X?

852
00:33:43.560 --> 00:33:45.750
I think you can see those two things are opposite, right?

853
00:33:45.750 --> 00:33:48.310
Given X find Y, given Y find index, okay?

854
00:33:48.310 --> 00:33:50.860
So I said, okay, I got the long-winded version.

855
00:33:50.860 --> 00:33:53.040
I got the short version of explaining

856
00:33:53.040 --> 00:33:54.510
how these things are different.

857
00:33:54.510 --> 00:33:56.320
I went and searched for some philosophers.

858
00:33:56.320 --> 00:33:57.160
Who've talked about this

859
00:33:57.160 --> 00:34:00.190
to see if I could put the description in another way.

860
00:34:00.190 --> 00:34:02.537
And sure enough I found Confucius that said

861
00:34:02.537 --> 00:34:05.240
"Study your past to know your future."

862
00:34:05.240 --> 00:34:07.520
So if you know anything about supervised machine learning

863
00:34:07.520 --> 00:34:09.630
where you have training sets to build a predictive model

864
00:34:09.630 --> 00:34:12.240
that's exactly a statement of supervised machine learning

865
00:34:12.240 --> 00:34:14.347
going back thousands of years from Confucius

866
00:34:14.347 --> 00:34:16.630
"study your past to know your future."

867
00:34:16.630 --> 00:34:17.800
So I had to look far and wide

868
00:34:17.800 --> 00:34:20.830
to find a philosopher who said something about prescriptive.

869
00:34:20.830 --> 00:34:21.890
I'd look really, really hard.

870
00:34:21.890 --> 00:34:25.190
And I finally found it famous baseball philosopher

871
00:34:25.190 --> 00:34:27.477
Yogi Berra, who said the future.

872
00:34:27.477 --> 00:34:28.567
"Ain't what it used to be."

873
00:34:28.567 --> 00:34:29.400
(laughing)

874
00:34:29.400 --> 00:34:31.240

That is to say, you predict an outcome,

875
00:34:31.240 --> 00:34:32.927
you don't like it, you can do something to change it.

876
00:34:32.927 --> 00:34:35.453
"The future ain't what it used to be", okay.

877
00:34:36.310 --> 00:34:38.350
So prescriptive analytics for me

878
00:34:38.350 --> 00:34:40.880
ties all of the things together in my life

879
00:34:40.880 --> 00:34:41.713
because what do we...

880
00:34:41.713 --> 00:34:43.780
What did I first learn in astronomy is these data points.

881
00:34:43.780 --> 00:34:45.740
For example, asteroids in space.

882
00:34:45.740 --> 00:34:47.710
We can see these asteroids

883
00:34:47.710 --> 00:34:49.270
measure their positions over time,

884
00:34:49.270 --> 00:34:51.020
and we can predict where it's going to go.

885
00:34:51.020 --> 00:34:52.920
And if it impacts earth,

886
00:34:52.920 --> 00:34:54.880
we call that a killer asteroid moment,

887
00:34:54.880 --> 00:34:56.380
it'll wipe out civilization,

888
00:34:56.380 --> 00:35:00.580
Oh there's gonna be one that's happening next Tuesday.

889
00:35:00.580 --> 00:35:02.320
Have a nice day.

890
00:35:02.320 --> 00:35:03.500
Well, if I say that to you, you'll say,

891
00:35:03.500 --> 00:35:04.380
wait Kirk come back.

892
00:35:04.380 --> 00:35:05.730
Can't you do something about it?

893
00:35:05.730 --> 00:35:06.563
(laughing)

894
00:35:06.563 --> 00:35:09.440
Well, I say, Oh, you don't want just a predictive model,

895
00:35:09.440 --> 00:35:11.960
you want to prescriptive model, okay.

896
00:35:11.960 --> 00:35:14.270
So every organization, every dentistry

897
00:35:14.270 --> 00:35:15.610
has its killer asteroid moment

898
00:35:15.610 --> 00:35:16.950
where you're predicting something

899
00:35:16.950 --> 00:35:18.710

you don't desire to happen.

900
00:35:18.710 --> 00:35:21.220
Whether it's a machine failure or an engine failure

901
00:35:21.220 --> 00:35:26.220
or a customer who leaves the leaves a shopping cart empty

902
00:35:26.330 --> 00:35:28.777
customer attrition or employee attrition

903
00:35:28.777 --> 00:35:30.323
of the employee who leaves,

904
00:35:31.540 --> 00:35:33.350
the patient who's not gonna get well,

905
00:35:33.350 --> 00:35:35.070
you always, always wanna find

906
00:35:35.070 --> 00:35:37.490
a prescriptive action that you can take

907
00:35:37.490 --> 00:35:40.230
from your data analytics, your data science explorations.

908
00:35:40.230 --> 00:35:42.300
What can I do to change the outcome?

909
00:35:42.300 --> 00:35:44.330
What can I do to change the future?

910
00:35:44.330 --> 00:35:46.090
And so I always tell this killer asteroid story

911
00:35:46.090 --> 00:35:49.083
as a metaphor or as an analogy to anything that we do.

912
00:35:51.080 --> 00:35:55.010
And so this ties back to all the stories today

913
00:35:55.010 --> 00:36:00.010
tie into this one message I want to end with here today.

914
00:36:01.420 --> 00:36:02.920
And that is a famous quote

915
00:36:02.920 --> 00:36:06.060
from this poet who said, I think about data...

916
00:36:06.060 --> 00:36:07.280
Well, he didn't say this, but I'm saying

917
00:36:07.280 --> 00:36:09.670
data scientists are explorers, we're exploring vast

918
00:36:09.670 --> 00:36:11.350
and endless seas of data.

919
00:36:11.350 --> 00:36:12.530
And so I take this quote

920
00:36:12.530 --> 00:36:15.457
about ship building and apply it to data science.

921
00:36:15.457 --> 00:36:16.487
"If you want to build a ship

922
00:36:16.487 --> 00:36:18.657
"don't drum up people to gather wood

923
00:36:18.657 --> 00:36:21.197
"and don't assign them tasks and work

924
00:36:21.197 --> 00:36:23.487

"but rather teach them to yearn

925
00:36:23.487 --> 00:36:25.077
"for the vast and endless sea."

926
00:36:26.170 --> 00:36:27.530
For me, that's the exact story

927
00:36:27.530 --> 00:36:31.010
of those high school students back in New York.

928
00:36:31.010 --> 00:36:36.010
But the IBM research show them something that they can do.

929
00:36:37.270 --> 00:36:38.940
Something that they care about

930
00:36:38.940 --> 00:36:40.870
something that will touch their lives

931
00:36:41.810 --> 00:36:42.990
and that math and science thing

932
00:36:42.990 --> 00:36:44.510
that they thought was just a task

933
00:36:44.510 --> 00:36:46.130
they had to get through at school

934
00:36:46.130 --> 00:36:48.083
is now something they want to do.

935
00:36:48.940 --> 00:36:50.340
For me data science is like that.

936
00:36:50.340 --> 00:36:53.120
I've given talks everywhere to people,

937
00:36:53.120 --> 00:36:57.070
general public, college students who hate math and science.

938
00:36:57.070 --> 00:36:58.700
And I see the transformation in people

939
00:36:58.700 --> 00:37:00.170
when they realize that thing in their hand,

940
00:37:00.170 --> 00:37:02.010
that digital phone those things

941
00:37:02.010 --> 00:37:04.660
on their laptops and desktops

942
00:37:04.660 --> 00:37:06.560
those things are producing value,

943
00:37:06.560 --> 00:37:10.610
creating new products, innovations, and you...

944
00:37:10.610 --> 00:37:12.950
Everyone can participate in that.

945
00:37:12.950 --> 00:37:14.730
Everyone is born in curious,

946
00:37:14.730 --> 00:37:17.070
everyone is born a scientist in my opinion.

947
00:37:17.070 --> 00:37:19.760
And once you learn that it's all about finding patterns

948
00:37:19.760 --> 00:37:21.120
which we all do as a child.

949
00:37:21.120 --> 00:37:24.010

From the very beginning, we recognize our parents' voice.

950
00:37:24.010 --> 00:37:27.630
We recognize when we're hungry, people will glom onto this.

951
00:37:27.630 --> 00:37:30.520
They will want to do this for the rest of their life,

952
00:37:30.520 --> 00:37:32.480
like I thought.

953
00:37:32.480 --> 00:37:34.100
And so I think,

954
00:37:34.100 --> 00:37:36.630
I know very little about drug addiction research

955
00:37:36.630 --> 00:37:39.150
but I do know about drug addiction.

956
00:37:39.150 --> 00:37:43.040
My younger brother died of a drug overdose four years ago.

957
00:37:43.040 --> 00:37:46.240
And to this day it still touches my heart painfully

958
00:37:46.240 --> 00:37:48.033
to know that that happened

959
00:37:48.033 --> 00:37:50.453
because he worked in a blue collar job.

960
00:37:51.570 --> 00:37:52.936
He developed blindness

961
00:37:52.936 --> 00:37:55.300
through the chemicals he interacted with everyday

962
00:37:55.300 --> 00:37:57.920
in his career and he was going blind

963
00:37:58.950 --> 00:38:00.860
and he just felt like he had no purpose in life.

964
00:38:00.860 --> 00:38:03.203
He had nothing to give back to society.

965
00:38:04.330 --> 00:38:08.700
And so he turned to drugs and it just saddens me to think

966
00:38:08.700 --> 00:38:12.090
that if he had just paid attention to himself

967
00:38:12.090 --> 00:38:14.320
because what did he do after he couldn't work anymore?

968
00:38:14.320 --> 00:38:15.360
And he was on workman's comp

969
00:38:15.360 --> 00:38:17.640
and he still had a little bit of vision left.

970
00:38:17.640 --> 00:38:19.550
He decided to go into online gaming.

971
00:38:19.550 --> 00:38:21.380
So he played games online

972
00:38:21.380 --> 00:38:23.740
but he didn't just play the games.

973
00:38:23.740 --> 00:38:25.630
He learned how to build the systems.

974
00:38:25.630 --> 00:38:27.880

He learned how to build GPU accelerators.

975
00:38:27.880 --> 00:38:28.713
He used...

976
00:38:28.713 --> 00:38:30.130
He learned how to do that.

977
00:38:30.130 --> 00:38:32.540
And he started teaching people how to do that.

978
00:38:32.540 --> 00:38:35.900
He taught people how to build their GPU accelarator,

979
00:38:35.900 --> 00:38:37.520
to build their gaming environments,

980
00:38:37.520 --> 00:38:39.510
to tune the CPU's right,

981
00:38:39.510 --> 00:38:43.470
to accelerate the performance of the processor.

982
00:38:43.470 --> 00:38:45.300
He was teaching people this stuff.

983
00:38:45.300 --> 00:38:48.180
And I said, Greg, I bet you've got an amazing skill here.

984
00:38:48.180 --> 00:38:49.013
This is incredible.

985
00:38:49.013 --> 00:38:52.390
You should teach people for a living how to do this.

986
00:38:52.390 --> 00:38:53.570
And in his Southern drawl, he said,

987
00:38:53.570 --> 00:38:57.590
Oh no, I'm not worth anything to anybody.

988
00:38:57.590 --> 00:38:59.430
And I still hear those words in my head.

989
00:38:59.430 --> 00:39:00.290
When I think about that

990
00:39:00.290 --> 00:39:03.910
he just was spiraled down and died of that addiction.

991
00:39:03.910 --> 00:39:05.040
And like I said, I don't know anything

992
00:39:05.040 --> 00:39:08.160
about the research you're doing, but I think

993
00:39:08.160 --> 00:39:11.600
and this isn't naive Kirk talking now

994
00:39:11.600 --> 00:39:15.560
that if you show people who feel their life is hopeless

995
00:39:15.560 --> 00:39:17.570
that they have nothing to resort to accept drugs

996
00:39:17.570 --> 00:39:19.440
are addictive things.

997
00:39:19.440 --> 00:39:22.867
There is a way there's something you can find passion in

998
00:39:22.867 --> 00:39:26.240
no matter what thing you are passionate about in life

999
00:39:26.240 --> 00:39:27.880

there's a data science component.

1000
00:39:27.880 --> 00:39:29.760
There's a data fluency component.

1001
00:39:29.760 --> 00:39:32.070
There's a data story that you can tell.

1002
00:39:32.070 --> 00:39:35.090
You can build that ship and explore those endless seas.

1003
00:39:35.090 --> 00:39:37.080
Whether you're a basketball fanatic

1004
00:39:38.290 --> 00:39:41.300
or you're a gamer or whatever you are,

1005
00:39:41.300 --> 00:39:44.100
there's a place there where every single person

1006
00:39:44.100 --> 00:39:45.810
has a purpose in life.

1007
00:39:45.810 --> 00:39:47.730
And I wish I had communicated that to my brother

1008
00:39:47.730 --> 00:39:49.290
when he was still with us.

1009
00:39:49.290 --> 00:39:50.123
So thank you.

1010
00:39:51.220 --> 00:39:52.053
My final comments.

1011
00:39:52.053 --> 00:39:54.670
I just wanna say, not like come for the data

1012
00:39:54.670 --> 00:39:56.850
say for the science, cause that's what I love.

1013
00:39:56.850 --> 00:40:00.940
But my one of my most favorite favorite quotes in science

1014
00:40:00.940 --> 00:40:03.080
is what Isaac, as well said.

1015
00:40:03.080 --> 00:40:05.617
He said "the most exciting phrase to hear in science,

1016
00:40:05.617 --> 00:40:09.500
"the one that heralds new discoveries is not 'Eureka!'

1017
00:40:09.500 --> 00:40:10.577
but 'That's funny."

1018
00:40:11.560 --> 00:40:14.966
So I'm wishing you many funny encounters with your data.

1019
00:40:14.966 --> 00:40:19.966
So thank you all very much this morning.

1020
00:40:20.067 --> 00:40:21.820
<v ->Thank you so much Kirk.</v>

1021
00:40:21.820 --> 00:40:24.520
That was an excellent and very inspiring presentation.

1022
00:40:24.520 --> 00:40:26.830
And that's one of my favorite quotes as well.

1023
00:40:26.830 --> 00:40:27.790
So just as a reminder

1024
00:40:27.790 --> 00:40:29.100

we'll take questions from the audience

1025
00:40:29.100 --> 00:40:31.870
after both speakers give their presentations.

1026
00:40:31.870 --> 00:40:33.990
And our next speaker is Dr. Martin Paulus

1027
00:40:33.990 --> 00:40:36.240
with NIDA funded researcher.

1028
00:40:36.240 --> 00:40:39.000
So Dr. Paulus has been a scientific director and president

1029
00:40:39.000 --> 00:40:41.880
of the Laureate Institute for brain research reliever

1030
00:40:41.880 --> 00:40:44.860
in Tulsa, Oklahoma, since may of 2014.

1031
00:40:44.860 --> 00:40:46.850
Prior to that, he had been a professor in the department

1032
00:40:46.850 --> 00:40:50.410
of psychiatry at the University of California, San Diego

1033
00:40:50.410 --> 00:40:51.840
and the director of tele mental health

1034
00:40:51.840 --> 00:40:54.840
at the veterans affairs, San Diego healthcare system.

1035
00:40:54.840 --> 00:40:57.970
Dr. Paula is a Google scholar H index of 101

1036
00:40:57.970 --> 00:41:01.290
and has published over 400 peer reviewed manuscripts.

1037
00:41:01.290 --> 00:41:05.440
Dr. Paulus is is the deputy editor of GMOs psychiatry

1038
00:41:05.440 --> 00:41:07.010
a series editor for the current topics

1039
00:41:07.010 --> 00:41:08.670
in behavioral neuroscience

1040
00:41:08.670 --> 00:41:11.520
and is on several editorial boards of top tier

1041
00:41:11.520 --> 00:41:14.050
psychiatric journals, sorry.

1042
00:41:14.050 --> 00:41:15.800
He has served on numerous NIH

1043
00:41:15.800 --> 00:41:17.160
and international study sections

1044
00:41:17.160 --> 00:41:19.770
and is currently on the NIH national Institute

1045
00:41:19.770 --> 00:41:22.400
of mental health board of scientific counselors.

1046
00:41:22.400 --> 00:41:26.040
The goal of LIBR is to identify disease modifying processes,

1047
00:41:26.040 --> 00:41:28.330
DMP, based on circuits, behavior

1048
00:41:28.330 --> 00:41:29.760
or other levels of analysis

1049
00:41:29.760 --> 00:41:33.950

which been unmodulated change the risk for serverity of,

1050
00:41:33.950 --> 00:41:37.120
or the recurrence of a disease such as mood, anxiety

1051
00:41:37.120 --> 00:41:39.080
or substance use disorder.

1052
00:41:39.080 --> 00:41:41.430
Dr. Paulas says, program of research is to do it

1053
00:41:41.430 --> 00:41:43.840
on eight DMPs and provide pathways

1054
00:41:43.840 --> 00:41:46.020
towards the development of process specific

1055
00:41:46.020 --> 00:41:49.800
trans diagnostic interventions, that have pragmatic utility

1056
00:41:49.800 --> 00:41:51.520
to improve a patient's condition faster

1057
00:41:51.520 --> 00:41:52.480
with fewer side effects

1058
00:41:52.480 --> 00:41:55.330
and fewer occurrences and explanatory value

1059
00:41:55.330 --> 00:41:58.230
or to refine our understanding of the causal relationships

1060
00:41:58.230 --> 00:42:01.150
between specific processes in a mental health condition.

1061
00:42:01.150 --> 00:42:03.673
So please join me in welcoming Dr. Martin Paulas

1062
00:42:03.673 --> 00:42:05.403
with some virtual applause.

1063
00:42:07.170 --> 00:42:08.013
<v ->Thank you guys.</v>

1064
00:42:09.098 --> 00:42:10.653
Can you guys hear me?

1065
00:42:13.000 --> 00:42:13.960
<v ->Yes.</v>

1066
00:42:13.960 --> 00:42:15.180
<v ->Okay, good.</v>

1067
00:42:15.180 --> 00:42:18.720
Well, this is a hard act to follow.

1068
00:42:18.720 --> 00:42:20.670
This is a passive talk.

1069
00:42:20.670 --> 00:42:22.240
Mine will be a little more science focused

1070
00:42:22.240 --> 00:42:24.410
but I really won't talk too much about the science

1071
00:42:24.410 --> 00:42:26.980
but really more about the science rather

1072
00:42:26.980 --> 00:42:28.390
than the science directly.

1073
00:42:28.390 --> 00:42:32.253
So let me get right in there.

1074
00:42:33.320 --> 00:42:35.450

When Susan introduced me there was a lot of jargon,

1075
00:42:35.450 --> 00:42:37.530
maybe too ma too much jargon

1076
00:42:37.530 --> 00:42:39.900
but I wanna explain to you a little bit what drives me

1077
00:42:39.900 --> 00:42:43.500
and why I went into this field

1078
00:42:43.500 --> 00:42:46.543
particularly in the field of substance use disorder.

1079
00:42:47.600 --> 00:42:51.300
This kind of graph summarizes a little bit of sort of

1080
00:42:51.300 --> 00:42:54.070
how I view a scientist...

1081
00:42:54.070 --> 00:42:56.970
The role of scientist particularly in biomedical research.

1082
00:43:00.290 --> 00:43:03.820
I want to emphasize that this is sort of a little bit of

1083
00:43:03.820 --> 00:43:06.610
a looking back for me because

1084
00:43:06.610 --> 00:43:08.550
as you will see from the data

1085
00:43:08.550 --> 00:43:11.880
I've done both sides of this kind of flow chart,

1086
00:43:11.880 --> 00:43:16.290
but I wanna point out is that as scientists or researchers

1087
00:43:16.290 --> 00:43:18.890
we really are problem solvers.

1088
00:43:18.890 --> 00:43:20.820
And oftentimes it happens,

1089
00:43:20.820 --> 00:43:23.960
we get stuck really solving the problems

1090
00:43:23.960 --> 00:43:25.720
that are convenient for us to solve

1091
00:43:25.720 --> 00:43:28.370
and that our peers tell us to solve.

1092
00:43:28.370 --> 00:43:30.140
But I really think that one

1093
00:43:30.140 --> 00:43:34.260
of the important elements is to pay attention

1094
00:43:34.260 --> 00:43:35.940
to who the stakeholders are

1095
00:43:35.940 --> 00:43:39.000
who are you solving problems for?

1096
00:43:39.000 --> 00:43:42.020
And from my perspective, and I've been a psychiatrist

1097
00:43:42.020 --> 00:43:47.020
for over 25 years, my goal is to solve problems

1098
00:43:47.900 --> 00:43:51.950
for patients, for patients as well as for families

1099
00:43:52.870 --> 00:43:56.970

but even if you're not directly in psychiatry

1100
00:43:56.970 --> 00:43:58.853
or in any mental health profession,

1101
00:44:00.590 --> 00:44:01.680
there are other stakeholders

1102
00:44:01.680 --> 00:44:03.960
that clearly need problem solved

1103
00:44:03.960 --> 00:44:07.270
such as the payers or policy makers.

1104
00:44:07.270 --> 00:44:09.560
And I think that that's an important consideration

1105
00:44:09.560 --> 00:44:11.090
that you need to listen to

1106
00:44:11.090 --> 00:44:14.340
what the problems are that really should be solved.

1107
00:44:14.340 --> 00:44:18.780
And then your job really is to turn those questions

1108
00:44:18.780 --> 00:44:20.900
into a researchable question.

1109
00:44:20.900 --> 00:44:23.080
Not every question that is being asked

1110
00:44:24.147 --> 00:44:26.450
by stakeholder is really researchable.

1111
00:44:26.450 --> 00:44:27.780
It's really can be formulated

1112
00:44:27.780 --> 00:44:30.023
into an experimental or into....

1113
00:44:32.510 --> 00:44:34.273
Within the hypothetical framework.

1114
00:44:35.120 --> 00:44:37.960
And then what was interesting when Kirk was talking,

1115
00:44:37.960 --> 00:44:41.350
I was listening to his prescriptive and descriptive signs

1116
00:44:41.350 --> 00:44:43.970
and it's interesting that different areas

1117
00:44:43.970 --> 00:44:47.200
of science form different terms

1118
00:44:47.200 --> 00:44:50.550
but in many ways we often talk about the same thing.

1119
00:44:50.550 --> 00:44:52.980
So one of the things that I think is important

1120
00:44:52.980 --> 00:44:53.813
right at the get go

1121
00:44:53.813 --> 00:44:55.810
when you're trying to solve a problem is to ask yourself,

1122
00:44:55.810 --> 00:44:57.980
what's my primary goal?

1123
00:44:57.980 --> 00:45:01.170
So the way I divided it up is to...

1124
00:45:02.300 --> 00:45:05.220

It's your primary goal and explanatory one, for example,

1125
00:45:05.220 --> 00:45:09.520
do you want to build a mechanistic disease models

1126
00:45:09.520 --> 00:45:10.600
and that's important

1127
00:45:10.600 --> 00:45:13.171
and I'll kind of talk a little bit about that

1128
00:45:13.171 --> 00:45:14.470
in a little bit

1129
00:45:14.470 --> 00:45:19.470
or is your primary goal to potentially generate a pragmatic

1130
00:45:21.010 --> 00:45:23.790
or general individual level predictions.

1131
00:45:23.790 --> 00:45:25.940
And during the course of my career

1132
00:45:25.940 --> 00:45:29.233
I've tried to do both and I'll show you example both.

1133
00:45:30.120 --> 00:45:32.870
And the reason why it's important to ask those questions

1134
00:45:32.870 --> 00:45:34.440
is because it frames,

1135
00:45:34.440 --> 00:45:36.910
what kinds of data you should use or collect

1136
00:45:37.870 --> 00:45:40.250
and what is this...

1137
00:45:40.250 --> 00:45:42.690
What are the criteria that you should be looking at?

1138
00:45:42.690 --> 00:45:44.840
So for examples, we explanatory this model.

1139
00:45:45.720 --> 00:45:48.560
Really the importance is what is the level

1140
00:45:48.560 --> 00:45:50.640
of causality that you can get to.

1141
00:45:50.640 --> 00:45:55.290
And it's quite obvious that in human research

1142
00:45:55.290 --> 00:45:58.230
we have limited networks of causality our best...

1143
00:45:58.230 --> 00:46:00.290
Basically our best level of causality

1144
00:46:00.290 --> 00:46:03.140
that we can get to is through randomized control trials.

1145
00:46:03.140 --> 00:46:06.110
But many questions in medicine cannot be addressed

1146
00:46:06.110 --> 00:46:08.066
with randomized control trials just

1147
00:46:08.066 --> 00:46:10.960
because it's not feasible, because it's too expensive,

1148
00:46:10.960 --> 00:46:12.460
because it's unethical.

1149
00:46:12.460 --> 00:46:15.970

So we need to look for something in humans sometimes

1150
00:46:18.681 --> 00:46:20.470
that is maybe next best.

1151
00:46:20.470 --> 00:46:24.740
And just kind of connecting up to what Kirk was saying.

1152
00:46:24.740 --> 00:46:26.800
There's a recent, very exciting development

1153
00:46:26.800 --> 00:46:29.620
in data science called statistical causal inference.

1154
00:46:29.620 --> 00:46:32.180
And there's lots of interesting and new work

1155
00:46:32.180 --> 00:46:35.150
that is being done right now in this area.

1156
00:46:35.150 --> 00:46:39.763
Very, very exciting area that we also getting into,

1157
00:46:40.890 --> 00:46:43.900
the point being is that you can actually under some...

1158
00:46:43.900 --> 00:46:47.620
With some assumption extract causal inferences,

1159
00:46:47.620 --> 00:46:49.870
even from descriptive data.

1160
00:46:49.870 --> 00:46:52.010
And that's important, it's important

1161
00:46:52.010 --> 00:46:54.740
because you need these causal relationships

1162
00:46:54.740 --> 00:46:58.820
to come up with explanation and potential new interventions

1163
00:46:58.820 --> 00:47:01.830
that can help people with drug addiction.

1164
00:47:01.830 --> 00:47:03.970
That's really what I want to emphasize

1165
00:47:03.970 --> 00:47:08.450
is that all the research that I've been trying to do

1166
00:47:08.450 --> 00:47:11.510
is trying to find ways of helping people

1167
00:47:11.510 --> 00:47:13.950
either not to get into addiction

1168
00:47:13.950 --> 00:47:18.470
or an easier way to come out of addiction and so...

1169
00:47:18.470 --> 00:47:20.540
And then the next level is

1170
00:47:20.540 --> 00:47:22.540
once you've solved really a problem

1171
00:47:22.540 --> 00:47:25.110
while you have a partial solution, because as scientists

1172
00:47:25.110 --> 00:47:27.830
as you all know, you really are...

1173
00:47:27.830 --> 00:47:31.240
It's an incremental step of solving

1174
00:47:31.240 --> 00:47:32.760

'cause you solve problems

1175
00:47:32.760 --> 00:47:35.660
then you need to turn this into actionable outcomes.

1176
00:47:35.660 --> 00:47:38.850
How can we translate what we're finding

1177
00:47:38.850 --> 00:47:41.430
into some thing that we can do something about?

1178
00:47:41.430 --> 00:47:43.460
And that's actually a very very tough problem

1179
00:47:43.460 --> 00:47:44.530
in (indistinct) of itself.

1180
00:47:44.530 --> 00:47:47.710
So it's not just to climb to solutions

1181
00:47:47.710 --> 00:47:49.680
through data science or otherwise

1182
00:47:49.680 --> 00:47:52.100
but also then to take those solutions

1183
00:47:52.100 --> 00:47:55.093
and make them actionable so that people out there,

1184
00:47:56.000 --> 00:47:59.410
who suffering from these disorders can actually

1185
00:47:59.410 --> 00:48:00.980
receive the help

1186
00:48:00.980 --> 00:48:02.760
that has to do with dissemination,

1187
00:48:02.760 --> 00:48:05.030
that has to do with implementation.

1188
00:48:05.030 --> 00:48:08.280
And so for me, that's sort of the way I view

1189
00:48:09.660 --> 00:48:14.150
how I would like to progress in science in times.

1190
00:48:14.150 --> 00:48:19.150
And most of my career has been focused on stimulants

1191
00:48:19.870 --> 00:48:23.070
and I've always been fascinated by stimulants.

1192
00:48:23.070 --> 00:48:28.070
It's a strange thing because tend to be a very energetic

1193
00:48:28.490 --> 00:48:30.400
and hyper person

1194
00:48:30.400 --> 00:48:33.820
and stimulus would be the last thing I would consider taking

1195
00:48:33.820 --> 00:48:36.430
but it seemed for me something

1196
00:48:36.430 --> 00:48:39.920
that excited me to try to understand

1197
00:48:39.920 --> 00:48:43.700
what is it that people crave

1198
00:48:43.700 --> 00:48:44.970
when they take these stimulants?

1199
00:48:44.970 --> 00:48:46.490

What does it do?

1200
00:48:46.490 --> 00:48:51.210
Because of course it's a very prevalent problem.

1201
00:48:51.210 --> 00:48:52.550
And I'll show you just in a moment

1202
00:48:52.550 --> 00:48:54.590
just that it's actually coming back

1203
00:48:55.540 --> 00:48:57.620
and just to kind of so that we're on the same page.

1204
00:48:57.620 --> 00:48:59.140
What do I mean by stimulants?

1205
00:48:59.140 --> 00:49:01.760
Of course, it's the main stimulants that we're talking

1206
00:49:01.760 --> 00:49:04.060
about, amphetamines, methamphetamine, cocaine.

1207
00:49:04.930 --> 00:49:07.100
Now there's other classes of stimulants

1208
00:49:07.100 --> 00:49:09.180
but those are the ones that I've spent most

1209
00:49:09.180 --> 00:49:12.360
of my work studying.

1210
00:49:12.360 --> 00:49:14.020
And of course we understand very well.

1211
00:49:14.020 --> 00:49:16.270
And quite frankly, the director

1212
00:49:16.270 --> 00:49:21.120
of the nationalists for drug abuse was elementary

1213
00:49:21.120 --> 00:49:23.710
in helping us to understand how these stimulants work

1214
00:49:23.710 --> 00:49:25.810
in the brain of individuals

1215
00:49:25.810 --> 00:49:30.410
but just the fact that they're working

1216
00:49:30.410 --> 00:49:33.200
on a particular receptor or use a particular transmission

1217
00:49:33.200 --> 00:49:36.040
doesn't mean that we really understand how addiction works,

1218
00:49:36.040 --> 00:49:37.170
because of course addiction's

1219
00:49:37.170 --> 00:49:39.000
a much more complicated process

1220
00:49:39.000 --> 00:49:42.220
it's simply the initial action of the drug.

1221
00:49:42.220 --> 00:49:43.370
And that's sort of what I'm trying

1222
00:49:43.370 --> 00:49:46.160
to also kind of convey today is that it's...

1223
00:49:47.000 --> 00:49:48.310
Addiction is almost like an ogre.

1224
00:49:48.310 --> 00:49:51.980

You kind of shave off layers of an onion.

1225
00:49:51.980 --> 00:49:55.470
And as you understand these different factors

1226
00:49:56.420 --> 00:50:01.030
you understand that it's beyond just the pharmacology

1227
00:50:01.030 --> 00:50:02.473
that we're looking at here.

1228
00:50:03.310 --> 00:50:05.150
I just wanna emphasize, and I do wanna say

1229
00:50:05.150 --> 00:50:07.880
this is something that is not widely recognized.

1230
00:50:07.880 --> 00:50:10.030
That for example, with amphetamine,

1231
00:50:10.030 --> 00:50:13.700
we are re-experiencing a recurrence of a new wave

1232
00:50:13.700 --> 00:50:17.350
of methamphetamine, and this has happened over the decades.

1233
00:50:17.350 --> 00:50:20.960
We know that drug use comes and goes

1234
00:50:20.960 --> 00:50:23.780
because a lot has been focused on opioids

1235
00:50:23.780 --> 00:50:26.780
in recent years and rightfully so,

1236
00:50:26.780 --> 00:50:31.030
and in some ways as the opiate crisis

1237
00:50:31.030 --> 00:50:32.490
is still very much alive,

1238
00:50:32.490 --> 00:50:34.710
we've been focused very much on COVID

1239
00:50:34.710 --> 00:50:38.230
but the opiate crisis is very much alive.

1240
00:50:38.230 --> 00:50:39.260
What's interesting is that

1241
00:50:39.260 --> 00:50:41.310
the blue line shows the number of publications.

1242
00:50:41.310 --> 00:50:44.900
So, again for people who are trying to think

1243
00:50:44.900 --> 00:50:47.560
about anti- secret behavior.

1244
00:50:47.560 --> 00:50:49.280
Now, one of the things is that

1245
00:50:51.520 --> 00:50:54.750
what I've learned is you you want to really stick

1246
00:50:54.750 --> 00:50:57.870
with what it fascinates and excites you.

1247
00:50:57.870 --> 00:51:02.130
And there comes a times when it's very popular

1248
00:51:02.130 --> 00:51:04.250
and people will call you and say,

1249
00:51:04.250 --> 00:51:05.970

Oh, you wanna report us on this

1250
00:51:05.970 --> 00:51:08.283
and there are times when it's not so popular,

1251
00:51:09.152 --> 00:51:12.810
but in essence, as you getting to know a field

1252
00:51:12.810 --> 00:51:16.630
as you're getting to know an area deeper and deeper

1253
00:51:16.630 --> 00:51:17.830
you're building expertise

1254
00:51:17.830 --> 00:51:20.270
and you can solve a better problems

1255
00:51:20.270 --> 00:51:23.130
and you can really come up with better solutions,

1256
00:51:23.130 --> 00:51:24.850
here's an interesting exam.

1257
00:51:24.850 --> 00:51:26.920
So I would, for example,

1258
00:51:26.920 --> 00:51:28.540
recommend that people really look at

1259
00:51:28.540 --> 00:51:30.350
the stimulant use problem in this country

1260
00:51:30.350 --> 00:51:32.840
and see whether they can apply themselves

1261
00:51:32.840 --> 00:51:35.700
and find new solution to it.

1262
00:51:35.700 --> 00:51:40.510
Now, of course, a lot of what we did was motivated.

1263
00:51:40.510 --> 00:51:44.210
And this goes back now quite a while to the nineties

1264
00:51:45.130 --> 00:51:46.810
what we knew at the time

1265
00:51:46.810 --> 00:51:48.743
that was what dopamine was doing,

1266
00:51:49.940 --> 00:51:52.920
dopamine which is of course the target substance

1267
00:51:52.920 --> 00:51:56.370
at the stimulants all modulate

1268
00:51:56.370 --> 00:51:58.453
was thought to be a teaching signal.

1269
00:51:59.860 --> 00:52:01.460
What you're seeing there in the slide

1270
00:52:01.460 --> 00:52:05.770
is this famous recordings, the neuro recordings

1271
00:52:05.770 --> 00:52:08.660
by Scholtz and colleagues

1272
00:52:08.660 --> 00:52:12.060
showing that you get a surge of dopamine

1273
00:52:12.060 --> 00:52:14.270
when there is, what's called a prediction here

1274
00:52:14.270 --> 00:52:17.433

when something that you didn't expect happened,

1275
00:52:18.270 --> 00:52:20.260
and it tells your brain, wait a minute

1276
00:52:20.260 --> 00:52:22.020
I need to pay attention to this.

1277
00:52:22.020 --> 00:52:24.240
I need to learn something here.

1278
00:52:24.240 --> 00:52:27.050
And as part of that, there's of course,

1279
00:52:27.050 --> 00:52:31.080
an explosion of studies that were going on

1280
00:52:31.080 --> 00:52:33.660
and we were just the tiny part of it.

1281
00:52:33.660 --> 00:52:34.890
But the explosion really was

1282
00:52:34.890 --> 00:52:37.290
around trying to understand that process,

1283
00:52:37.290 --> 00:52:40.550
of course (audio breaks)at the same time.

1284
00:52:40.550 --> 00:52:42.720
And I was very fortunate at that time.

1285
00:52:42.720 --> 00:52:45.190
It was also the emergence of a new technology,

1286
00:52:45.190 --> 00:52:47.220
functional magnetic resonance imaging

1287
00:52:47.220 --> 00:52:49.940
which really changed the way we looked at

1288
00:52:52.879 --> 00:52:55.360
what the substances do to the brain.

1289
00:52:55.360 --> 00:52:57.200
You have to understand that,

1290
00:52:57.200 --> 00:53:00.920
now it may seem like we were simple phrenologies

1291
00:53:00.920 --> 00:53:03.710
but really what it was is that

1292
00:53:03.710 --> 00:53:06.120
we for the first time had a tool

1293
00:53:06.120 --> 00:53:08.560
at our hands that we could easily

1294
00:53:08.560 --> 00:53:13.560
and the point is easily put people into a imaging machine

1295
00:53:14.040 --> 00:53:17.980
and see the living brain working and do it

1296
00:53:17.980 --> 00:53:20.630
at a scale that we've never been able to do.

1297
00:53:20.630 --> 00:53:24.710
And that was really the excitement that touched me.

1298
00:53:24.710 --> 00:53:25.543
I was actually...

1299
00:53:25.543 --> 00:53:28.470

And there's a connection here with Kirk as well.

1300
00:53:28.470 --> 00:53:30.133
I was always interested in that.

1301
00:53:31.030 --> 00:53:32.320
And so there's sort of...

1302
00:53:32.320 --> 00:53:35.680
I'm sort of a closet a math person,

1303
00:53:35.680 --> 00:53:38.641
in particular, the applied side of math is again

1304
00:53:38.641 --> 00:53:40.027
how can you make it useful?

1305
00:53:40.027 --> 00:53:41.310
Are we like the hammer.

1306
00:53:41.310 --> 00:53:42.710
That's what people call me like, yeah

1307
00:53:42.710 --> 00:53:46.760
you have your math tools are like the hammer.

1308
00:53:46.760 --> 00:53:48.940
That's the point being is that

1309
00:53:48.940 --> 00:53:52.900
I wanted to use this kind of this inclination

1310
00:53:52.900 --> 00:53:54.830
in the research setting that suited me

1311
00:53:54.830 --> 00:53:58.830
and functional magnetic resonance imaging was perfect

1312
00:53:58.830 --> 00:54:02.010
because it required that you understand

1313
00:54:02.010 --> 00:54:06.160
what the underlying signal is and how to analyze it.

1314
00:54:06.160 --> 00:54:09.570
And as all the signal analytics.

1315
00:54:09.570 --> 00:54:14.570
And so I got really deeply into MRI, FMRI research.

1316
00:54:15.400 --> 00:54:17.460
And of course, then the...

1317
00:54:17.460 --> 00:54:21.630
Initially the way to think about this then is to,

1318
00:54:21.630 --> 00:54:24.070
okay, where in the brain is something happening

1319
00:54:24.070 --> 00:54:25.900
under what conditions.

1320
00:54:25.900 --> 00:54:29.503
So that really was the question that we were asking.

1321
00:54:31.060 --> 00:54:34.250
And there were candidate regions

1322
00:54:34.250 --> 00:54:35.590
that came up relatively quickly.

1323
00:54:35.590 --> 00:54:36.720
I'm gonna just show you a few

1324
00:54:36.720 --> 00:54:39.210

without going into any details here.

1325
00:54:39.210 --> 00:54:41.570
There was the the anterior cingulate

1326
00:54:41.570 --> 00:54:43.733
which is a part of the brain.

1327
00:54:43.733 --> 00:54:46.130
And at that time we thought had to do

1328
00:54:46.130 --> 00:54:49.910
with processing conflict and processing errors.

1329
00:54:49.910 --> 00:54:51.520
There was the orbital frontal cortex

1330
00:54:51.520 --> 00:54:54.770
which is a very important part of the brain

1331
00:54:54.770 --> 00:54:57.120
that was processing value.

1332
00:54:57.120 --> 00:55:01.040
How much worth is something to you and did.

1333
00:55:01.040 --> 00:55:02.960
And then there was an area that was particularly

1334
00:55:02.960 --> 00:55:06.360
of interest to me, was the insular cortex.

1335
00:55:06.360 --> 00:55:08.131
And let me just talk a little bit about this

1336
00:55:08.131 --> 00:55:12.333
'cause that's something that I worked on for a long time.

1337
00:55:15.280 --> 00:55:19.740
One of the things that really was striking to me is

1338
00:55:19.740 --> 00:55:23.240
that when people, and I've worked with a lot of people

1339
00:55:23.240 --> 00:55:25.160
in substance with substance use disorder

1340
00:55:25.160 --> 00:55:27.820
'cause I worked on a substance use disorder unit.

1341
00:55:27.820 --> 00:55:31.200
And I have patients with lots of substance use disorder.

1342
00:55:31.200 --> 00:55:33.400
The thing that struck me always is

1343
00:55:33.400 --> 00:55:37.810
that there is an element of a person can be very rational

1344
00:55:37.810 --> 00:55:41.260
about their addiction can basically talking about,

1345
00:55:41.260 --> 00:55:43.425
yes I'm using too much, I'm doing this.

1346
00:55:43.425 --> 00:55:48.000
I'm engaging actions that make me do these things.

1347
00:55:48.000 --> 00:55:49.610
And yet there is a disconnect

1348
00:55:49.610 --> 00:55:53.070
because the person is the same time is driven to do it.

1349
00:55:53.070 --> 00:55:56.530

Is driven almost from a gut level response

1350
00:55:56.530 --> 00:55:57.893
to engage in something

1351
00:55:57.893 --> 00:56:02.800
that they know is not going to be good

1352
00:56:02.800 --> 00:56:06.660
for them or is leading them down the wrong path.

1353
00:56:06.660 --> 00:56:09.100
So there must be some disconnection

1354
00:56:09.100 --> 00:56:12.330
between the thinking parts, like the rational thinking part

1355
00:56:12.330 --> 00:56:13.800
the way we normally think about

1356
00:56:13.800 --> 00:56:17.090
and the gut level kind of choices that people make.

1357
00:56:17.090 --> 00:56:18.080
And we all make them.

1358
00:56:18.080 --> 00:56:19.864
I mean, we...

1359
00:56:19.864 --> 00:56:22.970
It's not that there's anything so radically different

1360
00:56:22.970 --> 00:56:24.690
it's the same thing that you,

1361
00:56:24.690 --> 00:56:26.440
if you're on a diet and you say,

1362
00:56:26.440 --> 00:56:28.960
ah, I'm going to have to lose these 20 pounds.

1363
00:56:28.960 --> 00:56:33.850
And yet you smell the Cinnabon or you smell something

1364
00:56:33.850 --> 00:56:36.303
and out of a sudden, it just goes away.

1365
00:56:37.139 --> 00:56:40.300
You call it whatever willpower and you just go for it.

1366
00:56:40.300 --> 00:56:41.910
And so it's...

1367
00:56:41.910 --> 00:56:44.770
I wanted to understand what is the component

1368
00:56:44.770 --> 00:56:46.669
that drives that.

1369
00:56:46.669 --> 00:56:48.814
And from my perspective, the Insular cortex

1370
00:56:48.814 --> 00:56:50.550
was ideally suited for that.

1371
00:56:50.550 --> 00:56:52.751
We knew even before I got into it

1372
00:56:52.751 --> 00:56:55.650
the that the insula cortex was important for castation

1373
00:56:55.650 --> 00:56:57.377
that it was important for.

1374
00:56:57.377 --> 00:56:59.973

It was very strongly activated with disgust.

1375
00:57:01.130 --> 00:57:02.890
And so we knew it had something to do

1376
00:57:02.890 --> 00:57:03.723
with the gut introception

1377
00:57:03.723 --> 00:57:05.480
but then there were other researchers

1378
00:57:05.480 --> 00:57:10.480
that really had done some works in this area before me

1379
00:57:13.320 --> 00:57:18.320
that had identified that really it's part of system

1380
00:57:21.010 --> 00:57:24.910
that tells you how something may actually appear to you

1381
00:57:24.910 --> 00:57:28.022
and how many actually may feel to you.

1382
00:57:28.022 --> 00:57:33.022
And so the sentence was, it gives the brain

1383
00:57:33.100 --> 00:57:38.090
and sort of it makes the Cinnabon smell come alive

1384
00:57:38.090 --> 00:57:42.460
for the rest of the brain and therefore drives your action.

1385
00:57:42.460 --> 00:57:44.110
So we really wanted to understand

1386
00:57:44.110 --> 00:57:46.140
what the incident cortex was doing

1387
00:57:46.140 --> 00:57:50.100
and the term into interoception

1388
00:57:50.100 --> 00:57:54.100
which was reanimated but Craig really took over

1389
00:57:54.100 --> 00:57:57.530
and we actually put a number of years, studied

1390
00:57:58.519 --> 00:57:59.710
(audio breaks)

1391
00:57:59.710 --> 00:58:01.690
still are studying intercept the pathways,

1392
00:58:01.690 --> 00:58:03.490
'cause again as we're learning more and more

1393
00:58:03.490 --> 00:58:05.313
we learn how complex it really is.

1394
00:58:05.313 --> 00:58:08.890
It's just basically sort of a macroscopic

1395
00:58:08.890 --> 00:58:12.150
and microscopic view of what we understood at that time

1396
00:58:12.150 --> 00:58:14.220
what the insula was doing.

1397
00:58:14.220 --> 00:58:17.410
But I wanted to kind of now talk about a few studies

1398
00:58:17.410 --> 00:58:20.363
just sort of give you a sense of what are the questions

1399
00:58:20.363 --> 00:58:22.620

that we were trying to address.

1400
00:58:22.620 --> 00:58:25.210
So we knew at the time when

1401
00:58:26.095 --> 00:58:28.160
and this was actually in the early two thousands

1402
00:58:28.160 --> 00:58:31.200
that prescription stimulant use was really starting

1403
00:58:31.200 --> 00:58:34.030
to become a major issue that

1404
00:58:35.050 --> 00:58:36.700
almost a hundred thousand adolescents

1405
00:58:36.700 --> 00:58:40.680
age 12 to 17 were meeting a criteria.

1406
00:58:40.680 --> 00:58:42.440
One in 10 American youth

1407
00:58:42.440 --> 00:58:45.190
and young adults were using stimulants.

1408
00:58:45.190 --> 00:58:48.270
And if there was a lot of the students reporting

1409
00:58:48.270 --> 00:58:49.970
using for recreational purposes,

1410
00:58:49.970 --> 00:58:54.820
but also a significant subset of people

1411
00:58:54.820 --> 00:58:56.610
were using it for studying purposes.

1412
00:58:56.610 --> 00:58:59.010
So either the methylphenidates

1413
00:58:59.010 --> 00:59:03.950
or stay amphetamines to study more intensively.

1414
00:59:03.950 --> 00:59:08.550
And so we looked at, this kind of distinction

1415
00:59:08.550 --> 00:59:12.389
between study would we call studious imperious,

1416
00:59:12.389 --> 00:59:17.389
and trying to see whether there were brain differences

1417
00:59:18.390 --> 00:59:21.790
associated with it but also in more importantly

1418
00:59:21.790 --> 00:59:26.790
we wanted to see who, when people start to use drugs

1419
00:59:27.150 --> 00:59:30.310
get really into a use disorder.

1420
00:59:30.310 --> 00:59:33.420
Because again, this is another interesting conundrum

1421
00:59:33.420 --> 00:59:35.840
we know and this is not limited to stimulants.

1422
00:59:35.840 --> 00:59:40.670
Only one out of seven people who actually try

1423
00:59:40.670 --> 00:59:43.950
either stimulants or opiates really progresses

1424
00:59:43.950 --> 00:59:45.520

into severe substance use disorder.

1425
00:59:45.520 --> 00:59:47.230
So it's this subset.

1426
00:59:47.230 --> 00:59:51.628
And it's important to understand that subset is...

1427
00:59:51.628 --> 00:59:52.990
And this is very...

1428
00:59:52.990 --> 00:59:57.550
We've just recently looked at this subset is not just brain.

1429
00:59:57.550 --> 01:00:00.800
And I think this is another important element.

1430
01:00:00.800 --> 01:00:03.040
We have to understand substance use disorder

1431
01:00:04.772 --> 01:00:06.800
not just as a brain process

1432
01:00:06.800 --> 01:00:10.190
but also as a process that happen within an environment

1433
01:00:10.190 --> 01:00:11.850
and within a community

1434
01:00:11.850 --> 01:00:13.840
and we are just beginning to look at this

1435
01:00:13.840 --> 01:00:18.840
in a more systematic way that substance use is really...

1436
01:00:20.140 --> 01:00:22.520
Not even with inseptic disorder

1437
01:00:22.520 --> 01:00:26.113
but it's between people disorder as well.

1438
01:00:27.560 --> 01:00:31.860
So we at that time, we recruited a number of people

1439
01:00:31.860 --> 01:00:34.900
who were using prescription drugs

1440
01:00:34.900 --> 01:00:37.650
or stimulants recreationally,

1441
01:00:37.650 --> 01:00:41.720
but could not have a stimulant use disorder at that time

1442
01:00:41.720 --> 01:00:44.380
or dependence as it was called at the time.

1443
01:00:44.380 --> 01:00:48.400
And our goal really was to, at that time again,

1444
01:00:48.400 --> 01:00:49.420
using neuro imaging,

1445
01:00:49.420 --> 01:00:51.330
can neuroimaging help us to determine

1446
01:00:51.330 --> 01:00:53.107
who will develop problems and who will not?

1447
01:00:53.107 --> 01:00:56.743
And that gets back to the prediction framework

1448
01:00:58.650 --> 01:01:00.253
that(audio breaks) early on

1449
01:01:00.253 --> 01:01:02.590

that also Chris was talking about.

1450
01:01:02.590 --> 01:01:05.720
So what we did is we actually,

1451
01:01:05.720 --> 01:01:08.160
recruited a bunch of people at baseline,

1452
01:01:08.160 --> 01:01:10.780
and we identified of course

1453
01:01:10.780 --> 01:01:13.250
not going to talk about that in detail,

1454
01:01:13.250 --> 01:01:16.140
how the stimulant uses that were more padious

1455
01:01:16.140 --> 01:01:18.660
versus the studious as how they differed.

1456
01:01:18.660 --> 01:01:22.037
And then we actually followed them up for two years.

1457
01:01:22.037 --> 01:01:24.080
And that's another interesting thing.

1458
01:01:24.080 --> 01:01:26.410
I've always been fascinated with longitudinal studies.

1459
01:01:26.410 --> 01:01:28.290
So they're very difficult to do

1460
01:01:28.290 --> 01:01:30.720
but you learn so much about a person.

1461
01:01:30.720 --> 01:01:33.180
So we've done and I'll show you this in a moment

1462
01:01:33.180 --> 01:01:36.930
a little bit studies with substance users,

1463
01:01:36.930 --> 01:01:38.010
severe substance users,

1464
01:01:38.010 --> 01:01:41.250
but we've also done studies with these folks

1465
01:01:42.490 --> 01:01:44.430
and I have to give a great shout out.

1466
01:01:44.430 --> 01:01:46.220
We did the beauty of being...

1467
01:01:46.220 --> 01:01:48.350
Having a career in science is you get to work

1468
01:01:48.350 --> 01:01:52.220
with a lot of great people and on all levels.

1469
01:01:52.220 --> 01:01:56.030
And I wanna say that these types of studies

1470
01:01:56.030 --> 01:01:58.180
would never have been possible

1471
01:01:58.180 --> 01:02:00.250
without dedicated research assistant

1472
01:02:00.250 --> 01:02:02.850
and grad students and post-docs,

1473
01:02:02.850 --> 01:02:06.810
but this is a village effort there's no question.

1474
01:02:06.810 --> 01:02:09.800

I'm fortunate enough to now report on this,

1475
01:02:09.800 --> 01:02:12.440
but really this is absolutely a group effort.

1476
01:02:12.440 --> 01:02:16.150
And the fun part of science from my perspective

1477
01:02:16.150 --> 01:02:20.650
is interacting with these people, the papers and the grants

1478
01:02:20.650 --> 01:02:24.480
what you have to produce to make it work in science.

1479
01:02:24.480 --> 01:02:27.660
But really the fun part is the day-to-day interaction.

1480
01:02:27.660 --> 01:02:29.173
I just wanna put a brief,

1481
01:02:30.040 --> 01:02:33.409
we were closed here for a little while at the LIBR

1482
01:02:33.409 --> 01:02:35.890
and I can tell you it was sort of

1483
01:02:35.890 --> 01:02:38.790
a very impoverished kind of experience.

1484
01:02:38.790 --> 01:02:40.810
The moment we all came back together

1485
01:02:40.810 --> 01:02:44.630
and we could talk about, the problems, the issues that...

1486
01:02:44.630 --> 01:02:47.860
So I think that what you have to understand is for me

1487
01:02:47.860 --> 01:02:52.860
science is a heavy social endeavor and it...

1488
01:02:53.650 --> 01:02:55.869
That is the fun part, no question.

1489
01:02:55.869 --> 01:02:59.050
So we wanna space as he can

1490
01:02:59.050 --> 01:03:01.200
we predict who's gonna develop problems.

1491
01:03:01.200 --> 01:03:04.550
So we use a particular probe at the time

1492
01:03:04.550 --> 01:03:07.120
which is what's called the Stop Signal Task.

1493
01:03:07.120 --> 01:03:09.970
It's basically how to hold yourself back

1494
01:03:09.970 --> 01:03:11.213
when it's hard to do so.

1495
01:03:12.125 --> 01:03:17.125
And then we basically look at which one...

1496
01:03:18.080 --> 01:03:22.300
Which brain areas were more likely to tell us

1497
01:03:22.300 --> 01:03:25.265
that this person was going to be a problem using

1498
01:03:25.265 --> 01:03:26.907
what we call the problem user or not.

1499
01:03:26.907 --> 01:03:29.860

And we found this various areas in the brain

1500
01:03:29.860 --> 01:03:31.910
where we could differentiate those.

1501
01:03:31.910 --> 01:03:33.860
And what's important to you is that the brain actually

1502
01:03:33.860 --> 01:03:35.990
could tell us more than the person.

1503
01:03:35.990 --> 01:03:38.160
'Cause if we looked at sort of individuals

1504
01:03:39.110 --> 01:03:41.110
kind of self descriptions,

1505
01:03:41.110 --> 01:03:44.970
and there was really nothing there to tell us

1506
01:03:44.970 --> 01:03:46.740
who's gonna develop problems and who's not.

1507
01:03:46.740 --> 01:03:50.340
So the brain actually helped us to find something

1508
01:03:50.340 --> 01:03:51.450
that the self-report was not,

1509
01:03:51.450 --> 01:03:53.130
and that was really the kind of

1510
01:03:53.130 --> 01:03:57.950
the major insight at the time and then...

1511
01:03:57.950 --> 01:03:59.030
And here's the other thing

1512
01:03:59.030 --> 01:04:02.170
and I think Kirk also beautifully described this,

1513
01:04:02.170 --> 01:04:04.610
Is you develop in your career

1514
01:04:04.610 --> 01:04:09.030
and you're kind of making points of contact with new ideas

1515
01:04:09.030 --> 01:04:10.700
with new ways of looking at it.

1516
01:04:10.700 --> 01:04:13.400
And so I got heavily into

1517
01:04:13.400 --> 01:04:15.610
what's now referred to as computations of pietry

1518
01:04:15.610 --> 01:04:19.670
or computational approaches and working again

1519
01:04:19.670 --> 01:04:21.990
with wonderful post-doc has a Katia Harle.

1520
01:04:21.990 --> 01:04:25.220
I'm gonna show you another post-doc in a little bit,

1521
01:04:25.220 --> 01:04:27.960
the idea was what does computational psychiatry

1522
01:04:27.960 --> 01:04:29.630
well, in the old approach,

1523
01:04:29.630 --> 01:04:33.450
basically what we did is we looked at the behavior

1524
01:04:33.450 --> 01:04:35.280

and we did correlative approaches

1525
01:04:36.368 --> 01:04:39.100
in the brain with the new approach

1526
01:04:39.100 --> 01:04:43.187
we now generating what's called a processing model.

1527
01:04:43.187 --> 01:04:46.090
And the processing model is how we think

1528
01:04:46.090 --> 01:04:49.943
that the person actually approaches a particular task.

1529
01:04:51.731 --> 01:04:54.940
And that then keeps us a way of thinking

1530
01:04:54.940 --> 01:04:56.620
what might be going wrong.

1531
01:04:56.620 --> 01:05:01.620
And that helps us to develop more deeper explanatory models.

1532
01:05:05.280 --> 01:05:06.470
And that's basically what we did.

1533
01:05:06.470 --> 01:05:08.820
And again, I'm not gonna go through all the details

1534
01:05:08.820 --> 01:05:11.940
of the model because that's not so relevant here

1535
01:05:11.940 --> 01:05:15.150
but enough to say that I wanna just show you one.

1536
01:05:15.150 --> 01:05:17.170
So what we were able to show is that

1537
01:05:17.170 --> 01:05:19.640
with this computational model,

1538
01:05:19.640 --> 01:05:24.640
we would better able to predict what's called an ROC curve.

1539
01:05:24.660 --> 01:05:26.160
We were better able to predict

1540
01:05:27.648 --> 01:05:32.160
who is going to develop problems and who's not.

1541
01:05:32.160 --> 01:05:34.140
And that was really exciting plus

1542
01:05:34.140 --> 01:05:37.181
because it not only gave us an advance

1543
01:05:37.181 --> 01:05:39.020
in our prediction abilities

1544
01:05:39.020 --> 01:05:41.920
but also it gives us what might actually be going on.

1545
01:05:41.920 --> 01:05:46.110
And then, so the summary of what we found

1546
01:05:46.110 --> 01:05:51.110
is that the people that did not go onto develop problems.

1547
01:05:52.270 --> 01:05:54.770
They actually, when they were doing this task,

1548
01:05:54.770 --> 01:05:57.400
were building up in their brains,

1549
01:05:57.400 --> 01:06:00.830

the very succinct inhibitory model.

1550
01:06:00.830 --> 01:06:03.460
So they were thinking, oh yeah, sometimes it gets hard

1551
01:06:03.460 --> 01:06:04.730
and I have to hold myself back.

1552
01:06:04.730 --> 01:06:06.630
And sometimes it's easier.

1553
01:06:06.630 --> 01:06:10.790
Whereas the ones that did not were not able to do so

1554
01:06:10.790 --> 01:06:12.957
now we don't know why they were not able to do so.

1555
01:06:12.957 --> 01:06:15.600
And that's something that would be the next step

1556
01:06:15.600 --> 01:06:17.270
but now we have a much better way.

1557
01:06:17.270 --> 01:06:20.320
So we know that the people(audio breaks)to get

1558
01:06:20.320 --> 01:06:23.200
into problems with stimulants

1559
01:06:23.200 --> 01:06:26.140
are the ones that have a difficult time for whatever reason,

1560
01:06:26.140 --> 01:06:31.140
to develop a detailed model

1561
01:06:31.960 --> 01:06:33.700
of when they have to hold themselves back

1562
01:06:33.700 --> 01:06:35.510
and when they can when they can let go.

1563
01:06:35.510 --> 01:06:37.050
Because of course, the point is

1564
01:06:37.050 --> 01:06:40.337
that it's the yin-yang between when you let yourself go

1565
01:06:40.337 --> 01:06:42.150
and when you hold yourself back,

1566
01:06:42.150 --> 01:06:44.310
that is so hard to regulate.

1567
01:06:44.310 --> 01:06:48.670
And that's what we found with these particular sites.

1568
01:06:48.670 --> 01:06:50.740
And so again, I told you a little bit

1569
01:06:50.740 --> 01:06:52.210
about how to get into drugs.

1570
01:06:52.210 --> 01:06:56.320
Now, this is a set of studies that we did

1571
01:06:56.320 --> 01:07:00.080
where we worked with very severely dependent individuals.

1572
01:07:00.080 --> 01:07:01.750
This was in San Diego, and now we're working here

1573
01:07:01.750 --> 01:07:04.350
in Tulsa people...

1574
01:07:04.350 --> 01:07:09.200

I mean unless you've really been at a substance use facility

1575
01:07:09.200 --> 01:07:10.900
and really talk to these people,

1576
01:07:10.900 --> 01:07:12.094
it's very hard to imagine.

1577
01:07:12.094 --> 01:07:14.730
I mean, I can tell you when we first

1578
01:07:14.730 --> 01:07:18.570
had research assistants working with us, with these folks,

1579
01:07:18.570 --> 01:07:21.410
they were very, very emotionally effected.

1580
01:07:21.410 --> 01:07:25.490
We used to have regular sort of post debriefing meetings

1581
01:07:25.490 --> 01:07:27.080
with the research assistant,

1582
01:07:27.080 --> 01:07:28.370
where we would talk about

1583
01:07:29.690 --> 01:07:32.300
the emotion that the researchers would have

1584
01:07:32.300 --> 01:07:36.370
about these terrible lives that has had happened to people.

1585
01:07:36.370 --> 01:07:39.387
So we need to remind ourselves that these people

1586
01:07:39.387 --> 01:07:42.230
who suffer from stimulant use or opiate use

1587
01:07:43.476 --> 01:07:44.900
this is a terrible condition.

1588
01:07:44.900 --> 01:07:49.900
This is not something that is sort of a

1589
01:07:50.210 --> 01:07:53.660
kind of disorder without tragedies.

1590
01:07:53.660 --> 01:07:56.300
There are lots of tragedies with these disorders

1591
01:07:56.300 --> 01:08:00.710
so enough of the statistics, but the point being

1592
01:08:00.710 --> 01:08:01.870
and this is still true.

1593
01:08:01.870 --> 01:08:05.130
I mean we're fortunate enough for the first time.

1594
01:08:05.130 --> 01:08:08.460
We now seem to have some pharmacological improvement

1595
01:08:08.460 --> 01:08:10.640
for stimulant use disorder,

1596
01:08:10.640 --> 01:08:14.620
but by and large, a stimulant use disorder

1597
01:08:14.620 --> 01:08:18.640
is still an enigma to addiction signs

1598
01:08:18.640 --> 01:08:22.600
or to our understanding of addiction

1599
01:08:22.600 --> 01:08:26.870

because there's not really a compelling way of treating it.

1600
01:08:26.870 --> 01:08:28.980
The only way there'll be treated right now is

1601
01:08:28.980 --> 01:08:31.890
with a structure support,

1602
01:08:31.890 --> 01:08:34.373
possibly what's called contingency management.

1603
01:08:35.250 --> 01:08:37.640
But overall, our treatment successes

1604
01:08:37.640 --> 01:08:40.810
are very very modest to say the least.

1605
01:08:40.810 --> 01:08:43.380
So that was one something that really struck me.

1606
01:08:43.380 --> 01:08:47.640
And here we show the relapse rates, which are tremendous.

1607
01:08:47.640 --> 01:08:50.220
So again, with a number of different people here

1608
01:08:50.220 --> 01:08:53.300
I show a Josh Gowlin, who's now in Colorado

1609
01:08:53.300 --> 01:08:57.000
who was a post-doc with me, and at AAA afterwards

1610
01:08:57.000 --> 01:08:58.450
and fantastic guy,

1611
01:08:58.450 --> 01:09:00.580
we did some studies looking at risk

1612
01:09:00.580 --> 01:09:01.990
related process differences

1613
01:09:01.990 --> 01:09:04.610
and not to, surprisingly what we found,

1614
01:09:04.610 --> 01:09:07.010
and again, I'm not going through the details here

1615
01:09:07.010 --> 01:09:12.010
is that in people who have methamphetamine dependence

1616
01:09:12.030 --> 01:09:15.360
or now use disorder their brain process

1617
01:09:15.360 --> 01:09:18.173
to risk versus benefit was really eschewed.

1618
01:09:20.169 --> 01:09:24.470
And again, it showed us in the brain more so

1619
01:09:24.470 --> 01:09:26.810
than what the person could tell us about.

1620
01:09:26.810 --> 01:09:29.350
And then again, with Katia's help

1621
01:09:29.350 --> 01:09:31.630
we actually developed the computational model.

1622
01:09:31.630 --> 01:09:35.030
And again, with this model,

1623
01:09:35.030 --> 01:09:37.230
we were even better able to predict

1624
01:09:38.890 --> 01:09:40.560

who was going to relapse

1625
01:09:40.560 --> 01:09:43.883
which was our big outcome measure at that time.

1626
01:09:45.599 --> 01:09:47.149
And so what's interesting again

1627
01:09:48.450 --> 01:09:51.980
what we found in this particular circumstance

1628
01:09:51.980 --> 01:09:53.710
was that those individuals

1629
01:09:54.943 --> 01:09:57.373
who have a less well developed internal model,

1630
01:09:57.373 --> 01:10:01.673
were those that biggest risks for relapse.

1631
01:10:02.580 --> 01:10:06.280
And again, this allowed us to go

1632
01:10:06.280 --> 01:10:08.710
beyond just looking at the brain.

1633
01:10:08.710 --> 01:10:12.410
Now, combining it with sort of a process in the brain

1634
01:10:12.410 --> 01:10:16.070
to come up with better ways of formulating

1635
01:10:16.070 --> 01:10:17.760
what's going on with addiction.

1636
01:10:17.760 --> 01:10:19.040
We're still at the beginning

1637
01:10:19.040 --> 01:10:20.920
and I'm just gonna finish up.

1638
01:10:20.920 --> 01:10:22.190
We're still at the beginning

1639
01:10:22.190 --> 01:10:24.610
there's lots more work to be done

1640
01:10:24.610 --> 01:10:27.170
and the beauty of it and also speaks...

1641
01:10:27.170 --> 01:10:28.420
I wanna come back to what Kirk said

1642
01:10:28.420 --> 01:10:30.950
is we now have a unique opportunity.

1643
01:10:30.950 --> 01:10:33.400
We are fortunate enough to be part of ABCD

1644
01:10:34.380 --> 01:10:38.460
which is the largest ever conducted neuro imaging study ever

1645
01:10:40.345 --> 01:10:44.430
is a fantastic opportunity for people who are interested

1646
01:10:44.430 --> 01:10:47.900
in data science to really dig themselves in

1647
01:10:47.900 --> 01:10:50.830
and trying to understand what happens,

1648
01:10:50.830 --> 01:10:52.960
what gets people into substance use.

1649
01:10:52.960 --> 01:10:54.050

This is a perfect time.

1650
01:10:54.050 --> 01:10:56.050
It's in the second decade of life.

1651
01:10:56.050 --> 01:10:59.610
It's been really most of the transition from,

1652
01:10:59.610 --> 01:11:03.710
first experimentation to later more severe use happens.

1653
01:11:03.710 --> 01:11:07.190
So I really wanna give a big shout for NIDA

1654
01:11:07.190 --> 01:11:12.190
to be at the forefront of being able to do this,

1655
01:11:12.460 --> 01:11:14.180
to make this study happen.

1656
01:11:14.180 --> 01:11:15.760
And lastly, I wanna say something

1657
01:11:15.760 --> 01:11:17.220
that I think is very dear to my heart.

1658
01:11:17.220 --> 01:11:20.080
So I've been very fortunate to be supported

1659
01:11:20.080 --> 01:11:21.660
by NIDA for many, many years.

1660
01:11:21.660 --> 01:11:23.930
And I would not have been so fortunate had I not

1661
01:11:23.930 --> 01:11:26.920
had a fantastic program officer as Steve Grant

1662
01:11:26.920 --> 01:11:29.890
who had been my programizer from day one.

1663
01:11:29.890 --> 01:11:32.730
Has been a rock and he...

1664
01:11:32.730 --> 01:11:36.320
I have really many, many telephone conversations

1665
01:11:36.320 --> 01:11:37.510
I've had with Steve.

1666
01:11:37.510 --> 01:11:41.590
And Steve is not an easy guy to persuade,

1667
01:11:41.590 --> 01:11:42.630
he has his own opinions.

1668
01:11:42.630 --> 01:11:44.060
He has his own way of thinking about it.

1669
01:11:44.060 --> 01:11:48.200
And he always, for me at least,

1670
01:11:48.200 --> 01:11:52.490
was a sounding board it's like

1671
01:11:52.490 --> 01:11:54.490
do you think I'm going in the right direction?

1672
01:11:54.490 --> 01:11:57.810
And do you think that this makes sense

1673
01:11:57.810 --> 01:12:01.640
and very, very thoughtful responses from him.

1674
01:12:01.640 --> 01:12:04.010

I know he just retired, I wish him all the best,

1675
01:12:04.010 --> 01:12:06.730
but I wanna say that's one of the things

1676
01:12:06.730 --> 01:12:09.480
that I really appreciate with NIDA

1677
01:12:09.480 --> 01:12:12.270
is having this kind of long-term relationship

1678
01:12:12.270 --> 01:12:16.030
because, science doesn't get done by one grant alone.

1679
01:12:16.030 --> 01:12:18.890
Science gets done as a whole career.

1680
01:12:18.890 --> 01:12:20.900
And by developing these relationships,

1681
01:12:20.900 --> 01:12:25.397
you really can make sure that you can have a career at NIDA

1682
01:12:27.390 --> 01:12:29.920
in trying to understand addiction.

1683
01:12:29.920 --> 01:12:33.370
So I wanna thank a lot of the supporters,

1684
01:12:33.370 --> 01:12:35.730
NIDA is the biggest one, quite frankly,

1685
01:12:35.730 --> 01:12:38.790
I wanna support the other people...

1686
01:12:38.790 --> 01:12:41.090
Some of the other people that contribute to here.

1687
01:12:41.090 --> 01:12:43.840
And I want to thank NIDA again for giving me opportunity

1688
01:12:43.840 --> 01:12:47.720
to talk about today, my work and a little bit about myself.

1689
01:12:47.720 --> 01:12:50.170
I'm not good at talking about myself.

1690
01:12:50.170 --> 01:12:51.653
I've lived other speak word,

1691
01:12:53.140 --> 01:12:55.570
but I'm happy to take any questions, thank you.

1692
01:12:57.600 --> 01:12:59.080
<v ->Thank you Martin, that was fantastic.</v>

1693
01:12:59.080 --> 01:13:00.940
It was great to hear about your career and your research

1694
01:13:00.940 --> 01:13:03.080
and thank you for the kind words about NIDA.

1695
01:13:03.080 --> 01:13:04.510
And I agree with everything you said about Steve.

1696
01:13:04.510 --> 01:13:06.790
He's a great guy and we wish him well in retirement.

1697
01:13:06.790 --> 01:13:08.360
Now I'm gonna turn it over to Roger.

1698
01:13:08.360 --> 01:13:09.860
Who's going to moderate the questions

1699
01:13:09.860 --> 01:13:12.200

and you can ask questions in the chat box

1700
01:13:12.200 --> 01:13:14.360
and then we'll do our best to get through all of them.

1701
01:13:14.360 --> 01:13:15.960
<v ->Sure, thanks Susan.</v>

1702
01:13:15.960 --> 01:13:20.260
And thanks to our speakers today and our attendees.

1703
01:13:20.260 --> 01:13:24.170
This is a question to both speakers.

1704
01:13:24.170 --> 01:13:26.890
What's the best and worst advice you've received

1705
01:13:26.890 --> 01:13:27.923
over your careers?

1706
01:13:30.330 --> 01:13:32.120
<v ->Oh, the best advice I ever got</v>

1707
01:13:32.120 --> 01:13:34.770
which was probably only useful for me

1708
01:13:36.227 --> 01:13:37.060
was when I was at the Hubble

1709
01:13:37.060 --> 01:13:39.900
and I was trying to finish up my last work there

1710
01:13:39.900 --> 01:13:41.530
before I moved on to my role

1711
01:13:41.530 --> 01:13:43.260
at NASA Goddard Space Flight Center

1712
01:13:43.260 --> 01:13:44.510
I was doing a big report

1713
01:13:44.510 --> 01:13:47.467
on the verification of the data archive.

1714
01:13:47.467 --> 01:13:49.240
And it was taking me forever to finish it.

1715
01:13:49.240 --> 01:13:53.660
And my boss's boss, who I got to know pretty well,

1716
01:13:53.660 --> 01:13:55.130
she knew I was sort of struggling to finish things

1717
01:13:55.130 --> 01:13:56.960
up because I was a perfectionist

1718
01:13:56.960 --> 01:13:58.070
and she knew I was a perfectionist.

1719
01:13:58.070 --> 01:13:59.110
So she said to me, Kirk

1720
01:13:59.110 --> 01:14:00.560
I'm gonna tell you something that I cannot...

1721
01:14:00.560 --> 01:14:02.483
I will never tell anybody else.

1722
01:14:03.320 --> 01:14:05.297
And she said to me, she said

1723
01:14:05.297 --> 01:14:08.147
"any job worth doing is worth doing poorly."

1724
01:14:09.530 --> 01:14:11.870

And by that, she meant if I get only 99%

1725
01:14:11.870 --> 01:14:14.390
of it done in my mind, that's poorly done,

1726
01:14:14.390 --> 01:14:15.860
but she said that's good enough,

1727
01:14:15.860 --> 01:14:18.580
99% it's okay, it's acceptable.

1728
01:14:18.580 --> 01:14:22.420
And so she really freed me up and I learned

1729
01:14:22.420 --> 01:14:25.180
how not to be a perfectionist with that advice.

1730
01:14:25.180 --> 01:14:26.527
And I don't know what the worst advice I ever

1731
01:14:26.527 --> 01:14:28.810
got was I I've been very fortunate with good advice.

1732
01:14:28.810 --> 01:14:29.944
So I'll think about that Ram.

1733
01:14:29.944 --> 01:14:31.383
Give Martin the floor.

1734
01:14:32.550 --> 01:14:33.383
<v ->Okay. It's so funny</v>

1735
01:14:33.383 --> 01:14:36.320
that you say that I have the same reaction.

1736
01:14:36.320 --> 01:14:38.310
I had a little bit of time to think about first.

1737
01:14:38.310 --> 01:14:42.980
I cannot quite think even if the advice may not have been...

1738
01:14:42.980 --> 01:14:45.050
If it was really bad, I probably forgot about it

1739
01:14:45.050 --> 01:14:47.570
because it didn't help me in any ways

1740
01:14:47.570 --> 01:14:50.130
but even if it was advice that maybe

1741
01:14:50.130 --> 01:14:52.800
I wouldn't have taken it took

1742
01:14:52.800 --> 01:14:54.650
and the second go around in the end

1743
01:14:54.650 --> 01:14:56.640
I kind of make it work in some ways, right?

1744
01:14:56.640 --> 01:14:59.310
So but I wanna say that I've been

1745
01:14:59.310 --> 01:15:02.750
very fortunate to have had great people

1746
01:15:02.750 --> 01:15:04.540
supervisors that worked with me.

1747
01:15:04.540 --> 01:15:08.620
I worked with Arnie Mandale, with Mark Geier,

1748
01:15:08.620 --> 01:15:11.220
with Mark Schuchat, with David Brown.

1749
01:15:11.220 --> 01:15:13.500

These are all people who have been really

1750
01:15:14.540 --> 01:15:16.280
fantastic in their fields.

1751
01:15:16.280 --> 01:15:19.490
And for me, what I always...

1752
01:15:21.100 --> 01:15:24.100
Again, what I found was useful is

1753
01:15:24.960 --> 01:15:28.670
how can I translate the words that a person is saying

1754
01:15:28.670 --> 01:15:30.930
to what the person has actually done?

1755
01:15:30.930 --> 01:15:33.880
Because words are cheap.

1756
01:15:33.880 --> 01:15:37.650
So I mean, quite frankly even what I'm saying today,

1757
01:15:37.650 --> 01:15:39.780
it's just a set of words.

1758
01:15:39.780 --> 01:15:41.960
If you can identify behavioral patterns

1759
01:15:41.960 --> 01:15:44.820
in a person and how they do something.

1760
01:15:44.820 --> 01:15:48.080
I think that for me has been incredibly insightful.

1761
01:15:48.080 --> 01:15:49.580
I give you a very practical example.

1762
01:15:49.580 --> 01:15:52.370
So Mark Shucket was an absolute stickler

1763
01:15:52.370 --> 01:15:53.923
for human subjects research.

1764
01:15:55.255 --> 01:15:56.088
And I will still remember

1765
01:15:56.088 --> 01:15:58.950
we used to do these arounds where you have

1766
01:15:58.950 --> 01:16:01.940
to present the case in front of him.

1767
01:16:01.940 --> 01:16:05.700
And it had to be exactly presented just the way he wanted

1768
01:16:05.700 --> 01:16:08.700
chief complained how long the substance use

1769
01:16:08.700 --> 01:16:10.370
had been going on, how it started

1770
01:16:10.370 --> 01:16:12.790
and if you deviated from that,

1771
01:16:12.790 --> 01:16:14.490
he would just come down on you and said

1772
01:16:14.490 --> 01:16:16.190
no, this is not the way we present.

1773
01:16:16.190 --> 01:16:19.330
And so you can imagine

1774
01:16:19.330 --> 01:16:20.870

that when you start out,

1775
01:16:20.870 --> 01:16:23.980
your stress level, your cortisol level was quite high.

1776
01:16:23.980 --> 01:16:27.380
But for me, what that taught me is that,

1777
01:16:27.380 --> 01:16:30.360
human substance research can be a pretty complex

1778
01:16:30.360 --> 01:16:32.040
because humans are complex.

1779
01:16:32.040 --> 01:16:35.000
So you have to bring some order to this complexity.

1780
01:16:35.000 --> 01:16:36.730
And he really helped me with that.

1781
01:16:36.730 --> 01:16:39.760
And I've taken, I'm probably not as good as he is

1782
01:16:39.760 --> 01:16:42.020
because he is second to none,

1783
01:16:42.020 --> 01:16:47.020
but I've taken a lot of his advice to heart

1784
01:16:47.310 --> 01:16:49.350
because he lived it, he...

1785
01:16:49.350 --> 01:16:52.083
I saw him act the way he was talking.

1786
01:16:53.670 --> 01:16:54.503
<v ->Thank you.</v>

1787
01:16:55.480 --> 01:16:57.340
There's a question here about

1788
01:16:57.340 --> 01:17:00.873
what are recommended resources for learning data science.

1789
01:17:03.090 --> 01:17:06.462
<v ->Well, my short answer is the follow Kirk Born on Twitter.</v>

1790
01:17:06.462 --> 01:17:07.710
(laughing)

1791
01:17:07.710 --> 01:17:10.020
I've spent nine years teaching the world

1792
01:17:10.020 --> 01:17:12.010
about data science, 140 characters

1793
01:17:12.010 --> 01:17:14.233
and now 280 characters at a time,

1794
01:17:15.100 --> 01:17:16.790
not entirely facetious

1795
01:17:16.790 --> 01:17:20.100
nearly 300,000 followers could probably testify to this,

1796
01:17:20.100 --> 01:17:21.910
but really there's a lot of places.

1797
01:17:21.910 --> 01:17:23.160
I mean, there's just like absolutely

1798
01:17:23.160 --> 01:17:25.750
no lack of places in the world,

1799
01:17:25.750 --> 01:17:28.040

but there's the online platforms, social media

1800
01:17:28.040 --> 01:17:31.130
with Coursera, Udacity, Udemy

1801
01:17:32.550 --> 01:17:34.190
I have a lot of followers in India

1802
01:17:34.190 --> 01:17:35.850
and I always point the people in India

1803
01:17:35.850 --> 01:17:37.940
when they asked me that question to analytics, video.com.

1804
01:17:37.940 --> 01:17:39.840
So analytics, video.com.

1805
01:17:39.840 --> 01:17:42.780
They just have a wealth of free online courses.

1806
01:17:42.780 --> 01:17:44.280
So you don't have to be from India.

1807
01:17:44.280 --> 01:17:46.100
It's all available online.

1808
01:17:46.100 --> 01:17:46.933
So there's really...

1809
01:17:46.933 --> 01:17:47.766
There's no lack.

1810
01:17:47.766 --> 01:17:49.760
You just can look and it's just everywhere.

1811
01:17:53.680 --> 01:17:55.670
<v ->And I would totally agree with that.</v>

1812
01:17:55.670 --> 01:18:00.650
And, as it gets to addiction signs, there are work groups.

1813
01:18:00.650 --> 01:18:01.747
I think Twitter has become

1814
01:18:01.747 --> 01:18:04.400
and I agree with Kirk on that too.

1815
01:18:04.400 --> 01:18:06.860
The go-to place to kind of have your fingers

1816
01:18:06.860 --> 01:18:09.290
on the pulse, so to speak.

1817
01:18:09.290 --> 01:18:11.368
And you quickly identify the people

1818
01:18:11.368 --> 01:18:14.083
who are moving things forward,

1819
01:18:14.960 --> 01:18:19.730
which I hate to say I'm a little beyond the peak already,

1820
01:18:19.730 --> 01:18:21.850
but it's still fun to...

1821
01:18:21.850 --> 01:18:23.970
Obviously my job is to help these people

1822
01:18:23.970 --> 01:18:26.370
help things move forward but it's....

1823
01:18:26.370 --> 01:18:28.470
I mean, one thing that the field

1824
01:18:28.470 --> 01:18:31.130

that is just exploding is of course deep learning

1825
01:18:31.130 --> 01:18:33.570
and we're just getting...

1826
01:18:33.570 --> 01:18:36.390
So we have a couple of models deep learning models,

1827
01:18:36.390 --> 01:18:39.100
they're very data hungry so you're gonna need

1828
01:18:39.100 --> 01:18:40.963
thousands and thousands of records.

1829
01:18:42.082 --> 01:18:45.410
And there's a vast community out there.

1830
01:18:45.410 --> 01:18:47.450
That's building up very quickly.

1831
01:18:47.450 --> 01:18:50.370
You just have to be curious enough and you...

1832
01:18:51.370 --> 01:18:53.560
It takes you less than a day to figure out,

1833
01:18:53.560 --> 01:18:57.820
okay, who's doing what and then follow these people

1834
01:18:57.820 --> 01:18:59.813
and pull those discussions online.

1835
01:19:02.020 --> 01:19:06.350
<v ->So this next question perhaps is more directed to Martin</v>

1836
01:19:06.350 --> 01:19:08.140
but I would also be extremely curious

1837
01:19:08.140 --> 01:19:11.790
to hear what your perspective would be Kirk,

1838
01:19:11.790 --> 01:19:14.440
simply because it is directed toward psychiatry,

1839
01:19:14.440 --> 01:19:17.500
but how do we use computational psychiatry approaches

1840
01:19:17.500 --> 01:19:19.770
to obtain the type of perspective modeling

1841
01:19:19.770 --> 01:19:21.063
that Kirk described?

1842
01:19:22.960 --> 01:19:24.040
<v ->Yeah, that's...</v>

1843
01:19:24.040 --> 01:19:26.353
And that's something that I'm very, very interested in

1844
01:19:26.353 --> 01:19:29.183
is kind of making this whole thing pragmatic and useful.

1845
01:19:30.060 --> 01:19:31.580
I do think that there's...

1846
01:19:32.620 --> 01:19:34.440
So here's one thing why I think

1847
01:19:34.440 --> 01:19:36.483
competition model is important.

1848
01:19:37.890 --> 01:19:40.630
One of the things that's often under appreciated

1849
01:19:40.630 --> 01:19:44.120

is that patients want to understand their condition.

1850
01:19:44.120 --> 01:19:45.250
And what does that mean?

1851
01:19:45.250 --> 01:19:48.590
It means that they want to know

1852
01:19:48.590 --> 01:19:50.693
why certain things happen to them.

1853
01:19:51.600 --> 01:19:54.500
And the why question is very difficult to answer.

1854
01:19:54.500 --> 01:19:56.120
We talked about the causality issue

1855
01:19:56.120 --> 01:19:57.940
but with process models.

1856
01:19:57.940 --> 01:20:00.830
So for example, the ability to hold yourself back,

1857
01:20:00.830 --> 01:20:04.700
or the ability to be overwhelmed by the Cinnabon smell.

1858
01:20:04.700 --> 01:20:09.420
Like if you can put that into an appropriate...

1859
01:20:09.420 --> 01:20:11.830
If you can take the model, which is mathematics

1860
01:20:11.830 --> 01:20:13.730
which most people will not understand,

1861
01:20:14.709 --> 01:20:16.690
but you translate it into something

1862
01:20:16.690 --> 01:20:18.580
that people can understand

1863
01:20:18.580 --> 01:20:21.860
then that gives them a metaphor, a true metaphor

1864
01:20:21.860 --> 01:20:24.987
because the truth of matter is how it current disease models

1865
01:20:24.987 --> 01:20:26.610
and the kind of disease modes,

1866
01:20:26.610 --> 01:20:29.350
particularly in addiction that people walk around with

1867
01:20:29.350 --> 01:20:32.944
are vastly outdated are not evidence-based,

1868
01:20:32.944 --> 01:20:35.240
there's no addictive personality.

1869
01:20:35.240 --> 01:20:39.230
There's no, lack of willpower.

1870
01:20:39.230 --> 01:20:41.200
I mean, it's these, these notions

1871
01:20:41.200 --> 01:20:45.020
that people walk around with an being stigmatized as

1872
01:20:46.750 --> 01:20:50.930
that it's just not based good sound signs.

1873
01:20:50.930 --> 01:20:55.577
So our job is to provide evidence-based process

1874
01:20:56.760 --> 01:20:59.690

models that people can understand

1875
01:20:59.690 --> 01:21:04.223
so that we go beyond the stigmatizing views of addiction.

1876
01:21:06.400 --> 01:21:07.233
<v ->Thank you.</v>

1877
01:21:09.375 --> 01:21:11.350
<v ->So you want me to throw in something there</v>

1878
01:21:11.350 --> 01:21:13.040
<v ->if you have anything,</v>

1879
01:21:13.040 --> 01:21:15.570
there are other questions waiting, so

1880
01:21:15.570 --> 01:21:17.766
<v ->Oh yeah, I can give you another lecture here.</v>

1881
01:21:17.766 --> 01:21:19.550
(laughing)

1882
01:21:19.550 --> 01:21:21.560
I'll give you a mini lecture.

1883
01:21:21.560 --> 01:21:24.560
So my first sort of like a buyer beware

1884
01:21:24.560 --> 01:21:26.860
is my mind works with metaphors, okay?

1885
01:21:26.860 --> 01:21:28.230
I always see connections

1886
01:21:28.230 --> 01:21:30.690
between things like my killer asteroid example,

1887
01:21:30.690 --> 01:21:33.650
then I told you about where you have a predictive model

1888
01:21:33.650 --> 01:21:34.560
of something going to happen

1889
01:21:34.560 --> 01:21:36.410
then you want to find a prescription

1890
01:21:36.410 --> 01:21:38.500
to change that outcome, okay?

1891
01:21:38.500 --> 01:21:40.160
So I talked about customer attrition,

1892
01:21:40.160 --> 01:21:41.460
employee attrition.

1893
01:21:41.460 --> 01:21:43.550
They (indistinct) is just a metaphor for you.

1894
01:21:43.550 --> 01:21:46.210
You see an outcome, but what can you do to change it?

1895
01:21:46.210 --> 01:21:48.700
And when I told that story about my younger brother

1896
01:21:48.700 --> 01:21:50.330
I was trying to make that connection

1897
01:21:50.330 --> 01:21:52.610
but maybe not so clearly that that it's the....

1898
01:21:52.610 --> 01:21:54.580
What's the evidence of the data

1899
01:21:54.580 --> 01:21:57.210

that can move that individual

1900
01:21:57.210 --> 01:21:59.310
to make a different decision than they made.

1901
01:21:59.310 --> 01:22:01.040
All right, just like those high school students

1902
01:22:01.040 --> 01:22:02.890
who didn't like math and science

1903
01:22:02.890 --> 01:22:05.780
and they'd heard about data science and basketball

1904
01:22:05.780 --> 01:22:08.807
and they all of a sudden move towards STEM careers

1905
01:22:08.807 --> 01:22:11.220
and they followed that path.

1906
01:22:11.220 --> 01:22:12.120
And I was hoping that,

1907
01:22:12.120 --> 01:22:13.270
my younger brother could have done that.

1908
01:22:13.270 --> 01:22:14.640
So where was the data there?

1909
01:22:14.640 --> 01:22:15.810
The data was what are the things

1910
01:22:15.810 --> 01:22:17.530
that are those people most passionate about?

1911
01:22:17.530 --> 01:22:20.943
Use that data just to stimulate them,

1912
01:22:22.030 --> 01:22:25.460
are they passionate about basketball, sports, art, music

1913
01:22:25.460 --> 01:22:26.610
healthcare, whatever it is

1914
01:22:26.610 --> 01:22:28.840
they're as passionate about space.

1915
01:22:28.840 --> 01:22:33.770
I move them internally first.

1916
01:22:33.770 --> 01:22:36.810
And I can't touch the whole concept

1917
01:22:36.810 --> 01:22:38.760
of computational psychiatry,

1918
01:22:38.760 --> 01:22:41.410
but I my whole career was computational astronomy.

1919
01:22:41.410 --> 01:22:43.770
So I built models of colliding galaxies.

1920
01:22:43.770 --> 01:22:46.190
And so when you build a model, you get insight

1921
01:22:46.190 --> 01:22:49.230
into what causes it to look one way or go another way.

1922
01:22:49.230 --> 01:22:50.210
So I would build models

1923
01:22:50.210 --> 01:22:51.530
of these things we see in the universe.

1924
01:22:51.530 --> 01:22:53.700

And I would tweak the parameters to see

1925
01:22:53.700 --> 01:22:55.780
what would happen if I changed the parameter

1926
01:22:55.780 --> 01:22:57.580
and how it would look different, okay?

1927
01:22:57.580 --> 01:22:59.276
So that's essentially the same thing.

1928
01:22:59.276 --> 01:23:01.070
You're finding the causal factors

1929
01:23:01.070 --> 01:23:03.130
that cause it to look different or behave different

1930
01:23:03.130 --> 01:23:04.600
or have a different outcome.

1931
01:23:04.600 --> 01:23:08.040
So science is both explanatory and pragmatic

1932
01:23:08.040 --> 01:23:09.810
in the sense that Martin is describing

1933
01:23:09.810 --> 01:23:11.870
that it gives you sort of actions you can take

1934
01:23:11.870 --> 01:23:13.470
to move it to a different place.

1935
01:23:14.339 --> 01:23:15.737
So I started my career with colliding and galaxies

1936
01:23:15.737 --> 01:23:17.070
and I moved on to a lot of

1937
01:23:17.070 --> 01:23:19.030
other things since then, obviously,

1938
01:23:19.030 --> 01:23:20.420
but in the industry,

1939
01:23:20.420 --> 01:23:21.780
there's this thing called digital twins.

1940
01:23:21.780 --> 01:23:24.720
So a digital twin is is a computer copy

1941
01:23:24.720 --> 01:23:25.900
of a physical system

1942
01:23:25.900 --> 01:23:29.860
whether it's a manufacturing plant or a jet engine

1943
01:23:29.860 --> 01:23:34.600
or a windmill, wind power windmill.

1944
01:23:34.600 --> 01:23:38.850
So people in industry I'll build digital copies

1945
01:23:38.850 --> 01:23:41.700
that are very high fidelity representations

1946
01:23:41.700 --> 01:23:44.810
of the physical system to model how it would respond

1947
01:23:44.810 --> 01:23:47.100
to different conditions like a windmill, for example

1948
01:23:47.100 --> 01:23:48.690
an energy generating for windmills,

1949
01:23:48.690 --> 01:23:53.050

high winds, high tour, high stress on the system

1950
01:23:53.050 --> 01:23:55.790
or a jet engine, run it under different conditions

1951
01:23:55.790 --> 01:23:57.500
in your model to see if the jet engine

1952
01:23:57.500 --> 01:23:59.700
will fail under certain conditions.

1953
01:23:59.700 --> 01:24:01.712
Or if the thing does fail, you can ...

1954
01:24:01.712 --> 01:24:04.830
You're collecting data from sensors

1955
01:24:04.830 --> 01:24:06.010
from the real physical system.

1956
01:24:06.010 --> 01:24:07.890
Everyone's got sensors on everything now, right?

1957
01:24:07.890 --> 01:24:10.700
So they can take the data from the real physical system

1958
01:24:10.700 --> 01:24:13.130
and play it through their model over

1959
01:24:13.130 --> 01:24:13.963
and over and over again

1960
01:24:13.963 --> 01:24:16.520
they can replay it sort of like rewind,

1961
01:24:16.520 --> 01:24:18.360
basically a time machine and you get to rewind it

1962
01:24:18.360 --> 01:24:19.962
and see what caused it to fail.

1963
01:24:19.962 --> 01:24:21.440
What caused it to behave this way

1964
01:24:21.440 --> 01:24:22.600
and what can we do about it

1965
01:24:22.600 --> 01:24:23.520
if we ever see it sort of

1966
01:24:23.520 --> 01:24:26.180
the precursor warning signs in the data,

1967
01:24:26.180 --> 01:24:27.640
but it's always about what are the signs

1968
01:24:27.640 --> 01:24:29.620
in the data that give you that insight

1969
01:24:29.620 --> 01:24:31.210
to know what action to take.

1970
01:24:31.210 --> 01:24:32.043
So I always say

1971
01:24:32.043 --> 01:24:34.740
that prescriptive analytics is insights discovery

1972
01:24:34.740 --> 01:24:36.100
'cause it gives you the insight to know

1973
01:24:36.100 --> 01:24:39.120
what are the causal things you can do to change the outcome?

1974
01:24:39.120 --> 01:24:41.950

What are the interventions you can take to have...

1975
01:24:41.950 --> 01:24:42.860
To change the future

1976
01:24:42.860 --> 01:24:45.810
As Yogi Berra said," the feature ain't what it used to be."

1977
01:24:47.190 --> 01:24:49.600
<v ->Thank you, Wilson.</v>

1978
01:24:49.600 --> 01:24:51.313
I believe has a question or two.

1979
01:24:52.869 --> 01:24:55.600
<v ->Pretty much, I really want to thank our speakers.</v>

1980
01:24:55.600 --> 01:24:56.620
One of our purposes

1981
01:24:56.620 --> 01:24:58.940
for this seminar is to inspire people

1982
01:24:58.940 --> 01:25:02.420
to establish and build careers in data science.

1983
01:25:02.420 --> 01:25:04.430
And I certainly see both of you

1984
01:25:04.430 --> 01:25:07.970
as wonderful examples that inspired me today

1985
01:25:07.970 --> 01:25:10.380
and make me wish I had another 30 years

1986
01:25:10.380 --> 01:25:12.326
to develop some of these topics.

1987
01:25:12.326 --> 01:25:13.330
(Kirk laughing)

1988
01:25:13.330 --> 01:25:15.490
I do have a question for you though

1989
01:25:15.490 --> 01:25:17.380
that relates particularly in the area

1990
01:25:17.380 --> 01:25:19.920
of social sciences and behavioral health,

1991
01:25:19.920 --> 01:25:23.580
where the quality of the data isn't always

1992
01:25:23.580 --> 01:25:25.850
as consistent as we might like.

1993
01:25:25.850 --> 01:25:30.850
And so, Kirk you're dealing with astrophysical data

1994
01:25:30.930 --> 01:25:33.160
where I don't think there may be bias

1995
01:25:33.160 --> 01:25:34.080
in how it's collected

1996
01:25:34.080 --> 01:25:36.440
or there might be, but you may know those.

1997
01:25:36.440 --> 01:25:40.200
We don't always know the biases in healthcare data

1998
01:25:40.200 --> 01:25:42.590
and they can be both systematic.

1999
01:25:42.590 --> 01:25:44.980

They can be systematic, not just random.

2000
01:25:44.980 --> 01:25:47.850
So when I think about some of our issues related

2001
01:25:47.850 --> 01:25:48.956
to racial equities in addiction

2002
01:25:48.956 --> 01:25:51.900
and I look at a rest rates

2003
01:25:51.900 --> 01:25:55.580
and think about who is subject to criminal justice issues

2004
01:25:55.580 --> 01:25:57.520
that has a direct impact on

2005
01:25:57.520 --> 01:26:01.030
how we might use data to develop theories.

2006
01:26:01.030 --> 01:26:02.400
And if we aren't careful,

2007
01:26:02.400 --> 01:26:05.210
some of the data analytics can reinforce

2008
01:26:05.210 --> 01:26:06.730
stigmatizing outcomes.

2009
01:26:06.730 --> 01:26:09.950
So I'm curious how we might protect ourselves from that

2010
01:26:09.950 --> 01:26:12.950
and how we might approach some of these complex issues

2011
01:26:12.950 --> 01:26:17.950
of unreliability and bias in our data itself?

2012
01:26:20.810 --> 01:26:21.930
<v ->Well, those are certainly big questions</v>

2013
01:26:21.930 --> 01:26:23.330
for all of the data science.

2014
01:26:24.230 --> 01:26:26.193
You could say that there's different types of biases

2015
01:26:26.193 --> 01:26:27.026
and there are many types,

2016
01:26:27.026 --> 01:26:29.020
but in some sense you can put it under sort of

2017
01:26:29.020 --> 01:26:31.760
one broad umbrella, sort of data bias

2018
01:26:31.760 --> 01:26:33.900
and modeling bias, are essentially in my mind

2019
01:26:33.900 --> 01:26:36.860
sort of similar in the sense that

2020
01:26:36.860 --> 01:26:38.530
if you train a model on the wrong data

2021
01:26:38.530 --> 01:26:41.010
you're obviously going to have some model bias.

2022
01:26:41.010 --> 01:26:43.136
You can also apply your model incorrectly.

2023
01:26:43.136 --> 01:26:44.861
So that's another form of model bias

2024
01:26:44.861 --> 01:26:48.220

where the application of it is incorrect.

2025
01:26:48.220 --> 01:26:50.480
So again, I don't wanna claim I have answers

2026
01:26:50.480 --> 01:26:51.913
and clinical science at all,

2027
01:26:52.810 --> 01:26:54.340
but certainly even in the sciences,

2028
01:26:54.340 --> 01:26:56.690
like astronomy where our subjects are remote.

2029
01:26:56.690 --> 01:26:57.860
And I remember when I was at NASA

2030
01:26:57.860 --> 01:26:59.700
they had all these federal regulations

2031
01:26:59.700 --> 01:27:01.680
about doing data mining and national agencies.

2032
01:27:01.680 --> 01:27:03.650
So I had to sign an affidavit every year to swear

2033
01:27:03.650 --> 01:27:05.560
and I wasn't stealing the identity

2034
01:27:05.560 --> 01:27:08.370
or releasing the personal identifiable information

2035
01:27:08.370 --> 01:27:09.954
from the subjects of my research.

2036
01:27:09.954 --> 01:27:12.443
And I would have to list all the galaxies I was working on.

2037
01:27:13.330 --> 01:27:15.350
So that piece of paper is in some file cabinet

2038
01:27:15.350 --> 01:27:17.570
in some government agency, somewhere these days

2039
01:27:17.570 --> 01:27:19.460
I did wanna go to jail so I did that.

2040
01:27:19.460 --> 01:27:20.720
I filled out the form every year,

2041
01:27:20.720 --> 01:27:22.840
but it did seem a little off topic there.

2042
01:27:22.840 --> 01:27:25.060
But anyway, but we had plenty of biases

2043
01:27:25.060 --> 01:27:26.820
in the way we wanted to build a model

2044
01:27:26.820 --> 01:27:28.190
of how something works in the universe.

2045
01:27:28.190 --> 01:27:30.370
And if you collect limited data from..

2046
01:27:30.370 --> 01:27:32.266
And I always say that that cognitive biases is

2047
01:27:32.266 --> 01:27:34.500
we're not looking at the full dimensionality

2048
01:27:34.500 --> 01:27:35.530
of a thing, right?

2049
01:27:35.530 --> 01:27:37.030

We have a limited perspective.

2050
01:27:37.030 --> 01:27:38.260
Like for example, we have two...

2051
01:27:38.260 --> 01:27:39.460
Let's say we have two datasets

2052
01:27:39.460 --> 01:27:40.862
that are projected right in front of one another

2053
01:27:40.862 --> 01:27:41.800
and you do a scatterplot.

2054
01:27:41.800 --> 01:27:43.170
It looks like one dataset

2055
01:27:43.170 --> 01:27:44.800
until you get this from the side view.

2056
01:27:44.800 --> 01:27:46.300
And you see it's actually two clusters

2057
01:27:46.300 --> 01:27:47.750
that are clearly separated.

2058
01:27:47.750 --> 01:27:48.890
So cognitive bias again

2059
01:27:48.890 --> 01:27:51.570
is missing the full structure of something.

2060
01:27:51.570 --> 01:27:54.230
So for example, when I was a hiring manager at NASA

2061
01:27:54.230 --> 01:27:56.000
and that contract,

2062
01:27:56.000 --> 01:27:58.480
the last three successful candidates were all guys

2063
01:27:58.480 --> 01:27:59.313
who wore white shirts

2064
01:27:59.313 --> 01:28:00.790
I would have a model in my head

2065
01:28:00.790 --> 01:28:03.010
that that's a successful job candidates

2066
01:28:03.010 --> 01:28:04.590
are men who wear white shirts?

2067
01:28:04.590 --> 01:28:06.500
Well, that's a very, very limited perspective.

2068
01:28:06.500 --> 01:28:09.080
I'm not so bias is in statistics.

2069
01:28:09.080 --> 01:28:10.670
We have a word called bias

2070
01:28:10.670 --> 01:28:12.420
which basically means under fitting, right?

2071
01:28:12.420 --> 01:28:13.317
And it's the same thing

2072
01:28:13.317 --> 01:28:15.590
but there's more to this thing in front of me

2073
01:28:15.590 --> 01:28:19.390
whether it's a job candidate or a galaxy or whatever

2074
01:28:19.390 --> 01:28:21.450

if we don't look at all those other perspectives

2075
01:28:21.450 --> 01:28:23.230
if we don't get the big picture.

2076
01:28:23.230 --> 01:28:25.590
And so we have to sort of help ourselves to realize

2077
01:28:25.590 --> 01:28:28.270
that we need those multiple perspectives

2078
01:28:28.270 --> 01:28:29.490
and not just human perspectives,

2079
01:28:29.490 --> 01:28:31.020
but also data projections.

2080
01:28:31.020 --> 01:28:33.380
I mean, so there's this great cartoon

2081
01:28:33.380 --> 01:28:36.590
which I wish I put in my talk of a circular cylinder.

2082
01:28:36.590 --> 01:28:38.340
If you look at a circular cylinder from the side,

2083
01:28:38.340 --> 01:28:39.310
it looks like a rectangle.

2084
01:28:39.310 --> 01:28:41.520
If you look at it from the end, it looks like a circle.

2085
01:28:41.520 --> 01:28:43.740
So there's two people staring at this thing.

2086
01:28:43.740 --> 01:28:45.090
One from one side, one from the other,

2087
01:28:45.090 --> 01:28:47.230
one person says, hey, it's a rectangle.

2088
01:28:47.230 --> 01:28:49.290
And the other person says, no, it's the circle.

2089
01:28:49.290 --> 01:28:50.123
The other guys know it's a rectangle.

2090
01:28:50.123 --> 01:28:52.240
The other guy says, no, it's a circle.

2091
01:28:52.240 --> 01:28:54.280
Well, the fact is they're both right,

2092
01:28:54.280 --> 01:28:56.290
but it's not the truth, right?

2093
01:28:56.290 --> 01:28:58.640
The truth is that it's circular cylinder, okay?

2094
01:28:58.640 --> 01:29:00.320
So the truth lives in higher dimensions

2095
01:29:00.320 --> 01:29:03.260
than our perspectives, our purchase projections proceed

2096
01:29:03.260 --> 01:29:06.210
and we have to constantly test ourselves on

2097
01:29:06.210 --> 01:29:08.963
are we actually getting those diverse perspectives?

2098
01:29:11.780 --> 01:29:14.467
<v ->I think just on a specific side for like</v>

2099
01:29:14.467 --> 01:29:16.400

what NIDA is doing is that,

2100
01:29:16.400 --> 01:29:20.700
we do obviously need more diversity in those

2101
01:29:20.700 --> 01:29:22.080
who study the problems

2102
01:29:22.080 --> 01:29:27.080
and we need more diversity in studying the people.

2103
01:29:27.080 --> 01:29:31.490
Now, again, ABCD I think has been a great step forward

2104
01:29:31.490 --> 01:29:35.230
because it is trying to get to diverse populations.

2105
01:29:35.230 --> 01:29:37.610
I also do think that with the ability

2106
01:29:37.610 --> 01:29:41.123
of having non-intrusive measurements,

2107
01:29:42.150 --> 01:29:44.820
to fit bit through web presence, whatever,

2108
01:29:44.820 --> 01:29:48.570
we are able to gather data more widely

2109
01:29:48.570 --> 01:29:51.780
and hopefully more in more diverse population

2110
01:29:51.780 --> 01:29:54.393
to build better social and behavioral models.

2111
01:29:58.470 --> 01:29:59.570
<v ->Thank you both.</v>

2112
01:30:00.850 --> 01:30:05.850
I believe we're at the end of our talk time today

2113
01:30:06.360 --> 01:30:09.103
so I'll turn it back over to Dr. Wright.

2114
01:30:13.283 --> 01:30:14.116
<v ->Thank you, Roger.</v>

2115
01:30:14.116 --> 01:30:15.949
And I just want to thank our speakers again.

2116
01:30:15.949 --> 01:30:19.590
I feel like we had a really excellent morning hearing

2117
01:30:19.590 --> 01:30:20.423
about your careers.

2118
01:30:20.423 --> 01:30:22.130
It was very inspiring, and I think that's exactly

2119
01:30:22.130 --> 01:30:23.390
what we were hoping to get out of this.

2120
01:30:23.390 --> 01:30:26.340
So thank you again to Dr. Warren and Dr. Paulus.

2121
01:30:26.340 --> 01:30:27.550
And thank you to our audiences

2122
01:30:27.550 --> 01:30:29.190
these have been some great questions.

2123
01:30:29.190 --> 01:30:30.860
If there were some questions we didn't get to

2124
01:30:30.860 --> 01:30:33.340

I think we'll try to answer them via email

2125
01:30:33.340 --> 01:30:36.430
and feel free to reach out to us via email as well.

2126
01:30:36.430 --> 01:30:37.570
And just wanna remind you

2127
01:30:37.570 --> 01:30:41.160
that next week we'll have our third seminar of the series

2128
01:30:41.160 --> 01:30:42.940
and we're featuring women in data science

2129
01:30:42.940 --> 01:30:45.590
and we'll have two speakers, Dr. Brenda Curtis

2130
01:30:45.590 --> 01:30:48.360
from our IRP program here at night

2131
01:30:48.360 --> 01:30:50.110
and also Dr. Christian loom

2132
01:30:50.110 --> 01:30:51.490
from the University of Pennsylvania.

2133
01:30:51.490 --> 01:30:53.050
So please tune in next week.

2134
01:30:53.050 --> 01:30:55.160
The registration link is here

2135
01:30:55.160 --> 01:30:57.940
and we'll have one more seminar following that

2136
01:30:57.940 --> 01:31:00.240
the last week will be April 5th.

2137
01:31:00.240 --> 01:31:03.710
And thanks again, virtual applause for our speakers.

2138
01:31:03.710 --> 01:31:04.746
<v ->Thank you.</v>

2139
01:31:04.746 --> 01:31:05.746
<v ->Thank you.</v>