

**NATHAN
MYHRVOLD**



**NASA IS
LYING**

LST
1688
1688
LTO/R



1
00:00:03,030 --> 00:00:01,670
nathan mirvold is one of those rare

2
00:00:05,030 --> 00:00:03,040
individuals who it's difficult to

3
00:00:07,030 --> 00:00:05,040
overstate the accomplishments of here is

4
00:00:08,950 --> 00:00:07,040
just a small sample of a list of fields

5
00:00:09,669 --> 00:00:08,960
that he's made extensive contributions

6
00:00:11,749 --> 00:00:09,679
to

7
00:00:12,789 --> 00:00:11,759
it's by no means exhaustive nuclear

8
00:00:15,669 --> 00:00:12,799
power that is

9
00:00:16,750 --> 00:00:15,679
the inventing of new reactor types one

10
00:00:19,189 --> 00:00:16,760
that can use

11
00:00:21,189 --> 00:00:19,199
uranium-238 and spent rods of other

12
00:00:23,429 --> 00:00:21,199
nuclear reactors he also in his early

13
00:00:25,589 --> 00:00:23,439

days founded microsoft research

14

00:00:27,029 --> 00:00:25,599

which back then startup software

15

00:00:28,390 --> 00:00:27,039

companies didn't have a research

16

00:00:30,470 --> 00:00:28,400

component to them

17

00:00:31,429 --> 00:00:30,480

this trend of apple research and google

18

00:00:33,430 --> 00:00:31,439

research

19

00:00:34,549 --> 00:00:33,440

they're just adam brations of his

20

00:00:36,790 --> 00:00:34,559

original creation

21

00:00:38,549 --> 00:00:36,800

he founded a company based solely on

22

00:00:40,470 --> 00:00:38,559

inventing he thought well there is no

23

00:00:42,069 --> 00:00:40,480

modern-day equivalent of edison people

24

00:00:44,229 --> 00:00:42,079

just invent in their own specialized

25

00:00:45,430 --> 00:00:44,239

field why not have a company of a team

26

00:00:47,990 --> 00:00:45,440

of people like edison

27

00:00:50,229 --> 00:00:48,000

he also invented new methods of modes of

28

00:00:51,990 --> 00:00:50,239

delivery of treatments for malaria and

29

00:00:53,830 --> 00:00:52,000

other infectious diseases under the bill

30

00:00:55,670 --> 00:00:53,840

gates foundation he also came up with

31

00:00:56,790 --> 00:00:55,680

geo-engineering solutions to the problem

32

00:00:58,709 --> 00:00:56,800

of global warming

33

00:01:01,029 --> 00:00:58,719

we were scheduled to talk for just under

34

00:01:02,389 --> 00:01:01,039

an hour but it went far over two hours

35

00:01:04,390 --> 00:01:02,399

and i didn't even get to half the

36

00:01:06,870 --> 00:01:04,400

questions that i had written down

37

00:01:07,429 --> 00:01:06,880

enjoy this wide-ranging conversation

38

00:01:10,310 --> 00:01:07,439

with

39

00:01:12,070 --> 00:01:10,320

nathan muirvold okay so why am i

40

00:01:15,510 --> 00:01:12,080

interested in you

41

00:01:25,109 --> 00:01:15,520

i've been following you for

42

00:01:26,550 --> 00:01:25,119

12 years

43

00:01:28,469 --> 00:01:26,560

when i was an undergrad i remember

44

00:01:30,469 --> 00:01:28,479

hearing about your book on modernist

45

00:01:33,670 --> 00:01:30,479

cuisine and being fascinated and doing

46

00:01:34,390 --> 00:01:33,680

plenty of research into you and thinking

47

00:01:36,149 --> 00:01:34,400

that

48

00:01:37,749 --> 00:01:36,159

there are few people very few people in

49

00:01:42,230 --> 00:01:37,759

my life that i wish were my uncle

50

00:01:46,950 --> 00:01:44,469

that i can persistently and bothersomely

51

00:01:48,630 --> 00:01:46,960

ask questions too

52

00:01:50,230 --> 00:01:48,640

and and so for years and years i've had

53

00:01:51,350 --> 00:01:50,240

this fascination with you every once in

54

00:01:52,950 --> 00:01:51,360

a while i'd check in on you

55

00:01:54,870 --> 00:01:52,960

and i admire you you probably get this a

56

00:01:56,230 --> 00:01:54,880

lot but i admire you i look up to you

57

00:01:59,270 --> 00:01:56,240

there are very few people i say that

58

00:02:01,190 --> 00:01:59,280

about and so even with this podcast

59

00:02:02,630 --> 00:02:01,200

i don't give people introductions

60

00:02:04,550 --> 00:02:02,640

because i like to just get right into

61

00:02:06,149 --> 00:02:04,560

the meat of it but for you

62

00:02:07,510 --> 00:02:06,159

i have to tell the audience about my

63

00:02:07,990 --> 00:02:07,520

journey with you and some of your

64

00:02:10,070 --> 00:02:08,000

accolades

65

00:02:16,869 --> 00:02:10,080

so if you don't mind can i just get rid

66

00:02:16,879 --> 00:02:21,430

i'll try not to roll my eyes yeah yeah

67

00:02:24,550 --> 00:02:23,110

i'm just gonna read some of this so this

68

00:02:25,830 --> 00:02:24,560

this podcast is about theories of

69

00:02:27,190 --> 00:02:25,840

everything and

70

00:02:28,470 --> 00:02:27,200

it's also about publicizing some

71

00:02:29,190 --> 00:02:28,480

intellectuals that i don't think get as

72

00:02:31,190 --> 00:02:29,200

much credit

73

00:02:32,390 --> 00:02:31,200

as they deserve now obviously you're

74

00:02:34,150 --> 00:02:32,400

extremely successful

75

00:02:35,430 --> 00:02:34,160

but i was watching your ted talk which i

76

00:02:37,509 --> 00:02:35,440

think is superior

77

00:02:38,470 --> 00:02:37,519

to the majority of ted talks that i see

78

00:02:40,150 --> 00:02:38,480

and it

79

00:02:41,750 --> 00:02:40,160

many ted talks have tens of millions of

80

00:02:42,630 --> 00:02:41,760

views sometimes but yet yours only has

81

00:02:45,670 --> 00:02:42,640

two hundred thousand

82

00:02:47,509 --> 00:02:45,680

okay so if i can help that in any way

83

00:02:49,670 --> 00:02:47,519

i would love to with this minor podcast

84

00:02:50,869 --> 00:02:49,680

of mine

85

00:02:52,550 --> 00:02:50,879

it doesn't seem like you need my help

86

00:02:52,869 --> 00:02:52,560

you're effectively a billionaire and you

87

00:02:55,589 --> 00:02:52,879

have

88

00:02:56,710 --> 00:02:55,599

many scholarly accolades nathan mirvold

89

00:02:59,750 --> 00:02:56,720

is someone who has

90

00:03:01,190 --> 00:02:59,760

a variety of interests and

91

00:03:02,869 --> 00:03:01,200

it just astounds me i don't know of

92

00:03:03,990 --> 00:03:02,879

anyone else who has the same amount so i

93

00:03:05,670 --> 00:03:04,000

decided why don't i just start

94

00:03:07,030 --> 00:03:05,680

to list them and i don't think this is

95

00:03:07,430 --> 00:03:07,040

exhaustive in the least i asked your

96

00:03:08,790 --> 00:03:07,440

team

97

00:03:10,710 --> 00:03:08,800

and even they couldn't come up with all

98

00:03:11,670 --> 00:03:10,720

of them is there a list online well

99

00:03:13,670 --> 00:03:11,680

anyway here's some so

100

00:03:15,110 --> 00:03:13,680

dinosaur slash paleontologists you like

101
00:03:15,589 --> 00:03:15,120
dinosaurs you love looking into paleo

102
00:03:18,229 --> 00:03:15,599
you like

103
00:03:19,110 --> 00:03:18,239
even digging okay great asteroids you

104
00:03:22,550 --> 00:03:19,120
have an interest

105
00:03:23,910 --> 00:03:22,560
in scanning the skies and analyzing the

106
00:03:27,190 --> 00:03:23,920
data of nasa

107
00:03:28,070 --> 00:03:27,200
yup nuclear power okay eradicating

108
00:03:30,390 --> 00:03:28,080
malaria

109
00:03:31,670 --> 00:03:30,400
meta materials quantum gravity in your

110
00:03:34,710 --> 00:03:31,680
former days

111
00:03:37,270 --> 00:03:34,720
software obviously microsoft food

112
00:03:38,390 --> 00:03:37,280
modernist cuisine penguins okay i

113
00:03:39,750 --> 00:03:38,400

thought it was just penguins apparently

114

00:03:41,750 --> 00:03:39,760

it's more but i forgot what your team

115

00:03:44,830 --> 00:03:41,760

told me

116

00:03:47,430 --> 00:03:44,840

all kinds of birds and animals hungry

117

00:03:50,470 --> 00:03:47,440

animals great great great

118

00:03:58,470 --> 00:03:54,470

um well i do a lot of photography

119

00:03:59,830 --> 00:03:58,480

right um so photography of

120

00:04:01,990 --> 00:03:59,840

almost all of the things that you

121

00:04:03,990 --> 00:04:02,000

mentioned photography of

122

00:04:05,110 --> 00:04:04,000

stars and meteors and asteroids

123

00:04:08,309 --> 00:04:05,120

photography

124

00:04:09,990 --> 00:04:08,319

of landscapes in the natural world uh

125

00:04:13,509 --> 00:04:10,000

photography of food

126

00:04:14,789 --> 00:04:13,519

uh for the cookbooks so that's another

127

00:04:18,310 --> 00:04:14,799

one

128

00:04:22,150 --> 00:04:18,320

um uh you know

129

00:04:26,830 --> 00:04:22,160

more generally math and

130

00:04:30,469 --> 00:04:26,840

uh technology fascinate me science

131

00:04:32,070 --> 00:04:30,479

so i think of you as a convivial and

132

00:04:34,310 --> 00:04:32,080

quirky version of elon musk

133

00:04:35,590 --> 00:04:34,320

a lesser known convivial and quirky elon

134

00:04:37,749 --> 00:04:35,600

musk and i've

135

00:04:39,510 --> 00:04:37,759

never had the fascination with elon

136

00:04:41,189 --> 00:04:39,520

mainly because of perhaps personality

137

00:04:42,870 --> 00:04:41,199

differences i'm more on the

138

00:04:44,310 --> 00:04:42,880

theoretical end that's my my background

139

00:04:47,350 --> 00:04:44,320

is in physics

140

00:04:49,030 --> 00:04:47,360

and he's much more practical you seem to

141

00:04:52,150 --> 00:04:49,040

have

142

00:04:53,749 --> 00:04:52,160

both no for me like

143

00:04:55,830 --> 00:04:53,759

i'm more comfortable with qft than i am

144

00:04:56,870 --> 00:04:55,840

with bernoulli's equation like i for

145

00:05:01,510 --> 00:04:56,880

some reason

146

00:05:05,510 --> 00:05:01,520

practical in in the engineering side is

147

00:05:08,710 --> 00:05:05,520

it's difficult for me to apprehend

148

00:05:09,350 --> 00:05:08,720

nathan first of all how do you spend

149

00:05:10,710 --> 00:05:09,360

your days

150

00:05:12,469 --> 00:05:10,720

like what does your average day look

151
00:05:13,510 --> 00:05:12,479
like if there's an average day how much

152
00:05:17,510 --> 00:05:13,520
sleep do you get

153
00:05:19,670 --> 00:05:17,520
what is the structure well you know

154
00:05:20,790 --> 00:05:19,680
i don't think there's any single typical

155
00:05:24,469 --> 00:05:20,800
day

156
00:05:27,749 --> 00:05:24,479
um many of the things that i

157
00:05:31,110 --> 00:05:27,759
do involve you know

158
00:05:33,029 --> 00:05:31,120
very different activities uh today i had

159
00:05:36,390 --> 00:05:33,039
some of the last meetings that

160
00:05:38,230 --> 00:05:36,400
we'll have on um our pizza book

161
00:05:40,710 --> 00:05:38,240
i just wrote a book called modernist

162
00:05:42,710 --> 00:05:40,720
pizza yeah which is aiming to be the

163
00:05:44,710 --> 00:05:42,720

definitive book on pizza

164

00:05:46,469 --> 00:05:44,720

uh and so we had a few meetings to wrap

165

00:05:47,110 --> 00:05:46,479

that up today and not probably a few

166

00:05:48,629 --> 00:05:47,120

more but

167

00:05:50,830 --> 00:05:48,639

it's we're getting down to the short

168

00:05:55,029 --> 00:05:50,840

strokes we're almost done

169

00:05:58,230 --> 00:05:55,039

um i had my picture taken for the book

170

00:06:00,629 --> 00:05:58,240

um because you know it's

171

00:06:01,510 --> 00:06:00,639

kind of goes to the territory i did a

172

00:06:04,830 --> 00:06:01,520

bunch of work

173

00:06:10,150 --> 00:06:04,840

on astro photography

174

00:06:13,510 --> 00:06:10,160

um in december there was a really big

175

00:06:15,029 --> 00:06:13,520

uh meteor shower a shower called the

176
00:06:19,350 --> 00:06:15,039
geminids

177
00:06:22,629 --> 00:06:19,360
my

178
00:06:24,950 --> 00:06:22,639
experience every time i

179
00:06:26,950 --> 00:06:24,960
remember to look to see about going to

180
00:06:30,950 --> 00:06:26,960
see them

181
00:06:33,670 --> 00:06:30,960
what happens is there's it's cloudy

182
00:06:36,070 --> 00:06:33,680
or well the moon is up when the moon is

183
00:06:39,510 --> 00:06:36,080
up you can't see as many of them

184
00:06:41,430 --> 00:06:39,520
um well this year or i guess last year

185
00:06:43,110 --> 00:06:41,440
the very end of 2020

186
00:06:45,189 --> 00:06:43,120
everything came together and i took some

187
00:06:49,270 --> 00:06:45,199
great pictures of the

188
00:06:52,390 --> 00:06:49,280

geminids and now we have to process them

189

00:06:55,029 --> 00:06:52,400

um and the way i do photography

190

00:06:57,029 --> 00:06:55,039

these days is very computationally

191

00:07:00,870 --> 00:06:57,039

intensive

192

00:07:04,629 --> 00:07:00,880

right so in the case of these meteors

193

00:07:06,070 --> 00:07:04,639

uh i took about two and a half thousand

194

00:07:09,189 --> 00:07:06,080

pictures

195

00:07:11,749 --> 00:07:09,199

per camera times four bit cameras so

196

00:07:14,230 --> 00:07:11,759

it's about ten thousand pictures

197

00:07:15,510 --> 00:07:14,240

over the course of one night while these

198

00:07:19,110 --> 00:07:15,520

cameras tracked

199

00:07:20,710 --> 00:07:19,120

a part of the sky and then

200

00:07:22,790 --> 00:07:20,720

because you're tracking the sky the

201
00:07:24,390 --> 00:07:22,800
stars are all nice little dots and those

202
00:07:29,270 --> 00:07:24,400
look really nice

203
00:07:33,189 --> 00:07:31,510
uh well there's all kinds of processing

204
00:07:36,390 --> 00:07:33,199
that we have to do

205
00:07:39,589 --> 00:07:36,400
to get uh

206
00:07:42,629 --> 00:07:39,599
a usable picture out of all that stuff

207
00:07:45,189 --> 00:07:42,639
um i mean so far the pictures

208
00:07:46,390 --> 00:07:45,199
and then all of the temporary files that

209
00:07:47,510 --> 00:07:46,400
you create as you

210
00:07:49,029 --> 00:07:47,520
because sometimes you have to put it in

211
00:07:50,629 --> 00:07:49,039
different formats for different pieces

212
00:07:54,230 --> 00:07:50,639
of software

213
00:07:58,869 --> 00:07:57,430

20 terabytes for one night what will be

214

00:08:02,070 --> 00:07:58,879

one image

215

00:08:03,990 --> 00:08:02,080

ah uh-huh wow okay i'm very anxious to

216

00:08:06,390 --> 00:08:04,000

see how that turned out

217

00:08:07,510 --> 00:08:06,400

uh so how much sleep do you get on an

218

00:08:11,350 --> 00:08:07,520

average day

219

00:08:14,869 --> 00:08:11,360

um you know i've been through periods

220

00:08:17,189 --> 00:08:14,879

where uh i'm traveling

221

00:08:18,550 --> 00:08:17,199

or we're working on some big deadline

222

00:08:19,749 --> 00:08:18,560

for something where i get very little

223

00:08:21,830 --> 00:08:19,759

but usually i get

224

00:08:23,270 --> 00:08:21,840

enough sleep i get eight nine hours of

225

00:08:24,790 --> 00:08:23,280

sleep

226

00:08:26,629 --> 00:08:24,800

the reason i'm asking is that i see you

227

00:08:29,350 --> 00:08:26,639

as someone who's extremely productive

228

00:08:31,350 --> 00:08:29,360

and when i speak to intellectuals i find

229

00:08:33,829 --> 00:08:31,360

that they generally are regimented

230

00:08:35,350 --> 00:08:33,839

that they eat a certain type of food at

231

00:08:36,870 --> 00:08:35,360

a certain time of day

232

00:08:38,230 --> 00:08:36,880

or they don't eat a certain type of food

233

00:08:39,110 --> 00:08:38,240

at a certain time of day or they

234

00:08:42,389 --> 00:08:39,120

meditate

235

00:08:46,790 --> 00:08:42,399

or they take a certain nootropic

236

00:08:48,230 --> 00:08:46,800

and i'm curious what is it that you do

237

00:08:51,750 --> 00:08:48,240

such that you can accomplish all that

238

00:08:55,750 --> 00:08:54,150

it's different each day well it is

239

00:08:58,470 --> 00:08:55,760

different each day so

240

00:09:00,550 --> 00:08:58,480

you know this today was a mix of

241

00:09:03,750 --> 00:09:00,560

different things

242

00:09:07,190 --> 00:09:03,760

um in

243

00:09:10,550 --> 00:09:07,200

i guess the end of february early march

244

00:09:13,670 --> 00:09:10,560

i'm gonna go to missouri i i built

245

00:09:14,630 --> 00:09:13,680

a special camera outfit which looks

246

00:09:16,790 --> 00:09:14,640

pretty ridiculous

247

00:09:19,190 --> 00:09:16,800

it lashes three cameras together each

248

00:09:21,750 --> 00:09:19,200

one of the giant lens

249

00:09:22,470 --> 00:09:21,760

um and i did it so i could photograph

250

00:09:25,829 --> 00:09:22,480

two things

251
00:09:27,910 --> 00:09:25,839
one is big storm waves

252
00:09:29,190 --> 00:09:27,920
so i want to take some super high

253
00:09:32,790 --> 00:09:29,200
quality panoramas

254
00:09:37,030 --> 00:09:32,800
of ocean waves uh and also

255
00:09:38,710 --> 00:09:37,040
um huge flocks of birds

256
00:09:41,430 --> 00:09:38,720
well in missouri they don't have any

257
00:09:44,949 --> 00:09:41,440
storm waves but they do have

258
00:09:45,509 --> 00:09:44,959
uh migrating uh geese so about two

259
00:09:48,230 --> 00:09:45,519
million

260
00:09:48,870 --> 00:09:48,240
of them are due the end of february so

261
00:09:51,030 --> 00:09:48,880
when i go

262
00:09:53,509 --> 00:09:51,040
there i'll probably be there for three

263
00:09:57,430 --> 00:09:53,519

four days maybe a little bit longer

264

00:09:59,509 --> 00:09:57,440

and that'll all be about that and i'll

265

00:10:01,990 --> 00:09:59,519

um i went to see some other migrating

266

00:10:03,670 --> 00:10:02,000

birds in december

267

00:10:05,670 --> 00:10:03,680

or late i got late november actually

268

00:10:08,150 --> 00:10:05,680

late november um

269

00:10:09,750 --> 00:10:08,160

and that was about getting up at four

270

00:10:11,430 --> 00:10:09,760

every day

271

00:10:13,590 --> 00:10:11,440

um so that you could actually be out

272

00:10:14,630 --> 00:10:13,600

where the birds are well before the sun

273

00:10:16,870 --> 00:10:14,640

comes up

274

00:10:18,310 --> 00:10:16,880

because that's like that's the whole

275

00:10:22,069 --> 00:10:18,320

thing

276

00:10:25,110 --> 00:10:22,079

um with the uh

277

00:10:27,269 --> 00:10:25,120

the meteors uh the meteor shower

278

00:10:29,269 --> 00:10:27,279

uh besides all of this technical

279

00:10:33,110 --> 00:10:29,279

equipment that i brought

280

00:10:35,590 --> 00:10:33,120

i also bring a lawn chair because

281

00:10:36,150 --> 00:10:35,600

you want to sit outside and see them and

282

00:10:40,710 --> 00:10:36,160

it's

283

00:10:43,350 --> 00:10:40,720

good enough to see

284

00:10:45,430 --> 00:10:43,360

all of them you see you want to get a

285

00:10:47,190 --> 00:10:45,440

camera catches more

286

00:10:48,470 --> 00:10:47,200

but a camera catches it from a narrow

287

00:10:50,949 --> 00:10:48,480

thing whereas if you're out there you

288

00:10:54,870 --> 00:10:50,959

see them across the whole sky which is

289

00:10:57,350 --> 00:10:54,880

is quite remarkable so anyway different

290

00:10:58,790 --> 00:10:57,360

projects will require you to jump in

291

00:11:01,670 --> 00:10:58,800

with both feet

292

00:11:03,350 --> 00:11:01,680

and be a hundred percent on that project

293

00:11:05,110 --> 00:11:03,360

but most of the time

294

00:11:08,230 --> 00:11:05,120

not and so that's what allows me to

295

00:11:10,310 --> 00:11:08,240

multitask between projects

296

00:11:11,750 --> 00:11:10,320

how do you choose what project are you

297

00:11:14,150 --> 00:11:11,760

just driven by your

298

00:11:16,150 --> 00:11:14,160

intuition your feelings your desires or

299

00:11:19,750 --> 00:11:16,160

is there some grander plan

300

00:11:25,590 --> 00:11:23,030

it's of course there's intuition

301
00:11:26,829 --> 00:11:25,600
and feelings and if i don't want to do

302
00:11:30,630 --> 00:11:26,839
it i'm not going to go do

303
00:11:34,790 --> 00:11:30,640
it and i would hope that my

304
00:11:37,910 --> 00:11:34,800
it's not just my raw passion

305
00:11:41,509 --> 00:11:37,920
uh a lot of the things that i do

306
00:11:44,949 --> 00:11:41,519
are technically difficult to do

307
00:11:47,750 --> 00:11:44,959
so far they haven't been impossible

308
00:11:49,430 --> 00:11:47,760
now i'd hate to pick an impossible one

309
00:11:51,829 --> 00:11:49,440
and get passionate about it

310
00:11:52,870 --> 00:11:51,839
because then you'd waste a lot of time

311
00:11:54,629 --> 00:11:52,880
right

312
00:11:56,310 --> 00:11:54,639
is there something that you found to be

313
00:11:57,590 --> 00:11:56,320

outside of your domain of competence or

314

00:11:59,910 --> 00:11:57,600

outside of what you can do

315

00:12:01,350 --> 00:11:59,920

of course there's i mean problems like

316

00:12:04,389 --> 00:12:01,360

nuclear power

317

00:12:05,910 --> 00:12:04,399

um or there i was one of the inventors

318

00:12:08,470 --> 00:12:05,920

of this new type of a

319

00:12:09,269 --> 00:12:08,480

nuclear power plant i started the

320

00:12:12,949 --> 00:12:09,279

company

321

00:12:15,990 --> 00:12:12,959

moment it's

322

00:12:17,590 --> 00:12:16,000

uh was recently chosen by the

323

00:12:20,230 --> 00:12:17,600

us government to build some test

324

00:12:23,990 --> 00:12:20,240

reactors

325

00:12:26,870 --> 00:12:24,000

but i don't this is not

326

00:12:28,310 --> 00:12:26,880

a one man or even one company thing

327

00:12:30,710 --> 00:12:28,320

nuclear power

328

00:12:32,389 --> 00:12:30,720

intrinsically also involves the decision

329

00:12:34,470 --> 00:12:32,399

society makes

330

00:12:36,550 --> 00:12:34,480

um of course one of the reasons we've

331

00:12:39,269 --> 00:12:36,560

done it is because we want to have a new

332

00:12:42,949 --> 00:12:39,279

type of carbon free

333

00:12:45,990 --> 00:12:42,959

ener source of energy because of our

334

00:12:49,350 --> 00:12:46,000

impending climate crisis

335

00:12:53,590 --> 00:12:49,360

which is a crisis for everybody

336

00:12:57,670 --> 00:12:53,600

um and uh it

337

00:13:00,150 --> 00:12:57,680

there's a bunch of things that i i

338

00:13:02,069 --> 00:13:00,160

so yes i'm working on the climate crisis

339

00:13:04,870 --> 00:13:02,079

i've done other things for climate

340

00:13:06,629 --> 00:13:04,880

but it's not like it's up to me okay not

341

00:13:09,750 --> 00:13:06,639

like i have a magic wand

342

00:13:10,550 --> 00:13:09,760

and i can school solve that problem i

343

00:13:14,150 --> 00:13:10,560

can make it

344

00:13:15,750 --> 00:13:14,160

that's when i make a contribution i try

345

00:13:17,430 --> 00:13:15,760

and we'll see what the world does with

346

00:13:21,190 --> 00:13:17,440

it

347

00:13:24,470 --> 00:13:21,200

whereas if i um last year i

348

00:13:28,230 --> 00:13:24,480

uh created a the world's highest

349

00:13:32,310 --> 00:13:28,240

resolution microscope dedicated

350

00:13:35,509 --> 00:13:32,320

to photographing snowflakes

351
00:13:36,710 --> 00:13:35,519
i saw that now

352
00:13:38,790 --> 00:13:36,720
there's a lot of things you could ask

353
00:13:41,910 --> 00:13:38,800
like who cares or why

354
00:13:45,189 --> 00:13:41,920
but that's one that was

355
00:13:48,069 --> 00:13:45,199
within the scope of

356
00:13:49,509 --> 00:13:48,079
what i thought was possible for me to do

357
00:13:50,470 --> 00:13:49,519
that turned out to be a lot harder than

358
00:13:54,150 --> 00:13:50,480
i thought it would be

359
00:13:55,910 --> 00:13:54,160
but we got it done that's very different

360
00:13:58,949 --> 00:13:55,920
than a societal problem like

361
00:14:01,030 --> 00:13:58,959
eliminating malaria i've contributed i

362
00:14:01,750 --> 00:14:01,040
think a tremendous amount towards that

363
00:14:04,150 --> 00:14:01,760

fight

364

00:14:05,189 --> 00:14:04,160

but it's a tremendous amount towards a

365

00:14:08,550 --> 00:14:05,199

fight that's

366

00:14:12,710 --> 00:14:08,560

you know this far along against

367

00:14:14,949 --> 00:14:12,720

many miles to go so uh

368

00:14:16,949 --> 00:14:14,959

and i i think it's important to work on

369

00:14:20,069 --> 00:14:16,959

both kinds of things

370

00:14:23,590 --> 00:14:20,079

you know you could say

371

00:14:25,509 --> 00:14:23,600

the climate crisis or malaria is

372

00:14:26,629 --> 00:14:25,519

tilting at windmills or doing things

373

00:14:29,509 --> 00:14:26,639

that are

374

00:14:31,590 --> 00:14:29,519

you know beyond anybody's single persons

375

00:14:34,150 --> 00:14:31,600

ability and it's true they are

376

00:14:35,430 --> 00:14:34,160

i to the degree you find a way to

377

00:14:38,389 --> 00:14:35,440

contribute

378

00:14:40,069 --> 00:14:38,399

i still want to work on them but it's

379

00:14:43,269 --> 00:14:40,079

also nice to

380

00:14:46,870 --> 00:14:43,279

do things like write a book on pizza

381

00:14:50,230 --> 00:14:49,030

i've written a couple other cookbooks so

382

00:14:52,150 --> 00:14:50,240

if you ask the question

383

00:14:53,509 --> 00:14:52,160

is it possible for me to write a book on

384

00:14:56,470 --> 00:14:53,519

pizza the answer is sure

385

00:14:58,310 --> 00:14:56,480

that was not ever a question like will

386

00:15:01,430 --> 00:14:58,320

will he write the book

387

00:15:03,829 --> 00:15:01,440

um now you can the what's that question

388

00:15:05,430 --> 00:15:03,839

is is it a good book is it not a good

389

00:15:06,790 --> 00:15:05,440

book what does the rest of the world

390

00:15:09,990 --> 00:15:06,800

think of it

391

00:15:11,350 --> 00:15:10,000

um we're publishing it uh not only in

392

00:15:12,230 --> 00:15:11,360

english but we will publish it in

393

00:15:15,269 --> 00:15:12,240

italian

394

00:15:19,509 --> 00:15:15,279

what will they think of it right

395

00:15:20,150 --> 00:15:19,519

um so anyway it's of a very different

396

00:15:21,829 --> 00:15:20,160

nature

397

00:15:24,629 --> 00:15:21,839

than something where you don't know if

398

00:15:28,389 --> 00:15:26,389

a lot of people don't know that you did

399

00:15:29,590 --> 00:15:28,399

your postdoc under stephen hawking in

400

00:15:31,749 --> 00:15:29,600

quantum gravity

401

00:15:32,949 --> 00:15:31,759

yeah what was that like how do you

402

00:15:34,710 --> 00:15:32,959

practically speaking how do you

403

00:15:35,910 --> 00:15:34,720

communicate to stephen hawking how does

404

00:15:39,509 --> 00:15:35,920

that process work given

405

00:15:41,590 --> 00:15:39,519

his challenges uh

406

00:15:43,269 --> 00:15:41,600

well back in the day that i was with

407

00:15:44,550 --> 00:15:43,279

stephen he didn't have a voice

408

00:15:46,949 --> 00:15:44,560

synthesizer

409

00:15:48,389 --> 00:15:46,959

you know if you've seen him on more

410

00:15:51,269 --> 00:15:48,399

recent

411

00:15:53,030 --> 00:15:51,279

uh tv specials or something he always

412

00:15:54,470 --> 00:15:53,040

has a voice synthesizer he hadn't he

413

00:15:57,829 --> 00:15:54,480

didn't have that

414

00:15:59,749 --> 00:15:57,839

so he would speak as best he could

415

00:16:01,829 --> 00:15:59,759

which didn't really sound like human

416

00:16:05,509 --> 00:16:01,839

speech at all

417

00:16:08,710 --> 00:16:05,519

um and uh

418

00:16:10,710 --> 00:16:08,720

his it was slower what was it also

419

00:16:14,069 --> 00:16:10,720

slower

420

00:16:17,269 --> 00:16:14,079

well it was we'd have to it was slow

421

00:16:17,590 --> 00:16:17,279

it was very very hard to understand and

422

00:16:21,110 --> 00:16:17,600

so

423

00:16:25,030 --> 00:16:21,120

understanding it was partially about

424

00:16:28,550 --> 00:16:25,040

listening and partially about guessing

425

00:16:30,389 --> 00:16:28,560

and the part that was really um

426

00:16:32,550 --> 00:16:30,399

unfortunate about that is he loved to

427

00:16:34,629 --> 00:16:32,560

tell jokes

428

00:16:35,590 --> 00:16:34,639

well it turns out the punchline of a

429

00:16:39,030 --> 00:16:35,600

joke by

430

00:16:39,350 --> 00:16:39,040

definition isn't expected right right

431

00:16:41,910 --> 00:16:39,360

right

432

00:16:43,110 --> 00:16:41,920

you can't guess ahead beat the punchline

433

00:16:45,110 --> 00:16:43,120

four and five

434

00:16:46,870 --> 00:16:45,120

and look at the tension is growing with

435

00:16:50,389 --> 00:16:46,880

everyone like oh my god why don't we

436

00:16:53,749 --> 00:16:50,399

get we get this um so the thing about

437

00:16:56,629 --> 00:16:53,759

working with stephen is uh it's very

438

00:16:59,509 --> 00:16:56,639

hard to feel sorry for yourself

439

00:17:01,350 --> 00:16:59,519

if you're working with stephen you know

440

00:17:04,789 --> 00:17:01,360

you might get up and you think oh

441

00:17:07,110 --> 00:17:04,799

god am i feeling that great and oh it's

442

00:17:09,110 --> 00:17:07,120

cold outside and i forgot

443

00:17:10,549 --> 00:17:09,120

you know this and that and the other

444

00:17:14,710 --> 00:17:10,559

thing and i'm

445

00:17:17,189 --> 00:17:14,720

oh my god my life sucks and then

446

00:17:19,510 --> 00:17:17,199

you have stephen there who has these

447

00:17:22,789 --> 00:17:19,520

incredible physical challenges

448

00:17:26,470 --> 00:17:22,799

and has just an incredibly

449

00:17:30,549 --> 00:17:29,029

and so it just it made it impossible to

450

00:17:34,310 --> 00:17:30,559

feel sorry for yourself

451
00:17:34,950 --> 00:17:34,320
and it's to this day it's something that

452
00:17:38,150 --> 00:17:34,960
when

453
00:17:41,590 --> 00:17:38,160
i'm ever tempted to i was thinking yeah

454
00:17:44,390 --> 00:17:41,600
but i can walk you know i can go to the

455
00:17:45,909 --> 00:17:44,400
bathroom by myself

456
00:17:47,590 --> 00:17:45,919
you know some people denigrate stephen

457
00:17:49,669 --> 00:17:47,600
because he was heralded as the next

458
00:17:51,590 --> 00:17:49,679
einstein at least in the popular media

459
00:17:52,950 --> 00:17:51,600
but then it's a it might be a stretch to

460
00:17:55,190 --> 00:17:52,960
say he was the next einstein

461
00:17:57,669 --> 00:17:55,200
but what you can't fault him on at all

462
00:18:00,789 --> 00:17:57,679
is his diligence his persistence

463
00:18:02,710 --> 00:18:00,799

and the only other person i can compare

464

00:18:04,150 --> 00:18:02,720

him to would be euler who was blind

465

00:18:06,549 --> 00:18:04,160

and still did math but at least euler

466

00:18:09,669 --> 00:18:06,559

had his hands

467

00:18:13,270 --> 00:18:09,679

so um well

468

00:18:15,830 --> 00:18:13,280

stephen was driven to do the work

469

00:18:16,870 --> 00:18:15,840

that he wanted to do and it wasn't a

470

00:18:19,909 --> 00:18:16,880

question of

471

00:18:23,350 --> 00:18:19,919

oh we had to go do it because

472

00:18:25,590 --> 00:18:23,360

you know he needed the salary because

473

00:18:26,710 --> 00:18:25,600

you know the any of these other things

474

00:18:29,590 --> 00:18:26,720

and

475

00:18:31,029 --> 00:18:29,600

he certainly worked as hard as he could

476

00:18:36,789 --> 00:18:31,039

you know

477

00:18:37,830 --> 00:18:36,799

um yeah and it obviously at different

478

00:18:40,150 --> 00:18:37,840

times his

479

00:18:42,070 --> 00:18:40,160

ability to work was compromised by his

480

00:18:46,470 --> 00:18:42,080

condition

481

00:18:49,830 --> 00:18:46,480

but he did incredible things

482

00:18:53,430 --> 00:18:49,840

now the the problem with comparing

483

00:18:57,590 --> 00:18:53,440

um to einstein

484

00:19:01,110 --> 00:18:57,600

is that einstein

485

00:19:08,710 --> 00:19:04,789

unique combination of both brilliance

486

00:19:12,630 --> 00:19:08,720

and he came at a time when he could

487

00:19:16,150 --> 00:19:12,640

discover a tremendous amount of things

488

00:19:18,470 --> 00:19:16,160

um you know if if you want to call

489

00:19:20,230 --> 00:19:18,480

someone the next einstein

490

00:19:24,870 --> 00:19:20,240

the first thing to ask is well who was

491

00:19:26,630 --> 00:19:24,880

the is who was it before einstein

492

00:19:28,470 --> 00:19:26,640

and you could make a case for it being

493

00:19:30,549 --> 00:19:28,480

newton

494

00:19:32,230 --> 00:19:30,559

but okay if you if you take those two

495

00:19:35,270 --> 00:19:32,240

data points that means we should get one

496

00:19:38,390 --> 00:19:35,280

every 500 years

497

00:19:41,510 --> 00:19:38,400

so calm down on the

498

00:19:45,190 --> 00:19:41,520

who's the next einstein um

499

00:19:48,710 --> 00:19:45,200

there's a wonderful organization

500

00:19:50,870 --> 00:19:48,720

uh created by a uh a friend who was

501
00:19:52,710 --> 00:19:50,880
also at cambridge at one point not the

502
00:19:55,909 --> 00:19:52,720
same time i was there

503
00:19:57,750 --> 00:19:55,919
um and it was

504
00:20:00,630 --> 00:19:57,760
the name the organization is next

505
00:20:02,950 --> 00:20:00,640
einstein from africa

506
00:20:03,909 --> 00:20:02,960
and their idea was let's improve

507
00:20:07,190 --> 00:20:03,919
education

508
00:20:09,590 --> 00:20:07,200
and so forth and my

509
00:20:11,029 --> 00:20:09,600
my running joke with the guy who started

510
00:20:12,710 --> 00:20:11,039
it is

511
00:20:15,270 --> 00:20:12,720
okay but there's never been an einstein

512
00:20:20,950 --> 00:20:15,280
from america

513
00:20:26,630 --> 00:20:25,110

phds in physics and has more nobel

514

00:20:29,590 --> 00:20:26,640

prizes

515

00:20:30,950 --> 00:20:29,600

than any other country and then if you

516

00:20:33,590 --> 00:20:30,960

include

517

00:20:34,230 --> 00:20:33,600

in america's column people from other

518

00:20:36,789 --> 00:20:34,240

countries

519

00:20:37,669 --> 00:20:36,799

that did their work they got the phd in

520

00:20:40,630 --> 00:20:37,679

america

521

00:20:42,390 --> 00:20:40,640

it's huge and yet you could make a

522

00:20:43,590 --> 00:20:42,400

strong case that there's never been an

523

00:20:45,430 --> 00:20:43,600

american

524

00:20:47,190 --> 00:20:45,440

that had the breadth of contribution

525

00:20:48,710 --> 00:20:47,200

that einstein did

526

00:20:51,270 --> 00:20:48,720

now that doesn't mean we didn't have

527

00:20:54,310 --> 00:20:51,280

some awesome physicists we did

528

00:20:57,830 --> 00:20:54,320

fine uh um you know the feynman

529

00:21:01,029 --> 00:20:57,840

is a terrific example

530

00:21:03,029 --> 00:21:01,039

but einstein had the unique case that he

531

00:21:05,909 --> 00:21:03,039

was able to make

532

00:21:08,390 --> 00:21:05,919

very fundamental contributions in

533

00:21:10,549 --> 00:21:08,400

multiple areas

534

00:21:11,510 --> 00:21:10,559

you know we know him most in the

535

00:21:13,430 --> 00:21:11,520

particular

536

00:21:15,350 --> 00:21:13,440

popular realm for his theory of

537

00:21:16,950 --> 00:21:15,360

relativity

538

00:21:19,110 --> 00:21:16,960

amusingly that isn't what he got his

539

00:21:20,310 --> 00:21:19,120

nobel prize for for

540

00:21:22,630 --> 00:21:20,320

um he got something called the

541

00:21:24,950 --> 00:21:22,640

photoelectric effect which was

542

00:21:27,350 --> 00:21:24,960

uh one of the first great proofs of

543

00:21:29,270 --> 00:21:27,360

quantum mechanics

544

00:21:31,590 --> 00:21:29,280

which is weird because people usually

545

00:21:33,510 --> 00:21:31,600

think of einstein as being anti-quantum

546

00:21:34,870 --> 00:21:33,520

but the part i really love about it is

547

00:21:37,350 --> 00:21:34,880

that max

548

00:21:39,430 --> 00:21:37,360

planck who was the great physicist of

549

00:21:42,390 --> 00:21:39,440

that era

550

00:21:43,430 --> 00:21:42,400

wrote a recommendation letter for

551
00:21:47,350 --> 00:21:43,440
einstein

552
00:21:50,390 --> 00:21:47,360
to the um uh nobel prize committee

553
00:21:52,070 --> 00:21:50,400
saying look don't effectively

554
00:21:54,390 --> 00:21:52,080
don't worry about this relativity

555
00:21:57,029 --> 00:21:54,400
nonsense it'll blow over

556
00:21:59,029 --> 00:21:57,039
the kid is young you gotta reward him

557
00:22:02,230 --> 00:21:59,039
for this other thing

558
00:22:05,270 --> 00:22:02,240
interesting and yet today

559
00:22:08,549 --> 00:22:05,280
uh we think of him for that but his

560
00:22:13,029 --> 00:22:08,559
uh his role in statistical mechanics

561
00:22:17,110 --> 00:22:13,039
with um what we now call boze statistics

562
00:22:19,350 --> 00:22:17,120
uh it is also incredible

563
00:22:20,950 --> 00:22:19,360

and you must keep going through field

564

00:22:24,630 --> 00:22:20,960

after field where he

565

00:22:28,149 --> 00:22:24,640

was able to be incredibly influential as

566

00:22:32,310 --> 00:22:28,159

was um uh

567

00:22:35,510 --> 00:22:32,320

newton um my favorite crazy newton story

568

00:22:39,510 --> 00:22:35,520

is that uh you know he was made

569

00:22:42,789 --> 00:22:39,520

the chancellor of the british mint

570

00:22:45,669 --> 00:22:42,799

and at the time that was done

571

00:22:48,390 --> 00:22:45,679

as a political favor and it was

572

00:22:50,950 --> 00:22:48,400

explicitly a position that they would

573

00:22:52,630 --> 00:22:50,960

uh call a sinicure meaning without care

574

00:22:54,310 --> 00:22:52,640

like he didn't have to show up at the

575

00:22:58,950 --> 00:22:54,320

office you know

576

00:23:02,950 --> 00:22:58,960

he got into it okay and

577

00:23:06,310 --> 00:23:02,960

if you have an american quarter

578

00:23:08,070 --> 00:23:06,320

the edge is ripped the person who

579

00:23:12,149 --> 00:23:08,080

invented that

580

00:23:15,750 --> 00:23:12,159

sir isaac newton and the reason was

581

00:23:19,510 --> 00:23:15,760

they had a problem with uh

582

00:23:23,430 --> 00:23:19,520

many of the metals with the

583

00:23:24,149 --> 00:23:23,440

the edge of the uh coin holding up there

584

00:23:25,990 --> 00:23:24,159

was a

585

00:23:28,870 --> 00:23:26,000

maintenance there's certainly a problem

586

00:23:31,669 --> 00:23:28,880

of they couldn't make a clean edge

587

00:23:32,950 --> 00:23:31,679

and then it would also wear and then it

588

00:23:35,909 --> 00:23:32,960

was harder to tell

589

00:23:37,110 --> 00:23:35,919
counterfeits so that milling and i

590

00:23:38,870 --> 00:23:37,120
forget the name of it now but that

591

00:23:42,630 --> 00:23:38,880
milling was invented by

592

00:23:45,190 --> 00:23:42,640
newton so he did some now

593

00:23:49,750 --> 00:23:45,200
he also did some crazy [h__\h] he was into

594

00:23:53,190 --> 00:23:52,070
have you thought much about what's

595

00:23:55,269 --> 00:23:53,200
holding physics back

596

00:23:56,789 --> 00:23:55,279
if you see physics as being held back in

597

00:23:58,950 --> 00:23:56,799
the fundamental laws

598

00:24:00,390 --> 00:23:58,960
for the past 40 years some people say

599

00:24:01,830 --> 00:24:00,400
that it's been taken over by string

600

00:24:04,310 --> 00:24:01,840
theory as well as we don't have

601
00:24:05,350 --> 00:24:04,320
much of data when it comes to we don't

602
00:24:07,350 --> 00:24:05,360
have much new data

603
00:24:09,029 --> 00:24:07,360
so have you thought much about that oh

604
00:24:14,070 --> 00:24:09,039
sure this is

605
00:24:14,080 --> 00:24:17,269
the

606
00:24:21,350 --> 00:24:19,190
my joke with friends from graduate

607
00:24:25,029 --> 00:24:21,360
school is that it all went to hell

608
00:24:27,830 --> 00:24:25,039
uh as soon as i left physics um but

609
00:24:29,430 --> 00:24:27,840
yeah you gotta go back man no it wasn't

610
00:24:32,070 --> 00:24:29,440
i'll be with you every step of the way

611
00:24:32,710 --> 00:24:32,080
i'm not the reason okay it was it was

612
00:24:35,830 --> 00:24:32,720
either

613
00:24:37,510 --> 00:24:35,840

good choice on my part or it was a

614

00:24:40,470 --> 00:24:37,520

coincidence i don't think i could have

615

00:24:43,990 --> 00:24:40,480

solved i think there's a causal arrow

616

00:24:47,830 --> 00:24:44,000

yeah we have uh we've had the situation

617

00:24:49,269 --> 00:24:47,840

where uh you know in the 19th century

618

00:24:50,950 --> 00:24:49,279

they thought they were on the verge of

619

00:24:53,510 --> 00:24:50,960

figuring everything out there was just a

620

00:24:55,909 --> 00:24:53,520

few pesky problems

621

00:24:56,789 --> 00:24:55,919

then in the early part of the 20th

622

00:24:59,669 --> 00:24:56,799

century

623

00:25:01,750 --> 00:24:59,679

up through the 20s and the 30s they

624

00:25:05,190 --> 00:25:01,760

realized

625

00:25:08,710 --> 00:25:05,200

they had no [h__\h] basically

626

00:25:11,909 --> 00:25:08,720

and this led to

627

00:25:14,230 --> 00:25:11,919

the development of quantum mechanics

628

00:25:16,149 --> 00:25:14,240

well quantum mechanics was fantastically

629

00:25:19,350 --> 00:25:16,159

successful

630

00:25:21,909 --> 00:25:19,360

uh then it ran up against fundamental uh

631

00:25:22,789 --> 00:25:21,919

physics and relativity so they had to

632

00:25:25,190 --> 00:25:22,799

create

633

00:25:27,510 --> 00:25:25,200

relativistic quantum mechanics and

634

00:25:30,950 --> 00:25:27,520

quantum field theory

635

00:25:34,310 --> 00:25:30,960

and all of that was

636

00:25:38,470 --> 00:25:34,320

pretty much in place um i

637

00:25:42,630 --> 00:25:38,480

i went to uh graduate school in physics

638

00:25:45,990 --> 00:25:42,640

in 79 the fall of 79.

639

00:25:48,149 --> 00:25:46,000

and while i was

640

00:25:49,830 --> 00:25:48,159

there maybe the first year maybe it was

641

00:25:53,430 --> 00:25:49,840

the second year

642

00:25:54,870 --> 00:25:53,440

um a guy who had been a

643

00:25:56,870 --> 00:25:54,880

graduate student who'd stayed on as

644

00:26:00,630 --> 00:25:56,880

opposed to frank wilczak

645

00:26:04,070 --> 00:26:00,640

gave a talk about asymptotic freedom

646

00:26:06,950 --> 00:26:04,080

which was one of the last

647

00:26:07,669 --> 00:26:06,960

pieces to really be put together as part

648

00:26:12,950 --> 00:26:07,679

of

649

00:26:15,830 --> 00:26:12,960

what people call quantum chromodynamics

650

00:26:19,190 --> 00:26:15,840

or the standard model

651
00:26:21,990 --> 00:26:19,200
uh and uh frankly got the name about

652
00:26:25,990 --> 00:26:25,190
well you could pick other moments in

653
00:26:27,830 --> 00:26:26,000
time but

654
00:26:30,230 --> 00:26:27,840
for me that's a good moment in time

655
00:26:34,149 --> 00:26:30,240
because at that point in time

656
00:26:36,390 --> 00:26:34,159
we knew there were a

657
00:26:39,510 --> 00:26:36,400
tremendous number of questions that we

658
00:26:42,470 --> 00:26:39,520
couldn't answer

659
00:26:43,190 --> 00:26:42,480
we had successfully integrated multiple

660
00:26:46,950 --> 00:26:43,200
kinds

661
00:26:49,230 --> 00:26:46,960
of uh fundamental physics so

662
00:26:51,669 --> 00:26:49,240
we had successfully integrated

663
00:26:53,510 --> 00:26:51,679

electromagnetism

664

00:26:55,430 --> 00:26:53,520

with something called the weak theory

665

00:26:56,870 --> 00:26:55,440

for the weak interaction it was an old

666

00:26:58,870 --> 00:26:56,880

electro weak theory

667

00:27:00,149 --> 00:26:58,880

then we had developed quantum

668

00:27:03,110 --> 00:27:00,159

chromodynamics

669

00:27:04,230 --> 00:27:03,120

or qcd and together these things develop

670

00:27:06,070 --> 00:27:04,240

what

671

00:27:07,590 --> 00:27:06,080

since then we call the standard model of

672

00:27:08,870 --> 00:27:07,600

course we didn't call it the standard

673

00:27:11,430 --> 00:27:08,880

model when it was just

674

00:27:13,430 --> 00:27:11,440

freshly done because it was a little

675

00:27:17,590 --> 00:27:13,440

arrogant to call it standard

676

00:27:21,909 --> 00:27:20,950

and yet we didn't know a lot of very

677

00:27:25,350 --> 00:27:21,919

basic things

678

00:27:29,430 --> 00:27:25,360

we didn't know the

679

00:27:32,549 --> 00:27:29,440

precise relationship between many of our

680

00:27:35,830 --> 00:27:32,559

sets of particles um

681

00:27:38,389 --> 00:27:35,840

leptons which means an electron or a

682

00:27:40,149 --> 00:27:38,399

variety of other particles like that

683

00:27:42,070 --> 00:27:40,159

what are their relationship to the

684

00:27:45,269 --> 00:27:42,080

hadrons

685

00:27:48,549 --> 00:27:47,990

we didn't know the biggest ones we've

686

00:27:51,669 --> 00:27:48,559

now had

687

00:27:55,269 --> 00:27:51,679

all of that fit with gravity

688

00:27:58,389 --> 00:27:55,279

um now by that time we knew that

689

00:28:00,870 --> 00:27:58,399

the uh einstein's general theory of

690

00:28:04,549 --> 00:28:00,880

gravitation

691

00:28:05,990 --> 00:28:04,559

worked great and it predicted all kinds

692

00:28:10,789 --> 00:28:06,000

of things

693

00:28:13,990 --> 00:28:10,799

um still works great

694

00:28:14,389 --> 00:28:14,000

and that's the problem the standard

695

00:28:17,430 --> 00:28:14,399

model

696

00:28:20,630 --> 00:28:17,440

works great in its

697

00:28:24,710 --> 00:28:20,640

sphere of influence

698

00:28:28,310 --> 00:28:24,720

jr works great for gravity

699

00:28:31,510 --> 00:28:28,320

how the hell are they related and

700

00:28:31,990 --> 00:28:31,520

they have to be related because there

701
00:28:35,029 --> 00:28:32,000
are

702
00:28:39,029 --> 00:28:35,039
many many things that

703
00:28:42,830 --> 00:28:39,039
uh are clearly

704
00:28:45,669 --> 00:28:42,840
truly involve both quantum mechanics and

705
00:28:47,750 --> 00:28:45,679
um uh and gravity

706
00:28:49,190 --> 00:28:47,760
my my favorite simple one is candle

707
00:28:54,310 --> 00:28:49,200
flame

708
00:28:57,590 --> 00:28:54,320
wick on the candle

709
00:29:00,230 --> 00:28:57,600
it goes up as it go up gravity

710
00:29:00,710 --> 00:29:00,240
it's heating the gases they become less

711
00:29:03,990 --> 00:29:00,720
dense

712
00:29:05,510 --> 00:29:04,000
it goes up that light

713
00:29:09,029 --> 00:29:05,520

that light you're saying is quantum

714

00:29:13,669 --> 00:29:11,029

there's clearly quantum phenomena going

715

00:29:17,269 --> 00:29:13,679

on in a gravitational field

716

00:29:20,070 --> 00:29:17,279

how are they related now that's a very

717

00:29:22,549 --> 00:29:20,080

simple example and people could probably

718

00:29:23,669 --> 00:29:22,559

sort of explain that or wave their hands

719

00:29:27,590 --> 00:29:23,679

to explain it

720

00:29:30,070 --> 00:29:27,600

but when you get to uh black holes

721

00:29:31,750 --> 00:29:30,080

and and the intense things that space

722

00:29:36,389 --> 00:29:31,760

time does around black holes

723

00:29:39,510 --> 00:29:36,399

or you get to the origin of the universe

724

00:29:41,430 --> 00:29:39,520

or a variety of other things you got a

725

00:29:44,549 --> 00:29:41,440

problem

726

00:29:47,750 --> 00:29:44,559

and so

727

00:29:51,510 --> 00:29:47,760

people set out to solve that

728

00:29:53,990 --> 00:29:51,520

and uh the quote theory of everything is

729

00:29:58,149 --> 00:29:54,000

one of the names that people

730

00:30:00,070 --> 00:29:58,159

gave to that pursuit uh there was a

731

00:30:03,190 --> 00:30:00,080

time when people called it a grand

732

00:30:05,750 --> 00:30:03,200

unified theory instead

733

00:30:07,990 --> 00:30:05,760

but the goal even though the there was

734

00:30:11,990 --> 00:30:08,000

slight differences in what you

735

00:30:15,669 --> 00:30:12,000

would approach the goal was very similar

736

00:30:19,430 --> 00:30:15,679

um so anyway that was

737

00:30:22,630 --> 00:30:19,440

uh that was the situation

738

00:30:24,470 --> 00:30:22,640

40 years ago and it's the situation

739

00:30:26,230 --> 00:30:24,480

today

740

00:30:28,070 --> 00:30:26,240

have you been keeping up with any of the

741

00:30:30,149 --> 00:30:28,080

latest theories of everything such as

742

00:30:31,190 --> 00:30:30,159

weinstein eric weinstein's geometric

743

00:30:34,630 --> 00:30:31,200

unity or

744

00:30:38,470 --> 00:30:34,640

stephen wolfram's yes

745

00:30:41,909 --> 00:30:40,389

i i need to backtrack though there's one

746

00:30:44,630 --> 00:30:41,919

other thing that is

747

00:30:46,149 --> 00:30:44,640

remarkable about this last period of

748

00:30:49,269 --> 00:30:46,159

time

749

00:30:51,269 --> 00:30:49,279

um and uh that

750

00:30:52,950 --> 00:30:51,279

goes a little bit to your question of

751
00:30:55,110 --> 00:30:52,960
the whole world's attention was captured

752
00:30:58,149 --> 00:30:55,120
by string theory well

753
00:31:01,350 --> 00:30:58,159
it starting

754
00:31:03,669 --> 00:31:01,360
with relativity so really starting in

755
00:31:06,549 --> 00:31:03,679
1905 you could argue

756
00:31:10,070 --> 00:31:06,559
but particularly then general relativity

757
00:31:15,509 --> 00:31:13,350
an enormous amount of advances were made

758
00:31:18,470 --> 00:31:15,519
by considering the mathematical

759
00:31:20,389 --> 00:31:18,480
structure of the problem

760
00:31:22,310 --> 00:31:20,399
and in particular the mathematical

761
00:31:24,870 --> 00:31:22,320
symmetries of the problem

762
00:31:27,350 --> 00:31:24,880
and that when you found a mathematical

763
00:31:30,310 --> 00:31:27,360

symmetry

764

00:31:31,269 --> 00:31:30,320

it would if you took that seriously that

765

00:31:34,630 --> 00:31:31,279

would give you

766

00:31:38,470 --> 00:31:34,640

new and important physics

767

00:31:41,830 --> 00:31:38,480

so general relativity is in some sense

768

00:31:45,029 --> 00:31:41,840

the theory of general covariance

769

00:31:46,230 --> 00:31:45,039

so if you take einstein's extremely

770

00:31:48,789 --> 00:31:46,240

simple set of

771

00:31:50,389 --> 00:31:48,799

things of saying you know you you have

772

00:31:53,509 --> 00:31:50,399

these relative observers

773

00:31:58,389 --> 00:31:53,519

and um the inertial frames are the same

774

00:32:02,070 --> 00:32:01,190

uh that gives you general covariance and

775

00:32:04,149 --> 00:32:02,080

that gives you

776

00:32:06,710 --> 00:32:04,159

general relativity and then those same

777

00:32:09,430 --> 00:32:06,720

thoughts about applying covariance

778

00:32:11,830 --> 00:32:09,440

uh give you a tremendous amount of what

779

00:32:14,710 --> 00:32:11,840

it takes for a quantum field theory

780

00:32:16,310 --> 00:32:14,720

you then also take the idea of

781

00:32:19,350 --> 00:32:16,320

symmetries

782

00:32:20,230 --> 00:32:19,360

and say hey we have mathematical

783

00:32:23,269 --> 00:32:20,240

symmetries

784

00:32:25,590 --> 00:32:23,279

are coming and that's uh murray gilman

785

00:32:26,389 --> 00:32:25,600

was famous for calling this the eighth

786

00:32:29,909 --> 00:32:26,399

fold way

787

00:32:35,029 --> 00:32:31,750

group theory with an eight-fold symmetry

788

00:32:38,870 --> 00:32:37,590

and so mathematics was a tremendous

789

00:32:40,830 --> 00:32:38,880

guide

790

00:32:42,549 --> 00:32:40,840

and when you found a mathematical

791

00:32:44,230 --> 00:32:42,559

symmetry

792

00:32:46,950 --> 00:32:44,240

it usually would have a physical

793

00:32:49,990 --> 00:32:46,960

interpretation

794

00:32:50,789 --> 00:32:50,000

well until we found a mathematical

795

00:32:55,190 --> 00:32:50,799

symmetry called

796

00:32:59,509 --> 00:32:55,200

supersymmetry and supersymmetry

797

00:33:02,070 --> 00:32:59,519

from a fundamental mathematics

798

00:33:05,269 --> 00:33:02,080

perspective

799

00:33:11,990 --> 00:33:08,789

and it has sucked an enormous amount of

800

00:33:17,590 --> 00:33:14,149

into saying look this is so beautiful

801
00:33:21,990 --> 00:33:19,909
only so far as we can tell it's not

802
00:33:25,509 --> 00:33:22,000
correct

803
00:33:27,509 --> 00:33:25,519
like it got normal energies meaning the

804
00:33:29,990 --> 00:33:27,519
what we've been able to observe so far

805
00:33:36,149 --> 00:33:30,000
with even our best

806
00:33:39,590 --> 00:33:37,430
it predicts there should be twice as

807
00:33:42,710 --> 00:33:39,600
many particles as there are

808
00:33:44,070 --> 00:33:42,720
those those particles are called super

809
00:33:47,110 --> 00:33:44,080
partners

810
00:33:49,830 --> 00:33:47,120
and fundamentally if you have a

811
00:33:50,630 --> 00:33:49,840
the super symmetry it's analogous to

812
00:33:53,990 --> 00:33:50,640
saying

813
00:33:56,070 --> 00:33:54,000

well if i've got a charge

814

00:33:58,549 --> 00:33:56,080

you know minus one particles i better

815

00:34:01,990 --> 00:33:58,559

have charge plus one particles

816

00:34:02,710 --> 00:34:02,000

and so i have supercharges well then i

817

00:34:05,750 --> 00:34:02,720

need super

818

00:34:08,869 --> 00:34:05,760

partners so then

819

00:34:12,389 --> 00:34:08,879

and this idea was so seductive

820

00:34:17,669 --> 00:34:15,909

um gone

821

00:34:20,710 --> 00:34:17,679

put enormous amounts of brain power into

822

00:34:24,550 --> 00:34:20,720

trying to make it work

823

00:34:25,669 --> 00:34:24,560

and the the big showdown that everyone

824

00:34:28,869 --> 00:34:25,679

expected

825

00:34:32,629 --> 00:34:28,879

was the lhc

826

00:34:37,750 --> 00:34:32,639

and the stated purpose of the lhc

827

00:34:37,760 --> 00:34:41,589

but

828

00:34:47,909 --> 00:34:45,030

almost everyone expected

829

00:34:50,629 --> 00:34:47,919

this would also be where we got the new

830

00:34:52,790 --> 00:34:50,639

set of clues

831

00:34:55,589 --> 00:34:52,800

and this is where we would be able to

832

00:34:59,430 --> 00:34:55,599

solve this fundamental problem

833

00:35:02,630 --> 00:34:59,440

because we've gone this 30 or 40 years

834

00:35:07,030 --> 00:35:02,640

staring at the old clues

835

00:35:12,550 --> 00:35:09,670

and in general physics has progressed

836

00:35:14,790 --> 00:35:12,560

best when we had clues

837

00:35:16,710 --> 00:35:14,800

now general relativity is the great

838

00:35:21,109 --> 00:35:16,720

exception to that

839

00:35:24,310 --> 00:35:21,119

einstein's uh inspiration for that

840

00:35:28,829 --> 00:35:24,320

is so

841

00:35:31,589 --> 00:35:28,839

weak it's so

842

00:35:34,870 --> 00:35:31,599

simple it it almost sounds

843

00:35:37,589 --> 00:35:34,880

simple-minded you know like someone

844

00:35:39,510 --> 00:35:37,599

coming into you and saying ah

845

00:35:41,349 --> 00:35:39,520

i've got this guy in an elevator and

846

00:35:43,510 --> 00:35:41,359

this guy is on this

847

00:35:45,030 --> 00:35:43,520

and i'm going to tell you all about the

848

00:35:45,910 --> 00:35:45,040

structure of the universe from this

849

00:35:49,270 --> 00:35:45,920

you'd say

850

00:35:52,630 --> 00:35:49,280

no no no no you're in that case

851
00:35:54,870 --> 00:35:52,640
but not not not einstein so that was a

852
00:35:55,829 --> 00:35:54,880
rare example of someone who had very few

853
00:35:59,349 --> 00:35:55,839
clues

854
00:36:01,750 --> 00:35:59,359
um uh newton

855
00:36:03,829 --> 00:36:01,760
had very few clues you know that there's

856
00:36:07,589 --> 00:36:03,839
an apocryphal story about the apple

857
00:36:11,990 --> 00:36:10,790
that guy did not take very much in the

858
00:36:16,390 --> 00:36:12,000
way of

859
00:36:19,510 --> 00:36:16,400
uh inspiration to get going

860
00:36:21,190 --> 00:36:19,520
um so that was another great one but

861
00:36:23,190 --> 00:36:21,200
we've we have this problem now that we

862
00:36:26,870 --> 00:36:23,200
have the same clues we've looked at for

863
00:36:31,109 --> 00:36:26,880

30 or 40 years

864

00:36:39,190 --> 00:36:35,670

um it didn't find any super partners

865

00:36:42,950 --> 00:36:39,200

and so far it hasn't had any hint

866

00:36:45,190 --> 00:36:42,960

of that and periodically

867

00:36:46,310 --> 00:36:45,200

over the last three or four years there

868

00:36:48,870 --> 00:36:46,320

will be a murmur

869

00:36:49,349 --> 00:36:48,880

in the field of oh there's someone's got

870

00:36:51,430 --> 00:36:49,359

you know

871

00:36:53,670 --> 00:36:51,440

so and so in this to the two different

872

00:36:56,470 --> 00:36:53,680

projects of this atlas

873

00:36:58,950 --> 00:36:56,480

and alice oh alice is seeing something

874

00:37:01,990 --> 00:36:58,960

or atlas is seeing something

875

00:37:08,550 --> 00:37:05,829

but so far that's all come to naught

876

00:37:09,190 --> 00:37:08,560

and it's probably true well certainly

877

00:37:12,630 --> 00:37:09,200

given

878

00:37:16,069 --> 00:37:12,640

that outcome

879

00:37:19,109 --> 00:37:16,079

if you looked back at the field 20 years

880

00:37:21,750 --> 00:37:19,119

ago or 25 years ago and said

881

00:37:23,270 --> 00:37:21,760

okay we don't really know what's going

882

00:37:28,069 --> 00:37:23,280

on

883

00:37:31,750 --> 00:37:28,079

basket

884

00:37:34,829 --> 00:37:31,760

you'd say no let's you know

885

00:37:36,069 --> 00:37:34,839

we should bet on lots of different ideas

886

00:37:39,109 --> 00:37:36,079

but

887

00:37:39,910 --> 00:37:39,119

there was an overwhelming bat on super

888

00:37:44,630 --> 00:37:39,920

symmetry

889

00:37:53,430 --> 00:37:47,670

the weirder it got in going

890

00:37:57,750 --> 00:37:56,069

it didn't dissuade people now there's

891

00:37:59,270 --> 00:37:57,760

friends of mine who say oh nathan you're

892

00:38:04,150 --> 00:37:59,280

out of it you don't understand how

893

00:38:07,750 --> 00:38:04,160

wonderful and how beautiful it is

894

00:38:11,270 --> 00:38:07,760

i i will stipulate to it being beautiful

895

00:38:13,750 --> 00:38:11,280

um and string theory has

896

00:38:15,190 --> 00:38:13,760

uh led to some interesting discoveries

897

00:38:17,670 --> 00:38:15,200

mathematics

898

00:38:18,950 --> 00:38:17,680

uh ed whitton who i've known since

899

00:38:22,630 --> 00:38:18,960

graduate school is a

900

00:38:25,910 --> 00:38:22,640

great friend and i think the world of ed

901
00:38:28,390 --> 00:38:25,920
uh got the fields medal in mathematics

902
00:38:29,750 --> 00:38:28,400
for a lot of things he worked on while

903
00:38:31,589 --> 00:38:29,760
trying to

904
00:38:33,030 --> 00:38:31,599
investigate super symmetry and string

905
00:38:38,470 --> 00:38:33,040
theory

906
00:38:41,589 --> 00:38:38,480
physical result to its name and that

907
00:38:42,630 --> 00:38:41,599
helps you calculate the modes in a black

908
00:38:45,589 --> 00:38:42,640
hole

909
00:38:47,109 --> 00:38:45,599
which uh go to the still somewhat

910
00:38:49,270 --> 00:38:47,119
controversial

911
00:38:53,750 --> 00:38:49,280
uh issue of whether a black hole

912
00:39:00,550 --> 00:38:57,589
but at this stage

913
00:39:01,510 --> 00:39:00,560

we need one of two things to happen we

914

00:39:05,349 --> 00:39:01,520

either need

915

00:39:08,470 --> 00:39:05,359

new clues or we need

916

00:39:11,589 --> 00:39:08,480

some damn genius who's so smart he or

917

00:39:14,470 --> 00:39:11,599

she does not need clues

918

00:39:16,550 --> 00:39:14,480

well those geniuses seem to come around

919

00:39:18,310 --> 00:39:16,560

every 500 years

920

00:39:20,870 --> 00:39:18,320

now maybe we got a little larger

921

00:39:22,870 --> 00:39:20,880

population today and we're educating a

922

00:39:25,190 --> 00:39:22,880

larger fraction of that population so

923

00:39:28,310 --> 00:39:25,200

maybe it isn't 500 but

924

00:39:32,470 --> 00:39:28,320

it's not a great uh it's not

925

00:39:36,150 --> 00:39:32,480

not great statistics there um or

926

00:39:43,589 --> 00:39:36,160

you need new clues but uh

927

00:39:46,550 --> 00:39:43,599

lhc was ridiculously expensive

928

00:39:46,950 --> 00:39:46,560

trying to come up with a something that

929

00:39:50,150 --> 00:39:46,960

is

930

00:39:53,670 --> 00:39:50,160

dramatically better than lhc

931

00:39:56,710 --> 00:39:53,680

yeah they probably can eat

932

00:39:58,950 --> 00:39:56,720

some number of factors and i i'm not

933

00:40:01,589 --> 00:39:58,960

involved in it so i won't speculate as

934

00:40:05,030 --> 00:40:01,599

to how many factors but

935

00:40:07,990 --> 00:40:05,040

let's say they got a factor of 10.

936

00:40:08,829 --> 00:40:08,000

um we don't know what the present will a

937

00:40:12,309 --> 00:40:08,839

factor of 10

938

00:40:14,630 --> 00:40:12,319

matter or will it be a factor

939

00:40:17,030 --> 00:40:14,640
of 100 or will it be a factor of a

940

00:40:20,950 --> 00:40:17,040
thousand or

941

00:40:29,990 --> 00:40:25,589
and as a result

942

00:40:32,309 --> 00:40:30,000
that very confused story

943

00:40:33,190 --> 00:40:32,319
doesn't seem like it's the single best

944

00:40:36,630 --> 00:40:33,200
story to go

945

00:40:38,550 --> 00:40:36,640
take to nation states and say please

946

00:40:41,109 --> 00:40:38,560
give us

947

00:40:43,030 --> 00:40:41,119
500 billion dollars that it might take

948

00:40:46,390 --> 00:40:43,040
to make something that was

949

00:40:49,510 --> 00:40:46,400
many orders of magnitude better right

950

00:40:51,589 --> 00:40:49,520
right or or we just say okay we have to

951
00:40:54,390 --> 00:40:51,599
put on our thinking gaps

952
00:40:55,430 --> 00:40:54,400
and come up with cheap ways or cheaper

953
00:40:57,510 --> 00:40:55,440
ways

954
00:41:00,390 --> 00:40:57,520
to get to that next level of power

955
00:41:04,630 --> 00:41:00,400
that's also a possibility

956
00:41:09,109 --> 00:41:04,640
but either way we either need

957
00:41:11,829 --> 00:41:09,119
some genius on the old clues

958
00:41:12,390 --> 00:41:11,839
or some new clues now there are people

959
00:41:15,990 --> 00:41:12,400
who are

960
00:41:20,470 --> 00:41:16,000
working on this um peter white who was

961
00:41:22,870 --> 00:41:20,480
uh my roommate in graduate school

962
00:41:24,630 --> 00:41:22,880
one of the most articulate critics of

963
00:41:30,710 --> 00:41:24,640

string theory

964

00:41:36,950 --> 00:41:34,309

peter has recently come out with what

965

00:41:40,150 --> 00:41:36,960

to me look like some very intriguing

966

00:41:44,150 --> 00:41:42,470

and they're along a different approach

967

00:41:47,349 --> 00:41:44,160

than most people have taken

968

00:41:51,990 --> 00:41:50,150

but they're not done yet either they're

969

00:41:55,190 --> 00:41:52,000

uh

970

00:41:58,870 --> 00:41:55,200

they're a stab in the dark

971

00:42:03,030 --> 00:41:58,880

and it will require a lot more work

972

00:42:06,870 --> 00:42:03,040

um within the field of computing

973

00:42:09,510 --> 00:42:06,880

there have been since the 1960s

974

00:42:11,030 --> 00:42:09,520

there have been a variety of people who

975

00:42:14,829 --> 00:42:11,040

have tried to take

976
00:42:16,790 --> 00:42:14,839
the idea of computing as a metaphor

977
00:42:20,470 --> 00:42:16,800
seriously

978
00:42:27,589 --> 00:42:23,990
there's a great uh essay which was

979
00:42:31,430 --> 00:42:27,599
originally a lecture um

980
00:42:34,069 --> 00:42:31,440
by uh edvard vigner

981
00:42:35,510 --> 00:42:34,079
vigner was a nobel prize winner in uh

982
00:42:38,710 --> 00:42:35,520
physics

983
00:42:40,790 --> 00:42:38,720
and the name of this essay is the

984
00:42:41,829 --> 00:42:40,800
unreasonable effectiveness of

985
00:42:47,109 --> 00:42:41,839
mathematics

986
00:42:51,750 --> 00:42:47,119
in physics and so finger says look

987
00:42:55,829 --> 00:42:51,760
how come it's so damn easy

988
00:42:59,270 --> 00:42:55,839

you know we we a lot of physical laws

989

00:43:02,230 --> 00:42:59,280

are first or second order equations

990

00:43:05,910 --> 00:43:02,240

and most of it's linear which means we

991

00:43:11,270 --> 00:43:09,109

and then of course we know that there

992

00:43:15,270 --> 00:43:11,280

are other parts of physics that aren't

993

00:43:19,030 --> 00:43:15,280

linear but

994

00:43:23,349 --> 00:43:19,040

the if i were to give a modern

995

00:43:26,150 --> 00:43:23,359

version of wigner's thing

996

00:43:28,230 --> 00:43:26,160

i would say hey not only has it been

997

00:43:30,870 --> 00:43:28,240

math has had it it's a great

998

00:43:33,270 --> 00:43:30,880

run but are we sure that it's

999

00:43:34,630 --> 00:43:33,280

mathematics in the same way we've done

1000

00:43:39,190 --> 00:43:34,640

it before

1001
00:43:41,510 --> 00:43:39,200
that we need next and that's why people

1002
00:43:43,670 --> 00:43:41,520
like david deutsch as an example david

1003
00:43:47,190 --> 00:43:43,680
deutsch

1004
00:43:50,790 --> 00:43:47,200
is a physicist he was

1005
00:43:52,550 --> 00:43:50,800
the inventor of quantum computing if you

1006
00:43:53,670 --> 00:43:52,560
will he had the idea that maybe you

1007
00:43:56,790 --> 00:43:53,680
could compute

1008
00:43:59,109 --> 00:43:56,800
with quantum systems

1009
00:44:00,550 --> 00:43:59,119
and david has done some very deep

1010
00:44:03,190 --> 00:44:00,560
thinking about

1011
00:44:06,829 --> 00:44:03,200
what it would mean to have a computable

1012
00:44:10,150 --> 00:44:06,839
universe versus not

1013
00:44:13,910 --> 00:44:10,160

where instead of relying

1014

00:44:17,750 --> 00:44:13,920

on uh

1015

00:44:19,990 --> 00:44:17,760

simple equations with polynomials or

1016

00:44:21,990 --> 00:44:20,000

sines and cosines the things that we're

1017

00:44:24,470 --> 00:44:22,000

used to in

1018

00:44:26,790 --> 00:44:24,480

in school maybe the world is

1019

00:44:30,470 --> 00:44:26,800

fundamentally more about

1020

00:44:34,829 --> 00:44:30,480

computation and computation

1021

00:44:36,150 --> 00:44:34,839

is in some sense fundamentally more

1022

00:44:40,069 --> 00:44:36,160

complex

1023

00:44:45,829 --> 00:44:43,109

and you can figure that out

1024

00:44:47,270 --> 00:44:45,839

in things like the various complexity

1025

00:44:49,510 --> 00:44:47,280

theories

1026
00:44:51,829 --> 00:44:49,520
that you know a simple touring machine

1027
00:44:55,270 --> 00:44:51,839
can't predict when it will end

1028
00:44:58,710 --> 00:44:55,280
just as a matter of principle it can't

1029
00:45:01,030 --> 00:44:58,720
yep well um

1030
00:45:02,550 --> 00:45:01,040
there's a whole pile of people besides

1031
00:45:06,550 --> 00:45:02,560
deutsch that have

1032
00:45:09,030 --> 00:45:06,560
gotten excited about this uh

1033
00:45:11,030 --> 00:45:09,040
but i've known stephen wolfram since i

1034
00:45:12,870 --> 00:45:11,040
was at princeton he was at the institute

1035
00:45:14,630 --> 00:45:12,880
for advanced study at the time and

1036
00:45:17,030 --> 00:45:14,640
he's a great friend of mine i have huge

1037
00:45:20,230 --> 00:45:17,040
respect for him

1038
00:45:23,270 --> 00:45:20,240

i use mathematica almost every day

1039

00:45:27,270 --> 00:45:23,280

is his great uh contribution uh

1040

00:45:30,950 --> 00:45:27,280

to software um he's got

1041

00:45:36,150 --> 00:45:30,960

a uh an approach where

1042

00:45:39,270 --> 00:45:36,160

he has been able to replicate

1043

00:45:40,470 --> 00:45:39,280

the classical this is perhaps slightly

1044

00:45:42,150 --> 00:45:40,480

unfair did but

1045

00:45:44,829 --> 00:45:42,160

he's able to replicate some of the

1046

00:45:49,349 --> 00:45:44,839

classical features

1047

00:45:52,230 --> 00:45:49,359

of uh quantum field theory

1048

00:45:53,270 --> 00:45:52,240

um so if you think about all of these

1049

00:45:56,150 --> 00:45:53,280

fields have got

1050

00:45:58,870 --> 00:45:56,160

a quantization com component but they

1051
00:46:00,790 --> 00:45:58,880
also have a classical component

1052
00:46:02,790 --> 00:46:00,800
electromagnetism being the simplest

1053
00:46:05,109 --> 00:46:02,800
example of that but there is a

1054
00:46:06,550 --> 00:46:05,119
effectively a classical component of

1055
00:46:09,990 --> 00:46:06,560
these other things and

1056
00:46:13,430 --> 00:46:10,000
stephen has shown that you can use

1057
00:46:16,390 --> 00:46:13,440
very simple computational systems

1058
00:46:17,430 --> 00:46:16,400
like cellular automata or other simple

1059
00:46:21,109 --> 00:46:17,440
things

1060
00:46:21,119 --> 00:46:25,589
many of the same

1061
00:46:33,270 --> 00:46:29,030
symmetries as

1062
00:46:37,910 --> 00:46:37,109
now there's two ways to view that one

1063
00:46:42,230 --> 00:46:37,920

way to view that

1064

00:46:46,470 --> 00:46:42,240

is to say yes that's great but

1065

00:46:49,030 --> 00:46:46,480

now tie them into a real quantum theory

1066

00:46:50,470 --> 00:46:49,040

and stephen would i think be the first

1067

00:46:52,069 --> 00:46:50,480

to say well

1068

00:46:54,309 --> 00:46:52,079

that's hard he hasn't quite done that

1069

00:46:56,550 --> 00:46:54,319

yet but he has done this intriguing

1070

00:46:58,309 --> 00:46:56,560

first part um

1071

00:47:00,150 --> 00:46:58,319

my friend peter has in a different way

1072

00:47:02,069 --> 00:47:00,160

done that first part

1073

00:47:03,510 --> 00:47:02,079

computation as well or completely

1074

00:47:05,990 --> 00:47:03,520

different is it also computational this

1075

00:47:10,150 --> 00:47:06,000

is much more about traditional

1076

00:47:13,670 --> 00:47:10,160

very very obtuse mathematics

1077

00:47:20,309 --> 00:47:16,870

the

1078

00:47:24,069 --> 00:47:20,319

that will work

1079

00:47:25,750 --> 00:47:24,079

but maybe not

1080

00:47:26,950 --> 00:47:25,760

so you're agnostic you don't have a

1081

00:47:28,150 --> 00:47:26,960

preference to which one of these

1082

00:47:31,589 --> 00:47:28,160

theories

1083

00:47:38,549 --> 00:47:34,870

i mean part of the tragedy

1084

00:47:42,950 --> 00:47:38,559

of super symmetry is that hunches

1085

00:47:46,790 --> 00:47:42,960

based on a mathematical idea

1086

00:47:49,670 --> 00:47:46,800

for the first time didn't work

1087

00:47:50,710 --> 00:47:49,680

right makes you pessimistic and so once

1088

00:47:53,589 --> 00:47:50,720

that's occurred

1089

00:47:55,589 --> 00:47:53,599

then you say and and man that one had

1090

00:47:59,190 --> 00:47:55,599

all the iq in the world

1091

00:48:01,430 --> 00:47:59,200

trying to desperately resuscitate it and

1092

00:48:02,870 --> 00:48:01,440

revive it and make it work

1093

00:48:06,230 --> 00:48:02,880

and yet it doesn't seem to be the way

1094

00:48:09,270 --> 00:48:06,240

nature operates

1095

00:48:12,950 --> 00:48:09,280

um at the same time

1096

00:48:16,549 --> 00:48:12,960

i have a basic faith in the

1097

00:48:18,870 --> 00:48:16,559

idea of physics which is

1098

00:48:20,630 --> 00:48:18,880

that we can figure out how the universe

1099

00:48:22,950 --> 00:48:20,640

works

1100

00:48:25,589 --> 00:48:22,960

and if you think about what we've

1101

00:48:28,309 --> 00:48:25,599

achieved so far

1102

00:48:30,150 --> 00:48:28,319

general relativity quantum field theory

1103

00:48:33,670 --> 00:48:30,160

um

1104

00:48:36,870 --> 00:48:33,680

boy oh boy we have understood

1105

00:48:40,630 --> 00:48:36,880

the universe around us uh

1106

00:48:43,829 --> 00:48:40,640

vastly better than in some sense we have

1107

00:48:51,349 --> 00:48:48,549

and um

1108

00:48:52,390 --> 00:48:51,359

you know whether you think that's luck

1109

00:48:55,990 --> 00:48:52,400

or

1110

00:48:58,790 --> 00:48:56,000

that's because there's some metric that

1111

00:49:02,150 --> 00:48:58,800

the simplest things actually work

1112

00:49:06,470 --> 00:49:02,160

or i mean you can go all

1113

00:49:08,309 --> 00:49:06,480

round and round on that um

1114

00:49:09,990 --> 00:49:08,319

you know the the counter example of

1115

00:49:14,390 --> 00:49:10,000

simple things

1116

00:49:18,069 --> 00:49:14,400

working out simply is number theory

1117

00:49:22,069 --> 00:49:18,079

where you know i can explain to a child

1118

00:49:25,750 --> 00:49:22,079

in a few minutes what integers are

1119

00:49:29,030 --> 00:49:25,760

and uh you can easily show

1120

00:49:31,190 --> 00:49:29,040

how factoring works and multiplication

1121

00:49:32,790 --> 00:49:31,200

works

1122

00:49:36,150 --> 00:49:32,800

and then you can state something like

1123

00:49:38,710 --> 00:49:36,160

the goldbach goldbox conjecture

1124

00:49:40,150 --> 00:49:38,720

and we have no clue how to prove it even

1125

00:49:46,950 --> 00:49:40,160

though it's obviously true

1126
00:49:50,630 --> 00:49:48,950
and that's an extraordinarily simple

1127
00:49:52,790 --> 00:49:50,640
system

1128
00:49:55,270 --> 00:49:52,800
so maybe it's that our idea of

1129
00:49:58,790 --> 00:49:55,280
simplicity isn't right

1130
00:50:00,230 --> 00:49:58,800
um anyway hey i still think it's worth

1131
00:50:02,069 --> 00:50:00,240
people trying to figure out the

1132
00:50:05,190 --> 00:50:02,079
fundamental laws

1133
00:50:07,190 --> 00:50:05,200
and it's well worth it but

1134
00:50:08,549 --> 00:50:07,200
we have gone through a very difficult

1135
00:50:10,069 --> 00:50:08,559
period in that

1136
00:50:12,390 --> 00:50:10,079
what do you mean when you say that our

1137
00:50:14,150 --> 00:50:12,400
idea of simplicity may be wrong what

1138
00:50:16,390 --> 00:50:14,160

could it be first of all what is it and

1139

00:50:19,510 --> 00:50:16,400

then what we are highly biased

1140

00:50:20,950 --> 00:50:19,520

towards things which we can explain with

1141

00:50:24,390 --> 00:50:20,960

simple continuum

1142

00:50:27,829 --> 00:50:24,400

model stuff

1143

00:50:31,589 --> 00:50:27,839

um so uh

1144

00:50:34,710 --> 00:50:31,599

the newton's great invention was the

1145

00:50:37,990 --> 00:50:34,720

calculus which was to say okay let's

1146

00:50:40,950 --> 00:50:38,000

reason about a continuum

1147

00:50:43,030 --> 00:50:40,960

of things starting off with the fact

1148

00:50:44,549 --> 00:50:43,040

well guys that we only have 10 fingers

1149

00:50:47,589 --> 00:50:44,559

and they're kind of discreet

1150

00:50:48,309 --> 00:50:47,599

it looks like you almost have nine yeah

1151

00:50:58,069 --> 00:50:48,319

i

1152

00:51:00,710 --> 00:50:58,079

would always joke to people and say yeah

1153

00:51:02,230 --> 00:51:00,720

he's a scientist and he's using his

1154

00:51:04,470 --> 00:51:02,240

physics background and his lab

1155

00:51:06,309 --> 00:51:04,480

to transform food it's essentially like

1156

00:51:07,670 --> 00:51:06,319

laser cooking a chicken to perfection

1157

00:51:09,589 --> 00:51:07,680

and then i always said that laser

1158

00:51:11,190 --> 00:51:09,599

cooking chicken but then i thought well

1159

00:51:12,790 --> 00:51:11,200

i don't see anything that you do as a

1160

00:51:14,069 --> 00:51:12,800

laser cooking then i thought well maybe

1161

00:51:16,069 --> 00:51:14,079

you do maybe i should ask you

1162

00:51:17,670 --> 00:51:16,079

is there anything uh sure you do

1163

00:51:18,630 --> 00:51:17,680

approximate something like a laser

1164

00:51:22,230 --> 00:51:18,640

cooking

1165

00:51:24,069 --> 00:51:22,240

oh sure um we uh

1166

00:51:26,230 --> 00:51:24,079

well there's lots of things where you

1167

00:51:28,549 --> 00:51:26,240

cook with light

1168

00:51:30,230 --> 00:51:28,559

so a neapolitan pizza is cooked with

1169

00:51:32,790 --> 00:51:30,240

light

1170

00:51:35,349 --> 00:51:32,800

um uh broiling is about cooking with

1171

00:51:38,309 --> 00:51:35,359

light it's all about infrared light

1172

00:51:39,589 --> 00:51:38,319

but for lasers specifically uh we've

1173

00:51:41,430 --> 00:51:39,599

done a bunch of

1174

00:51:43,190 --> 00:51:41,440

stuff that i think is cool i'm not sure

1175

00:51:45,750 --> 00:51:43,200

it's very fundamental

1176

00:51:47,430 --> 00:51:45,760

uh using laser cutters or leaves or

1177

00:51:50,150 --> 00:51:47,440

engravers

1178

00:51:50,870 --> 00:51:50,160

to do cool things you know we could etch

1179

00:51:54,150 --> 00:51:50,880

your face

1180

00:51:55,349 --> 00:51:54,160

on a piece of meat or on a slice of

1181

00:51:58,870 --> 00:51:55,359

bread because

1182

00:52:02,829 --> 00:51:58,880

it looks just like you um

1183

00:52:06,230 --> 00:52:02,839

or cut impossibly complicated

1184

00:52:06,870 --> 00:52:06,240

uh or otherwise impossibly complicated

1185

00:52:09,589 --> 00:52:06,880

patterns

1186

00:52:11,670 --> 00:52:09,599

out of a layer of sugar it sounds more

1187

00:52:15,510 --> 00:52:11,680

like presentation then

1188

00:52:20,309 --> 00:52:15,520

well for a laser cutter yes um lasers

1189

00:52:26,870 --> 00:52:23,829

don't do a lot of things that we

1190

00:52:30,829 --> 00:52:26,880

would want to do with cooking

1191

00:52:34,230 --> 00:52:30,839

right i mean we're just we would rather

1192

00:52:37,670 --> 00:52:34,240

cook with a broad source

1193

00:52:41,109 --> 00:52:37,680

and continuous source of infrared than a

1194

00:52:42,470 --> 00:52:41,119

pulsed laser that would either burn a

1195

00:52:45,829 --> 00:52:42,480

hole

1196

00:52:49,430 --> 00:52:45,839

or be too diffuse so

1197

00:52:52,630 --> 00:52:49,440

in general lasers uh

1198

00:52:55,510 --> 00:52:52,640

are not the be-all and end-all um

1199

00:52:57,190 --> 00:52:55,520

but they're useful for some things

1200

00:52:58,150 --> 00:52:57,200

that's another reason why i wanted you

1201

00:53:01,829 --> 00:52:58,160

as an uncle

1202

00:53:03,190 --> 00:53:01,839

because i love food tremendously

1203

00:53:04,870 --> 00:53:03,200

and when i read that you made the

1204

00:53:05,750 --> 00:53:04,880

perfect fry with bathing it and

1205

00:53:08,870 --> 00:53:05,760

ultrasonic oil

1206

00:53:11,750 --> 00:53:08,880

is that correct yeah i'm like man i wish

1207

00:53:12,950 --> 00:53:11,760

i knew this guy because just so you know

1208

00:53:16,309 --> 00:53:12,960

before each interview

1209

00:53:17,030 --> 00:53:16,319

i fast so right now i'm at a a 48 hour

1210

00:53:19,190 --> 00:53:17,040

fast

1211

00:53:20,870 --> 00:53:19,200

and one of the reasons is because i try

1212

00:53:22,069 --> 00:53:20,880

to research as much as possible about

1213

00:53:23,670 --> 00:53:22,079

the interviewee

1214

00:53:25,190 --> 00:53:23,680

and one of the ways that i productively

1215

00:53:26,309 --> 00:53:25,200

do that is just by not eating so i can

1216

00:53:28,549 --> 00:53:26,319

just focus on work

1217

00:53:29,670 --> 00:53:28,559

until i sleep okay but another reason is

1218

00:53:33,109 --> 00:53:29,680

because i'm so

1219

00:53:35,270 --> 00:53:33,119

avaricious that when i do eat i eat like

1220

00:53:38,549 --> 00:53:35,280

mad and then i have to just i'm like

1221

00:53:45,670 --> 00:53:40,470

glad for this to end is what you just

1222

00:53:48,710 --> 00:53:47,349

yeah okay so going back going back to

1223

00:53:53,589 --> 00:53:48,720

news

1224

00:53:53,599 --> 00:53:58,950

in physics for things that

1225

00:54:04,390 --> 00:54:02,069

can be solved by simple equations

1226

00:54:05,190 --> 00:54:04,400

ideally linear if they're non-linear

1227

00:54:08,870 --> 00:54:05,200

well not

1228

00:54:14,390 --> 00:54:12,309

and uh

1229

00:54:15,990 --> 00:54:14,400

and that's worked super well for lots of

1230

00:54:18,870 --> 00:54:16,000

things but

1231

00:54:20,150 --> 00:54:18,880

uh you know the the discoveries that

1232

00:54:24,790 --> 00:54:20,160

people had of

1233

00:54:28,470 --> 00:54:24,800

uh chaos and dynamical systems

1234

00:54:30,230 --> 00:54:28,480

and more generally fractals

1235

00:54:31,829 --> 00:54:30,240

out in whether there's fractals in the

1236

00:54:36,829 --> 00:54:31,839

real world or fractals

1237

00:54:46,230 --> 00:54:39,270

the

1238

00:54:50,390 --> 00:54:46,240

totally modeled by very simple

1239

00:54:52,150 --> 00:54:50,400

models might be quite limited and we

1240

00:54:54,390 --> 00:54:52,160

might have already

1241

00:54:55,990 --> 00:54:54,400

slipped them all up you have like we

1242

00:54:57,750 --> 00:54:56,000

mentioned we have variegated fields that

1243

00:55:00,069 --> 00:54:57,760

you're pretty much an expert in

1244

00:55:01,750 --> 00:55:00,079

how practically speaking do you do the

1245

00:55:04,150 --> 00:55:01,760

research when you're interested in

1246

00:55:05,589 --> 00:55:04,160

let's say some new field field x what do

1247

00:55:07,430 --> 00:55:05,599

you start out with do you

1248

00:55:09,030 --> 00:55:07,440

interview do you call experts do you

1249

00:55:09,990 --> 00:55:09,040

just go on wikipedia do you go on google

1250

00:55:11,589 --> 00:55:10,000

scholar

1251

00:55:13,349 --> 00:55:11,599

what does the journey from knowing

1252

00:55:15,190 --> 00:55:13,359

nothing to becoming

1253

00:55:18,549 --> 00:55:15,200

moderately ensconced in it to becoming

1254

00:55:21,910 --> 00:55:21,109

well it's got all those steps um you

1255

00:55:23,990 --> 00:55:21,920

know you

1256

00:55:25,670 --> 00:55:24,000

first i try to read as much as i can

1257

00:55:29,589 --> 00:55:25,680

about it

1258

00:55:32,630 --> 00:55:29,599

um often that means i will buy

1259

00:55:34,150 --> 00:55:32,640

books on amazon as the first step do you

1260

00:55:36,309 --> 00:55:34,160

mind taking us through a specific

1261

00:55:39,589 --> 00:55:36,319

example you can pick photography you can

1262

00:55:42,630 --> 00:55:39,599

pick paleontology asteroids

1263

00:55:44,630 --> 00:55:42,640

um well sure i'll pick out let me start

1264

00:55:48,069 --> 00:55:44,640

with asteroids with asteroids

1265

00:55:50,950 --> 00:55:48,079

some people came to me with

1266

00:55:52,309 --> 00:55:50,960

actually a request to donate money to a

1267

00:55:54,230 --> 00:55:52,319

project

1268

00:55:56,230 --> 00:55:54,240

to build a satellite to go look at

1269

00:56:00,549 --> 00:55:56,240

asteroids

1270

00:56:02,630 --> 00:56:00,559

and we spent some time discussing the

1271

00:56:05,910 --> 00:56:02,640

physics of it and i wasn't very

1272

00:56:09,990 --> 00:56:05,920

satisfied and so they sent me

1273

00:56:11,910 --> 00:56:10,000

a white paper about

1274

00:56:13,510 --> 00:56:11,920

this and then i was really dissatisfied

1275

00:56:15,030 --> 00:56:13,520

because i just figured this has to be

1276
00:56:18,470 --> 00:56:15,040
wrong

1277
00:56:20,309 --> 00:56:18,480
and so i reached out to some folks and i

1278
00:56:23,910 --> 00:56:20,319
got some data

1279
00:56:26,150 --> 00:56:23,920
and it took me a few months

1280
00:56:27,670 --> 00:56:26,160
but i showed there's a whole bunch of

1281
00:56:30,630 --> 00:56:27,680
stuff that was

1282
00:56:31,270 --> 00:56:30,640
wrong with their approach you wrote a

1283
00:56:34,470 --> 00:56:31,280
100

1284
00:56:35,670 --> 00:56:34,480
page paper well i've had a couple of

1285
00:56:37,190 --> 00:56:35,680
them

1286
00:56:38,789 --> 00:56:37,200
actually so i don't know if the first

1287
00:56:42,870 --> 00:56:38,799
one was 100 it might have been

1288
00:56:46,470 --> 00:56:42,880

i've written a bunch of papers on it and

1289

00:56:49,589 --> 00:56:46,480

along the way yes i contacted

1290

00:56:53,030 --> 00:56:49,599

uh experts

1291

00:56:56,789 --> 00:56:53,040

contacting experts is

1292

00:57:00,549 --> 00:56:56,799

always tricky because

1293

00:57:04,549 --> 00:57:02,470

experts are busy people and if you

1294

00:57:06,150 --> 00:57:04,559

contact them and say hi i'm some guy

1295

00:57:11,190 --> 00:57:06,160

you've never heard of

1296

00:57:15,750 --> 00:57:13,990

um you better make sure that question is

1297

00:57:17,750 --> 00:57:15,760

a sensible question otherwise they're

1298

00:57:21,030 --> 00:57:17,760

just never going to respond to you

1299

00:57:22,549 --> 00:57:21,040

right um or they'll respond and say oh

1300

00:57:24,829 --> 00:57:22,559

that's nice kid

1301
00:57:27,109 --> 00:57:24,839
you know clearly you don't understand a

1302
00:57:31,109 --> 00:57:27,119
thing

1303
00:57:34,069 --> 00:57:31,119
and it's both a very natural human

1304
00:57:37,349 --> 00:57:34,079
response to being busy and to

1305
00:57:39,910 --> 00:57:37,359
you know not wasting your time on

1306
00:57:41,109 --> 00:57:39,920
crack pots and of the things on the

1307
00:57:44,630 --> 00:57:41,119
other hand

1308
00:57:47,510 --> 00:57:44,640
science isn't about that

1309
00:57:50,069 --> 00:57:47,520
but usually you can find some scientist

1310
00:57:53,670 --> 00:57:52,069
is willing to answer some questions if

1311
00:57:54,710 --> 00:57:53,680
you've got good questions about their

1312
00:57:57,829 --> 00:57:54,720
work

1313
00:58:01,589 --> 00:57:57,839

yeah uh and i love google scholar

1314

00:58:03,270 --> 00:58:01,599

i use google scholar not every day but

1315

00:58:06,630 --> 00:58:03,280

certainly every week

1316

00:58:07,990 --> 00:58:06,640

i'm looking something up and that's

1317

00:58:12,230 --> 00:58:08,000

useful because you can

1318

00:58:16,549 --> 00:58:12,240

get an idea of what the world thinks

1319

00:58:19,349 --> 00:58:16,559

and for a lot of um a lot of stuff

1320

00:58:22,069 --> 00:58:19,359

it's way more current than you would

1321

00:58:25,270 --> 00:58:22,079

find in textbooks

1322

00:58:29,910 --> 00:58:25,280

now it's i mean

1323

00:58:33,829 --> 00:58:29,920

typically a physics paper doesn't use

1324

00:58:35,829 --> 00:58:33,839

mathematics that isn't in a textbook

1325

00:58:37,510 --> 00:58:35,839

it might use physics it's not a textbook

1326

00:58:38,390 --> 00:58:37,520

but not mathematics that's not in the

1327

00:58:40,950 --> 00:58:38,400

text that's correct

1328

00:58:42,390 --> 00:58:40,960

right right right right um uh and so

1329

00:58:42,950 --> 00:58:42,400

sometimes you have to go to the math

1330

00:58:45,109 --> 00:58:42,960

literature

1331

00:58:46,309 --> 00:58:45,119

then to find new math for things and

1332

00:58:50,549 --> 00:58:46,319

that

1333

00:58:53,750 --> 00:58:50,559

uh going

1334

00:58:55,510 --> 00:58:53,760

in a field to the literature is both

1335

00:58:59,510 --> 00:58:55,520

super important

1336

00:59:02,630 --> 00:58:59,520

but it's also a little challenging for

1337

00:59:05,910 --> 00:59:02,640

an outsider because

1338

00:59:09,430 --> 00:59:05,920

people will have their own

1339

00:59:10,950 --> 00:59:09,440

a field will develop its own vocabulary

1340

00:59:13,430 --> 00:59:10,960

its own things that are sort of

1341

00:59:17,510 --> 00:59:13,440

obviously everyone knows x

1342

00:59:20,710 --> 00:59:17,520

versus no they they don't know x

1343

00:59:23,430 --> 00:59:20,720

um but

1344

00:59:26,710 --> 00:59:23,440

in general i have found that there are

1345

00:59:30,829 --> 00:59:26,720

enough scientists enough experts who

1346

00:59:33,910 --> 00:59:30,839

uh i can talk to who

1347

00:59:37,349 --> 00:59:33,920

will help me

1348

00:59:40,630 --> 00:59:37,359

guide me in the right way um

1349

00:59:45,109 --> 00:59:40,640

sometimes join on as collaborators

1350

00:59:48,549 --> 00:59:45,119

um or be good at critiquing things

1351

00:59:53,030 --> 00:59:48,559

mm-hmm and so away you go from there

1352

00:59:56,390 --> 00:59:53,040

um now in the case of asteroids

1353

00:59:58,150 --> 00:59:56,400

the buy every book on amazon

1354

00:59:59,670 --> 00:59:58,160

that's on asteroids is pretty easy

1355

01:00:01,750 --> 00:59:59,680

there's not very many

1356

01:00:02,950 --> 01:00:01,760

but in that case well then you also need

1357

01:00:05,270 --> 01:00:02,960

to make sure you that you've got

1358

01:00:07,910 --> 01:00:05,280

everything understood about

1359

01:00:09,030 --> 01:00:07,920

radiative heat transfer and conductive

1360

01:00:12,549 --> 01:00:09,040

heat transfer

1361

01:00:15,990 --> 01:00:12,559

and the mechanics

1362

01:00:19,910 --> 01:00:16,000

of the engineering aspects of

1363

01:00:21,430 --> 01:00:19,920

uh telescopes and optical aspects and ir

1364

01:00:24,870 --> 01:00:21,440

telescopes in particular

1365

01:00:28,789 --> 01:00:26,950

you know eventually draws in a lot of

1366

01:00:30,390 --> 01:00:28,799

stuff so it doesn't seem like you're

1367

01:00:31,270 --> 01:00:30,400

going completely out of field because

1368

01:00:33,190 --> 01:00:31,280

when you mention

1369

01:00:34,549 --> 01:00:33,200

telescopes and conductive heat it sounds

1370

01:00:36,069 --> 01:00:34,559

like that's building on some of your

1371

01:00:38,150 --> 01:00:36,079

previous knowledge

1372

01:00:39,910 --> 01:00:38,160

is there an example of where you've gone

1373

01:00:43,589 --> 01:00:39,920

completely out of left field i don't

1374

01:00:47,990 --> 01:00:43,599

recall what the saying is um

1375

01:00:49,430 --> 01:00:48,000

well depends what you mean by completely

1376

01:00:51,109 --> 01:00:49,440

okay how about this how about this let's

1377

01:00:52,870 --> 01:00:51,119

take why don't you take me through your

1378

01:00:54,549 --> 01:00:52,880

how you would sort out this problem

1379

01:00:57,430 --> 01:00:54,559

let's say there is the

1380

01:00:58,710 --> 01:00:57,440

issue of when do we go back to

1381

01:01:01,270 --> 01:00:58,720

quote-unquote normal

1382

01:01:02,789 --> 01:01:01,280

from kovid okay so there are quite a few

1383

01:01:04,630 --> 01:01:02,799

variables to think about

1384

01:01:05,829 --> 01:01:04,640

obviously there's politics as well but

1385

01:01:08,230 --> 01:01:05,839

let's say okay

1386

01:01:09,190 --> 01:01:08,240

well what's the infection rate and how

1387

01:01:12,950 --> 01:01:09,200

effective are

1388

01:01:15,750 --> 01:01:12,960

so so how would you go about

1389

01:01:17,190 --> 01:01:15,760

solving the problem obviously we

1390

01:01:18,710 --> 01:01:17,200

mentioned you mentioned it doesn't just

1391

01:01:20,069 --> 01:01:18,720

depend on you but how would you go about

1392

01:01:23,109 --> 01:01:20,079

thinking about it i have

1393

01:01:27,109 --> 01:01:23,119

spent a lot of time working on

1394

01:01:29,270 --> 01:01:27,119

um computer models of infectious disease

1395

01:01:31,910 --> 01:01:29,280

so i'm very familiar with the state of

1396

01:01:34,710 --> 01:01:31,920

the art there in fact my company

1397

01:01:35,430 --> 01:01:34,720

uh created a whole unit of the company

1398

01:01:38,390 --> 01:01:35,440

called the

1399

01:01:39,670 --> 01:01:38,400

institute for disease modeling so in

1400

01:01:43,109 --> 01:01:39,680

that case i know

1401

01:01:46,309 --> 01:01:43,119

all about yet but

1402

01:01:49,349 --> 01:01:46,319

you don't need to have the details

1403

01:01:53,589 --> 01:01:49,359

to get the big picture

1404

01:01:56,710 --> 01:01:53,599

okay so the big picture on kovid

1405

01:02:01,109 --> 01:01:56,720

is very simple that

1406

01:02:03,750 --> 01:02:01,119

right now most people don't have it

1407

01:02:05,349 --> 01:02:03,760

okay which means most people are

1408

01:02:09,670 --> 01:02:05,359

vulnerable

1409

01:02:10,950 --> 01:02:09,680

and by most it's like 80 percent 85

1410

01:02:14,549 --> 01:02:10,960

percent

1411

01:02:20,309 --> 01:02:17,510

well if you have 85 vulnerable you will

1412

01:02:23,750 --> 01:02:20,319

have another wave

1413

01:02:24,950 --> 01:02:23,760

okay unless you're extraordinarily lucky

1414

01:02:27,430 --> 01:02:24,960

and you're able to

1415

01:02:28,390 --> 01:02:27,440

plug every gap and do every other thing

1416

01:02:32,789 --> 01:02:28,400

but

1417

01:02:34,470 --> 01:02:32,799

that's that's an extraordinarily special

1418

01:02:37,670 --> 01:02:34,480

state of affairs

1419

01:02:38,069 --> 01:02:37,680

now the problem with diseases is they

1420

01:02:42,150 --> 01:02:38,079

grow

1421

01:02:44,470 --> 01:02:42,160

exponentially you know

1422

01:02:46,150 --> 01:02:44,480

if you get sick you can infect some

1423

01:02:48,950 --> 01:02:46,160

number of people

1424

01:02:49,670 --> 01:02:48,960

there's practical limits on how many you

1425

01:02:53,750 --> 01:02:49,680

can in

1426

01:02:56,309 --> 01:02:53,760

fact but no conceptual limit

1427

01:02:58,150 --> 01:02:56,319

well each of those can go out and do a

1428

01:02:58,950 --> 01:02:58,160

whole bunch of people and each of those

1429

01:03:03,190 --> 01:02:58,960

can do

1430

01:03:06,390 --> 01:03:03,200

and so it grows exponentially and

1431

01:03:08,230 --> 01:03:06,400

to get rid of a disease you have to make

1432

01:03:11,029 --> 01:03:08,240

sure that its

1433

01:03:13,270 --> 01:03:11,039

growth factor is negative so it dies

1434

01:03:17,029 --> 01:03:13,280

exponentially

1435

01:03:20,950 --> 01:03:17,039

but there's a tremendous

1436

01:03:22,549 --> 01:03:20,960

amount of evidence that most countries

1437

01:03:25,990 --> 01:03:22,559

in the world

1438

01:03:30,069 --> 01:03:26,000

are unable to have

1439

01:03:33,430 --> 01:03:30,079

a locks down enough society

1440

01:03:38,150 --> 01:03:36,470

so it was

1441

01:03:42,390 --> 01:03:38,160

it's a little annoying to me when you

1442

01:03:48,150 --> 01:03:44,309

do a very normal human thing which is to

1443

01:03:51,670 --> 01:03:48,160

criticize folks that did it poorly

1444

01:03:55,750 --> 01:03:51,680

but in fact it's extremely hard

1445

01:03:57,750 --> 01:03:55,760

to do your reopening right

1446

01:04:00,390 --> 01:03:57,760

this oh my god we're shocked there's a

1447

01:04:02,309 --> 01:04:00,400

second wave

1448

01:04:04,150 --> 01:04:02,319

hello of course there was going to be a

1449

01:04:05,510 --> 01:04:04,160

second wave oh my god there's a new

1450

01:04:09,349 --> 01:04:05,520

strain

1451

01:04:12,950 --> 01:04:09,359

well you're lucky it took this long

1452

01:04:16,309 --> 01:04:12,960

viruses particularly rna viruses

1453

01:04:18,309 --> 01:04:16,319

are messy replicators they mutate like

1454

01:04:21,589 --> 01:04:18,319

crazy

1455

01:04:24,950 --> 01:04:21,599

so we have been lucky that covet

1456

01:04:29,670 --> 01:04:24,960

hasn't mutated more than it does

1457

01:04:33,430 --> 01:04:29,680

right right right and okay china

1458

01:04:35,670 --> 01:04:33,440

maybe south korea you can say there's

1459

01:04:37,990 --> 01:04:35,680

a couple people that you know did it

1460

01:04:41,510 --> 01:04:38,000

right

1461

01:04:44,150 --> 01:04:41,520

most other places a lot of other places

1462

01:04:47,589 --> 01:04:44,160

for a while thought oh we did it right

1463

01:04:50,630 --> 01:04:47,599

look at us we have low rates

1464

01:04:51,430 --> 01:04:50,640

and then they got another wave as they

1465

01:04:54,710 --> 01:04:51,440

were

1466

01:04:57,589 --> 01:04:54,720

going to get the other wave okay um

1467

01:04:59,829 --> 01:04:57,599

that's the other thing that is hard for

1468

01:05:00,150 --> 01:04:59,839

people to accept about something that's

1469

01:05:03,270 --> 01:05:00,160

so

1470

01:05:06,870 --> 01:05:03,280

important is that luck makes

1471

01:05:12,870 --> 01:05:10,549

okay so we know about a variety of super

1472

01:05:16,549 --> 01:05:12,880

spreader events

1473

01:05:18,950 --> 01:05:16,559

um early in the epidemic there was some

1474

01:05:20,150 --> 01:05:18,960

birthday party in connecticut i think

1475

01:05:23,349 --> 01:05:20,160

that

1476

01:05:24,710 --> 01:05:23,359

30 or 40 people got infected and went

1477

01:05:26,710 --> 01:05:24,720

all over the place even in different

1478

01:05:31,750 --> 01:05:26,720

countries

1479

01:05:37,510 --> 01:05:35,829

that specific thing is bad luck

1480

01:05:39,109 --> 01:05:37,520

you couldn't have predicted up front

1481

01:05:42,630 --> 01:05:39,119

this will happen in

1482

01:05:44,309 --> 01:05:42,640

connecticut um

1483

01:05:46,230 --> 01:05:44,319

you could predict that it'll happen

1484

01:05:49,270 --> 01:05:46,240

somewhere

1485

01:05:51,190 --> 01:05:49,280

and there were places who for a variety

1486

01:05:54,309 --> 01:05:51,200

of reasons

1487

01:05:57,910 --> 01:05:56,630

and yet they pat themselves in their

1488

01:06:00,710 --> 01:05:57,920

back and they go yeah that's because we

1489

01:06:03,430 --> 01:06:00,720

were so damn smart

1490

01:06:04,710 --> 01:06:03,440

and there were places that were unlucky

1491

01:06:07,670 --> 01:06:04,720

now they were unlucky

1492

01:06:08,950 --> 01:06:07,680

and they weren't doing a perfect job but

1493

01:06:11,990 --> 01:06:08,960

if you look back and say how many

1494

01:06:15,029 --> 01:06:12,000

countries did a perfect job of this

1495

01:06:17,990 --> 01:06:15,039

um we can't really tell

1496

01:06:21,109 --> 01:06:18,000

until it's in retrospect but china has

1497

01:06:25,029 --> 01:06:21,119

done a very good job of containment

1498

01:06:26,549 --> 01:06:25,039

saying arguably south korea has

1499

01:06:28,390 --> 01:06:26,559

and i'm sure you could come up with a

1500

01:06:32,309 --> 01:06:28,400

few other also rams and

1501

01:06:35,990 --> 01:06:32,319

and others um

1502

01:06:40,150 --> 01:06:37,910

you know italy was an interesting

1503

01:06:42,470 --> 01:06:40,160

example italy

1504

01:06:43,190 --> 01:06:42,480

the worst part of the first wave of the

1505

01:06:46,789 --> 01:06:43,200

epidemic

1506

01:06:49,029 --> 01:06:46,799

was all in the north of italy

1507

01:06:52,150 --> 01:06:49,039

which is not what most people would

1508

01:06:56,150 --> 01:06:54,309

because the health care system it's

1509

01:06:58,150 --> 01:06:56,160

widely believed

1510

01:06:59,589 --> 01:06:58,160

in italy and elsewhere that the health

1511

01:07:02,630 --> 01:06:59,599

care system

1512

01:07:06,390 --> 01:07:02,640

in the south is not as good

1513

01:07:09,109 --> 01:07:06,400

and that's a quantifiable thing it's

1514

01:07:10,549 --> 01:07:09,119

number of hospital beds and so on and so

1515

01:07:14,789 --> 01:07:10,559

forth

1516

01:07:17,270 --> 01:07:14,799

um so oddly

1517

01:07:18,789 --> 01:07:17,280

italy got sickest where their healthcare

1518

01:07:20,710 --> 01:07:18,799

was the strongest

1519

01:07:22,630 --> 01:07:20,720

now in a way that's really good because

1520

01:07:24,230 --> 01:07:22,640

at least they had some hope

1521

01:07:26,829 --> 01:07:24,240

and you're saying that's based on luck

1522

01:07:30,230 --> 01:07:26,839

in that example

1523

01:07:33,910 --> 01:07:30,240

well it's it's probably based

1524

01:07:37,190 --> 01:07:33,920

on the other thing the north is good

1525

01:07:40,549 --> 01:07:37,200

is known for which is the north of italy

1526

01:07:41,109 --> 01:07:40,559

is the industrial part of italy and they

1527

01:07:44,789 --> 01:07:41,119

have

1528

01:07:48,309 --> 01:07:44,799

the largest exports

1529

01:07:54,150 --> 01:07:48,319

and it's very likely that it was

1530

01:07:57,109 --> 01:07:54,160

people um in china on business

1531

01:07:58,549 --> 01:07:57,119

that brought it back to the rokkovic

1532

01:08:02,069 --> 01:07:58,559

back to

1533

01:08:05,829 --> 01:08:02,079

uh to the north of italy and

1534

01:08:09,190 --> 01:08:05,839

then from italy to new york because the

1535

01:08:10,150 --> 01:08:09,200

current um understanding is that the new

1536

01:08:13,750 --> 01:08:10,160

york epidemic

1537

01:08:17,910 --> 01:08:13,760

really was gotten from western europe

1538

01:08:20,390 --> 01:08:17,920

and italy in particular um

1539

01:08:25,349 --> 01:08:20,400

unlike in seattle where it was directly

1540

01:08:28,309 --> 01:08:25,359

uh directly people from china

1541

01:08:29,269 --> 01:08:28,319

so you know it i wouldn't you might not

1542

01:08:32,470 --> 01:08:29,279

say it was

1543

01:08:34,950 --> 01:08:32,480

luck pure luck because there might be a

1544

01:08:36,950 --> 01:08:34,960

factor like oh if you have

1545

01:08:39,349 --> 01:08:36,960

lots of industry in that industry

1546

01:08:41,669 --> 01:08:39,359

manufactures things in china

1547

01:08:43,510 --> 01:08:41,679

you're going to have a lot of engineers

1548

01:08:45,669 --> 01:08:43,520

and product managers and other people

1549

01:08:48,870 --> 01:08:45,679

going back and forth

1550

01:08:49,829 --> 01:08:48,880

so maybe calling that luck is too strong

1551

01:08:52,309 --> 01:08:49,839

a word

1552

01:08:53,269 --> 01:08:52,319

but it's not got anything to do with

1553

01:08:55,749 --> 01:08:53,279

your

1554

01:08:57,269 --> 01:08:55,759

medical system it's not got anything to

1555

01:08:59,910 --> 01:08:57,279

do with your hygiene it's

1556

01:09:02,309 --> 01:08:59,920

nothing to do with with that what about

1557

01:09:08,709 --> 01:09:02,319

government

1558

01:09:11,910 --> 01:09:08,719

you can find lots of instances where

1559

01:09:15,110 --> 01:09:11,920

the governments have done a

1560

01:09:16,870 --> 01:09:15,120

better job or a worse job

1561

01:09:21,430 --> 01:09:16,880

nathan you're in charge of the us right

1562

01:09:23,189 --> 01:09:21,440

now okay it's not guidance

1563

01:09:24,709 --> 01:09:23,199

you're in charge and my country canada

1564

01:09:28,149 --> 01:09:24,719

so what do you advise

1565

01:09:31,829 --> 01:09:28,159

canada and the us to do

1566

01:09:35,030 --> 01:09:31,839

well i really want to take more snow

1567

01:09:37,110 --> 01:09:35,040

off like pictures and i can't go to here

1568

01:09:40,149 --> 01:09:37,120

i doubt i'll be allowed to go this

1569

01:09:43,189 --> 01:09:40,159

winter so that pisses me off

1570

01:09:46,470 --> 01:09:43,199

but uh well the

1571

01:09:48,789 --> 01:09:46,480

only way all of the

1572

01:09:51,910 --> 01:09:48,799

kinds of shutdowns and things we've done

1573

01:09:51,920 --> 01:09:57,110

have mostly been uh

1574

01:10:01,189 --> 01:09:59,189

it was a fascinating question that would

1575

01:10:03,669 --> 01:10:01,199

require lots of detail analysis to say

1576

01:10:05,270 --> 01:10:03,679

was it worth it

1577

01:10:07,270 --> 01:10:05,280

there certainly is a point of view that

1578

01:10:10,550 --> 01:10:07,280

says

1579

01:10:14,830 --> 01:10:10,560

if you could have walked the talk

1580

01:10:16,870 --> 01:10:14,840

and really buckled down like the chinese

1581

01:10:20,070 --> 01:10:16,880

did great

1582

01:10:21,990 --> 01:10:20,080

but if you can't do that doing a

1583

01:10:25,510 --> 01:10:22,000

half-assed job is probably

1584

01:10:28,630 --> 01:10:25,520

worse than doing nothing interesting or

1585

01:10:29,030 --> 01:10:28,640

it it gives you a double dose of bad

1586

01:10:30,470 --> 01:10:29,040

things

1587

01:10:32,709 --> 01:10:30,480

wait why is it worse because of its

1588

01:10:34,229 --> 01:10:32,719

effect on the economy huge effect on the

1589

01:10:38,870 --> 01:10:34,239

economy

1590

01:10:41,189 --> 01:10:38,880

affects health outcomes in people's

1591

01:10:45,350 --> 01:10:41,199

lives

1592

01:10:48,550 --> 01:10:45,360

so you can't really separate the two

1593

01:10:50,310 --> 01:10:48,560

super cleanly you can it

1594

01:10:51,990 --> 01:10:50,320

you know because i hear some people say

1595

01:10:53,270 --> 01:10:52,000

yeah you're prioritizing the economy

1596

01:10:54,550 --> 01:10:53,280

over people's lives but what you're

1597

01:10:56,149 --> 01:10:54,560

saying is that they're inextricably

1598

01:10:59,510 --> 01:10:56,159

linked

1599

01:11:02,709 --> 01:10:59,520

many parts of the world they are

1600

01:11:05,110 --> 01:11:02,719

uh and it

1601

01:11:06,149 --> 01:11:05,120

it's a it's an interesting question that

1602

01:11:08,149 --> 01:11:06,159

we'll have to ask

1603

01:11:09,830 --> 01:11:08,159

answer after the fact would we have been

1604

01:11:15,110 --> 01:11:09,840

better off

1605

01:11:21,430 --> 01:11:18,149

but really meaning it

1606

01:11:24,470 --> 01:11:21,440

like okay you are arrested or

1607

01:11:25,669 --> 01:11:24,480

i don't want to say shot on site but you

1608

01:11:29,270 --> 01:11:25,679

don't want to say it

1609

01:11:32,550 --> 01:11:29,280

tased on sight if you don't ask

1610

01:11:33,669 --> 01:11:32,560

but don't go through a whole bunch of

1611

01:11:36,390 --> 01:11:33,679

the other

1612

01:11:39,750 --> 01:11:36,400

silly things and you know here in

1613

01:11:46,709 --> 01:11:43,430

we had a i think a very well-meaning

1614

01:11:48,550 --> 01:11:46,719

government but you have the problem that

1615

01:11:49,669 --> 01:11:48,560

policymakers don't really know what to

1616

01:11:50,709 --> 01:11:49,679

do

1617

01:11:53,630 --> 01:11:50,719

because they haven't been in this

1618

01:11:59,030 --> 01:11:53,640

situation before

1619

01:12:06,070 --> 01:12:03,110

have not always given great advice or

1620

01:12:08,390 --> 01:12:06,080

they have allowed themselves to be

1621

01:12:11,030 --> 01:12:08,400

talked down

1622

01:12:11,990 --> 01:12:11,040

in weird ways so for example when the

1623

01:12:13,750 --> 01:12:12,000

thing first came out

1624

01:12:15,830 --> 01:12:13,760

oh we're going to ban all meetings of

1625

01:12:18,390 --> 01:12:15,840

more than 100 people

1626

01:12:20,950 --> 01:12:18,400

oh wait wait did i say 100 i meant 10.

1627

01:12:24,709 --> 01:12:20,960

oh did i say 10 i meant

1628

01:12:28,709 --> 01:12:24,719

[h__\h] about somebody

1629

01:12:30,790 --> 01:12:28,719

with lots of well-meaning intentions

1630

01:12:32,310 --> 01:12:30,800

saying oh wait do we really have to

1631

01:12:35,270 --> 01:12:32,320

scrap

1632

01:12:36,189 --> 01:12:35,280

you know groups of 10 people and the

1633

01:12:39,750 --> 01:12:36,199

answer

1634

01:12:43,030 --> 01:12:39,760

epidemiologically was always two

1635

01:12:46,709 --> 01:12:43,040

don't allow two if everyone's alone

1636

01:12:48,550 --> 01:12:46,719

they can't transmit and then okay people

1637

01:12:49,990 --> 01:12:48,560

are gonna live with their families and

1638

01:12:52,950 --> 01:12:50,000

we're not to fix that

1639

01:12:54,310 --> 01:12:52,960

so don't expand it that was the right

1640

01:12:57,830 --> 01:12:54,320

answer

1641

01:12:59,750 --> 01:12:57,840

but you go through this thing of

1642

01:13:01,270 --> 01:12:59,760

saying something and changing it and

1643

01:13:03,669 --> 01:13:01,280

changing it and each one of those things

1644

01:13:05,430 --> 01:13:03,679

was a damn lie

1645

01:13:07,910 --> 01:13:05,440

the you go through another thing where

1646

01:13:09,189 --> 01:13:07,920

people and they're lying because

1647

01:13:11,030 --> 01:13:09,199

they don't feel like people will listen

1648

01:13:11,350 --> 01:13:11,040

if you say keep your social circle to

1649

01:13:13,189 --> 01:13:11,360

two

1650

01:13:14,630 --> 01:13:13,199

or because of some other reason i think

1651

01:13:21,510 --> 01:13:14,640

it sounded too

1652

01:13:25,430 --> 01:13:22,630

there's a lot of people say oh you're

1653

01:13:27,430 --> 01:13:25,440

overreacting you're overreacting you're

1654

01:13:29,189 --> 01:13:27,440

overreacting

1655

01:13:30,870 --> 01:13:29,199

also i heard in the beginning that who

1656

01:13:33,189 --> 01:13:30,880

said that masks were counter effective

1657

01:13:36,310 --> 01:13:33,199

well so

1658

01:13:42,390 --> 01:13:36,320

yes this was a great example

1659

01:13:46,390 --> 01:13:42,400

of well-meaning people

1660

01:13:50,709 --> 01:13:46,400

saying [h__\h] that was wrong

1661

01:13:52,229 --> 01:13:50,719

and you could eat in some cases

1662

01:13:54,229 --> 01:13:52,239

they couldn't help saying things are

1663

01:13:57,510 --> 01:13:54,239

wrong because we didn't know

1664

01:13:59,350 --> 01:13:57,520

but in in that case the mask thing was

1665

01:14:01,030 --> 01:13:59,360

horrifically stupid they had people

1666

01:14:02,950 --> 01:14:01,040

saying

1667

01:14:04,870 --> 01:14:02,960

literally oh it doesn't matter because

1668

01:14:05,830 --> 01:14:04,880

viruses are so tiny they'll go through

1669

01:14:10,870 --> 01:14:05,840

any

1670

01:14:12,950 --> 01:14:10,880

hole but you're not spewing pure viruses

1671

01:14:13,990 --> 01:14:12,960

so who the [h__\h] thought that was a good

1672

01:14:17,510 --> 01:14:14,000

thing you're

1673

01:14:19,669 --> 01:14:17,520

spitting okay and

1674

01:14:21,030 --> 01:14:19,679

if you have if you wear one of those

1675

01:14:24,310 --> 01:14:21,040

face masks

1676

01:14:26,630 --> 01:14:24,320

plastic face mask wear one even just

1677

01:14:28,630 --> 01:14:26,640

around the house for a little bit

1678

01:14:30,149 --> 01:14:28,640

and see how filthy it gets near your

1679

01:14:32,630 --> 01:14:30,159

mouth it's gross

1680

01:14:33,590 --> 01:14:32,640

but you're spitting all the time that's

1681

01:14:37,030 --> 01:14:33,600

how we

1682

01:14:37,990 --> 01:14:37,040

speaking i see i see then there was a whole

1683

01:14:41,189 --> 01:14:38,000

set of other

1684

01:14:43,270 --> 01:14:41,199

weird political in uh there's a point

1685

01:14:47,110 --> 01:14:43,280

where

1686

01:14:49,030 --> 01:14:47,120

uh in washington state it was okay

1687

01:14:51,350 --> 01:14:49,040

to go golfing but you couldn't go

1688

01:14:53,910 --> 01:14:51,360

fishing

1689

01:14:54,790 --> 01:14:53,920

well that was some political [h__h]

1690

01:14:58,310 --> 01:14:54,800

i'm sorry

1691

01:15:01,350 --> 01:14:58,320

there was no science that says

1692

01:15:05,030 --> 01:15:01,360

oh there's this then you also have

1693

01:15:08,830 --> 01:15:05,040

the scientists i have to say are also at

1694

01:15:08,840 --> 01:15:12,470

because

1695

01:15:19,110 --> 01:15:15,590

there wasn't enough thinking about okay

1696

01:15:22,550 --> 01:15:19,120

is something worth doing at the level

1697

01:15:27,350 --> 01:15:22,560

we could actually do it

1698

01:15:30,229 --> 01:15:27,360

right so if we it's clearly the case

1699

01:15:30,630 --> 01:15:30,239

that if the us and canada could have

1700

01:15:34,149 --> 01:15:30,640

done

1701

01:15:38,870 --> 01:15:34,159

what china did it would be way better

1702

01:15:42,630 --> 01:15:38,880

for both the uh economy

1703

01:15:45,830 --> 01:15:42,640

and for the number of people killed

1704

01:15:51,590 --> 01:15:45,840

okay the the us has vastly more people

1705

01:15:59,350 --> 01:15:55,669

but the fact is we couldn't do that

1706

01:16:01,750 --> 01:15:59,360

and given that you can't do it

1707

01:16:05,910 --> 01:16:01,760

and even you could argue well we didn't

1708

01:16:07,669 --> 01:16:05,920

know how incompetent we were up front

1709

01:16:09,189 --> 01:16:07,679

maybe

1710

01:16:10,950 --> 01:16:09,199

but i mean you say we didn't have enough

1711

01:16:12,229 --> 01:16:10,960

data about the virus or the people

1712

01:16:14,390 --> 01:16:12,239

involved in policymaking were

1713

01:16:16,950 --> 01:16:14,400

incompetent

1714

01:16:19,669 --> 01:16:16,960

well no but look you're never going to

1715

01:16:22,790 --> 01:16:19,679

get 100 compliance in anything

1716

01:16:24,390 --> 01:16:22,800

right like we all have laws about

1717

01:16:26,390 --> 01:16:24,400

speeding

1718

01:16:27,510 --> 01:16:26,400

yet virtually everyone who's ever driven

1719

01:16:29,430 --> 01:16:27,520

a car

1720

01:16:30,870 --> 01:16:29,440

has broken one of those laws at some

1721

01:16:34,229 --> 01:16:30,880

point in time it's

1722

01:16:37,910 --> 01:16:34,239

almost none of us get caught right

1723

01:16:38,390 --> 01:16:37,920

and we tr we use those laws to try to

1724

01:16:42,630 --> 01:16:38,400

get

1725

01:16:50,550 --> 01:16:45,910

but if we had something that depended

1726

01:16:53,110 --> 01:16:50,560

critically on us following traffic laws

1727

01:16:54,070 --> 01:16:53,120

we would be [h__h] right because we

1728

01:16:59,110 --> 01:16:54,080

cannot

1729

01:17:03,030 --> 01:16:59,120

bring ourselves to obey traffic laws

1730

01:17:04,950 --> 01:17:03,040

it's just a damn fact i you can

1731

01:17:07,110 --> 01:17:04,960

maybe someone could come up with some

1732

01:17:09,350 --> 01:17:07,120

way to make that occur but we

1733

01:17:10,870 --> 01:17:09,360

so china was able to go do it south

1734

01:17:11,590 --> 01:17:10,880

korea seems to be able to do it and

1735

01:17:15,510 --> 01:17:11,600

they're

1736

01:17:17,910 --> 01:17:15,520

a much more free society than china

1737

01:17:19,510 --> 01:17:17,920

um they still have a right sorry to

1738

01:17:21,430 --> 01:17:19,520

interrupt was china able to quote

1739

01:17:23,270 --> 01:17:21,440

unquote do it because they have a larger

1740

01:17:25,030 --> 01:17:23,280

enforcement mechanism such as they will

1741

01:17:25,910 --> 01:17:25,040

shoot you or they will tase you in your

1742

01:17:29,030 --> 01:17:25,920

previous example

1743

01:17:32,310 --> 01:17:29,040

or is it something else well

1744

01:17:37,189 --> 01:17:32,320

or the obedience of the population well

1745

01:17:45,189 --> 01:17:41,510

the the way we have a law-abiding

1746

01:17:48,070 --> 01:17:45,199

society is through a combination

1747

01:17:49,669 --> 01:17:48,080

of catching the people who break the

1748

01:17:52,870 --> 01:17:49,679

laws

1749

01:17:56,830 --> 01:17:52,880

but mostly providing an incentive to

1750

01:17:56,840 --> 01:18:01,590

right so uh

1751

01:18:05,669 --> 01:18:04,390

who is it because the chinese were

1752

01:18:09,030 --> 01:18:05,679

conditioned

1753

01:18:10,550 --> 01:18:09,040

to do what they're told or because the

1754

01:18:11,750 --> 01:18:10,560

threat there was threat of punishment

1755

01:18:13,910 --> 01:18:11,760

but wasn't that thriller

1756

01:18:15,350 --> 01:18:13,920

i mean i don't know you didn't separate

1757

01:18:19,990 --> 01:18:15,360

those two things

1758

01:18:24,149 --> 01:18:22,630

i can't totally remember the name of the

1759

01:18:26,310 --> 01:18:24,159

movie but it was a

1760

01:18:28,709 --> 01:18:26,320

sort of a comedic western movie where

1761

01:18:31,750 --> 01:18:28,719

this guy is given the

1762

01:18:33,669 --> 01:18:31,760

um is made sheriff he's given the star

1763

01:18:34,709 --> 01:18:33,679

of the former sheriff that is this big

1764

01:18:37,830 --> 01:18:34,719

dent unit

1765

01:18:39,189 --> 01:18:37,840

due to a bullet and the guy says well at

1766

01:18:46,950 --> 01:18:39,199

least this

1767

01:18:49,430 --> 01:18:46,960

was badge saved my predecessor

1768

01:18:50,709 --> 01:18:49,440

and guy giving it to him says well it

1769

01:18:52,950 --> 01:18:50,719

would have if it wasn't for all the

1770

01:18:56,470 --> 01:18:52,960

other bullets

1771

01:19:00,149 --> 01:18:56,480

right i mean it if you

1772

01:19:03,270 --> 01:19:00,159

if you sent the police out or you sent

1773

01:19:05,910 --> 01:19:03,280

the soldiers out with

1774

01:19:09,510 --> 01:19:05,920

something the size of my cell phone that

1775

01:19:12,550 --> 01:19:09,520

was completely bulletproof

1776

01:19:13,350 --> 01:19:12,560

it wouldn't be worth doing even if it

1777

01:19:16,149 --> 01:19:13,360

was perfect

1778

01:19:16,709 --> 01:19:16,159

where it was yeah there's too many other

1779

01:19:20,390 --> 01:19:16,719

holes

1780

01:19:23,510 --> 01:19:20,400

in the armor it's pointless

1781

01:19:26,790 --> 01:19:23,520

it's not worth anything it's true and

1782

01:19:30,790 --> 01:19:26,800

i i think that that is what

1783

01:19:34,470 --> 01:19:30,800

occurred in the covet response

1784

01:19:37,510 --> 01:19:34,480

of most of the countries in the world

1785

01:19:42,229 --> 01:19:37,520

they either enacted half

1786

01:19:45,669 --> 01:19:42,239

steps that could never could have worked

1787

01:19:46,470 --> 01:19:45,679

or they enacted ones that should have

1788

01:19:48,630 --> 01:19:46,480

worked

1789

01:19:49,990 --> 01:19:48,640

but they couldn't walk the talk they

1790

01:19:53,350 --> 01:19:50,000

couldn't actually

1791

01:19:55,430 --> 01:19:53,360

have enough compliance or

1792

01:19:57,110 --> 01:19:55,440

they waited until it was too late to do

1793

01:19:58,790 --> 01:19:57,120

that and exactly

1794

01:20:01,110 --> 01:19:58,800

and you probably come up with five other

1795

01:20:04,550 --> 01:20:01,120

reasons so i don't claim i know

1796

01:20:09,189 --> 01:20:04,560

all of the exact mistakes yeah

1797

01:20:09,990 --> 01:20:09,199

but it's when you have an exponentially

1798

01:20:13,030 --> 01:20:10,000

growing

1799

01:20:16,790 --> 01:20:13,040

thing it requires a

1800

01:20:20,709 --> 01:20:16,800

fanatical approach to try

1801
01:20:23,430 --> 01:20:20,719
to eliminate the disease

1802
01:20:25,189 --> 01:20:23,440
and we know that that's true from cases

1803
01:20:28,550 --> 01:20:25,199
where they eliminated

1804
01:20:29,750 --> 01:20:28,560
a malaria within a region we've never

1805
01:20:31,830 --> 01:20:29,760
done it for the whole earth

1806
01:20:33,030 --> 01:20:31,840
but we've done it in regions we know

1807
01:20:36,149 --> 01:20:33,040
that that was the case

1808
01:20:39,990 --> 01:20:36,159
with smallpox

1809
01:20:43,350 --> 01:20:40,000
but in smallpox we had a vaccine

1810
01:20:44,229 --> 01:20:43,360
so anyway it was very clear to me early

1811
01:20:46,070 --> 01:20:44,239
on

1812
01:20:48,149 --> 01:20:46,080
that we're just basically [h__\h] until

1813
01:20:51,430 --> 01:20:48,159

we get a vaccine

1814

01:20:54,470 --> 01:20:51,440

and it is worth going through

1815

01:20:56,390 --> 01:20:54,480

the various things some certainly it's

1816

01:20:58,470 --> 01:20:56,400

worth wearing masks

1817

01:20:59,750 --> 01:20:58,480

i believe that all along the current

1818

01:21:01,510 --> 01:20:59,760

belief is it's true

1819

01:21:03,030 --> 01:21:01,520

but we went through a phase of denying

1820

01:21:05,669 --> 01:21:03,040

that it was good for masks

1821

01:21:10,070 --> 01:21:05,679

or saying oh masks aren't good for you

1822

01:21:13,189 --> 01:21:11,510

now what about that is there any truth

1823

01:21:15,030 --> 01:21:13,199

to that

1824

01:21:17,350 --> 01:21:15,040

that's not what the latest research

1825

01:21:21,110 --> 01:21:17,360

shows

1826
01:21:24,229 --> 01:21:21,120
because fundamentally why do i never

1827
01:21:25,910 --> 01:21:24,239
sorry your spit and you don't want to

1828
01:21:30,070 --> 01:21:25,920
breathe my spit

1829
01:21:33,590 --> 01:21:30,080
yep and the whole point of these masks

1830
01:21:36,870 --> 01:21:33,600
is to reduce the amount of spit transfer

1831
01:21:41,430 --> 01:21:36,880
now it's not cutting it to zero

1832
01:21:44,950 --> 01:21:41,440
but we're reducing it and statistically

1833
01:21:47,990 --> 01:21:44,960
that means that there are people who

1834
01:21:50,870 --> 01:21:48,000
if in fact you were you know

1835
01:21:53,510 --> 01:21:50,880
locked in an elevator with someone for

1836
01:21:56,470 --> 01:21:53,520
48 hours

1837
01:21:58,390 --> 01:21:56,480
you know unless you had scuba tanks with

1838
01:22:00,229 --> 01:21:58,400

separate air systems

1839

01:22:02,550 --> 01:22:00,239

i don't know how you're going to avoid

1840

01:22:06,070 --> 01:22:02,560

some contagion

1841

01:22:08,310 --> 01:22:06,080

but for a lot of things

1842

01:22:10,470 --> 01:22:08,320

the mass would have worked but it also

1843

01:22:11,910 --> 01:22:10,480

undermined mask making you have people

1844

01:22:14,950 --> 01:22:11,920

think

1845

01:22:17,669 --> 01:22:14,960

it'd be much better from a compliance

1846

01:22:21,189 --> 01:22:17,679

perspective to tell people

1847

01:22:24,390 --> 01:22:21,199

oh this is all for you buddy

1848

01:22:27,590 --> 01:22:24,400

do it for yourself if your friends

1849

01:22:28,550 --> 01:22:27,600

don't want to do it fine you can cry at

1850

01:22:31,170 --> 01:22:28,560

their funeral

1851
01:22:33,189 --> 01:22:31,180
present the other way around

1852
01:22:36,629 --> 01:22:33,199
[Music]

1853
01:22:41,830 --> 01:22:36,639
so anyway uh i think that

1854
01:22:45,270 --> 01:22:41,840
the vaccine is the only thing that

1855
01:22:48,229 --> 01:22:45,280
given our general lack

1856
01:22:50,149 --> 01:22:48,239
of ability to control it with lockdowns

1857
01:22:53,669 --> 01:22:50,159
and

1858
01:22:57,430 --> 01:22:53,679
we've tried in canada

1859
01:22:59,110 --> 01:22:57,440
and the us and all of europe and

1860
01:23:02,390 --> 01:22:59,120
essentially every other country except

1861
01:23:05,510 --> 01:23:02,400
china nobody's gotten

1862
01:23:06,950 --> 01:23:05,520
and south korea south korea nobody has

1863
01:23:09,270 --> 01:23:06,960

gotten a line on this so

1864

01:23:10,709 --> 01:23:09,280

obviously it's the vaccine that's our

1865

01:23:12,310 --> 01:23:10,719

next hope

1866

01:23:14,229 --> 01:23:12,320

you mentioned south korea but they don't

1867

01:23:15,189 --> 01:23:14,239

have the same authoritarian government

1868

01:23:19,110 --> 01:23:15,199

as china so

1869

01:23:19,120 --> 01:23:23,669

well um

1870

01:23:30,070 --> 01:23:26,950

i don't know uh

1871

01:23:31,189 --> 01:23:30,080

i i have friends who are korean or of

1872

01:23:35,430 --> 01:23:31,199

korean

1873

01:23:38,550 --> 01:23:35,440

background who would say oh actually

1874

01:23:42,790 --> 01:23:38,560

it may not be as authoritarian

1875

01:23:46,070 --> 01:23:42,800

but koreans have a very strong

1876
01:23:48,470 --> 01:23:46,080
sense of community and being gung-ho

1877
01:23:50,550 --> 01:23:48,480
interesting and cultural difference and

1878
01:23:53,750 --> 01:23:50,560
that there was a cultural difference

1879
01:23:57,430 --> 01:23:53,760
that they were more likely to follow

1880
01:24:00,470 --> 01:23:57,440
the rules now they also tested up the

1881
01:24:07,590 --> 01:24:03,750
we didn't do [h__\h] for testing here yeah

1882
01:24:11,270 --> 01:24:07,600
and still barely don't

1883
01:24:13,270 --> 01:24:11,280
well how the hell are you going to stop

1884
01:24:15,350 --> 01:24:13,280
this exponential spread thing

1885
01:24:19,910 --> 01:24:15,360
if you can't identify who the hell has

1886
01:24:23,910 --> 01:24:22,310
anyway so this stage our only hope is

1887
01:24:27,830 --> 01:24:23,920
the vaccine

1888
01:24:30,470 --> 01:24:27,840

and we have to get it rolled out to

1889

01:24:31,750 --> 01:24:30,480

essentially everybody as soon as

1890

01:24:34,870 --> 01:24:31,760

possible now

1891

01:24:38,149 --> 01:24:34,880

there's a word that's been bandied

1892

01:24:41,350 --> 01:24:38,159

about called herd immunity

1893

01:24:44,470 --> 01:24:41,360

and herd immunity is a real feature of a

1894

01:24:47,910 --> 01:24:44,480

mathematical model of a disease

1895

01:24:51,590 --> 01:24:47,920

which basically states

1896

01:24:56,550 --> 01:24:51,600

if enough people get it

1897

01:25:02,629 --> 01:24:59,830

then it's hard for the disease to spread

1898

01:25:04,470 --> 01:25:02,639

because if you have it but almost

1899

01:25:08,149 --> 01:25:04,480

everyone you run into

1900

01:25:11,669 --> 01:25:08,159

is immune then

1901

01:25:11,990 --> 01:25:11,679

you will resolve as doctors say that

1902

01:25:15,270 --> 01:25:12,000

means

1903

01:25:16,470 --> 01:25:15,280

either get better or die you will

1904

01:25:19,189 --> 01:25:16,480

resolve

1905

01:25:21,270 --> 01:25:19,199

and or at least stop being stop

1906

01:25:25,510 --> 01:25:21,280

transmitting

1907

01:25:27,270 --> 01:25:25,520

before you reach a vulnerable person

1908

01:25:28,790 --> 01:25:27,280

it's one of the ways to think about an

1909

01:25:30,629 --> 01:25:28,800

infectious disease

1910

01:25:32,310 --> 01:25:30,639

so you mean to say in hurt immunity that

1911

01:25:33,910 --> 01:25:32,320

if enough healthy people get it so that

1912

01:25:34,550 --> 01:25:33,920

they survive and then they become immune

1913

01:25:38,390 --> 01:25:34,560

to it

1914

01:25:40,790 --> 01:25:38,400

well you need to have immune people

1915

01:25:42,310 --> 01:25:40,800

okay now the through vaccination right

1916

01:25:46,310 --> 01:25:42,320

here of getting effect

1917

01:25:50,070 --> 01:25:46,320

of this well there's two ways there's

1918

01:25:52,870 --> 01:25:50,080

recovered people because for almost

1919

01:25:53,350 --> 01:25:52,880

every disease in the world infectious

1920

01:25:56,229 --> 01:25:53,360

disease

1921

01:25:57,830 --> 01:25:56,239

i should say you get some amount of

1922

01:26:02,229 --> 01:25:57,840

immunity

1923

01:26:05,430 --> 01:26:02,239

after you've had it um

1924

01:26:09,910 --> 01:26:05,440

malaria has the least immunity

1925

01:26:13,430 --> 01:26:11,910

or you don't get it as strongly or

1926

01:26:17,110 --> 01:26:13,440

there's a variety of other

1927

01:26:19,990 --> 01:26:17,120

things so basically

1928

01:26:21,030 --> 01:26:20,000

once you have society either recover

1929

01:26:24,870 --> 01:26:21,040

from that

1930

01:26:25,669 --> 01:26:24,880

or get vaccinated then you can stop it

1931

01:26:27,990 --> 01:26:25,679

but people

1932

01:26:29,590 --> 01:26:28,000

started talking about herd immunity when

1933

01:26:32,470 --> 01:26:29,600

five percent of the country

1934

01:26:35,430 --> 01:26:32,480

was infected or two percent was infected

1935

01:26:39,350 --> 01:26:35,440

and that was just absurd

1936

01:26:41,669 --> 01:26:39,360

and it was somebody working really hard

1937

01:26:43,430 --> 01:26:41,679

to try to find hope and say well maybe

1938

01:26:46,950 --> 01:26:43,440

maybe maybe we could

1939

01:26:49,270 --> 01:26:46,960

it's like be serious in

1940

01:26:50,950 --> 01:26:49,280

most any model you don't get to hurt

1941

01:26:54,149 --> 01:26:50,960

immunity until you get

1942

01:26:54,550 --> 01:26:54,159

well over half and usually it's more

1943

01:26:57,750 --> 01:26:54,560

like

1944

01:26:59,990 --> 01:26:57,760

three quarters so in

1945

01:27:01,430 --> 01:27:00,000

the stage when three quarters of the

1946

01:27:06,550 --> 01:27:01,440

population

1947

01:27:09,030 --> 01:27:06,560

have been rendered immune

1948

01:27:09,590 --> 01:27:09,040

then you can start to talk about her

1949

01:27:15,750 --> 01:27:09,600

immunity

1950

01:27:22,390 --> 01:27:19,270

the way you typically model diseases

1951

01:27:24,550 --> 01:27:22,400

is as if every one of us

1952

01:27:25,430 --> 01:27:24,560

might have some random possibility of

1953

01:27:29,910 --> 01:27:25,440

meeting some

1954

01:27:33,510 --> 01:27:29,920

other one of us any fine day

1955

01:27:35,430 --> 01:27:33,520

that's how the world works okay covid

1956

01:27:37,669 --> 01:27:35,440

was devastating

1957

01:27:39,350 --> 01:27:37,679

around the world what it got into

1958

01:27:42,310 --> 01:27:39,360

assisted living centers

1959

01:27:45,430 --> 01:27:42,320

and nursing homes because you're a set

1960

01:27:50,149 --> 01:27:45,440

of people that can't get away

1961

01:27:56,390 --> 01:27:53,030

and you have caregivers that work at

1962

01:28:03,510 --> 01:28:00,310

doctors nurses other caregivers

1963

01:28:07,669 --> 01:28:03,520

so once coveted got

1964

01:28:12,790 --> 01:28:07,679

into an assisted living center

1965

01:28:16,070 --> 01:28:12,800

it was going to explode and and no

1966

01:28:17,990 --> 01:28:16,080

you know if if you had the last people

1967

01:28:21,590 --> 01:28:18,000

on earth to be vaccinated

1968

01:28:23,430 --> 01:28:21,600

we're all in the same nursing home

1969

01:28:25,590 --> 01:28:23,440

there's no herd immunity that's going to

1970

01:28:27,669 --> 01:28:25,600

save them if

1971

01:28:29,590 --> 01:28:27,679

covet lands there they're all going to

1972

01:28:30,550 --> 01:28:29,600

get it or a large fraction we'll get it

1973

01:28:36,070 --> 01:28:30,560

and die and

1974

01:28:48,229 --> 01:28:39,510

the

1975

01:28:52,229 --> 01:28:48,239

to achieve some slowing of infection

1976

01:28:54,229 --> 01:28:52,239

due to inoculation we don't know

1977

01:28:57,350 --> 01:28:54,239

but it depends on the circles that

1978

01:29:01,110 --> 01:28:57,360

people move in

1979

01:29:03,030 --> 01:29:01,120

you know if in fact

1980

01:29:04,870 --> 01:29:03,040

you had kids that go to a particular

1981

01:29:07,669 --> 01:29:04,880

school

1982

01:29:09,270 --> 01:29:07,679

if covet gets to one of the parents and

1983

01:29:11,110 --> 01:29:09,280

then gets to the kids and then they

1984

01:29:14,149 --> 01:29:11,120

spread the at school

1985

01:29:17,510 --> 01:29:14,159

then you have a much tighter connection

1986

01:29:21,189 --> 01:29:17,520

to the other parents in that school

1987

01:29:22,870 --> 01:29:21,199

than you might have to some other group

1988

01:29:24,470 --> 01:29:22,880

of folks on the other side of town like

1989

01:29:26,229 --> 01:29:24,480

maybe a nursing home

1990

01:29:27,590 --> 01:29:26,239

right okay on the other hand once it

1991

01:29:28,149 --> 01:29:27,600

gets to the nursing home the nursing

1992

01:29:30,950 --> 01:29:28,159

home at

1993

01:29:33,350 --> 01:29:30,960

home has very strong connectivity to

1994

01:29:36,149 --> 01:29:33,360

each other

1995

01:29:37,350 --> 01:29:36,159

so it's a it's a complicated thing now

1996

01:29:39,590 --> 01:29:37,360

um

1997

01:29:41,590 --> 01:29:39,600

israel is doing a great job of giving

1998

01:29:46,709 --> 01:29:41,600

people injections

1999

01:29:49,910 --> 01:29:46,719

um of the people that are in their

2000

01:29:51,510 --> 01:29:49,920

priority groups for the first wave

2001
01:29:54,390 --> 01:29:51,520
in like the first week they've done a

2002
01:29:58,629 --> 01:29:57,510
okay it's a smaller country it doesn't

2003
01:30:01,270 --> 01:29:58,639
have a problem

2004
01:30:04,870 --> 01:30:01,280
that canada and united states both have

2005
01:30:07,750 --> 01:30:04,880
of a huge rural population

2006
01:30:08,470 --> 01:30:07,760
but still our cities aren't doing that

2007
01:30:11,830 --> 01:30:08,480
well

2008
01:30:15,669 --> 01:30:11,840
right and

2009
01:30:21,270 --> 01:30:18,790
we have somehow failed

2010
01:30:24,149 --> 01:30:21,280
we have the weird situation that we

2011
01:30:27,350 --> 01:30:24,159
panic enough to do some things like

2012
01:30:29,189 --> 01:30:27,360
close the borders you know close all

2013
01:30:31,510 --> 01:30:29,199

restaurants close this

2014

01:30:32,470 --> 01:30:31,520

but we don't seem to be panic enough to

2015

01:30:35,189 --> 01:30:32,480

say

2016

01:30:36,790 --> 01:30:35,199

okay this is a [h__h] public health

2017

01:30:39,030 --> 01:30:36,800

emergency

2018

01:30:40,229 --> 01:30:39,040

we're calling out the national guard

2019

01:30:43,110 --> 01:30:40,239

we're putting people

2020

01:30:44,390 --> 01:30:43,120

or just put them in every damn walgreens

2021

01:30:47,910 --> 01:30:44,400

and cvs

2022

01:30:49,510 --> 01:30:47,920

or there's a hundred ways you could roll

2023

01:30:52,229 --> 01:30:49,520

out a vaccine

2024

01:30:54,229 --> 01:30:52,239

yeah way more effectively but instead

2025

01:30:56,790 --> 01:30:54,239

it's sort of like oh

2026

01:30:58,390 --> 01:30:56,800

yeah each state will decide and if the

2027

01:30:59,990 --> 01:30:58,400

state does a good job well that's good

2028

01:31:02,070 --> 01:31:00,000

if they do a bad job well those people

2029

01:31:03,350 --> 01:31:02,080

are a little [h__\h]

2030

01:31:04,870 --> 01:31:03,360

okay i don't want to keep talking about

2031

01:31:05,750 --> 01:31:04,880

covid i wanted to ask you some physics

2032

01:31:07,270 --> 01:31:05,760

questions but

2033

01:31:09,030 --> 01:31:07,280

i don't get to speak to someone who

2034

01:31:10,550 --> 01:31:09,040

studies infectious diseases much

2035

01:31:12,470 --> 01:31:10,560

and i haven't been keeping up with the

2036

01:31:13,830 --> 01:31:12,480

covid news and i hear that some people

2037

01:31:15,830 --> 01:31:13,840

say colvit isn't much

2038

01:31:17,350 --> 01:31:15,840

more dangerous than the flu so first of

2039

01:31:18,550 --> 01:31:17,360

all i want to know what do you say to

2040

01:31:21,270 --> 01:31:18,560

that and then second

2041

01:31:22,550 --> 01:31:21,280

what is the deal with this new strain is

2042

01:31:28,870 --> 01:31:22,560

it more

2043

01:31:35,510 --> 01:31:31,030

well in both cases the world doesn't

2044

01:31:43,590 --> 01:31:40,229

there is we have a very strange

2045

01:31:46,629 --> 01:31:43,600

situation in our lives in general

2046

01:31:50,550 --> 01:31:46,639

where we get used to old risks and we

2047

01:31:57,270 --> 01:31:54,629

so yeah influenza killed

2048

01:31:58,310 --> 01:31:57,280

you know hundreds of millions of people

2049

01:32:05,990 --> 01:31:58,320

in

2050

01:32:09,030 --> 01:32:06,000

every year it's killed a shitload of

2051
01:32:13,590 --> 01:32:11,830
now why are we okay with that well we're

2052
01:32:14,709 --> 01:32:13,600
okay with that because we tried as hard

2053
01:32:17,750 --> 01:32:14,719
as we could

2054
01:32:21,189 --> 01:32:17,760
to make vaccines we

2055
01:32:21,590 --> 01:32:21,199
did come up with vaccine that usually in

2056
01:32:25,590 --> 01:32:21,600
most

2057
01:32:28,149 --> 01:32:25,600
years sort of kind of helps

2058
01:32:30,229 --> 01:32:28,159
but it's also true that the number of

2059
01:32:34,229 --> 01:32:30,239
people who have died in the annual

2060
01:32:37,030 --> 01:32:34,239
um flu epidemic from say 1918

2061
01:32:40,950 --> 01:32:37,040
to today 100 years worth that's about

2062
01:32:44,470 --> 01:32:40,960
the same as died in 1918.

2063
01:32:48,950 --> 01:32:44,480

now you have a new thing like covid

2064

01:32:51,189 --> 01:32:48,960

and covid i should say in 1918 it had a

2065

01:32:54,950 --> 01:32:51,199

very weird pattern

2066

01:32:59,350 --> 01:32:54,960

of mortality

2067

01:33:02,470 --> 01:32:59,360

so it was terrible on 18 to 24

2068

01:33:06,790 --> 01:33:02,480

year old men and

2069

01:33:09,910 --> 01:33:06,800

yet it was very uh few fatalities and

2070

01:33:13,750 --> 01:33:09,920

little infectiousness in

2071

01:33:15,910 --> 01:33:13,760

people i think at over the age of 65 or

2072

01:33:18,470 --> 01:33:15,920

60 something like that

2073

01:33:20,550 --> 01:33:18,480

and it's believed the reason why is that

2074

01:33:23,910 --> 01:33:20,560

there was another flu epidemic

2075

01:33:26,950 --> 01:33:23,920

not as severe that was

2076

01:33:30,070 --> 01:33:26,960

like 50 years earlier

2077

01:33:32,470 --> 01:33:30,080

and so the people who got that influenza

2078

01:33:34,470 --> 01:33:32,480

were pretty much spared the new one

2079

01:33:37,669 --> 01:33:34,480

interesting

2080

01:33:42,870 --> 01:33:37,679

um anyway

2081

01:33:42,880 --> 01:33:47,110

it's a few percent death risk

2082

01:33:51,030 --> 01:33:49,990

for many parts of the population but

2083

01:33:55,430 --> 01:33:51,040

i'll just take me

2084

01:33:58,709 --> 01:33:55,440

i'm 61 so i'm over 60.

2085

01:34:01,669 --> 01:33:58,719

um i've had some uh

2086

01:34:02,229 --> 01:34:01,679

respiratory infections in the past i

2087

01:34:03,590 --> 01:34:02,239

like that

2088

01:34:06,070 --> 01:34:03,600

difficult number theory probably just

2089

01:34:07,189 --> 01:34:06,080

said i'm 61 so i'm over 60.

2090

01:34:08,870 --> 01:34:07,199

yeah it's one of those go back

2091

01:34:10,149 --> 01:34:08,880

conjecture problems well but that's one

2092

01:34:12,310 --> 01:34:10,159

of the thresholds

2093

01:34:13,350 --> 01:34:12,320

and i'm not over 65 where it gets even

2094

01:34:15,669 --> 01:34:13,360

worse

2095

01:34:16,830 --> 01:34:15,679

but i also have had a bunch of sinus

2096

01:34:21,750 --> 01:34:16,840

infections

2097

01:34:24,709 --> 01:34:21,760

chronically i'm arguably high risk

2098

01:34:26,470 --> 01:34:24,719

and then oh besides it killing you it

2099

01:34:29,830 --> 01:34:26,480

can also

2100

01:34:33,270 --> 01:34:29,840

put you in a in a permanent brain

2101
01:34:34,550 --> 01:34:33,280
fog there's a whole bunch of evidence

2102
01:34:37,030 --> 01:34:34,560
for that

2103
01:34:38,149 --> 01:34:37,040
it can take away your sense of taste now

2104
01:34:39,750 --> 01:34:38,159
that would [ʌh__ʌh] up my

2105
01:34:43,270 --> 01:34:39,760
cookbook career if i couldn't taste

2106
01:34:49,910 --> 01:34:46,629
so and it it will kill

2107
01:34:53,189 --> 01:34:49,920
lots and lots of people and it is a

2108
01:34:55,750 --> 01:34:53,199
because it's a new thing

2109
01:34:57,109 --> 01:34:55,760
we arguably should do everything we can

2110
01:35:00,310 --> 01:34:57,119
within reason

2111
01:35:02,229 --> 01:35:00,320
to stop it and saying oh it's just as

2112
01:35:03,990 --> 01:35:02,239
bad as the other stuff

2113
01:35:05,270 --> 01:35:04,000

is like well yeah but you don't want to

2114

01:35:09,430 --> 01:35:05,280

multiply that by

2115

01:35:12,709 --> 01:35:09,440

something i mean car deaths

2116

01:35:15,669 --> 01:35:12,719

are horrendous in the united states and

2117

01:35:19,030 --> 01:35:15,679

in canada and all over the world

2118

01:35:22,950 --> 01:35:19,040

um there are many more people

2119

01:35:25,430 --> 01:35:22,960

killed uh by cars in the united states

2120

01:35:29,750 --> 01:35:25,440

than there are by people

2121

01:35:31,990 --> 01:35:29,760

okay the it's like twice the murder rate

2122

01:35:34,310 --> 01:35:32,000

and our murder rate is way too high for

2123

01:35:38,790 --> 01:35:34,320

a developed country it's a

2124

01:35:40,709 --> 01:35:38,800

it's a shame it should be much lower um

2125

01:35:42,550 --> 01:35:40,719

well if you if you introduced a new

2126

01:35:45,590 --> 01:35:42,560

thing as an oh but it's just as

2127

01:35:47,350 --> 01:35:45,600

it's only as bad as cars well cars all

2128

01:35:50,229 --> 01:35:47,360

over again

2129

01:35:51,350 --> 01:35:50,239

takes a large mortality factor and

2130

01:35:53,990 --> 01:35:51,360

doubles down

2131

01:35:55,990 --> 01:35:54,000

you don't want to do that and is it only

2132

01:36:00,149 --> 01:35:56,000

as bad as the flu or is it more

2133

01:36:03,990 --> 01:36:03,510

well it turns out people don't really

2134

01:36:07,430 --> 01:36:04,000

know

2135

01:36:08,070 --> 01:36:07,440

both sides of that equation we certainly

2136

01:36:11,430 --> 01:36:08,080

know

2137

01:36:14,550 --> 01:36:11,440

that it is got uh

2138

01:36:18,550 --> 01:36:14,560

the mortality in some

2139

01:36:21,750 --> 01:36:18,560

age groups appears to be

2140

01:36:23,189 --> 01:36:21,760

way worse than we would than you'd say

2141

01:36:26,870 --> 01:36:23,199

for a typical

2142

01:36:30,390 --> 01:36:26,880

annual flu that it's more like the

2143

01:36:33,109 --> 01:36:30,400

epidemic flu of 1918

2144

01:36:35,990 --> 01:36:33,119

but then somebody else says but oh do we

2145

01:36:39,030 --> 01:36:36,000

really know how many people

2146

01:36:42,070 --> 01:36:39,040

have had it

2147

01:36:45,350 --> 01:36:42,080

and the answer is we don't

2148

01:36:48,229 --> 01:36:45,360

so there are people who are

2149

01:36:49,030 --> 01:36:48,239

living in close proximity with others

2150

01:36:52,390 --> 01:36:49,040

who had it

2151
01:36:55,510 --> 01:36:52,400
who didn't seem to get it

2152
01:36:58,149 --> 01:36:55,520
now did those people get it and repel it

2153
01:37:02,070 --> 01:36:58,159
and beat it

2154
01:37:05,350 --> 01:37:02,080
did they have some pre-existing

2155
01:37:07,189 --> 01:37:05,360
immunity there's a thought that there

2156
01:37:10,390 --> 01:37:07,199
are two coronaviruses

2157
01:37:14,709 --> 01:37:10,400
that are implicated in the common cold

2158
01:37:16,629 --> 01:37:14,719
mainly maybe if you had a cold last year

2159
01:37:18,470 --> 01:37:16,639
and it was one of those coronary viruses

2160
01:37:22,709 --> 01:37:18,480
maybe you're immune to it

2161
01:37:26,149 --> 01:37:22,719
we don't know now

2162
01:37:29,270 --> 01:37:26,159
it was weird in the uh

2163
01:37:32,629 --> 01:37:29,280

1918 flu that it mostly

2164

01:37:35,510 --> 01:37:32,639

killed young adults um

2165

01:37:36,709 --> 01:37:35,520

this one is weird in that it doesn't

2166

01:37:40,149 --> 01:37:36,719

seem to

2167

01:37:43,750 --> 01:37:40,159

kill young children it can

2168

01:37:47,510 --> 01:37:43,760

kill young children it's not zero

2169

01:37:50,870 --> 01:37:47,520

but the mortality rate is way way lower

2170

01:37:52,070 --> 01:37:50,880

now that's a it's a little surprising

2171

01:37:55,109 --> 01:37:52,080

because

2172

01:37:58,790 --> 01:37:55,119

very small children don't have a

2173

01:38:05,990 --> 01:38:02,470

number one number two it's

2174

01:38:09,109 --> 01:38:06,000

just usually it's a new disease

2175

01:38:10,310 --> 01:38:09,119

hits the very old and the very young and

2176

01:38:12,950 --> 01:38:10,320

it's the people in the middle that are

2177

01:38:16,149 --> 01:38:12,960

okay this one's not like that

2178

01:38:19,270 --> 01:38:16,159

it's the sums it's the very

2179

01:38:22,950 --> 01:38:19,280

old and the middle part of

2180

01:38:25,669 --> 01:38:22,960

the the stack and older that uh

2181

01:38:26,709 --> 01:38:25,679

that seem to be most at risk but a lot

2182

01:38:32,149 --> 01:38:26,719

of this

2183

01:38:38,629 --> 01:38:36,390

a level of research that either

2184

01:38:41,430 --> 01:38:38,639

is difficult to do or hasn't been done

2185

01:38:47,430 --> 01:38:43,990

um now with regard to the new strain

2186

01:38:49,750 --> 01:38:47,440

yeah well the new strain

2187

01:38:51,750 --> 01:38:49,760

appears to be this is a kind of the same

2188

01:38:55,030 --> 01:38:51,760

thing you

2189

01:38:58,390 --> 01:38:55,040

it's viruses are messy when they

2190

01:39:00,950 --> 01:38:58,400

um replicate you

2191

01:39:02,390 --> 01:39:00,960

almost always see some replication

2192

01:39:05,030 --> 01:39:02,400

errors

2193

01:39:06,950 --> 01:39:05,040

and that allows for example the

2194

01:39:10,070 --> 01:39:06,960

conclusion

2195

01:39:11,750 --> 01:39:10,080

that the seattle epidemic started with

2196

01:39:13,830 --> 01:39:11,760

people from china

2197

01:39:16,790 --> 01:39:13,840

whereas the european the new york

2198

01:39:19,750 --> 01:39:16,800

epidemic started with people from

2199

01:39:20,229 --> 01:39:19,760

europe that conclusion is precisely

2200

01:39:22,709 --> 01:39:20,239

because

2201

01:39:24,470 --> 01:39:22,719

the strains are always mutating a little

2202

01:39:27,270 --> 01:39:24,480

bit

2203

01:39:28,229 --> 01:39:27,280

and the first new york strains were more

2204

01:39:31,030 --> 01:39:28,239

similar

2205

01:39:35,270 --> 01:39:31,040

to the western european ones than to the

2206

01:39:42,229 --> 01:39:39,270

are you okay do you have one of them

2207

01:39:44,229 --> 01:39:42,239

i every year i get this allergic cough

2208

01:39:46,790 --> 01:39:44,239

but he does have everyone around me

2209

01:39:49,189 --> 01:39:46,800

thinking oh my god this is it

2210

01:39:51,350 --> 01:39:49,199

um he's in the final death of causing

2211

01:39:55,669 --> 01:39:51,360

fear to all your loved ones

2212

01:39:58,470 --> 01:39:55,679

um so uh anyway

2213

01:40:00,229 --> 01:39:58,480

this strain has been or some strain that

2214

01:40:03,590 --> 01:40:00,239

appears

2215

01:40:06,790 --> 01:40:03,600

to have popped up from nowhere

2216

01:40:09,830 --> 01:40:06,800

in the uk and also

2217

01:40:14,550 --> 01:40:09,840

in south africa and it's been found

2218

01:40:18,790 --> 01:40:17,510

it's definitely a new strain by itself

2219

01:40:21,910 --> 01:40:18,800

that's not a big

2220

01:40:25,270 --> 01:40:21,920

surprise it might be more

2221

01:40:28,310 --> 01:40:25,280

infectious or more transmissible

2222

01:40:29,350 --> 01:40:28,320

that does occur with viruses we don't

2223

01:40:32,070 --> 01:40:29,360

know right now

2224

01:40:33,750 --> 01:40:32,080

i don't think there is enough there's so

2225

01:40:36,229 --> 01:40:33,760

many people that have said yes and

2226

01:40:40,070 --> 01:40:36,239

people who have said no

2227

01:40:42,470 --> 01:40:40,080

and a

2228

01:40:43,189 --> 01:40:42,480

out of an abundance of caution we have

2229

01:40:47,030 --> 01:40:43,199

to act

2230

01:40:49,669 --> 01:40:47,040

like oh it's it's yes

2231

01:40:50,629 --> 01:40:49,679

at the same time it's probably already

2232

01:40:53,910 --> 01:40:50,639

everywhere so

2233

01:40:54,790 --> 01:40:53,920

locking the doors probably doesn't do

2234

01:40:57,109 --> 01:40:54,800

that much

2235

01:40:59,270 --> 01:40:57,119

what it really ought to do is make you

2236

01:41:02,070 --> 01:40:59,280

want to get the vaccine out there

2237

01:41:02,550 --> 01:41:02,080

right wait sorry and this vaccine would

2238

01:41:04,310 --> 01:41:02,560

also

2239

01:41:06,390 --> 01:41:04,320

prevent the new strain from infecting

2240

01:41:09,590 --> 01:41:06,400

you well we don't

2241

01:41:12,550 --> 01:41:09,600

actually know that either see here's one

2242

01:41:19,270 --> 01:41:16,830

in physics we are able to use

2243

01:41:21,669 --> 01:41:19,280

abstractions to

2244

01:41:24,390 --> 01:41:21,679

say here's a very general theory and we

2245

01:41:26,870 --> 01:41:24,400

can calculate it in a very simplified

2246

01:41:29,189 --> 01:41:26,880

situation but it also works in a more

2247

01:41:31,990 --> 01:41:29,199

complicated one

2248

01:41:33,510 --> 01:41:32,000

so for example we say conservation of

2249

01:41:37,270 --> 01:41:33,520

mass

2250

01:41:39,430 --> 01:41:37,280

conservation of momentum conservation of

2251
01:41:44,229 --> 01:41:39,440
energy

2252
01:41:46,229 --> 01:41:44,239
well you can use those principles

2253
01:41:49,590 --> 01:41:46,239
in lots of a very com otherwise

2254
01:41:53,030 --> 01:41:49,600
complicated circumstances

2255
01:41:55,109 --> 01:41:53,040
the problem here is the effect that a

2256
01:41:56,550 --> 01:41:55,119
vaccine has we know in theory what a

2257
01:41:59,590 --> 01:41:56,560
vaccine does

2258
01:42:03,669 --> 01:41:59,600
is it stimulates your immune system

2259
01:42:05,669 --> 01:42:03,679
to be on the lookout for this pathogen

2260
01:42:06,950 --> 01:42:05,679
and that allows your immune system to

2261
01:42:11,990 --> 01:42:06,960
mount a response

2262
01:42:17,990 --> 01:42:12,000
and overwhelm the pathogen vastly sooner

2263
01:42:24,070 --> 01:42:22,149

but we don't know exactly whether

2264

01:42:28,070 --> 01:42:24,080

this is going to work with the others

2265

01:42:30,709 --> 01:42:28,080

because we haven't tested it

2266

01:42:31,270 --> 01:42:30,719

now this is one where if they have

2267

01:42:38,310 --> 01:42:31,280

enough

2268

01:42:41,510 --> 01:42:39,990

they'll be able to figure this one out

2269

01:42:46,310 --> 01:42:41,520

relatively quickly

2270

01:42:49,750 --> 01:42:46,320

and my bet would be it does

2271

01:42:52,390 --> 01:42:49,760

but it's a bat and you know in the case

2272

01:42:56,070 --> 01:42:52,400

of flow

2273

01:43:00,149 --> 01:42:56,080

uh flu famously mutates enough that

2274

01:43:07,350 --> 01:43:04,709

now because that's true for flu

2275

01:43:09,510 --> 01:43:07,360

you get this whole bunch of silly things

2276

01:43:12,149 --> 01:43:09,520

statements by scientists

2277

01:43:13,669 --> 01:43:12,159

where you know early in the epidemic

2278

01:43:14,550 --> 01:43:13,679

they'll say oh it'll all go away in the

2279

01:43:17,350 --> 01:43:14,560

summer

2280

01:43:19,910 --> 01:43:17,360

because it's a seasonal thing just like

2281

01:43:22,870 --> 01:43:21,430

and people would say scientists would

2282

01:43:24,390 --> 01:43:22,880

say this to me he said what do you want

2283

01:43:27,350 --> 01:43:24,400

drugs

2284

01:43:29,189 --> 01:43:27,360

there's no evidence of that you're

2285

01:43:31,910 --> 01:43:29,199

hoping it's true

2286

01:43:33,270 --> 01:43:31,920

oh there's you but most most respiratory

2287

01:43:35,270 --> 01:43:33,280

viruses are and i said

2288

01:43:37,189 --> 01:43:35,280

what do you mean by most once you

2289

01:43:39,510 --> 01:43:37,199

subtract out flu

2290

01:43:41,510 --> 01:43:39,520

we really don't know squat about about

2291

01:43:45,350 --> 01:43:41,520

the cold

2292

01:43:47,030 --> 01:43:45,360

well common colds do propagate during

2293

01:43:48,709 --> 01:43:47,040

the summer

2294

01:43:50,870 --> 01:43:48,719

and in fact there's a fascinating thing

2295

01:43:53,510 --> 01:43:50,880

that no one knows why

2296

01:43:54,390 --> 01:43:53,520

we seem to associate colds more with the

2297

01:43:57,990 --> 01:43:54,400

winter

2298

01:44:00,709 --> 01:43:58,000

mm-hmm i see okay also

2299

01:44:01,590 --> 01:44:00,719

even though flu is seasonal no one knows

2300

01:44:04,709 --> 01:44:01,600

why

2301

01:44:06,390 --> 01:44:04,719

cold is not seasonal then or is it only

2302

01:44:07,830 --> 01:44:06,400

somewhat seasonal i don't believe that

2303

01:44:09,590 --> 01:44:07,840

the common well the common goals is

2304

01:44:13,750 --> 01:44:09,600

certainly not entirely seasonal

2305

01:44:16,070 --> 01:44:13,760

the um annual epidemic of influenza is

2306

01:44:20,709 --> 01:44:16,080

strongly seasonal

2307

01:44:22,629 --> 01:44:20,719

so if you take 50 years of data between

2308

01:44:25,669 --> 01:44:22,639

france united states this is what i

2309

01:44:29,109 --> 01:44:25,679

happen to know the statistics

2310

01:44:30,950 --> 01:44:29,119

the day on which the peak epidemic

2311

01:44:32,790 --> 01:44:30,960

occurs

2312

01:44:34,149 --> 01:44:32,800

as recorded by say number of hospital

2313

01:44:38,070 --> 01:44:34,159

admissions or

2314

01:44:43,750 --> 01:44:40,149

it's only a few days different every

2315

01:44:46,790 --> 01:44:45,669

now that means it's got to have some

2316

01:44:51,350 --> 01:44:46,800

very powerful

2317

01:44:55,350 --> 01:44:53,430

well that so obviously we figured that

2318

01:44:59,030 --> 01:44:55,360

out right

2319

01:45:00,629 --> 01:44:59,040

we haven't there's multiple theories

2320

01:45:02,709 --> 01:45:00,639

the theories of course contradict each

2321

01:45:07,189 --> 01:45:02,719

other and the theories also

2322

01:45:08,790 --> 01:45:07,199

frankly contradict common sense mostly

2323

01:45:10,629 --> 01:45:08,800

as far as i know one of the theories is

2324

01:45:11,590 --> 01:45:10,639

that in the cold we congregate more such

2325

01:45:13,750 --> 01:45:11,600

as in buses

2326

01:45:14,629 --> 01:45:13,760

so what about that common cold there's

2327

01:45:21,270 --> 01:45:14,639

that

2328

01:45:25,189 --> 01:45:21,280

this is one of the great questions

2329

01:45:26,550 --> 01:45:25,199

that is part of what rudyard kipling

2330

01:45:29,350 --> 01:45:26,560

would call a just so

2331

01:45:31,750 --> 01:45:29,360

story he had these just those stories

2332

01:45:33,830 --> 01:45:31,760

how the leopard got its spots and

2333

01:45:34,950 --> 01:45:33,840

they're sort of little fables for

2334

01:45:38,310 --> 01:45:34,960

children

2335

01:45:40,790 --> 01:45:38,320

yes it's true that we congregate in we

2336

01:45:43,109 --> 01:45:40,800

ride the bus more whereas we might walk

2337

01:45:46,790 --> 01:45:43,119

or ride bicycles

2338

01:45:53,750 --> 01:45:46,800

right um

2339

01:45:59,590 --> 01:45:57,830

excuse me what timing huh yeah exactly

2340

01:46:03,750 --> 01:45:59,600

yeah give me one minute i'll be right

2341

01:46:07,270 --> 01:46:05,270

you know the the number of things we

2342

01:46:11,189 --> 01:46:07,280

don't know is

2343

01:46:13,510 --> 01:46:11,199

frighteningly large um

2344

01:46:14,870 --> 01:46:13,520

but at the moment i think look our best

2345

01:46:18,390 --> 01:46:14,880

bet is the vaccines

2346

01:46:20,390 --> 01:46:18,400

and let's hope that the vaccines

2347

01:46:21,990 --> 01:46:20,400

do provide protection against this other

2348

01:46:25,669 --> 01:46:22,000

strain

2349

01:46:28,149 --> 01:46:25,679

um and whatever

2350

01:46:31,189 --> 01:46:28,159

one thing that's terrible about having a

2351

01:46:35,910 --> 01:46:31,199

large epidemic

2352

01:46:39,590 --> 01:46:35,920

is that in a very crude way

2353

01:46:43,910 --> 01:46:41,910

determines the rate of evolution of the

2354

01:46:45,669 --> 01:46:43,920

virus

2355

01:46:47,350 --> 01:46:45,679

because every time he gets transmitted

2356

01:46:49,270 --> 01:46:47,360

to a new person you're running a new

2357

01:46:50,790 --> 01:46:49,280

evolutionary experiment and you could

2358

01:46:52,149 --> 01:46:50,800

have new mutations

2359

01:46:53,910 --> 01:46:52,159

that's why you're surprised that there's

2360

01:46:56,629 --> 01:46:53,920

only one new strain well

2361

01:46:57,430 --> 01:46:56,639

there isn't one there's hundreds of

2362

01:46:59,590 --> 01:46:57,440

strains

2363

01:47:01,510 --> 01:46:59,600

but they're little teeny teeny

2364

01:47:04,390 --> 01:47:01,520

differences i think this is one that

2365

01:47:07,990 --> 01:47:04,400

seems to be a larger macro difference

2366

01:47:10,149 --> 01:47:08,000

okay okay let's get back to some of your

2367

01:47:11,669 --> 01:47:10,159

asteroid research i remember you said

2368

01:47:14,229 --> 01:47:11,679

that in i believe it was

2369

01:47:15,430 --> 01:47:14,239

nasa's data they analyzed some of the

2370

01:47:17,910 --> 01:47:15,440

asteroids as

2371

01:47:18,950 --> 01:47:17,920

circular i mean sorry spherical when

2372

01:47:21,189 --> 01:47:18,960

when they're oblong when they're

2373

01:47:22,950 --> 01:47:21,199

elongated

2374

01:47:24,390 --> 01:47:22,960

please let me know if you recall what

2375

01:47:25,750 --> 01:47:24,400

i'm saying and but to me and to

2376

01:47:26,070 --> 01:47:25,760

virtually anyone listening that seems

2377

01:47:27,910 --> 01:47:26,080

like an

2378

01:47:29,750 --> 01:47:27,920

obvious mistake so why would these

2379

01:47:34,390 --> 01:47:29,760

experts model them spherically just

2380

01:47:34,400 --> 01:47:37,669

well

2381

01:47:42,070 --> 01:47:40,870

the it's true that the model that they

2382

01:47:44,310 --> 01:47:42,080

used

2383

01:47:47,189 --> 01:47:44,320

is a model which assumes that the

2384

01:47:49,669 --> 01:47:47,199

asteroid is a sphere

2385

01:47:50,790 --> 01:47:49,679

now if you have enough measurements of

2386

01:47:54,629 --> 01:47:50,800

it

2387

01:47:56,390 --> 01:47:54,639

compensate

2388

01:47:58,070 --> 01:47:56,400

they typically didn't have enough

2389

01:48:01,030 --> 01:47:58,080

measurements of it

2390

01:48:04,070 --> 01:48:01,040

but these the using a spherical model is

2391

01:48:07,910 --> 01:48:04,080

not the worst thing they did

2392

01:48:11,669 --> 01:48:07,920

they also just made data up

2393

01:48:13,669 --> 01:48:11,679

and just just cheated

2394

01:48:15,109 --> 01:48:13,679

yeah when you say they made data up they

2395

01:48:17,030 --> 01:48:15,119

copied data is that what you mean when

2396

01:48:20,870 --> 01:48:17,040

you say they made them up

2397

01:48:25,510 --> 01:48:20,880

yeah so you're supposed to be deriving

2398

01:48:28,790 --> 01:48:25,520

the um diameter of these asteroids

2399

01:48:31,270 --> 01:48:28,800

and instead you know and

2400

01:48:32,870 --> 01:48:31,280

the ones the way you tell if you did a

2401
01:48:34,709 --> 01:48:32,880
good job is you have about a hundred

2402
01:48:36,870 --> 01:48:34,719
asteroids

2403
01:48:39,189 --> 01:48:36,880
that you know the diameter of from a

2404
01:48:41,270 --> 01:48:39,199
different method

2405
01:48:43,510 --> 01:48:41,280
so you say right the way i determine my

2406
01:48:44,550 --> 01:48:43,520
accuracy is i predict it over here and i

2407
01:48:48,149 --> 01:48:44,560
compare it

2408
01:48:49,990 --> 01:48:48,159
to the known results and my predictions

2409
01:48:50,390 --> 01:48:50,000
match then i pat myself in the back and

2410
01:48:53,510 --> 01:48:50,400
said

2411
01:48:55,910 --> 01:48:53,520
i did something that was accurate yeah

2412
01:48:58,870 --> 01:48:55,920
um these people just copied all the

2413
01:49:06,470 --> 01:49:03,030

and the consequence of that is what well

2414

01:49:10,070 --> 01:49:06,480

it well it's deeply unethical

2415

01:49:11,830 --> 01:49:10,080

number one number two they did this and

2416

01:49:13,109 --> 01:49:11,840

then they claimed that they had the most

2417

01:49:15,350 --> 01:49:13,119

accurate

2418

01:49:17,830 --> 01:49:15,360

diameters and they criticized everyone

2419

01:49:21,750 --> 01:49:17,840

else who had done

2420

01:49:24,870 --> 01:49:21,760

other data sets in the past even though

2421

01:49:26,229 --> 01:49:24,880

they had no idea of what their accuracy

2422

01:49:29,990 --> 01:49:26,239

was

2423

01:49:33,030 --> 01:49:30,000

and because they took the only cases

2424

01:49:35,030 --> 01:49:33,040

that uh where we know the answer and

2425

01:49:37,510 --> 01:49:35,040

they copied those

2426
01:49:40,550 --> 01:49:37,520
you can't now tell what the accuracy of

2427
01:49:43,030 --> 01:49:40,560
any of their things are

2428
01:49:44,229 --> 01:49:43,040
so they built it on a shaky foundation

2429
01:49:47,589 --> 01:49:44,239
yeah and i

2430
01:49:50,070 --> 01:49:47,599
i think it was just a rush

2431
01:49:51,669 --> 01:49:50,080
to try to get their project done and

2432
01:49:53,270 --> 01:49:51,679
also to make their project look like it

2433
01:49:55,350 --> 01:49:53,280
was a success

2434
01:49:56,790 --> 01:49:55,360
and we're talking about nasa here we're

2435
01:49:59,910 --> 01:49:56,800
talking about jpl

2436
01:50:03,189 --> 01:49:59,920
the jet propulsion laboratory so it's

2437
01:50:06,550 --> 01:50:03,199
a laboratory managed by caltech but

2438
01:50:07,990 --> 01:50:06,560

it's effectively part of nasa and

2439

01:50:10,229 --> 01:50:08,000

and some of the scientists who were

2440

01:50:14,070 --> 01:50:10,239

involved in this weren't njpl there are

2441

01:50:16,470 --> 01:50:14,080

various universities and so

2442

01:50:19,830 --> 01:50:16,480

you know it's the kind of thing that if

2443

01:50:22,390 --> 01:50:19,840

you or i had done as an undergraduate

2444

01:50:26,310 --> 01:50:22,400

um and we've been found out we would

2445

01:50:28,870 --> 01:50:26,320

have been expelled

2446

01:50:30,790 --> 01:50:28,880

and you know we'd be talking about how

2447

01:50:31,750 --> 01:50:30,800

our lives took this big turn we couldn't

2448

01:50:34,870 --> 01:50:31,760

become physicists

2449

01:50:38,390 --> 01:50:34,880

we were expelled for cheating and

2450

01:50:40,390 --> 01:50:38,400

um but because nasa

2451

01:50:42,390 --> 01:50:40,400

is very influential and gives out lots

2452

01:50:45,189 --> 01:50:42,400

of money

2453

01:50:48,870 --> 01:50:45,199

other scientists really didn't want to

2454

01:50:52,950 --> 01:50:50,790

a bunch they needed someone like you

2455

01:50:57,030 --> 01:50:52,960

who's independent to say

2456

01:50:59,430 --> 01:50:57,040

yes that's right this was

2457

01:51:02,310 --> 01:50:59,440

you know people would sometimes ask me

2458

01:51:03,990 --> 01:51:02,320

why are you doing this and the answer is

2459

01:51:06,629 --> 01:51:04,000

because paradoxically i'm the only one

2460

01:51:08,070 --> 01:51:06,639

who could

2461

01:51:10,629 --> 01:51:08,080

this is interesting this brings me to a

2462

01:51:11,189 --> 01:51:10,639

larger a thought occurs to me how much

2463

01:51:13,669 --> 01:51:11,199

of

2464

01:51:15,270 --> 01:51:13,679

let's say problems in science in general

2465

01:51:15,830 --> 01:51:15,280

there's a variety i'm sure but i'm

2466

01:51:17,430 --> 01:51:15,840

thinking

2467

01:51:18,950 --> 01:51:17,440

specifically right now about theoretical

2468

01:51:21,350 --> 01:51:18,960

physics and string theory

2469

01:51:22,310 --> 01:51:21,360

but problems in general are due to the

2470

01:51:24,070 --> 01:51:22,320

dependence on

2471

01:51:25,910 --> 01:51:24,080

funding from a certain agency versus

2472

01:51:27,669 --> 01:51:25,920

someone like you who can be independent

2473

01:51:29,430 --> 01:51:27,679

and say well here's what i think

2474

01:51:30,870 --> 01:51:29,440

and i can stand up to you well i don't

2475

01:51:36,709 --> 01:51:30,880

think it's super

2476

01:51:41,750 --> 01:51:39,910

the the string theory

2477

01:51:43,030 --> 01:51:41,760

is so complicated that generally it's

2478

01:51:46,790 --> 01:51:43,040

very hard to compute

2479

01:51:53,910 --> 01:51:50,149

um that that's why uh

2480

01:51:56,470 --> 01:51:53,920

my friend peter named his blog

2481

01:51:58,709 --> 01:51:56,480

uh after a saying of wolf king paulies

2482

01:52:02,629 --> 01:51:58,719

who was a great uh german physicist

2483

01:52:05,990 --> 01:52:02,639

it's not even wrong

2484

01:52:07,189 --> 01:52:06,000

so it's wrong would be it makes a

2485

01:52:10,310 --> 01:52:07,199

prediction

2486

01:52:12,470 --> 01:52:10,320

and it doesn't match the world but in

2487

01:52:16,149 --> 01:52:12,480

most cases in string theory

2488

01:52:19,189 --> 01:52:16,159

it's so mathematically difficult to make

2489

01:52:23,189 --> 01:52:19,199

a actual prediction

2490

01:52:27,910 --> 01:52:26,149

you're not even at that level okay okay

2491

01:52:29,990 --> 01:52:27,920

now the ramifications of the asteroids

2492

01:52:31,350 --> 01:52:30,000

does it have something to do with the

2493

01:52:32,070 --> 01:52:31,360

threat of asteroids being

2494

01:52:35,109 --> 01:52:32,080

underdetermined

2495

01:52:38,310 --> 01:52:35,119

well yes it the threat

2496

01:52:41,430 --> 01:52:38,320

the size of the asteroids is important

2497

01:52:43,430 --> 01:52:41,440

for two reasons one is as a

2498

01:52:45,030 --> 01:52:43,440

part of understanding how the solar

2499

01:52:46,950 --> 01:52:45,040

system was built

2500

01:52:48,870 --> 01:52:46,960

asteroids are a very critical part of

2501
01:52:52,629 --> 01:52:48,880
that

2502
01:52:54,950 --> 01:52:52,639
um asteroids are a little bit

2503
01:52:56,149 --> 01:52:54,960
like the junk you see at a construction

2504
01:52:59,270 --> 01:52:56,159
site

2505
01:53:02,629 --> 01:52:59,280
they're building a house you'll see

2506
01:53:04,470 --> 01:53:02,639
sawed off pieces of 2x4 and nails and

2507
01:53:08,390 --> 01:53:04,480
all this other stuff

2508
01:53:11,510 --> 01:53:08,400
and that's a great analogy by the way

2509
01:53:13,350 --> 01:53:11,520
this is the material that was left over

2510
01:53:16,229 --> 01:53:13,360
from building

2511
01:53:17,510 --> 01:53:16,239
the solar system and it never really got

2512
01:53:19,669 --> 01:53:17,520
into a planet

2513
01:53:20,950 --> 01:53:19,679

or another thing and so it's kind of the

2514

01:53:22,709 --> 01:53:20,960

drug left over but

2515

01:53:25,109 --> 01:53:22,719

it's super interesting to understand

2516

01:53:25,990 --> 01:53:25,119

that junk to understand the conditions

2517

01:53:28,709 --> 01:53:26,000

under which the solar

2518

01:53:30,709 --> 01:53:28,719

system formed the other reason is

2519

01:53:34,470 --> 01:53:30,719

practical that we want to know

2520

01:53:36,870 --> 01:53:34,480

the threat that asteroids pose um

2521

01:53:37,750 --> 01:53:36,880

they were kind of tough on the dinosaurs

2522

01:53:40,470 --> 01:53:37,760

right right

2523

01:53:41,510 --> 01:53:40,480

we now know and you were there at one of

2524

01:53:44,550 --> 01:53:41,520

the first lectures

2525

01:53:46,229 --> 01:53:44,560

where that was proposed yes yeah that's

2526
01:53:49,510 --> 01:53:46,239
pretty cool

2527
01:53:50,310 --> 01:53:49,520
yeah it was that was a great example of

2528
01:54:19,830 --> 01:53:50,320
a

2529
01:54:22,550 --> 01:54:19,840
been

2530
01:54:23,430 --> 01:54:22,560
traced to lots of other mass extinctions

2531
01:54:28,470 --> 01:54:23,440
not just

2532
01:54:33,910 --> 01:54:31,510
going back to the threat uh

2533
01:54:34,950 --> 01:54:33,920
yeah so it's very important to know for

2534
01:54:37,830 --> 01:54:34,960
the threat

2535
01:54:38,550 --> 01:54:37,840
particularly because the way some of

2536
01:54:40,790 --> 01:54:38,560
these

2537
01:54:42,709 --> 01:54:40,800
this asteroid work is funded is by

2538
01:54:44,790 --> 01:54:42,719

telling congress oh this is important

2539

01:54:47,350 --> 01:54:44,800

for the threat

2540

01:54:48,629 --> 01:54:47,360

yes you tell congress look this isn't

2541

01:54:51,189 --> 01:54:48,639

just

2542

01:54:52,550 --> 01:54:51,199

a bunch of scientists having fun with

2543

01:54:55,589 --> 01:54:52,560

the origin of the

2544

01:54:58,470 --> 01:54:55,599

uh solar system no no this might

2545

01:55:02,229 --> 01:54:58,480

tell you what thing is going to plunk

2546

01:55:05,189 --> 01:55:02,239

down in the middle of kansas next week

2547

01:55:07,189 --> 01:55:05,199

and so we really need to know it yeah

2548

01:55:09,510 --> 01:55:07,199

and it's compelling argument

2549

01:55:11,589 --> 01:55:09,520

so they have an incentive to overplay

2550

01:55:12,709 --> 01:55:11,599

the threat of asteroids or did you find

2551

01:55:14,390 --> 01:55:12,719

in your research that we're actually

2552

01:55:17,430 --> 01:55:14,400

underplaying it

2553

01:55:20,790 --> 01:55:17,440

well it's in

2554

01:55:23,750 --> 01:55:20,800

they're using that threat as a way to

2555

01:55:26,070 --> 01:55:23,760

ask for more funding and i say you

2556

01:55:30,550 --> 01:55:26,080

shouldn't give those people more funding

2557

01:55:33,830 --> 01:55:30,560

until they learn math or

2558

01:55:36,390 --> 01:55:33,840

and ethics uh so

2559

01:55:37,990 --> 01:55:36,400

um and that goes for both now there's

2560

01:55:38,550 --> 01:55:38,000

lots of other people at jpl that are

2561

01:55:40,470 --> 01:55:38,560

great

2562

01:55:42,229 --> 01:55:40,480

there's not everyone at jpl but there's

2563

01:55:45,510 --> 01:55:42,239

one group of jpl

2564

01:55:49,350 --> 01:55:45,520

there's one person but one professor at

2565

01:55:53,990 --> 01:55:49,360

ucla that

2566

01:55:55,669 --> 01:55:54,000

really screwed up um

2567

01:55:57,830 --> 01:55:55,679

and had a giant amount of arrogance

2568

01:55:58,550 --> 01:55:57,840

about that screw up and so didn't admit

2569

01:56:01,030 --> 01:55:58,560

it and has

2570

01:56:02,550 --> 01:56:01,040

fought it to the mail because they

2571

01:56:03,830 --> 01:56:02,560

thought you i recall that they put out

2572

01:56:06,149 --> 01:56:03,840

an article

2573

01:56:07,589 --> 01:56:06,159

oh yeah no they they did did a smear

2574

01:56:12,149 --> 01:56:07,599

campaign on me

2575

01:56:15,669 --> 01:56:14,950

they it's been very hard for me i have

2576

01:56:17,990 --> 01:56:15,679

published

2577

01:56:18,950 --> 01:56:18,000

several papers including one over 100

2578

01:56:22,550 --> 01:56:18,960

pages

2579

01:56:24,790 --> 01:56:22,560

but it's been much more difficult for me

2580

01:56:28,390 --> 01:56:24,800

to do that because

2581

01:56:32,310 --> 01:56:28,400

uh i'm the guy who's saying that

2582

01:56:35,270 --> 01:56:32,320

people in the field are totally wrong

2583

01:56:35,589 --> 01:56:35,280

and some people in the field agree with

2584

01:56:37,350 --> 01:56:35,599

me

2585

01:56:39,669 --> 01:56:37,360

but say well why don't you just like be

2586

01:56:42,709 --> 01:56:39,679

a little quieter about it

2587

01:56:45,270 --> 01:56:42,719

it's like no that's

2588

01:56:47,510 --> 01:56:45,280

unethical to be quieter about something

2589

01:56:50,149 --> 01:56:47,520

that's this bad

2590

01:56:51,669 --> 01:56:50,159

um are you driven by ethics or were you

2591

01:56:54,830 --> 01:56:51,679

always disagreeable and you'll point out

2592

01:56:54,840 --> 01:56:59,030

well

2593

01:57:04,390 --> 01:57:01,589

i certainly noticed that they had done

2594

01:57:06,310 --> 01:57:04,400

some things very seriously wrong

2595

01:57:08,390 --> 01:57:06,320

and initially it wasn't this copying

2596

01:57:11,750 --> 01:57:08,400

initially what i noticed is that they

2597

01:57:14,070 --> 01:57:11,760

didn't understand freshman physics

2598

01:57:16,790 --> 01:57:14,080

and they even the professor didn't

2599

01:57:19,990 --> 01:57:16,800

understand freshman physics

2600

01:57:23,030 --> 01:57:20,000

yep um

2601
01:57:25,030 --> 01:57:23,040
just no they is there something called

2602
01:57:29,109 --> 01:57:25,040
kirchhoff's law of radiation

2603
01:57:31,750 --> 01:57:29,119
it's in all early physics classes

2604
01:57:33,350 --> 01:57:31,760
it's part of understanding what's called

2605
01:57:35,189 --> 01:57:33,360
black body radiation which is

2606
01:57:36,830 --> 01:57:35,199
fundamental to all of the modeling they

2607
01:57:41,350 --> 01:57:36,840
do

2608
01:57:42,950 --> 01:57:41,360
they didn't understand it at all

2609
01:57:44,470 --> 01:57:42,960
um when you say they didn't understand

2610
01:57:45,830 --> 01:57:44,480
it do you mean to say that they didn't

2611
01:57:48,790 --> 01:57:45,840
incorporate it

2612
01:57:51,350 --> 01:57:48,800
okay they their approach to modeling

2613
01:57:55,270 --> 01:57:51,360

totally violates it

2614

01:57:58,950 --> 01:57:55,280

so they're they tried to apply

2615

01:58:02,070 --> 01:57:58,960

a method which violates physical law

2616

01:58:04,070 --> 01:58:02,080

which that's a bad thing to do

2617

01:58:05,589 --> 01:58:04,080

now it's a bad thing to do that most

2618

01:58:07,430 --> 01:58:05,599

people would generally ascribe to

2619

01:58:10,790 --> 01:58:07,440

ignorance

2620

01:58:14,070 --> 01:58:10,800

arrogance

2621

01:58:17,510 --> 01:58:14,080

not ethics it was that

2622

01:58:21,189 --> 01:58:17,520

after you've i found the ethical things

2623

01:58:22,310 --> 01:58:21,199

that in some sense made it even worse

2624

01:58:25,430 --> 01:58:22,320

and the ethical things you're talking

2625

01:58:28,550 --> 01:58:25,440

about the copying of data okay

2626

01:58:31,750 --> 01:58:28,560

unethical things and uh

2627

01:58:35,270 --> 01:58:31,760

the science

2628

01:58:36,950 --> 01:58:35,280

exists because we trust it and we can

2629

01:58:40,870 --> 01:58:36,960

only trust it

2630

01:58:43,270 --> 01:58:40,880

if we're vigilant to it and

2631

01:58:45,990 --> 01:58:43,280

you could get lots of scientists to say

2632

01:58:48,790 --> 01:58:46,000

oh yes that's true

2633

01:58:49,270 --> 01:58:48,800

but the ones in general they don't apply

2634

01:58:52,229 --> 01:58:49,280

that

2635

01:58:53,589 --> 01:58:52,239

uniformly in this case the professor at

2636

01:58:56,149 --> 01:58:53,599

ucla

2637

01:58:57,430 --> 01:58:56,159

is kind of a loudmouth jerk who likes to

2638

01:58:59,669 --> 01:58:57,440

one-up people

2639

01:59:01,189 --> 01:58:59,679

and has a reputation for being really

2640

01:59:04,310 --> 01:59:01,199

smart

2641

01:59:05,589 --> 01:59:04,320

um which is weird because in all of his

2642

01:59:08,390 --> 01:59:05,599

interactions with me

2643

01:59:09,109 --> 01:59:08,400

he's nothing he says makes any sense at

2644

01:59:11,270 --> 01:59:09,119

all

2645

01:59:14,830 --> 01:59:11,280

but he says it are you able to say his

2646

01:59:19,830 --> 01:59:16,709

um

2647

01:59:20,870 --> 01:59:19,840

uh aggressively oh you don't understand

2648

01:59:21,430 --> 01:59:20,880

it because of this theory i'm not

2649

01:59:24,470 --> 01:59:21,440

throwing

2650

01:59:26,310 --> 01:59:24,480

that and it's only if you both know all

2651
01:59:27,350 --> 01:59:26,320
those theories and this you say wait a

2652
01:59:30,149 --> 01:59:27,360
minute

2653
01:59:32,149 --> 01:59:30,159
that is a bunch of [h__h] this brings

2654
01:59:33,910 --> 01:59:32,159
me to a larger problem

2655
01:59:35,430 --> 01:59:33,920
that you mentioned with regard to kovit

2656
01:59:37,510 --> 01:59:35,440
and now nasa and

2657
01:59:39,750 --> 01:59:37,520
a general cultural movement to distrust

2658
01:59:41,510 --> 01:59:39,760
mainstream science

2659
01:59:43,030 --> 01:59:41,520
well here's what's interesting is that

2660
01:59:44,070 --> 01:59:43,040
there's seems to me

2661
01:59:45,669 --> 01:59:44,080
from the outside let's say i'm

2662
01:59:46,310 --> 01:59:45,679
investigating an issue like global

2663
01:59:47,669 --> 01:59:46,320

warming

2664

01:59:49,030 --> 01:59:47,679

now obviously some people say it exists

2665

01:59:49,589 --> 01:59:49,040

some people say it doesn't exist and you

2666

01:59:52,149 --> 01:59:49,599

have your

2667

01:59:53,669 --> 01:59:52,159

your own you you seem to know the answer

2668

01:59:56,470 --> 01:59:53,679

to that because you've investigated it

2669

01:59:57,109 --> 01:59:56,480

but to me from the outside okay how does

2670

02:00:00,229 --> 01:59:57,119

one

2671

02:00:02,310 --> 02:00:00,239

go about researching a contentious issue

2672

02:00:04,149 --> 02:00:02,320

when it seems like there are incentive

2673

02:00:05,510 --> 02:00:04,159

structures on each side to either say

2674

02:00:05,910 --> 02:00:05,520

that global warming exists or doesn't

2675

02:00:07,030 --> 02:00:05,920

exist

2676

02:00:09,109 --> 02:00:07,040

or whatever the issue whether it's

2677

02:00:09,510 --> 02:00:09,119

global warming or not given that as you

2678

02:00:11,510 --> 02:00:09,520

mentioned

2679

02:00:12,709 --> 02:00:11,520

sometimes these large institutions all

2680

02:00:15,109 --> 02:00:12,719

agree on a single

2681

02:00:16,629 --> 02:00:15,119

narrative and they might be colluding or

2682

02:00:17,189 --> 02:00:16,639

they might be just ignorant or whatever

2683

02:00:19,510 --> 02:00:17,199

it may be

2684

02:00:24,550 --> 02:00:19,520

so what what are we to do as individuals

2685

02:00:27,750 --> 02:00:26,629

hey i don't have a good answer for you

2686

02:00:31,030 --> 02:00:27,760

you know we

2687

02:00:34,390 --> 02:00:31,040

we have this situation

2688

02:00:37,189 --> 02:00:34,400

that for a variety of reasons

2689

02:00:38,550 --> 02:00:37,199

there are folks that don't want to take

2690

02:00:41,830 --> 02:00:38,560

the vaccine

2691

02:00:44,149 --> 02:00:41,840

because they don't trust some element

2692

02:00:45,030 --> 02:00:44,159

of this whole thing they either say i

2693

02:00:49,109 --> 02:00:45,040

don't trust

2694

02:00:50,950 --> 02:00:49,119

we

2695

02:00:53,990 --> 02:00:50,960

develop this under record time why don't

2696

02:00:55,589 --> 02:00:54,000

they go back and do it more slowly

2697

02:00:59,109 --> 02:00:55,599

you don't [h__h] people are dying that's

2698

02:00:59,119 --> 02:01:03,350

and it turns out that the

2699

02:01:08,310 --> 02:01:05,750

the argument that they ought to be made

2700

02:01:10,790 --> 02:01:08,320

to them is very straightforward

2701
02:01:11,830 --> 02:01:10,800
which is current goals and speed you

2702
02:01:15,189 --> 02:01:11,840
will get

2703
02:01:16,870 --> 02:01:15,199
cover every one of us will

2704
02:01:19,350 --> 02:01:16,880
i'm not referring to coveting specific

2705
02:01:22,310 --> 02:01:19,360
i'm just well okay but here's the deal

2706
02:01:24,790 --> 02:01:22,320
every one of us will get it and for

2707
02:01:27,189 --> 02:01:24,800
almost every one of us

2708
02:01:28,229 --> 02:01:27,199
like probably every one of us getting

2709
02:01:31,189 --> 02:01:28,239
covered

2710
02:01:33,109 --> 02:01:31,199
has a higher risk threshold than the

2711
02:01:35,750 --> 02:01:33,119
worst vaccine anyone ever made in

2712
02:01:39,109 --> 02:01:37,430
so these vaccines actually seem like

2713
02:01:39,589 --> 02:01:39,119

they're the best vaccines anyone made in

2714

02:01:42,310 --> 02:01:39,599

history

2715

02:01:44,870 --> 02:01:42,320

as it turns out just out by accident but

2716

02:01:47,030 --> 02:01:44,880

even if it was the worst

2717

02:01:48,950 --> 02:01:47,040

give it a break this is like people

2718

02:01:49,350 --> 02:01:48,960

driving to the airport who are afraid

2719

02:01:51,750 --> 02:01:49,360

about

2720

02:01:52,870 --> 02:01:51,760

a plane crash because a plane they're

2721

02:01:55,350 --> 02:01:52,880

going to get on

2722

02:01:56,709 --> 02:01:55,360

but then driving the airport is vastly

2723

02:02:00,070 --> 02:01:56,719

more dangerous

2724

02:02:02,470 --> 02:02:00,080

i see okay now how you get people

2725

02:02:03,109 --> 02:02:02,480

to internalize those things and believe

2726

02:02:06,709 --> 02:02:03,119

them

2727

02:02:10,550 --> 02:02:06,719

i don't know it certainly doesn't help

2728

02:02:13,669 --> 02:02:10,560

that kovit has been politicized

2729

02:02:17,270 --> 02:02:13,679

and i mean that with both capital p

2730

02:02:20,149 --> 02:02:17,280

politics you know associated with

2731

02:02:20,870 --> 02:02:20,159

the the trump administration or the this

2732

02:02:23,910 --> 02:02:20,880

or that

2733

02:02:27,350 --> 02:02:23,920

but it also means small p politics like

2734

02:02:30,950 --> 02:02:27,360

oh let's say it's okay to golf but not

2735

02:02:34,870 --> 02:02:32,629

know these golf courses are going to be

2736

02:02:39,589 --> 02:02:34,880

really mad at us

2737

02:02:41,589 --> 02:02:39,599

it it and so you have a situation where

2738

02:02:44,790 --> 02:02:41,599

people also the scientists

2739

02:02:47,270 --> 02:02:44,800

have been groping their way

2740

02:02:49,510 --> 02:02:47,280

now the fact that they the they've

2741

02:02:53,830 --> 02:02:49,520

changed their minds

2742

02:02:59,750 --> 02:02:57,030

if you say yep i had my mind made up

2743

02:03:01,109 --> 02:02:59,760

and nothing i can see will ever change

2744

02:03:04,870 --> 02:03:01,119

my mind

2745

02:03:05,990 --> 02:03:04,880

you should not trust that man because

2746

02:03:08,070 --> 02:03:06,000

you need to have someone who's

2747

02:03:10,310 --> 02:03:08,080

constantly weighing evidence

2748

02:03:11,990 --> 02:03:10,320

and new evidence of new things can

2749

02:03:14,709 --> 02:03:12,000

change your mind

2750

02:03:15,189 --> 02:03:14,719

but we've had the unfortunate situation

2751

02:03:18,629 --> 02:03:15,199

that

2752

02:03:21,830 --> 02:03:18,639

there are a lot of people who um

2753

02:03:24,229 --> 02:03:21,840

who don't believe and and will refuse

2754

02:03:27,109 --> 02:03:24,239

the vaccine

2755

02:03:29,750 --> 02:03:27,119

now the rude thing to say is that's just

2756

02:03:32,790 --> 02:03:29,760

evolution in action

2757

02:03:33,910 --> 02:03:32,800

those people will suffer a higher rate

2758

02:03:37,830 --> 02:03:33,920

of

2759

02:03:43,430 --> 02:03:37,840

uh consequences

2760

02:03:45,990 --> 02:03:43,440

from uh covet than from the vaccine and

2761

02:03:46,550 --> 02:03:46,000

to a certain percentage we can tolerate

2762

02:03:50,310 --> 02:03:46,560

that

2763

02:03:52,149 --> 02:03:50,320

in society um

2764

02:03:53,830 --> 02:03:52,159

i say a certain percentage because of

2765

02:03:57,270 --> 02:03:53,840

that herd immunity thing because you

2766

02:04:00,629 --> 02:03:57,280

don't have to get to every last

2767

02:04:01,350 --> 02:04:00,639

person however i think when it comes to

2768

02:04:04,069 --> 02:04:01,360

stuff

2769

02:04:05,030 --> 02:04:04,079

like the anti-vaxxers that don't want

2770

02:04:09,270 --> 02:04:05,040

their children

2771

02:04:13,830 --> 02:04:12,629

it is a real danger to other kids in the

2772

02:04:21,669 --> 02:04:13,840

school

2773

02:04:23,910 --> 02:04:21,679

children of families that have someone

2774

02:04:25,990 --> 02:04:23,920

a kid in the school and so on and so

2775

02:04:27,430 --> 02:04:26,000

forth to have those kids not be

2776

02:04:30,709 --> 02:04:27,440

vaccinated

2777

02:04:33,030 --> 02:04:30,719

and it's really bad for them

2778

02:04:34,470 --> 02:04:33,040

so you know on one hand in a free

2779

02:04:38,069 --> 02:04:34,480

society you want

2780

02:04:39,589 --> 02:04:38,079

to allow people to have a certain set of

2781

02:04:41,430 --> 02:04:39,599

freedoms

2782

02:04:42,629 --> 02:04:41,440

on the other hand you don't typically

2783

02:04:44,870 --> 02:04:42,639

allow those

2784

02:04:45,669 --> 02:04:44,880

freedoms to allow a parent to kill a

2785

02:04:49,430 --> 02:04:45,679

child

2786

02:04:52,310 --> 02:04:49,440

for example which

2787

02:04:54,310 --> 02:04:52,320

that comes up in the cases where for

2788

02:04:55,350 --> 02:04:54,320

example they're refusing a medical

2789

02:04:58,470 --> 02:04:55,360

procedure

2790

02:05:02,470 --> 02:04:58,480

for religious grounds

2791

02:05:03,430 --> 02:05:02,480

and the united states canada as far as i

2792

02:05:06,870 --> 02:05:03,440

know

2793

02:05:08,790 --> 02:05:06,880

uh europe they say no at a certain

2794

02:05:09,910 --> 02:05:08,800

point the state will intervene and they

2795

02:05:13,990 --> 02:05:09,920

will try to

2796

02:05:16,950 --> 02:05:14,000

say the kids get saved because

2797

02:05:17,830 --> 02:05:16,960

we we do protect children even if their

2798

02:05:20,390 --> 02:05:17,840

parents aren't

2799

02:05:23,669 --> 02:05:20,400

just like we take children away from

2800

02:05:29,109 --> 02:05:26,470

so what do you do with people who are

2801
02:05:32,790 --> 02:05:29,119
passionately convinced about something

2802
02:05:34,790 --> 02:05:32,800
that is demonstrably wrong

2803
02:05:36,069 --> 02:05:34,800
well when that demonstrably wrong thing

2804
02:05:40,069 --> 02:05:36,079
has constant

2805
02:05:43,109 --> 02:05:40,079
he if it's a religious matter

2806
02:05:45,189 --> 02:05:43,119
i say leave it alone people can have

2807
02:05:47,030 --> 02:05:45,199
different ideas about religion

2808
02:05:48,229 --> 02:05:47,040
they can each say well my god is right

2809
02:05:52,950 --> 02:05:48,239
and that other guy's

2810
02:06:00,069 --> 02:05:56,709
let him but when it comes to things like

2811
02:06:02,950 --> 02:06:00,079
not taking a vaccine um

2812
02:06:04,950 --> 02:06:02,960
you know there will be a period this

2813
02:06:07,109 --> 02:06:04,960

spring where people start

2814

02:06:09,589 --> 02:06:07,119

needing to go back to work and we'll

2815

02:06:12,950 --> 02:06:09,599

have enough people vaccinated

2816

02:06:14,390 --> 02:06:12,960

and i think it's very reasonable to say

2817

02:06:15,589 --> 02:06:14,400

you shouldn't go back to work if you're

2818

02:06:18,629 --> 02:06:15,599

not vaccinated

2819

02:06:22,149 --> 02:06:18,639

or have proof that you had

2820

02:06:25,910 --> 02:06:22,159

coveted um but

2821

02:06:27,830 --> 02:06:25,920

that'll cause a whole bunch of people to

2822

02:06:29,669 --> 02:06:27,840

get all worked up and say oh it's civil

2823

02:06:31,270 --> 02:06:29,679

liberties and we have to allow people

2824

02:06:37,510 --> 02:06:31,280

that

2825

02:06:40,870 --> 02:06:39,109

it's a very different issue than when it

2826

02:06:43,270 --> 02:06:40,880

affects others

2827

02:06:45,030 --> 02:06:43,280

let me restate the question a bit more

2828

02:06:46,629 --> 02:06:45,040

clearly some of the many of the audience

2829

02:06:48,229 --> 02:06:46,639

members almost all of them i think are

2830

02:06:49,430 --> 02:06:48,239

extremely extremely intelligent people

2831

02:06:50,790 --> 02:06:49,440

so for them

2832

02:06:53,030 --> 02:06:50,800

they're listening forget about covid

2833

02:06:54,470 --> 02:06:53,040

forget about covid like you mentioned

2834

02:06:56,709 --> 02:06:54,480

you're also extremely extremely

2835

02:06:58,470 --> 02:06:56,719

extremely bright and

2836

02:07:00,310 --> 02:06:58,480

probably if you didn't look into the

2837

02:07:02,390 --> 02:07:00,320

research on asteroids you would have

2838

02:07:03,910 --> 02:07:02,400

maybe you would have accepted what nasa

2839

02:07:07,030 --> 02:07:03,920

had said maybe you wouldn't have

2840

02:07:08,390 --> 02:07:07,040

regardless how do you sort out i was

2841

02:07:10,310 --> 02:07:08,400

going to say signal from the noise but

2842

02:07:13,189 --> 02:07:10,320

it's almost like signal from anti-signal

2843

02:07:13,510 --> 02:07:13,199

or from contrived signal when you do

2844

02:07:15,430 --> 02:07:13,520

like

2845

02:07:17,030 --> 02:07:15,440

what do you do as a as an intelligent

2846

02:07:17,430 --> 02:07:17,040

person do you just have to dive into the

2847

02:07:19,750 --> 02:07:17,440

field

2848

02:07:20,550 --> 02:07:19,760

do you just have to trust it because you

2849

02:07:22,149 --> 02:07:20,560

can't just doubt

2850

02:07:25,270 --> 02:07:22,159

everything you have to live your life

2851

02:07:32,069 --> 02:07:28,870

living in a society is something

2852

02:07:35,109 --> 02:07:32,079

that involves a lot of trust

2853

02:07:37,270 --> 02:07:35,119

right so it to live in a civil society

2854

02:07:39,189 --> 02:07:37,280

you have to have a certain degree of

2855

02:07:41,430 --> 02:07:39,199

trust that everyone else is going to

2856

02:07:44,950 --> 02:07:41,440

live up to their obligations

2857

02:07:46,709 --> 02:07:44,960

more or less and you know that if they

2858

02:07:49,030 --> 02:07:46,719

don't you have some recourse

2859

02:07:51,350 --> 02:07:49,040

you can call the police so you can

2860

02:07:55,109 --> 02:07:51,360

complain in some fashion

2861

02:07:59,189 --> 02:07:55,119

um but it yeah

2862

02:08:02,470 --> 02:07:59,199

you have to trust in the case of physics

2863

02:08:05,189 --> 02:08:02,480

you have to trust what

2864

02:08:07,189 --> 02:08:05,199

generations of physicists have produced

2865

02:08:09,109 --> 02:08:07,199

and that the scientific method and the

2866

02:08:10,069 --> 02:08:09,119

people looking at things and really

2867

02:08:13,189 --> 02:08:10,079

looking at things

2868

02:08:15,270 --> 02:08:13,199

and being critical of them including

2869

02:08:16,629 --> 02:08:15,280

publishing my papers things other stuff

2870

02:08:19,270 --> 02:08:16,639

is [h__h]

2871

02:08:20,550 --> 02:08:19,280

that that process will get us to the

2872

02:08:23,589 --> 02:08:20,560

right answer

2873

02:08:25,990 --> 02:08:23,599

most of the time and i think most of the

2874

02:08:29,350 --> 02:08:26,000

time it does

2875

02:08:32,470 --> 02:08:29,360

you know there certainly are examples

2876

02:08:36,069 --> 02:08:32,480

of uh fields or

2877

02:08:40,069 --> 02:08:36,079

particularly politicized fields

2878

02:08:43,270 --> 02:08:40,079

that i think it is much more difficult

2879

02:08:46,870 --> 02:08:43,280

you know certainly global warming

2880

02:08:50,629 --> 02:08:46,880

has gotten that way it is a politicized

2881

02:08:53,990 --> 02:08:50,639

field in that lots of politicians

2882

02:08:57,430 --> 02:08:54,000

or people on the street will have

2883

02:08:58,629 --> 02:08:57,440

very strong opinions that have nothing

2884

02:09:03,350 --> 02:08:58,639

to do with actual

2885

02:09:05,189 --> 02:09:03,360

science they will have to do with

2886

02:09:08,310 --> 02:09:05,199

you know the consequences on that on

2887

02:09:11,510 --> 02:09:08,320

their industry or

2888

02:09:16,870 --> 02:09:11,520

their ideology or some other set

2889

02:09:18,870 --> 02:09:16,880

of stuff that makes it more difficult

2890

02:09:20,870 --> 02:09:18,880

you find the same thing is true with

2891

02:09:27,430 --> 02:09:20,880

nutrition

2892

02:09:30,470 --> 02:09:27,440

uh has unfortunately

2893

02:09:34,149 --> 02:09:30,480

failed us broadly

2894

02:09:35,510 --> 02:09:34,159

you know it went on a jihad against fat

2895

02:09:37,430 --> 02:09:35,520

we should get rid of fat which

2896

02:09:40,229 --> 02:09:37,440

everything be low fat

2897

02:09:41,830 --> 02:09:40,239

and during the decades that we went on

2898

02:09:45,030 --> 02:09:41,840

the low fat

2899

02:09:47,589 --> 02:09:45,040

uh approach yeah the

2900

02:09:49,270 --> 02:09:47,599

obesity rate has gone up the rate of

2901

02:09:52,229 --> 02:09:49,280

ingestion of

2902

02:09:53,910 --> 02:09:52,239

uh i mean all the bad things they said

2903

02:09:57,189 --> 02:09:53,920

would go down have gone up

2904

02:10:00,390 --> 02:09:57,199

right right and in that case it's

2905

02:10:03,589 --> 02:10:00,400

probably based on

2906

02:10:09,350 --> 02:10:03,599

just some fundamental bad work

2907

02:10:12,790 --> 02:10:09,360

in the 1950s and 60s that got propagated

2908

02:10:17,109 --> 02:10:12,800

um and the fact that

2909

02:10:21,270 --> 02:10:17,119

there are people who make their money

2910

02:10:24,550 --> 02:10:21,280

either as you know commercial food

2911

02:10:25,109 --> 02:10:24,560

sellers or sellers of junk foods and so

2912

02:10:27,990 --> 02:10:25,119

forth

2913

02:10:29,430 --> 02:10:28,000

or people who are health food advocates

2914

02:10:32,550 --> 02:10:29,440

on the other side

2915

02:10:36,470 --> 02:10:32,560

helps to politicize with a small pee

2916

02:10:40,870 --> 02:10:36,480

this issue right so we have this huge

2917

02:10:44,229 --> 02:10:40,880

movement uh against gluten

2918

02:10:47,589 --> 02:10:44,239

and there is no good science

2919

02:10:50,149 --> 02:10:47,599

in support of it there are

2920

02:10:51,430 --> 02:10:50,159

people who shouldn't eat gluten because

2921

02:10:55,189 --> 02:10:51,440

they have

2922

02:10:59,270 --> 02:10:55,199

a very sp specific thing but

2923

02:11:03,189 --> 02:10:59,280

the overwhelming majority don't well

2924

02:11:06,910 --> 02:11:03,199

well the the trend has become oh

2925

02:11:11,430 --> 02:11:06,920

read a couple of websites and then

2926

02:11:14,629 --> 02:11:11,440

self-diagnose that you need this

2927

02:11:16,470 --> 02:11:14,639

and then uh eat a whole a diet

2928

02:11:18,069 --> 02:11:16,480

that has all kinds of other [h__\h] in it

2929

02:11:21,510 --> 02:11:18,079

that is much less

2930

02:11:23,109 --> 02:11:21,520

tested than gluten one of the beautiful

2931

02:11:23,990 --> 02:11:23,119

aspects of your book modernist cuisine

2932

02:11:25,510 --> 02:11:24,000

when i first read it

2933

02:11:26,950 --> 02:11:25,520

and by the way i think i went to the u

2934

02:11:27,669 --> 02:11:26,960

of t library the first day that it

2935

02:11:29,109 --> 02:11:27,679

ordered it

2936

02:11:30,629 --> 02:11:29,119

because i was so excited to read it but

2937

02:11:31,750 --> 02:11:30,639

it was a huge book and i couldn't afford

2938

02:11:33,510 --> 02:11:31,760

it at the time

2939

02:11:35,589 --> 02:11:33,520

was in the first chapter i believe you

2940

02:11:37,669 --> 02:11:35,599

dispel some of the myths some

2941

02:11:39,589 --> 02:11:37,679

extremely ingrained myths so for example

2942

02:11:40,790 --> 02:11:39,599

with butter versus margarine and i

2943

02:11:41,750 --> 02:11:40,800

didn't know that at the time okay that

2944

02:11:43,109 --> 02:11:41,760

butter is much

2945

02:11:44,950 --> 02:11:43,119

healthier for you it seems to be

2946

02:11:45,830 --> 02:11:44,960

something that we all seem to take for

2947

02:11:48,550 --> 02:11:45,840

granted now but

2948

02:11:49,189 --> 02:11:48,560

for 50 years or so that wasn't the case

2949

02:11:51,030 --> 02:11:49,199

also

2950

02:11:53,750 --> 02:11:51,040

i think you mentioned that bacon has

2951

02:11:56,470 --> 02:11:53,760

olic acid is oleic acid or olic acid

2952

02:11:58,229 --> 02:11:56,480

compared to all much at a higher

2953

02:12:01,830 --> 02:11:58,239

percentage than all this one

2954

02:12:03,910 --> 02:12:01,840

thing where it got to be trendy for

2955

02:12:06,629 --> 02:12:03,920

people to say that

2956

02:12:08,390 --> 02:12:06,639

there were protective features in olive

2957

02:12:13,109 --> 02:12:08,400

oil

2958

02:12:15,709 --> 02:12:13,119

based on very skimpy amounts of studies

2959

02:12:17,350 --> 02:12:15,719

you know a huge problem with nutritional

2960

02:12:19,589 --> 02:12:17,360

epidemiology

2961

02:12:20,709 --> 02:12:19,599

is that it's extremely difficult and

2962

02:12:23,430 --> 02:12:20,719

expensive

2963

02:12:24,550 --> 02:12:23,440

to do the kind of study you need to do

2964

02:12:27,750 --> 02:12:24,560

where you study

2965

02:12:29,669 --> 02:12:27,760

people and outcomes over a 20 or 25 year

2966

02:12:33,109 --> 02:12:29,679

period

2967

02:12:37,030 --> 02:12:33,119

so instead people would fixate

2968

02:12:38,709 --> 02:12:37,040

on a proxy measurement so they said oh

2969

02:12:40,069 --> 02:12:38,719

cholesterol is bad for you

2970

02:12:41,910 --> 02:12:40,079

so we'll measure cholesterol if your

2971

02:12:44,069 --> 02:12:41,920

cholesterol goes up then we know that's

2972

02:12:45,830 --> 02:12:44,079

bad for you

2973

02:12:47,270 --> 02:12:45,840

well then it later turns out well

2974

02:12:49,109 --> 02:12:47,280

actually there's good cholesterol

2975

02:12:51,990 --> 02:12:49,119

there's bad cholesterol

2976

02:12:53,430 --> 02:12:52,000

and then it turns out oops dietary

2977

02:12:57,669 --> 02:12:53,440

cholesterol

2978

02:13:01,669 --> 02:12:59,589

um just for the people listening that

2979

02:13:03,109 --> 02:13:01,679

means you can ingest cholesterol such as

2980

02:13:04,550 --> 02:13:03,119

an eggs and it doesn't raise your blood

2981

02:13:08,709 --> 02:13:04,560

cholesterol

2982

02:13:11,669 --> 02:13:08,719

well in particular there are

2983

02:13:12,550 --> 02:13:11,679

the the kind of cholesterol that you

2984

02:13:16,229 --> 02:13:12,560

would worry about

2985

02:13:19,109 --> 02:13:16,239

in a cardiac situation is manufactured

2986

02:13:25,669 --> 02:13:22,149

and so the dietary thing isn't

2987

02:13:27,189 --> 02:13:25,679

really a factor i see i see now that is

2988

02:13:31,350 --> 02:13:27,199

such

2989

02:13:33,750 --> 02:13:31,360

and of course when these things came out

2990

02:13:35,030 --> 02:13:33,760

did people come and say oh you know

2991

02:13:39,270 --> 02:13:35,040

something

2992

02:13:42,709 --> 02:13:39,280

we were wrong we [\h__\h] up we were wrong

2993

02:13:45,430 --> 02:13:42,719

we're sorry nope

2994

02:13:47,030 --> 02:13:45,440

most of this so most people still think

2995

02:13:50,950 --> 02:13:47,040

cholesterol

2996

02:13:53,350 --> 02:13:50,960

counts thing they kind of know there's a

2997

02:13:57,430 --> 02:13:53,360

good and a bad kind now

2998

02:14:00,149 --> 02:13:57,440

but the butter thing you mentioned

2999

02:14:01,589 --> 02:14:00,159

in one of the few really long term

3000

02:14:02,709 --> 02:14:01,599

really good stuff something called the

3001
02:14:06,310 --> 02:14:02,719
nurses study

3002
02:14:09,030 --> 02:14:06,320
over 25 years they awarded that now

3003
02:14:10,310 --> 02:14:09,040
they followed the health of 25 000

3004
02:14:12,069 --> 02:14:10,320
nurses

3005
02:14:13,830 --> 02:14:12,079
they found that the people who ate

3006
02:14:16,870 --> 02:14:13,840
margarine

3007
02:14:17,669 --> 02:14:16,880
had double the cardiac uh problem rate

3008
02:14:22,069 --> 02:14:17,679
and death rate

3009
02:14:23,589 --> 02:14:22,079
of people who ate butter which means

3010
02:14:25,109 --> 02:14:23,599
there's a whole lot of health food

3011
02:14:28,229 --> 02:14:25,119
advocates

3012
02:14:30,550 --> 02:14:28,239
that killed people straight up

3013
02:14:32,229 --> 02:14:30,560

they went out there recommending

3014

02:14:35,430 --> 02:14:32,239

margarine

3015

02:14:39,910 --> 02:14:35,440

time

3016

02:14:42,709 --> 02:14:39,920

was was what we now call a trans fat

3017

02:14:43,910 --> 02:14:42,719

but they had it so in their heads that

3018

02:14:47,310 --> 02:14:43,920

um

3019

02:14:52,470 --> 02:14:47,320

saturated fats were bad and this was a

3020

02:14:58,069 --> 02:14:56,069

and that little surmise

3021

02:15:00,069 --> 02:14:58,079

was dead wrong in fact trans fats

3022

02:15:01,669 --> 02:15:00,079

actually are bad literally dead wrong

3023

02:15:04,470 --> 02:15:01,679

right literally dead wrong it literally

3024

02:15:09,030 --> 02:15:04,480

killed lots of people

3025

02:15:09,430 --> 02:15:09,040

um and so when you have situations like

3026

02:15:12,470 --> 02:15:09,440

that

3027

02:15:12,950 --> 02:15:12,480

or some of the other absurd things to

3028

02:15:15,030 --> 02:15:12,960

come

3029

02:15:19,589 --> 02:15:15,040

bring it back to gofet you know the

3030

02:15:19,599 --> 02:15:23,910

that was an absurd thing

3031

02:15:27,350 --> 02:15:26,069

telling people who have a fever to stay

3032

02:15:30,629 --> 02:15:27,360

inside

3033

02:15:32,149 --> 02:15:30,639

makes tons of sense yep

3034

02:15:33,990 --> 02:15:32,159

what's absurd about taking someone's

3035

02:15:34,550 --> 02:15:34,000

temperature as you enter a store let's

3036

02:15:37,189 --> 02:15:34,560

see

3037

02:15:37,750 --> 02:15:37,199

hood there's a set of things that you

3038

02:15:42,149 --> 02:15:37,760

often

3039

02:15:49,510 --> 02:15:45,990

uh this sort of situation that i call

3040

02:15:57,350 --> 02:15:53,430

so lots of religions

3041

02:16:00,950 --> 02:15:57,360

have a thing on purification

3042

02:16:03,910 --> 02:16:00,960

that stuff gets to be dirty

3043

02:16:06,950 --> 02:16:03,920

in god's eyes somehow and then you have

3044

02:16:11,510 --> 02:16:06,960

to purify it with a ritual

3045

02:16:13,910 --> 02:16:11,520

and there's a controversial theory by

3046

02:16:15,589 --> 02:16:13,920

an anthropologist named robert uh

3047

02:16:18,629 --> 02:16:15,599

sapolsky

3048

02:16:21,830 --> 02:16:18,639

that says the reason religions

3049

02:16:22,709 --> 02:16:21,840

all have purification rituals is that

3050

02:16:27,109 --> 02:16:22,719

eventually

3051

02:16:31,270 --> 02:16:27,119

they get a priest who has ocd

3052

02:16:34,669 --> 02:16:31,280

and that priest's ocd winds up

3053

02:16:38,150 --> 02:16:34,679

being manifest in them writing lots of

3054

02:16:39,429 --> 02:16:38,160

purification rituals now i don't know if

3055

02:16:42,070 --> 02:16:39,439

that's really true

3056

02:16:42,790 --> 02:16:42,080

right i'm going to be talking to robert

3057

02:16:44,389 --> 02:16:42,800

at some point

3058

02:16:48,790 --> 02:16:44,399

i don't i have some issues with that but

3059

02:16:55,750 --> 02:16:52,150

the idea that you would empower

3060

02:16:58,870 --> 02:16:55,760

the nation's waitresses and sales clerks

3061

02:17:00,870 --> 02:16:58,880

to all go and take your temperature

3062

02:17:03,349 --> 02:17:00,880

and oh what are you supposed to do if

3063

02:17:05,429 --> 02:17:03,359

the person has the fever

3064

02:17:07,030 --> 02:17:05,439

are you in a hazmat suit when you're

3065

02:17:10,469 --> 02:17:07,040

doing this

3066

02:17:17,270 --> 02:17:14,549

and it's well-meaning

3067

02:17:18,950 --> 02:17:17,280

but it's something that i think if you

3068

02:17:23,110 --> 02:17:18,960

looked at the amount of effort

3069

02:17:26,309 --> 02:17:23,120

that it caused versus

3070

02:17:29,589 --> 02:17:26,319

the uh the you know

3071

02:17:30,950 --> 02:17:29,599

the cost benefit basically how much

3072

02:17:31,429 --> 02:17:30,960

heart would it cause for how much

3073

02:17:33,270 --> 02:17:31,439

benefit

3074

02:17:34,549 --> 02:17:33,280

so like at our company i said [h__\h]

3075

02:17:35,910 --> 02:17:34,559

we're not going to have some poor

3076

02:17:39,030 --> 02:17:35,920

employee

3077

02:17:41,830 --> 02:17:39,040

who has to go up and down a line and

3078

02:17:43,669 --> 02:17:41,840

do this and expose themselves they're

3079

02:17:47,509 --> 02:17:43,679

the ones that'll get it

3080

02:17:49,990 --> 02:17:47,519

yep why did we do that

3081

02:17:51,589 --> 02:17:50,000

yeah you know another thing is they said

3082

02:17:55,030 --> 02:17:51,599

oh you have to have everyone enter

3083

02:17:57,830 --> 02:17:55,040

in the same entrance so that you

3084

02:17:59,349 --> 02:17:57,840

can you know count them all and you can

3085

02:18:03,270 --> 02:17:59,359

know exactly how many people are in the

3086

02:18:09,349 --> 02:18:07,509

why well what if we have to contact

3087

02:18:13,190 --> 02:18:09,359

trace

3088

02:18:16,309 --> 02:18:13,200

and i said well we'll ask the people

3089

02:18:16,709 --> 02:18:16,319

i mean it turns out at my company and i

3090

02:18:19,830 --> 02:18:16,719

think

3091

02:18:21,190 --> 02:18:19,840

almost every company you don't act every

3092

02:18:24,870 --> 02:18:21,200

minute of the day

3093

02:18:28,469 --> 02:18:24,880

like you can't trust the people there

3094

02:18:31,589 --> 02:18:28,479

to do even the simplest thing

3095

02:18:34,070 --> 02:18:31,599

um you know if in fact they came into

3096

02:18:36,150 --> 02:18:34,080

the office on a particular day

3097

02:18:38,070 --> 02:18:36,160

well you'd know that regardless of which

3098

02:18:41,270 --> 02:18:38,080

entrance they came into because the

3099

02:18:42,629 --> 02:18:41,280

card key system does it so you can all

3100

02:18:45,110 --> 02:18:42,639

you can email everyone who's in the

3101

02:18:46,790 --> 02:18:45,120

building so if there was a contagion

3102

02:18:47,509 --> 02:18:46,800

event you would email them then you can

3103

02:18:50,070 --> 02:18:47,519

ask them

3104

02:18:51,429 --> 02:18:50,080

hey were you near george that day

3105

02:18:53,910 --> 02:18:51,439

because it turns out george came down

3106

02:18:57,190 --> 02:18:53,920

with coven

3107

02:18:58,950 --> 02:18:57,200

but there's always this oh let's lock

3108

02:19:02,389 --> 02:18:58,960

everything down

3109

02:19:08,870 --> 02:19:05,990

it would be a difficult calculation

3110

02:19:11,830 --> 02:19:08,880

to do but if you said okay what is

3111

02:19:14,950 --> 02:19:13,910

picking some set of people to be the

3112

02:19:19,270 --> 02:19:14,960

poor

3113

02:19:26,549 --> 02:19:22,389

with the temperature gun and

3114

02:19:29,110 --> 02:19:26,559

how many people did you really turn away

3115

02:19:30,150 --> 02:19:29,120

and therefore if you know how many you

3116

02:19:31,830 --> 02:19:30,160

turned away

3117

02:19:34,469 --> 02:19:31,840

what what did this really do for the

3118

02:19:37,669 --> 02:19:34,479

epidemic overall

3119

02:19:41,190 --> 02:19:37,679

now in a perfect world i don't doubt you

3120

02:19:44,469 --> 02:19:41,200

should stop those people from coming in

3121

02:19:47,589 --> 02:19:44,479

and in japan

3122

02:19:49,110 --> 02:19:47,599

when you go into customs man you're they

3123

02:19:51,910 --> 02:19:49,120

have all of these signs

3124

02:19:54,070 --> 02:19:51,920

and monitors up and it's zeroing in and

3125

02:19:56,230 --> 02:19:54,080

automatically taking your temperature

3126
02:19:57,750 --> 02:19:56,240
for everybody in the room and okay that

3127
02:19:59,830 --> 02:19:57,760
makes some sense

3128
02:20:01,429 --> 02:19:59,840
if you found somebody came coming in

3129
02:20:05,110 --> 02:20:01,439
with a horrible

3130
02:20:07,349 --> 02:20:05,120
fever you could then decide

3131
02:20:08,389 --> 02:20:07,359
to do something quarantine them for a

3132
02:20:10,710 --> 02:20:08,399
little bit

3133
02:20:12,070 --> 02:20:10,720
but of course what you can do with all

3134
02:20:13,030 --> 02:20:12,080
the people that happen to be standing

3135
02:20:15,910 --> 02:20:13,040
next to them

3136
02:20:17,030 --> 02:20:15,920
or run the flight with them or whatever

3137
02:20:19,190 --> 02:20:17,040
even then

3138
02:20:21,190 --> 02:20:19,200

it i don't think the japanese have fully

3139

02:20:24,309 --> 02:20:21,200

thought it through

3140

02:20:29,750 --> 02:20:24,319

because if that person really is

3141

02:20:32,550 --> 02:20:29,760

the um start of a terrible epidemic

3142

02:20:33,510 --> 02:20:32,560

because whenever you detected the fever

3143

02:20:37,110 --> 02:20:33,520

you'd have to like

3144

02:20:40,230 --> 02:20:37,120

stop the everything

3145

02:20:42,870 --> 02:20:40,240

you know have you know little tubes come

3146

02:20:46,150 --> 02:20:42,880

down from the ceiling and seal everyone

3147

02:20:48,150 --> 02:20:46,160

off separately it it would be really

3148

02:20:49,670 --> 02:20:48,160

very difficult

3149

02:20:51,110 --> 02:20:49,680

when i first heard about you i remember

3150

02:20:52,309 --> 02:20:51,120

you were talking about as could have

3151
02:20:53,670 --> 02:20:52,319
been a freakonomics you were talking

3152
02:20:55,750 --> 02:20:53,680
about a way of solving

3153
02:20:57,110 --> 02:20:55,760
global warming with geoengineering and i

3154
02:20:58,630 --> 02:20:57,120
remember being intrigued because you

3155
02:21:00,309 --> 02:20:58,640
said it requires something like a few

3156
02:21:01,990 --> 02:21:00,319
million dollars or maybe a few billion

3157
02:21:03,670 --> 02:21:02,000
but that's still relatively low

3158
02:21:05,750 --> 02:21:03,680
and you raise some balloons and you have

3159
02:21:06,469 --> 02:21:05,760
a tube that emits sulfur dioxide i

3160
02:21:09,830 --> 02:21:06,479
believe

3161
02:21:13,190 --> 02:21:09,840
okay that sounds like a an extremely

3162
02:21:16,510 --> 02:21:13,200
inventive and simple idea why

3163
02:21:19,190 --> 02:21:16,520

don't i hear much talk about

3164

02:21:21,429 --> 02:21:19,200

geoengineering solutions to the problem

3165

02:21:22,790 --> 02:21:21,439

of global warming

3166

02:21:25,349 --> 02:21:22,800

what are the problems with them in

3167

02:21:28,950 --> 02:21:27,030

oh let me explain where i'm coming from

3168

02:21:29,510 --> 02:21:28,960

because i see that we should get to zero

3169

02:21:32,230 --> 02:21:29,520

emissions

3170

02:21:33,590 --> 02:21:32,240

in carbon but then even if the carbon

3171

02:21:34,790 --> 02:21:33,600

that's in our atmosphere stays there

3172

02:21:36,630 --> 02:21:34,800

that's still going to cause a certain

3173

02:21:39,670 --> 02:21:36,640

amount of problems over time

3174

02:21:40,070 --> 02:21:39,680

which means that something else needs to

3175

02:21:44,630 --> 02:21:40,080

be done

3176

02:21:47,270 --> 02:21:44,640

anyway of course of course

3177

02:21:48,870 --> 02:21:47,280

it's is it political like what's going

3178

02:21:50,790 --> 02:21:48,880

on yes it's political

3179

02:21:52,309 --> 02:21:50,800

it's well first of all it's political

3180

02:21:54,070 --> 02:21:52,319

within the scientific community the

3181

02:21:58,389 --> 02:21:54,080

scientific community itself

3182

02:22:03,190 --> 02:21:58,399

has become very polarized

3183

02:22:07,590 --> 02:22:03,200

that the people who study global warming

3184

02:22:09,670 --> 02:22:07,600

uh got very

3185

02:22:10,790 --> 02:22:09,680

tight they kept saying oh this is a

3186

02:22:13,750 --> 02:22:10,800

problem

3187

02:22:14,389 --> 02:22:13,760

why look here thinking wow here's the

3188

02:22:17,110 --> 02:22:14,399

thing

3189

02:22:21,429 --> 02:22:17,120

if i show you this evidence society will

3190

02:22:24,630 --> 02:22:23,670

and no matter what they showed society

3191

02:22:28,630 --> 02:22:24,640

didn't

3192

02:22:32,150 --> 02:22:28,640

listen to them well that's caused

3193

02:22:38,710 --> 02:22:35,510

there are lots of scientists in

3194

02:22:41,030 --> 02:22:38,720

the field who are very leery

3195

02:22:43,190 --> 02:22:41,040

about publishing anything or doing any

3196

02:22:46,790 --> 02:22:43,200

research on global warming

3197

02:22:49,990 --> 02:22:46,800

because their fear their their

3198

02:22:54,150 --> 02:22:50,000

friends will chastise it as being some

3199

02:22:55,910 --> 02:22:54,160

form of accommodation to the other side

3200

02:22:57,510 --> 02:22:55,920

okay and what do you say other side

3201

02:23:00,389 --> 02:22:57,520

stupid what do you think

3202

02:23:00,870 --> 02:23:00,399

is stupid and it's counterproductive

3203

02:23:04,790 --> 02:23:00,880

well

3204

02:23:08,070 --> 02:23:04,800

then there's the there's a lot of

3205

02:23:11,510 --> 02:23:08,080

global warming activists or climate

3206

02:23:15,349 --> 02:23:13,910

and they think that the global warming

3207

02:23:18,790 --> 02:23:15,359

problem is very much

3208

02:23:21,830 --> 02:23:18,800

like a children's book that i read as

3209

02:23:23,990 --> 02:23:21,840

a as a little kid it's called the little

3210

02:23:25,910 --> 02:23:24,000

engine that could

3211

02:23:27,910 --> 02:23:25,920

there's not this little end a little

3212

02:23:30,950 --> 02:23:27,920

steam engine

3213

02:23:32,790 --> 02:23:30,960

and it needs to take this

3214

02:23:35,030 --> 02:23:32,800

stuff over the mountain and all the big

3215

02:23:37,990 --> 02:23:35,040

engines are scared to do it

3216

02:23:39,910 --> 02:23:38,000

and the little engine says i'll try and

3217

02:23:41,990 --> 02:23:39,920

then it says i think i can i think i can

3218

02:23:45,990 --> 02:23:42,000

i think i can

3219

02:23:49,349 --> 02:23:46,000

well a lot of people in the

3220

02:23:52,230 --> 02:23:49,359

uh global warming world

3221

02:23:54,710 --> 02:23:52,240

are like that they think look we know

3222

02:23:58,070 --> 02:23:54,720

exactly what to do

3223

02:24:01,510 --> 02:23:58,080

we have the technology it's easy

3224

02:24:04,389 --> 02:24:01,520

we're just a bunch of

3225

02:24:06,150 --> 02:24:04,399

you know fat [h__h] that are addicted to

3226

02:24:09,590 --> 02:24:06,160

our suvs

3227

02:24:11,270 --> 02:24:09,600

and is as soon as we just all do the

3228

02:24:17,750 --> 02:24:11,280

right thing

3229

02:24:21,590 --> 02:24:20,469

and and then if you come up with global

3230

02:24:25,270 --> 02:24:21,600

warming

3231

02:24:28,469 --> 02:24:25,280

then those very people will then

3232

02:24:30,550 --> 02:24:28,479

say you shut up

3233

02:24:32,870 --> 02:24:30,560

we're trying to convince society we're

3234

02:24:34,790 --> 02:24:32,880

probably we're trying to tell society

3235

02:24:36,950 --> 02:24:34,800

i think we can i think we can we'll try

3236

02:24:38,469 --> 02:24:36,960

to be positive here

3237

02:24:40,150 --> 02:24:38,479

and the minute you say you have a

3238

02:24:43,830 --> 02:24:40,160

different solution

3239

02:24:45,670 --> 02:24:43,840

it lets the air out of the balloon

3240

02:24:47,830 --> 02:24:45,680

we need to threaten these people that

3241

02:24:51,510 --> 02:24:47,840

there's no other way to save earth

3242

02:24:55,030 --> 02:24:51,520

otherwise they won't listen to us mm-hmm

3243

02:24:57,750 --> 02:24:55,040

so i say in response i say

3244

02:25:00,950 --> 02:24:57,760

okay show me how much progress we've

3245

02:25:07,910 --> 02:25:04,710

well we have made any progress

3246

02:25:09,110 --> 02:25:07,920

well okay suppose we did the full paris

3247

02:25:12,870 --> 02:25:09,120

accord

3248

02:25:14,389 --> 02:25:12,880

well everyone knows that is [h__h]

3249

02:25:16,469 --> 02:25:14,399

and of course then i did the

3250

02:25:19,910 --> 02:25:16,479

calculations for myself

3251

02:25:22,790 --> 02:25:19,920

if there was no

3252

02:25:23,990 --> 02:25:22,800

more emission tomorrow we stopped it

3253

02:25:27,830 --> 02:25:24,000

which there's no way we can do

3254

02:25:31,110 --> 02:25:27,840

it right right right but the temperature

3255

02:25:34,710 --> 02:25:31,120

would continue to rise for about

3256

02:25:42,070 --> 02:25:38,309

then it would start to slowly decrease

3257

02:25:44,389 --> 02:25:42,080

individual model in 145

3258

02:25:47,349 --> 02:25:44,399

years the temperature would be less than

3259

02:25:53,349 --> 02:25:50,950

so now i ask you is the is global

3260

02:25:56,389 --> 02:25:53,359

warming

3261

02:25:59,750 --> 02:25:56,399

a serious problem or not

3262

02:26:04,230 --> 02:25:59,760

and it's very funny to me because

3263

02:26:08,070 --> 02:26:04,240

if you if you talk to people who deny

3264

02:26:09,750 --> 02:26:08,080

the existence of global warming

3265

02:26:12,469 --> 02:26:09,760

there's a set of people that say listen

3266

02:26:14,870 --> 02:26:12,479

to the science

3267

02:26:16,710 --> 02:26:14,880

but then if you say okay tell me a

3268

02:26:20,150 --> 02:26:16,720

credible plan

3269

02:26:23,190 --> 02:26:20,160

for actually getting to zero emissions

3270

02:26:26,550 --> 02:26:23,200

and not having a disaster

3271

02:26:29,830 --> 02:26:26,560

according to you well

3272

02:26:33,030 --> 02:26:29,840

they can't but they also don't want you

3273

02:26:33,590 --> 02:26:33,040

to let that cat out of the bag hey shut

3274

02:26:37,910 --> 02:26:33,600

up

3275

02:26:39,750 --> 02:26:37,920

we'll get we'll get some level of

3276

02:26:41,670 --> 02:26:39,760

compliance now and then we'll we'll get

3277

02:26:45,110 --> 02:26:41,680

a little more in the future

3278

02:26:46,630 --> 02:26:45,120

and if we like told people the truth the

3279

02:26:49,030 --> 02:26:46,640

the ones that are honest will say if we

3280

02:26:53,030 --> 02:26:49,040

told people the truth

3281

02:26:56,469 --> 02:26:53,040

they would be too um afraid

3282

02:26:56,950 --> 02:26:56,479

well that's [h__\h] and lying to people

3283

02:26:58,950 --> 02:26:56,960

just

3284

02:27:00,830 --> 02:26:58,960

doesn't help the situation that's why no

3285

02:27:03,429 --> 02:27:00,840

one has believed this

3286

02:27:05,110 --> 02:27:03,439

right so

3287

02:27:07,830 --> 02:27:05,120

anyway so to those people i say we'll

3288

02:27:09,349 --> 02:27:07,840

listen to the science

3289

02:27:11,110 --> 02:27:09,359

because the science is actually very

3290

02:27:14,550 --> 02:27:11,120

very clear

3291

02:27:17,110 --> 02:27:14,560

that we don't have any natural way

3292

02:27:18,870 --> 02:27:17,120

to take co2 out of the atmosphere

3293

02:27:21,750 --> 02:27:18,880

quickly

3294

02:27:23,590 --> 02:27:21,760

and the science is very clear that at

3295

02:27:26,070 --> 02:27:23,600

any point in time

3296

02:27:30,070 --> 02:27:26,080

we have another 100 years of warming

3297

02:27:32,710 --> 02:27:30,080

that's already baked in the cake

3298

02:27:33,510 --> 02:27:32,720

so if you think that 100 years of

3299

02:27:35,349 --> 02:27:33,520

warming

3300

02:27:36,790 --> 02:27:35,359

and sorry that 100 years how much of an

3301

02:27:38,950 --> 02:27:36,800

increment is it

3302

02:27:40,550 --> 02:27:38,960

a couple degrees and that's

3303

02:27:42,230 --> 02:27:40,560

significantly for sure because different

3304

02:27:46,550 --> 02:27:42,240

models will say different things but

3305

02:27:47,030 --> 02:27:46,560

okay it you'll get people to say we

3306

02:27:49,590 --> 02:27:47,040

can't

3307

02:27:50,710 --> 02:27:49,600

possibly allow another one more degrees

3308

02:27:52,469 --> 02:27:50,720

c

3309

02:27:53,990 --> 02:27:52,479

mm-hmm but it's going to happen

3310

02:27:54,950 --> 02:27:54,000

regardless that's three degrees c no

3311

02:27:57,270 --> 02:27:54,960

matter what

3312

02:27:58,550 --> 02:27:57,280

yes yes yes number one number two if you

3313

02:28:01,750 --> 02:27:58,560

think

3314

02:28:05,030 --> 02:28:01,760

it's bad if your proposition

3315

02:28:08,469 --> 02:28:05,040

is that three degrees c will

3316

02:28:10,230 --> 02:28:08,479

you know unleash hell on earth well

3317

02:28:11,990 --> 02:28:10,240

let's start working on it because it's

3318

02:28:15,190 --> 02:28:12,000

common no matter what

3319

02:28:16,870 --> 02:28:15,200

we do okay so this seems to me like

3320

02:28:18,150 --> 02:28:16,880

people who are on the side that say well

3321

02:28:19,510 --> 02:28:18,160

let's just get to zero emissions and

3322

02:28:19,990 --> 02:28:19,520

that should solve it that they don't

3323

02:28:21,429 --> 02:28:20,000

actually

3324

02:28:22,630 --> 02:28:21,439

care about the saving of the earth

3325

02:28:24,150 --> 02:28:22,640

because if they did they would pursue

3326

02:28:24,630 --> 02:28:24,160

some of the geoengineering solutions as

3327

02:28:26,150 --> 02:28:24,640

well

3328

02:28:27,670 --> 02:28:26,160

so what is it that they care about do

3329

02:28:29,349 --> 02:28:27,680

they just dislike capitalism they

3330

02:28:32,469 --> 02:28:29,359

dislike the fact that we in the west

3331

02:28:33,830 --> 02:28:32,479

okay there's definitely people like that

3332

02:28:36,469 --> 02:28:33,840

and then there's definitely people who

3333

02:28:39,190 --> 02:28:36,479

are not like that you know when

3334

02:28:43,110 --> 02:28:39,200

you to people who are true

3335

02:28:44,469 --> 02:28:43,120

environmentalists or conservationists

3336

02:28:47,349 --> 02:28:44,479

they'll say what you mean we can

3337

02:28:53,510 --> 02:28:47,359

actually avoid destroying earth

3338

02:28:56,870 --> 02:28:55,750

the people who are the ones that are

3339

02:28:58,630 --> 02:28:56,880

most against it

3340

02:29:01,429 --> 02:28:58,640

i think are the ones that view this

3341

02:29:04,469 --> 02:29:01,439

mostly as a political struggle

3342

02:29:07,510 --> 02:29:04,479

and as something of a struggle

3343

02:29:09,429 --> 02:29:07,520

of capitalism versus

3344

02:29:10,630 --> 02:29:09,439

something they don't really propose an

3345

02:29:13,910 --> 02:29:10,640

alternative right

3346

02:29:17,270 --> 02:29:13,920

right but uh for those people

3347

02:29:18,150 --> 02:29:17,280

they would say hey you capitalist greedy

3348

02:29:21,429 --> 02:29:18,160

bastards

3349

02:29:25,910 --> 02:29:21,439

sinned against the environment this is

3350

02:29:28,070 --> 02:29:25,920

your fire and brimstone just cause

3351
02:29:30,230 --> 02:29:28,080
and don't go telling people you can make

3352
02:29:33,349 --> 02:29:30,240
it better

3353
02:29:35,270 --> 02:29:33,359
inventions

3354
02:29:36,710 --> 02:29:35,280
but then i say look if are you saying

3355
02:29:37,110 --> 02:29:36,720
it's going to destroy the environment

3356
02:29:40,309 --> 02:29:37,120
well

3357
02:29:43,270 --> 02:29:40,319
why don't we try not to destroy it

3358
02:29:44,950 --> 02:29:43,280
but he's near that oh it's going to kill

3359
02:29:47,349 --> 02:29:44,960
millions of people how about this let's

3360
02:29:50,550 --> 02:29:47,359
try not to kill millions of people

3361
02:29:53,429 --> 02:29:50,560
why is that not a good idea

3362
02:29:56,469 --> 02:29:53,439
we don't know how bad global warming

3363
02:29:59,750 --> 02:29:59,110

we have a bunch of models the models

3364

02:30:01,190 --> 02:29:59,760

predict

3365

02:30:03,990 --> 02:30:01,200

different amounts of temperature

3366

02:30:07,990 --> 02:30:04,000

increase in different time scales

3367

02:30:10,870 --> 02:30:08,000

at some point it'll be very bad

3368

02:30:13,030 --> 02:30:10,880

we don't know exactly which point and we

3369

02:30:16,630 --> 02:30:13,040

also don't know exactly which

3370

02:30:21,270 --> 02:30:18,630

so if people say i don't want to start

3371

02:30:23,349 --> 02:30:21,280

doing geoengineering today

3372

02:30:24,550 --> 02:30:23,359

i say fine don't start it today but

3373

02:30:28,469 --> 02:30:24,560

let's research

3374

02:30:29,830 --> 02:30:28,479

the hell out of it nathan what in your

3375

02:30:33,270 --> 02:30:29,840

eyes are the most efficacious

3376

02:30:36,150 --> 02:30:33,280

geoengineering prospects

3377

02:30:36,870 --> 02:30:36,160

well currently the one i like best is

3378

02:30:39,270 --> 02:30:36,880

something that

3379

02:30:41,670 --> 02:30:39,280

that goes on the rubric of solar

3380

02:30:43,910 --> 02:30:41,680

radiation management this means

3381

02:30:44,950 --> 02:30:43,920

you reflect a tiny amount of light from

3382

02:30:48,870 --> 02:30:44,960

the sun

3383

02:30:51,510 --> 02:30:48,880

way in the upper atmosphere um way less

3384

02:30:52,630 --> 02:30:51,520

light than i mean you could never

3385

02:30:55,429 --> 02:30:52,640

visually determine

3386

02:30:56,630 --> 02:30:55,439

exactly exactly it's imperceptible but

3387

02:30:58,790 --> 02:30:56,640

it would be enough

3388

02:31:01,429 --> 02:30:58,800

to stop global warming and it would be

3389

02:31:03,670 --> 02:31:01,439

with sulfur dioxide or some other method

3390

02:31:04,870 --> 02:31:03,680

well then you can get in then you go

3391

02:31:06,469 --> 02:31:04,880

down into the weeds

3392

02:31:07,990 --> 02:31:06,479

of a hundred different engineering

3393

02:31:09,990 --> 02:31:08,000

trade-offs

3394

02:31:12,070 --> 02:31:10,000

and people should study all those

3395

02:31:15,349 --> 02:31:12,080

different trade-offs

3396

02:31:18,469 --> 02:31:15,359

um sulfur dioxide has the

3397

02:31:20,630 --> 02:31:18,479

advantage that we know it works because

3398

02:31:23,429 --> 02:31:20,640

volcanoes do it

3399

02:31:24,870 --> 02:31:23,439

and we know that although sulfur dioxide

3400

02:31:27,990 --> 02:31:24,880

is not something we want

3401

02:31:30,150 --> 02:31:28,000

enormous amounts of in our world

3402

02:31:31,750 --> 02:31:30,160

we know that we're tolerant the

3403

02:31:35,030 --> 02:31:31,760

environment is currently tolerant of

3404

02:31:37,590 --> 02:31:35,040

quite a bit that comes from volcanoes

3405

02:31:39,830 --> 02:31:37,600

and the extra amount we would need is a

3406

02:31:43,190 --> 02:31:39,840

very small fraction above

3407

02:31:45,910 --> 02:31:43,200

what's coming from volcanoes so

3408

02:31:48,230 --> 02:31:45,920

there's a plausible argument that it's

3409

02:31:50,950 --> 02:31:48,240

the safest

3410

02:31:51,590 --> 02:31:50,960

there's lots of people who immediately

3411

02:31:53,910 --> 02:31:51,600

try as

3412

02:31:54,950 --> 02:31:53,920

hard as they can to see a problem with

3413

02:31:59,110 --> 02:31:54,960

that

3414

02:32:00,550 --> 02:31:59,120

and hey fair enough they they should

3415

02:32:02,389 --> 02:32:00,560

do that research and publish those

3416

02:32:03,830 --> 02:32:02,399

papers but other people should also be

3417

02:32:07,030 --> 02:32:03,840

saying let's try to figure out how to

3418

02:32:10,870 --> 02:32:09,110

because current course and speed we're

3419

02:32:15,030 --> 02:32:10,880

not doing [h__h]

3420

02:32:18,630 --> 02:32:16,870

nathan thank you so much for being

3421

02:32:20,469 --> 02:32:18,640

extremely generous with your time

3422

02:32:22,469 --> 02:32:20,479

please hopefully you recover from your

3423

02:32:24,150 --> 02:32:22,479

your kovid i wrote down that

3424

02:32:25,670 --> 02:32:24,160

other they're classically trained chefs

3425

02:32:27,670 --> 02:32:25,680

like gordon ramsay and someone i watch

3426
02:32:28,710 --> 02:32:27,680
plenty of his shows and he says that the

3427
02:32:31,670 --> 02:32:28,720
most important

3428
02:32:32,630 --> 02:32:31,680
aspect of any recipe is the ingredients

3429
02:32:34,550 --> 02:32:32,640
being fresh

3430
02:32:36,230 --> 02:32:34,560
i always wondered is that true or is

3431
02:32:38,230 --> 02:32:36,240
there something else like can you take

3432
02:32:40,309 --> 02:32:38,240
unfresh ingredients from walmart let's

3433
02:32:41,830 --> 02:32:40,319
say and create a wonderful meal

3434
02:32:44,790 --> 02:32:41,840
with some of your technologies tell me

3435
02:32:46,950 --> 02:32:44,800
your position on cheese

3436
02:32:49,429 --> 02:32:46,960
exactly yeah right cheese is very old

3437
02:32:53,670 --> 02:32:52,389
wine well that's kind of old spoiled

3438
02:32:56,870 --> 02:32:53,680

grape

3439

02:33:00,309 --> 02:32:56,880

um you know aged beef

3440

02:33:04,830 --> 02:33:00,319

uh so i agree

3441

02:33:07,510 --> 02:33:04,840

with uh him that you want high quality

3442

02:33:11,190 --> 02:33:07,520

ingredients high quality does not

3443

02:33:16,309 --> 02:33:11,200

mean necessarily mean that

3444

02:33:19,110 --> 02:33:16,319

it's all got to be absolutely fresh

3445

02:33:20,630 --> 02:33:19,120

there's enormous numbers of dishes made

3446

02:33:26,309 --> 02:33:20,640

with dried

3447

02:33:29,110 --> 02:33:26,319

pulses or beans or lentils or grains

3448

02:33:31,510 --> 02:33:29,120

and that stuff is dried and it doesn't

3449

02:33:34,870 --> 02:33:31,520

have to be fresh

3450

02:33:36,790 --> 02:33:34,880

so there are some foods where

3451

02:33:40,950 --> 02:33:36,800

the freshness of the ingredients is

3452

02:33:45,510 --> 02:33:44,469

there's other foods where aging the

3453

02:33:49,190 --> 02:33:45,520

ingredient

3454

02:33:51,910 --> 02:33:49,200

is absolutely paramount and most things

3455

02:33:55,910 --> 02:33:51,920

are somewhere in the middle

3456

02:33:58,870 --> 02:33:55,920

and it it's also

3457

02:34:00,309 --> 02:33:58,880

you know the a chef who is cooking for

3458

02:34:04,070 --> 02:34:00,319

other people

3459

02:34:07,349 --> 02:34:04,080

ought to do the best they can

3460

02:34:10,630 --> 02:34:07,359

but not every little restaurant

3461

02:34:11,510 --> 02:34:10,640

in the middle of the country can get

3462

02:34:15,590 --> 02:34:11,520

access

3463

02:34:18,309 --> 02:34:15,600

to diver caught scallops

3464

02:34:18,950 --> 02:34:18,319

and so then you have this dilemma does

3465

02:34:20,950 --> 02:34:18,960

that mean you

3466

02:34:22,710 --> 02:34:20,960

never serve scallops and some people

3467

02:34:25,670 --> 02:34:22,720

would say yes there was a scallops and

3468

02:34:27,110 --> 02:34:25,680

good for them but i think it's a little

3469

02:34:29,030 --> 02:34:27,120

bit elitist

3470

02:34:30,710 --> 02:34:29,040

to say oh no you can never serve a

3471

02:34:33,910 --> 02:34:30,720

frozen

3472

02:34:36,389 --> 02:34:33,920

piece of fish because you know the

3473

02:34:40,389 --> 02:34:36,399

fact is the middle of continents have a

3474

02:34:43,750 --> 02:34:40,399

very hard time getting fresh ocean fish

3475

02:34:49,750 --> 02:34:43,760

they can get it sometimes a huge expense

3476

02:34:53,990 --> 02:34:52,469

thank you thank you so much you gotta go

3477

02:34:55,910 --> 02:34:54,000

i appreciate your time man

3478

02:34:57,270 --> 02:34:55,920

thank you you're one of my idols have a

3479

02:34:58,710 --> 02:34:57,280

great one no i mean that man

3480

02:34:59,750 --> 02:34:58,720

i want to even ask you like how are the

3481

02:35:00,790 --> 02:34:59,760

pyramids made because i feel like you

3482

02:35:02,870 --> 02:35:00,800

have an answer for everything

3483

02:35:03,910 --> 02:35:02,880

and apparently there's a mystery there i

3484

02:35:05,990 --> 02:35:03,920

know actually a friend of mine has

3485

02:35:08,469 --> 02:35:06,000

figured that out

3486

02:35:10,630 --> 02:35:08,479

okay geologist friend of mine has really

3487

02:35:12,070 --> 02:35:10,640

figured out how they built the pyramids

3488

02:35:13,670 --> 02:35:12,080

you you can just reference the name so i

3489

02:35:14,550 --> 02:35:13,680

can search it unless you want to explain

3490

02:35:17,590 --> 02:35:14,560

it i know you gotta go

3491

02:35:21,110 --> 02:35:17,600

it's in a bunch of nova uh uh

3492

02:35:24,150 --> 02:35:21,120

videos um i'll email you the stuff

3493

02:35:24,630 --> 02:35:24,160

what's his name though i'm blanking on

3494

02:35:27,510 --> 02:35:24,640

it

3495

02:35:29,190 --> 02:35:27,520

okay i'll post the name all right man

3496

02:35:30,550 --> 02:35:29,200

there were a panoply of questions that i

3497

02:35:31,190 --> 02:35:30,560

had written down that i didn't get a

3498

02:35:32,790 --> 02:35:31,200

chance to

3499

02:35:35,110 --> 02:35:32,800

bring up during the interview but i

3500

02:35:37,510 --> 02:35:35,120

emailed him so here are two extra

3501

02:35:39,670 --> 02:35:37,520

questions

3502

02:35:41,670 --> 02:35:39,680

one i wanted to know what is his opinion

3503

02:35:43,030 --> 02:35:41,680

on the latest news regarding ufos and

3504

02:35:45,190 --> 02:35:43,040

even bob lazar

3505

02:35:46,630 --> 02:35:45,200

who claims to have worked on spacecraft

3506

02:35:48,309 --> 02:35:46,640

he said

3507

02:35:49,750 --> 02:35:48,319

i think it's arrogant to believe we are

3508

02:35:50,550 --> 02:35:49,760

the only intelligent beings in the

3509

02:35:52,550 --> 02:35:50,560

universe

3510

02:35:54,309 --> 02:35:52,560

that said i don't think that the hard

3511

02:35:56,950 --> 02:35:54,319

evidence for ufos is currently

3512

02:35:59,270 --> 02:35:56,960

sufficient to say that ufos are in fact

3513

02:36:01,510 --> 02:35:59,280

aliens visiting the planet the u in the

3514

02:36:02,309 --> 02:36:01,520

ufos is unidentified and that remains

3515

02:36:04,710 --> 02:36:02,319

the case

3516

02:36:06,070 --> 02:36:04,720

i don't know about mr lazar's claims so

3517

02:36:07,670 --> 02:36:06,080

i can't comment

3518

02:36:09,750 --> 02:36:07,680

okay the other question i had was about

3519

02:36:11,990 --> 02:36:09,760

consciousness do you think consciousness

3520

02:36:13,670 --> 02:36:12,000

emerges from a physical basis that is a

3521

02:36:14,950 --> 02:36:13,680

physical substrate like the materialists

3522

02:36:17,830 --> 02:36:14,960

might say

3523

02:36:19,349 --> 02:36:17,840

or not and why in other words what's

3524

02:36:21,190 --> 02:36:19,359

your opinion on the hard problem of

3525

02:36:23,590 --> 02:36:21,200

consciousness

3526

02:36:25,030 --> 02:36:23,600

nathan says our brains are physical so

3527

02:36:27,030 --> 02:36:25,040

yes i think that consciousness

3528

02:36:28,469 --> 02:36:27,040

originates in a physical organ

3529

02:36:30,550 --> 02:36:28,479

i think that a lot of consciousness

3530

02:36:33,190 --> 02:36:30,560

discussion goes away with

3531

02:36:35,110 --> 02:36:33,200

an obsession on human exceptionalism

3532

02:36:37,670 --> 02:36:35,120

animal experiments to show that a

3533

02:36:39,510 --> 02:36:37,680

number of species have a concept of self

3534

02:36:40,309 --> 02:36:39,520

have mirror neurons which model what

3535

02:36:43,190 --> 02:36:40,319

others think

3536

02:36:45,110 --> 02:36:43,200

and so forth while these traits may not

3537

02:36:46,230 --> 02:36:45,120

rise to the level of full human

3538

02:36:48,830 --> 02:36:46,240

consciousness

3539

02:36:53,830 --> 02:36:48,840

i think it's likely that they are

3540

02:36:58,550 --> 02:36:56,550

okay i hope you enjoyed this podcast if

3541

02:36:59,030 --> 02:36:58,560

you enjoyed it please consider donating

3542

02:37:00,710 --> 02:36:59,040

to

3543

02:37:02,550 --> 02:37:00,720

the patreon supporting this channel

3544

02:37:03,510 --> 02:37:02,560

because right now i'm pretty much doing

3545

02:37:05,910 --> 02:37:03,520

it pro bono

3546

02:37:07,030 --> 02:37:05,920

it takes up almost all of my time and it

3547

02:37:08,710 --> 02:37:07,040

would be great if i could

3548

02:37:11,590 --> 02:37:08,720

somehow manage to keep up the level of