



1  
00:00:06,550 --> 00:00:04,309  
well good afternoon everybody i'd like

2  
00:00:09,350 --> 00:00:06,560  
to welcome you to the first event of

3  
00:00:11,030 --> 00:00:09,360  
this week of innovation 2015 and of

4  
00:00:13,110 --> 00:00:11,040  
course we're really focusing this week

5  
00:00:15,350 --> 00:00:13,120  
on mars exploration

6  
00:00:17,269 --> 00:00:15,360  
it's an opportunity to step back from

7  
00:00:19,189 --> 00:00:17,279  
our day-to-day work and take some time

8  
00:00:21,590 --> 00:00:19,199  
to think about what we need to

9  
00:00:22,710 --> 00:00:21,600  
accomplish in order to explore mars with

10  
00:00:24,470 --> 00:00:22,720  
humans

11  
00:00:26,470 --> 00:00:24,480  
and give ourselves an opportunity to

12  
00:00:28,150 --> 00:00:26,480  
think differently about how we might go

13  
00:00:29,509 --> 00:00:28,160

about doing this

14

00:00:31,109 --> 00:00:29,519

you know i've heard some people say that

15

00:00:34,709 --> 00:00:31,119

they don't have time to attend these

16

00:00:36,470 --> 00:00:34,719

innovation events or uh or to to

17

00:00:38,310 --> 00:00:36,480

innovate themselves

18

00:00:41,990 --> 00:00:38,320

as if somehow it's not connected with

19

00:00:44,229 --> 00:00:42,000

our day-to-day mission but in fact

20

00:00:45,910 --> 00:00:44,239

we are what we are concentrating on this

21

00:00:47,990 --> 00:00:45,920

week has everything to do with our

22

00:00:49,350 --> 00:00:48,000

mission and it's imperative that we are

23

00:00:51,670 --> 00:00:49,360

innovative and that we are being

24

00:00:53,670 --> 00:00:51,680

deliberate about how we choose to

25

00:00:55,510 --> 00:00:53,680

approach exploration if we're going to

26

00:00:57,510 --> 00:00:55,520

succeed in the future

27

00:00:59,110 --> 00:00:57,520

so thank you for coming today and i

28

00:01:01,029 --> 00:00:59,120

encourage you to participate in the

29

00:01:02,950 --> 00:01:01,039

other events this week

30

00:01:05,590 --> 00:01:02,960

i think you know tomorrow andy weir will

31

00:01:07,030 --> 00:01:05,600

be here the author of the martian

32

00:01:09,350 --> 00:01:07,040

on wednesday

33

00:01:11,429 --> 00:01:09,360

we have a chance to hear essentially

34

00:01:13,350 --> 00:01:11,439

elevator pitches from the people who

35

00:01:17,030 --> 00:01:13,360

have submitted projects for the

36

00:01:18,950 --> 00:01:17,040

innovation charge account that's at 11.

37

00:01:21,190 --> 00:01:18,960

there'll also be a chance after that to

38

00:01:23,670 --> 00:01:21,200

do book signing with andy weir

39

00:01:25,190 --> 00:01:23,680

on thursday in here we can learn more

40

00:01:27,030 --> 00:01:25,200

about some of our engineering and

41

00:01:28,230 --> 00:01:27,040

science efforts that will take us to

42

00:01:29,749 --> 00:01:28,240

mars

43

00:01:31,429 --> 00:01:29,759

there's going to be a

44

00:01:33,350 --> 00:01:31,439

these are kind of in the format of like

45

00:01:36,390 --> 00:01:33,360

ted talks but we can't call them ted

46

00:01:38,069 --> 00:01:36,400

talks because those are like branded so

47

00:01:38,789 --> 00:01:38,079

talk mars that's what those are going to

48

00:01:42,469 --> 00:01:38,799

be

49

00:01:45,510 --> 00:01:42,479

inflate your space about inflatable

50

00:01:48,950 --> 00:01:45,520

structures uh ones on landing humans on

51  
00:01:50,789 --> 00:01:48,960  
mars and ones on robotics as precursors

52  
00:01:52,069 --> 00:01:50,799  
to mars so hope to have you attend that

53  
00:01:55,190 --> 00:01:52,079  
as well

54  
00:01:57,350 --> 00:01:55,200  
we're also going to be uh sending out or

55  
00:01:59,670 --> 00:01:57,360  
opening up some challenges this year and

56  
00:02:00,950 --> 00:01:59,680  
we the first one is going to launch this

57  
00:02:03,190 --> 00:02:00,960  
week and you'll hear a little bit more

58  
00:02:05,429 --> 00:02:03,200  
about it um during the week but it's

59  
00:02:08,229 --> 00:02:05,439  
going to be aimed at identifying

60  
00:02:10,710 --> 00:02:08,239  
maybe hidden gaps in our mars eva

61  
00:02:12,710 --> 00:02:10,720  
systems and operations so thinking about

62  
00:02:14,470 --> 00:02:12,720  
what we've already determined

63  
00:02:16,150 --> 00:02:14,480

our gaps and how we're moving forward

64

00:02:19,030 --> 00:02:16,160

but making sure there aren't other

65

00:02:21,190 --> 00:02:19,040

things that we need to be thinking about

66

00:02:23,350 --> 00:02:21,200

but really all week this is a chance to

67

00:02:26,229 --> 00:02:23,360

discuss and share how we engage all

68

00:02:28,070 --> 00:02:26,239

parts of jsc more collaboratively on our

69

00:02:30,869 --> 00:02:28,080

journey to mars

70

00:02:32,550 --> 00:02:30,879

so now i'd like to invite up jeff davis

71

00:02:34,150 --> 00:02:32,560

director of human health and performance

72

00:02:43,190 --> 00:02:34,160

who's going to introduce today's guest

73

00:02:47,110 --> 00:02:45,350

thanks ellen and as part of what human

74

00:02:49,750 --> 00:02:47,120

health performance is doing this week we

75

00:02:51,270 --> 00:02:49,760

are having a couple of days of blue sky

76

00:02:53,830 --> 00:02:51,280

events where we're

77

00:02:55,990 --> 00:02:53,840

really trying to think about disruptive

78

00:02:58,710 --> 00:02:56,000

innovation and and what does that mean

79

00:03:00,149 --> 00:02:58,720

for us to get to mars in the next 20 or

80

00:03:02,309 --> 00:03:00,159

25 years

81

00:03:05,670 --> 00:03:02,319

so to kick that off for us today it's my

82

00:03:07,990 --> 00:03:05,680

pleasure to introduce dr daniel kraft

83

00:03:10,229 --> 00:03:08,000

he and i have known each other

84

00:03:11,030 --> 00:03:10,239

over the last 25 years or so

85

00:03:12,630 --> 00:03:11,040

and

86

00:03:14,869 --> 00:03:12,640

he has 20 years of experience in

87

00:03:17,350 --> 00:03:14,879

clinical practice biomedical research

88

00:03:18,869 --> 00:03:17,360

and healthcare innovation

89

00:03:20,869 --> 00:03:18,879

he chairs the medicine track for

90

00:03:22,550 --> 00:03:20,879

singularity university some of you are

91

00:03:24,869 --> 00:03:22,560

probably familiar with that

92

00:03:27,030 --> 00:03:24,879

and is founding executive director of

93

00:03:29,110 --> 00:03:27,040

exponential medicine a program which

94

00:03:31,030 --> 00:03:29,120

explores convergent exponentially

95

00:03:33,670 --> 00:03:31,040

developing technologies and their

96

00:03:35,430 --> 00:03:33,680

potential in biomedicine and health care

97

00:03:37,509 --> 00:03:35,440

his various ted talks have over 1

98

00:03:39,350 --> 00:03:37,519

million views

99

00:03:41,750 --> 00:03:39,360

he was trained at brown university went

100

00:03:43,750 --> 00:03:41,760

to medical school at stanford

101  
00:03:45,430 --> 00:03:43,760  
and then attended the harvard combined

102  
00:03:47,990 --> 00:03:45,440  
internal medicine and pediatrics

103  
00:03:49,830 --> 00:03:48,000  
residency program at the mass general

104  
00:03:51,750 --> 00:03:49,840  
hospital in boston and the boston

105  
00:03:53,270 --> 00:03:51,760  
children's hospital he went on to

106  
00:03:55,670 --> 00:03:53,280  
complete stanford fellowships in

107  
00:03:57,830 --> 00:03:55,680  
hematology and oncology and bone marrow

108  
00:03:59,830 --> 00:03:57,840  
transplantation and has extensive

109  
00:04:01,589 --> 00:03:59,840  
research in stem cell biology and

110  
00:04:03,429 --> 00:04:01,599  
regenerative medicine

111  
00:04:05,190 --> 00:04:03,439  
he has multiple publications in nature

112  
00:04:07,990 --> 00:04:05,200  
and science and medical device

113  
00:04:09,910 --> 00:04:08,000

immunology and stem cell related patents

114

00:04:11,750 --> 00:04:09,920

through faculty positions with stanford

115

00:04:13,190 --> 00:04:11,760

and his clinical faculty

116

00:04:14,789 --> 00:04:13,200

for the pediatric bone marrow

117

00:04:16,789 --> 00:04:14,799

transplantation service at the

118

00:04:17,990 --> 00:04:16,799

university of california at san

119

00:04:19,909 --> 00:04:18,000

francisco

120

00:04:22,710 --> 00:04:19,919

so i think you'll enjoy this as a very

121

00:04:24,550 --> 00:04:22,720

diverse interesting talk about the what

122

00:04:26,870 --> 00:04:24,560

the future and potential of medicine can

123

00:04:35,510 --> 00:04:26,880

be with that i'll turn it over to dr

124

00:04:38,310 --> 00:04:36,950

thank you very much dr davis and really

125

00:04:40,629 --> 00:04:38,320

appreciate the invitation to be here

126

00:04:42,710 --> 00:04:40,639

it's amazing to be back at jfc some of

127

00:04:44,390 --> 00:04:42,720

the history that wasn't in my short bio

128

00:04:46,469 --> 00:04:44,400

is that um i

129

00:04:47,749 --> 00:04:46,479

had a great workshop uh with uh this

130

00:04:49,830 --> 00:04:47,759

morning but i actually got to spend some

131

00:04:51,350 --> 00:04:49,840

time here uh in the past not quite this

132

00:04:53,990 --> 00:04:51,360

far in the past but i was a wee pup i

133

00:04:56,390 --> 00:04:54,000

was at the apollo 17 launch uh and i was

134

00:04:58,150 --> 00:04:56,400

just home in dc at my parents house and

135

00:05:00,469 --> 00:04:58,160

found some of my original elements from

136

00:05:02,230 --> 00:05:00,479

that and just just a moment to thank all

137

00:05:03,909 --> 00:05:02,240

of you from the past and the future for

138

00:05:06,390 --> 00:05:03,919

the inspiration that's been in my life

139

00:05:09,270 --> 00:05:06,400

and and many many others it's been built

140

00:05:10,550 --> 00:05:09,280

right here at jsc um here's the best

141

00:05:12,550 --> 00:05:10,560

things i found in that old box my old

142

00:05:14,150 --> 00:05:12,560

coloring book um

143

00:05:16,550 --> 00:05:14,160

and some matches match collection maybe

144

00:05:18,710 --> 00:05:16,560

that's worth something on ebay um but um

145

00:05:20,150 --> 00:05:18,720

i went on after uh being inspired as a

146

00:05:23,029 --> 00:05:20,160

kid and growing up near the air and

147

00:05:24,790 --> 00:05:23,039

space museum uh to spend time uh at

148

00:05:25,749 --> 00:05:24,800

stanford working on missions to mars and

149

00:05:27,590 --> 00:05:25,759

then actually spent a summer at

150

00:05:29,110 --> 00:05:27,600

international space university of which

151  
00:05:31,350 --> 00:05:29,120  
some of the crowd here are alumni and

152  
00:05:33,110 --> 00:05:31,360  
friends um we did a whole mission to

153  
00:05:34,710 --> 00:05:33,120  
mars architecture and so i spent some

154  
00:05:35,909 --> 00:05:34,720  
time thinking about uh the issues of

155  
00:05:38,550 --> 00:05:35,919  
long-duration spaceflight everything

156  
00:05:40,310 --> 00:05:38,560  
from micro long duration uh um partial

157  
00:05:42,230 --> 00:05:40,320  
gravity on the way to mars and back but

158  
00:05:44,150 --> 00:05:42,240  
it really helped inspire my thinking as

159  
00:05:45,670 --> 00:05:44,160  
a physician and scientist about the the

160  
00:05:46,790 --> 00:05:45,680  
convergence of technologies coming in

161  
00:05:48,390 --> 00:05:46,800  
different places and even when i was a

162  
00:05:49,909 --> 00:05:48,400  
medical student at stanford i worked and

163  
00:05:51,350 --> 00:05:49,919

published an article on being a

164

00:05:53,189 --> 00:05:51,360

constructive thigh cuffs and my

165

00:05:55,990 --> 00:05:53,199

co-author uh some of you might remember

166

00:05:57,350 --> 00:05:56,000

uh recognize kell as um

167

00:05:59,350 --> 00:05:57,360

lingard flying to space station in a

168

00:06:00,870 --> 00:05:59,360

month or two so um that's a little bit

169

00:06:02,790 --> 00:06:00,880

of my past and i spent a month here as a

170

00:06:04,830 --> 00:06:02,800

medical student uh when i was at

171

00:06:06,710 --> 00:06:04,840

stanford i even published something

172

00:06:09,990 --> 00:06:06,720

on fluid

173

00:06:11,670 --> 00:06:10,000

on liquid cooling garments and um uh

174

00:06:12,870 --> 00:06:11,680

about 10 years ago came here to

175

00:06:14,230 --> 00:06:12,880

interview the astronaut course so i had

176

00:06:15,990 --> 00:06:14,240

a great experience then unfortunately

177

00:06:18,070 --> 00:06:16,000

the dock got knocked out my left eye was

178

00:06:20,390 --> 00:06:18,080

just over the 2200 uncorrected version

179

00:06:21,270 --> 00:06:20,400

so someone fix that for me please okay

180

00:06:22,629 --> 00:06:21,280

so

181

00:06:23,990 --> 00:06:22,639

let's look a little bit in the future of

182

00:06:26,150 --> 00:06:24,000

health and medicine and a broad

183

00:06:28,390 --> 00:06:26,160

perspective um that might inform some of

184

00:06:30,230 --> 00:06:28,400

your thinking about uh as we go to mars

185

00:06:31,830 --> 00:06:30,240

and beyond and it's a bit fun to go back

186

00:06:33,029 --> 00:06:31,840

to the future before we go

187

00:06:34,710 --> 00:06:33,039

dive into the

188

00:06:36,309 --> 00:06:34,720

into the future uh if you all remember

189

00:06:37,430 --> 00:06:36,319

the what year do they go into the future

190

00:06:39,430 --> 00:06:37,440

in this movie

191

00:06:41,029 --> 00:06:39,440

2015. we're actually in the future uh

192

00:06:42,390 --> 00:06:41,039

i'm waiting for my hoverboard it's under

193

00:06:44,309 --> 00:06:42,400

prototype but it's actually that's tony

194

00:06:46,870 --> 00:06:44,319

hawk on a hoverboard prototype

195

00:06:48,230 --> 00:06:46,880

but as we sort of look into the future

196

00:06:49,749 --> 00:06:48,240

it's sometimes helpful to know where we

197

00:06:51,189 --> 00:06:49,759

came from and i had a chance myself to

198

00:06:52,710 --> 00:06:51,199

go back to the future recently i trained

199

00:06:54,870 --> 00:06:52,720

at mass general hospital i was back

200

00:06:56,150 --> 00:06:54,880

there for the 200th anniversary of mgh

201  
00:06:57,430 --> 00:06:56,160  
those were the guys and girls i trained

202  
00:06:59,430 --> 00:06:57,440  
with in the trenches and of course it

203  
00:07:02,150 --> 00:06:59,440  
was in boston so we could joke about

204  
00:07:03,510 --> 00:07:02,160  
walking uphill both ways in the snow and

205  
00:07:05,510 --> 00:07:03,520  
i found myself after one of the

206  
00:07:07,430 --> 00:07:05,520  
receptions all by myself at midnight one

207  
00:07:09,270 --> 00:07:07,440  
of the most famous spots of healthcare

208  
00:07:10,629 --> 00:07:09,280  
history it's called the etherdome and

209  
00:07:13,430 --> 00:07:10,639  
it's called the etherdome because back

210  
00:07:15,510 --> 00:07:13,440  
in 1846 over 150 years ago the patient

211  
00:07:17,029 --> 00:07:15,520  
in this very picture was the very first

212  
00:07:18,309 --> 00:07:17,039  
to get general anesthesia with his

213  
00:07:19,830 --> 00:07:18,319

surgery before that they used to

214

00:07:21,189 --> 00:07:19,840

literally bite the bullet this picture

215

00:07:24,150 --> 00:07:21,199

is clearly before the hip of privacy

216

00:07:25,670 --> 00:07:24,160

laws came along um but if you uh

217

00:07:27,510 --> 00:07:25,680

if you go to the etherdom today which

218

00:07:29,350 --> 00:07:27,520

you can go to it's frozen in time you

219

00:07:30,629 --> 00:07:29,360

slowly see the same actual sponge and

220

00:07:31,589 --> 00:07:30,639

medical instruments from that actual

221

00:07:33,110 --> 00:07:31,599

case

222

00:07:34,710 --> 00:07:33,120

nothing has changed there

223

00:07:36,150 --> 00:07:34,720

i wandered down the hall about four

224

00:07:37,670 --> 00:07:36,160

minutes away to the ward where i spent

225

00:07:40,070 --> 00:07:37,680

my first month as a terrified young

226  
00:07:41,670 --> 00:07:40,080  
intern doctor in 1996 and to my shopkins

227  
00:07:43,830 --> 00:07:41,680  
may that was also frozen in time and

228  
00:07:45,589 --> 00:07:43,840  
unchanged

229  
00:07:48,070 --> 00:07:45,599  
some of the alarms beeping some of the

230  
00:07:49,909 --> 00:07:48,080  
same nurses some the same patients

231  
00:07:51,749 --> 00:07:49,919  
the only difference was the poor intern

232  
00:07:53,110 --> 00:07:51,759  
on call was pushing around this ancient

233  
00:07:54,469 --> 00:07:53,120  
laptop had to type out the medical

234  
00:07:56,150 --> 00:07:54,479  
record electronic version and put it in

235  
00:07:57,589 --> 00:07:56,160  
the paper chart and the front desk was

236  
00:07:59,510 --> 00:07:57,599  
using the cutting edge medical

237  
00:08:02,150 --> 00:07:59,520  
communication technology of our day

238  
00:08:03,749 --> 00:08:02,160

the fax machine right so here we are at

239

00:08:05,510 --> 00:08:03,759

a great medical institution still using

240

00:08:07,589 --> 00:08:05,520

fax machines still thinking in many ways

241

00:08:09,510 --> 00:08:07,599

like 1846 and old silos and all ways of

242

00:08:10,469 --> 00:08:09,520

thinking old departments and specialties

243

00:08:12,629 --> 00:08:10,479

kind of the way medicine has been

244

00:08:13,830 --> 00:08:12,639

structured but you know we're in this

245

00:08:16,309 --> 00:08:13,840

new age where we don't need to think

246

00:08:17,990 --> 00:08:16,319

about our doctor visit being a 37-minute

247

00:08:19,990 --> 00:08:18,000

wait on average for the 12-minute on

248

00:08:21,749 --> 00:08:20,000

average doctor visit we in this we're in

249

00:08:23,430 --> 00:08:21,759

this connected age this exponential age

250

00:08:25,029 --> 00:08:23,440

where we can think out of the bucket of

251  
00:08:26,790 --> 00:08:25,039  
body parts and specialties in different

252  
00:08:27,990 --> 00:08:26,800  
ways and i think the same thing applies

253  
00:08:29,830 --> 00:08:28,000  
for space flight all these different

254  
00:08:31,110 --> 00:08:29,840  
technologies and fields some old ways of

255  
00:08:33,430 --> 00:08:31,120  
thinking some new ones that can come

256  
00:08:34,790 --> 00:08:33,440  
together to reinvent space flight and

257  
00:08:36,230 --> 00:08:34,800  
aerospace medicine

258  
00:08:37,750 --> 00:08:36,240  
because we have challenges whether it's

259  
00:08:39,750 --> 00:08:37,760  
in space or on the ground and medicine

260  
00:08:41,909 --> 00:08:39,760  
lots of challenges rising costs the

261  
00:08:44,230 --> 00:08:41,919  
aging demographic 10 000 baby boomers

262  
00:08:45,750 --> 00:08:44,240  
turning 65 every day access to care no

263  
00:08:47,190 --> 00:08:45,760

matter what you think about obamacare we

264

00:08:49,350 --> 00:08:47,200

have a lot more covered americans but a

265

00:08:51,750 --> 00:08:49,360

big shortage of primary care physicians

266

00:08:52,949 --> 00:08:51,760

in many parts of the world let alone on

267

00:08:55,190 --> 00:08:52,959

other planets

268

00:08:56,630 --> 00:08:55,200

we have issues with uh big data coming

269

00:08:58,389 --> 00:08:56,640

us lots of data like you deal with but

270

00:08:59,670 --> 00:08:58,399

how do we make that insightful and

271

00:09:01,110 --> 00:08:59,680

actionable information that you can use

272

00:09:03,030 --> 00:09:01,120

as a patient as a consumer as a

273

00:09:04,389 --> 00:09:03,040

physician and a lot of that care as you

274

00:09:06,230 --> 00:09:04,399

might know is fragmented still sometimes

275

00:09:08,150 --> 00:09:06,240

on paper sometimes electronic

276

00:09:09,350 --> 00:09:08,160

so lots of waste in the system and even

277

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

though a lot of the innovations are here

278

00:09:12,310 --> 00:09:10,720

today the technology's here today i'll

279

00:09:14,470 --> 00:09:12,320

show you some of it our friends at the

280

00:09:16,630 --> 00:09:14,480

fda have problems regulating it our

281

00:09:17,829 --> 00:09:16,640

friends the payers who cover the costs

282

00:09:19,430 --> 00:09:17,839

don't know how to often pay for these

283

00:09:21,430 --> 00:09:19,440

things similar to you know uh the

284

00:09:22,470 --> 00:09:21,440

challenges of flying certain hardware

285

00:09:24,470 --> 00:09:22,480

so

286

00:09:26,070 --> 00:09:24,480

if we think about our health care system

287

00:09:28,150 --> 00:09:26,080

today it's really a bit of a sick care

288

00:09:29,670 --> 00:09:28,160

system it's built on a very intermittent

289

00:09:30,790 --> 00:09:29,680

and reactive model intermittent meaning

290

00:09:32,949 --> 00:09:30,800

every once in a while you get a piece of

291

00:09:34,630 --> 00:09:32,959

data blood pressure ekg

292

00:09:35,910 --> 00:09:34,640

a cholesterol level and the data you

293

00:09:37,670 --> 00:09:35,920

might get to your doctor occasionally

294

00:09:39,590 --> 00:09:37,680

very intermittently and we're very

295

00:09:41,190 --> 00:09:39,600

reactive we wait for the heart attack

296

00:09:42,870 --> 00:09:41,200

the stroke the lump to be stage three

297

00:09:44,470 --> 00:09:42,880

and detected what if we could use

298

00:09:46,310 --> 00:09:44,480

technology and you think

299

00:09:48,790 --> 00:09:46,320

new technology and new thinking to be

300

00:09:49,910 --> 00:09:48,800

much more proactive and continuous uh

301  
00:09:52,310 --> 00:09:49,920  
with her healthcare and that's the

302  
00:09:53,750 --> 00:09:52,320  
promise of technology another promise is

303  
00:09:55,110 --> 00:09:53,760  
to shift us from the sick care system

304  
00:09:56,470 --> 00:09:55,120  
where we spend 80 percent of our

305  
00:09:58,470 --> 00:09:56,480  
healthcare dollar on folks who already

306  
00:10:00,389 --> 00:09:58,480  
have chronic disease and instead of

307  
00:10:02,069 --> 00:10:00,399  
doing sort of what we call reimbursement

308  
00:10:03,509 --> 00:10:02,079  
based medicine we can do more real

309  
00:10:05,350 --> 00:10:03,519  
evidence-based medicine and proactive

310  
00:10:06,790 --> 00:10:05,360  
preventative and we can use technology

311  
00:10:08,230 --> 00:10:06,800  
today for ourselves and our friends and

312  
00:10:09,829 --> 00:10:08,240  
family to stay on the left side of the

313  
00:10:12,230 --> 00:10:09,839

curve and not get those acute and

314

00:10:13,350 --> 00:10:12,240

chronic diseases in the first place

315

00:10:15,190 --> 00:10:13,360

so that means we need to shift the

316

00:10:16,550 --> 00:10:15,200

incentives but we're also shifting where

317

00:10:17,990 --> 00:10:16,560

healthcare happens it used to only be in

318

00:10:19,670 --> 00:10:18,000

the clinic and the hospital but

319

00:10:22,230 --> 00:10:19,680

increasingly healthcare is coming to our

320

00:10:24,790 --> 00:10:22,240

homes onto our bodies and as has been

321

00:10:26,949 --> 00:10:24,800

pioneered here off the planet so where

322

00:10:29,430 --> 00:10:26,959

healthcare happens can really change

323

00:10:30,710 --> 00:10:29,440

including your core walmart or cvs or

324

00:10:32,630 --> 00:10:30,720

walgreens all of them want to be your

325

00:10:34,710 --> 00:10:32,640

primary care doctor in a sense and and

326

00:10:36,710 --> 00:10:34,720

you'll see more of that uh happen uh in

327

00:10:38,630 --> 00:10:36,720

the next few years

328

00:10:40,389 --> 00:10:38,640

so let's take a step back and realize

329

00:10:42,310 --> 00:10:40,399

how fast the world is really moving

330

00:10:44,150 --> 00:10:42,320

today i came back to stanford to do

331

00:10:46,470 --> 00:10:44,160

fellowships in hematology oncology about

332

00:10:48,630 --> 00:10:46,480

10 12 years ago and so much has happened

333

00:10:50,870 --> 00:10:48,640

even the last decade uh it was only

334

00:10:53,750 --> 00:10:50,880

night 2001 that the first ipod came out

335

00:10:55,829 --> 00:10:53,760

i thought it was like 1991 so 2001. that

336

00:10:57,350 --> 00:10:55,839

feels like not so long ago and if you

337

00:10:58,949 --> 00:10:57,360

think about apple and what's changed

338

00:11:00,870 --> 00:10:58,959

with that company they didn't invent the

339

00:11:02,550 --> 00:11:00,880

mp3 player or digital music they put it

340

00:11:05,590 --> 00:11:02,560

together in smart impactful ways that's

341

00:11:07,509 --> 00:11:05,600

changed the apple's business model and

342

00:11:09,829 --> 00:11:07,519

apple has been riding this exponential

343

00:11:12,150 --> 00:11:09,839

technology trend what used to fit on an

344

00:11:14,150 --> 00:11:12,160

imac of 2000 that fits on your iphone

345

00:11:16,790 --> 00:11:14,160

and as of this week fits on an apple

346

00:11:18,150 --> 00:11:16,800

watch right and and this is an example

347

00:11:19,670 --> 00:11:18,160

um and of course the computers are

348

00:11:22,230 --> 00:11:19,680

getting even smaller that's the size of

349

00:11:24,150 --> 00:11:22,240

a grain of sand that probably has almost

350

00:11:26,230 --> 00:11:24,160

as much computational ability as what a

351

00:11:28,550 --> 00:11:26,240

polyphon on a grain of sand size

352

00:11:31,350 --> 00:11:28,560

technology we have really an ability now

353

00:11:32,870 --> 00:11:31,360

to think exponentially the the speed and

354

00:11:34,389 --> 00:11:32,880

power and computing of this little

355

00:11:36,310 --> 00:11:34,399

smartphone this is an antique now this

356

00:11:37,670 --> 00:11:36,320

is an iphone one it still works but it

357

00:11:40,069 --> 00:11:37,680

would feel antique remember smartphones

358

00:11:41,910 --> 00:11:40,079

have only been out for seven years it's

359

00:11:44,630 --> 00:11:41,920

riding moore's law moore's law was 50

360

00:11:46,150 --> 00:11:44,640

years old as of a month ago a week ago

361

00:11:48,230 --> 00:11:46,160

and it's an example of an exponential

362

00:11:50,629 --> 00:11:48,240

technology doubling in computing power

363

00:11:52,470 --> 00:11:50,639

every two years or so and our brains

364

00:11:54,069 --> 00:11:52,480

think linearly 30 linear steps i'll be

365

00:11:56,470 --> 00:11:54,079

to the exit but 30 exponential steps

366

00:11:59,190 --> 00:11:56,480

doubling 2 4 8 16 32 64.

367

00:12:00,470 --> 00:11:59,200

by 15 steps i'm at 30 000 but by the

368

00:12:02,550 --> 00:12:00,480

30th step

369

00:12:04,230 --> 00:12:02,560

i'm at a billion that's 26 times you

370

00:12:06,310 --> 00:12:04,240

know in orbit around the uh around the

371

00:12:08,949 --> 00:12:06,320

planet and that's what we need to do in

372

00:12:10,949 --> 00:12:08,959

in terms of health medicine and aviation

373

00:12:12,710 --> 00:12:10,959

is to think exponentially that's where

374

00:12:14,470 --> 00:12:12,720

the disruptive opportunities from come

375

00:12:16,870 --> 00:12:14,480

from that we can use to reinvent and

376

00:12:18,629 --> 00:12:16,880

reimagine the world and of course it's

377

00:12:20,389 --> 00:12:18,639

not just moore's law it's 3d printing

378

00:12:22,310 --> 00:12:20,399

it's robotics social networks all these

379

00:12:24,069 --> 00:12:22,320

things are coming together really in

380

00:12:25,910 --> 00:12:24,079

interesting ways to enable us to

381

00:12:27,509 --> 00:12:25,920

reimagine things just like in the last

382

00:12:29,350 --> 00:12:27,519

decade we've reimaged how we read

383

00:12:31,509 --> 00:12:29,360

books we sell more ebooks than regular

384

00:12:33,350 --> 00:12:31,519

books amazon does they self-disrupted

385

00:12:34,949 --> 00:12:33,360

we've seen other companies go bust like

386

00:12:36,629 --> 00:12:34,959

kodak had their kodak moment they

387

00:12:38,069 --> 00:12:36,639

actually invented digital photography

388

00:12:39,269 --> 00:12:38,079

but didn't pay attention to the the

389

00:12:41,350 --> 00:12:39,279

curve of exponential so they were

390

00:12:42,790 --> 00:12:41,360

bankrupt and instagram sold for billion

391

00:12:44,069 --> 00:12:42,800

dollars 12 kids down the street from me

392

00:12:45,430 --> 00:12:44,079

in palo alto

393

00:12:46,790 --> 00:12:45,440

um what was the last time you went to a

394

00:12:48,150 --> 00:12:46,800

blockbuster they've gone bust they

395

00:12:50,710 --> 00:12:48,160

weren't paying attention to exponentials

396

00:12:52,550 --> 00:12:50,720

in terms of data any folks here use uber

397

00:12:53,829 --> 00:12:52,560

right uber is now a four-year-old

398

00:12:55,590 --> 00:12:53,839

company four five-year-old company worth

399

00:12:57,030 --> 00:12:55,600

over 40 billion dollars they did not

400

00:12:59,670 --> 00:12:57,040

invent any of the technology used the

401

00:13:01,269 --> 00:12:59,680

smartphone online gps mapping payments

402

00:13:03,750 --> 00:13:01,279

but they bundled it up in a smart way to

403

00:13:05,430 --> 00:13:03,760

now disrupt the traffic the the limo and

404

00:13:06,710 --> 00:13:05,440

the cab world to the point where there's

405

00:13:08,629 --> 00:13:06,720

now the the folks who are being

406

00:13:10,470 --> 00:13:08,639

disrupted like and the taxi drivers in

407

00:13:12,629 --> 00:13:10,480

berlin have a protest to get it it's

408

00:13:14,310 --> 00:13:12,639

been outlawed in in germany but that's

409

00:13:16,790 --> 00:13:14,320

an example of leveraging technologies

410

00:13:18,470 --> 00:13:16,800

together in fact yeah i was in in vegas

411

00:13:21,030 --> 00:13:18,480

and the mafia there uh i guess doesn't

412

00:13:23,350 --> 00:13:21,040

like it either but you know i asked the

413

00:13:25,509 --> 00:13:23,360

question how can you build the uber of

414

00:13:27,590 --> 00:13:25,519

of health care or even of manned space

415

00:13:29,430 --> 00:13:27,600

flight i asked a question about medicine

416

00:13:30,870 --> 00:13:29,440

and three companies said we've already

417

00:13:32,389 --> 00:13:30,880

built the uber for health care you

418

00:13:33,509 --> 00:13:32,399

download the app you press a button and

419

00:13:35,110 --> 00:13:33,519

a doctor comes to your house or

420

00:13:36,470 --> 00:13:35,120

apartment within three hours at least in

421

00:13:38,550 --> 00:13:36,480

new york not sure what kind of doctor

422

00:13:39,910 --> 00:13:38,560

you get a doctor and remember they can

423

00:13:42,069 --> 00:13:39,920

rate you and you can rate them so

424

00:13:43,509 --> 00:13:42,079

there's a transparency element and even

425

00:13:45,269 --> 00:13:43,519

uber did their own little pilot called

426

00:13:46,790 --> 00:13:45,279

uber health where you'd slide the thing

427

00:13:48,389 --> 00:13:46,800

to the right and an uber would come with

428

00:13:50,470 --> 00:13:48,399

a nurse and give you your flu vaccine so

429

00:13:51,990 --> 00:13:50,480

that kind of seamlessness of

430

00:13:53,590 --> 00:13:52,000

access knowing where the car is the

431

00:13:55,590 --> 00:13:53,600

payments is an example of the world

432

00:13:57,269 --> 00:13:55,600

shifting and where folks want technology

433

00:13:58,870 --> 00:13:57,279

to take them

434

00:14:00,470 --> 00:13:58,880

so disruptions are all around us it's

435

00:14:02,069 --> 00:14:00,480

happening in major industries including

436

00:14:03,910 --> 00:14:02,079

a spaceflight and i would encourage you

437

00:14:05,350 --> 00:14:03,920

to be the disrupter not the disruptee

438

00:14:07,110 --> 00:14:05,360

and to start thinking exponentially so

439

00:14:08,790 --> 00:14:07,120

we'll cover that as we go from into the

440

00:14:09,910 --> 00:14:08,800

the present day into the future and many

441

00:14:11,750 --> 00:14:09,920

of the elements from healthcare remember

442

00:14:13,829 --> 00:14:11,760

apply to many elements i think of

443

00:14:15,590 --> 00:14:13,839

particularly a man space flight

444

00:14:18,470 --> 00:14:15,600

so let's look at some exponentials at

445

00:14:20,150 --> 00:14:18,480

play the human genome it was only about

446

00:14:21,430 --> 00:14:20,160

12 years ago the first genome was

447

00:14:23,189 --> 00:14:21,440

sequenced to cost

448

00:14:24,629 --> 00:14:23,199

billions of dollars took several years

449

00:14:26,310 --> 00:14:24,639

the price and speed of sequencing your

450

00:14:27,829 --> 00:14:26,320

own genome has dropped at twice the rate

451  
00:14:29,269 --> 00:14:27,839  
of moore's law to it's about a thousand

452  
00:14:30,310 --> 00:14:29,279  
dollars today and can be done in a year

453  
00:14:31,910 --> 00:14:30,320  
and a couple years would be a hundred

454  
00:14:33,670 --> 00:14:31,920  
dollars or less than the price of most

455  
00:14:35,350 --> 00:14:33,680  
x-rays and other lab tests some of you

456  
00:14:36,949 --> 00:14:35,360  
might have done 23andme and other ways

457  
00:14:38,310 --> 00:14:36,959  
of accessing your genetic information

458  
00:14:40,150 --> 00:14:38,320  
there's lots of information there today

459  
00:14:41,509 --> 00:14:40,160  
for a hundred dollars the trick is what

460  
00:14:43,030 --> 00:14:41,519  
happens when you come to your doctor

461  
00:14:43,750 --> 00:14:43,040  
with your genome or disk drive they

462  
00:14:44,870 --> 00:14:43,760  
don't know what to do with this

463  
00:14:46,550 --> 00:14:44,880

information needs to be part of the

464

00:14:47,670 --> 00:14:46,560

workflow just like many of you access a

465

00:14:49,269 --> 00:14:47,680

lot of information you need to be part

466

00:14:51,269 --> 00:14:49,279

of how you see it how you make sense of

467

00:14:53,110 --> 00:14:51,279

it but we can already do things with our

468

00:14:55,509 --> 00:14:53,120

pharmacogenetics this is from a hundred

469

00:14:58,150 --> 00:14:55,519

dollar test here's my genes for a blood

470

00:14:59,590 --> 00:14:58,160

thinner here's uh 18 of my different

471

00:15:01,430 --> 00:14:59,600

drugs that might affect be affected by

472

00:15:02,629 --> 00:15:01,440

my genes that information is here now i

473

00:15:03,990 --> 00:15:02,639

would encourage you

474

00:15:05,269 --> 00:15:04,000

to even try some of these consumer

475

00:15:06,629 --> 00:15:05,279

genetic testing elements you may learn

476  
00:15:08,870 --> 00:15:06,639  
something about yourself that might be

477  
00:15:10,230 --> 00:15:08,880  
useful in fact i uploaded my genetic

478  
00:15:12,150 --> 00:15:10,240  
data and i can look at my this is called

479  
00:15:13,430 --> 00:15:12,160  
athlete they look at your athletic jeans

480  
00:15:14,790 --> 00:15:13,440  
and i can see i'm a pr i was always a

481  
00:15:16,230 --> 00:15:14,800  
good sprinter never a good endurance

482  
00:15:17,590 --> 00:15:16,240  
runner and i didn't quite get up for the

483  
00:15:19,910 --> 00:15:17,600  
gym this morning but i have an excuse my

484  
00:15:21,350 --> 00:15:19,920  
genes for motivation are low so i got an

485  
00:15:23,110 --> 00:15:21,360  
excuse there

486  
00:15:24,470 --> 00:15:23,120  
but you know as we look at long-duration

487  
00:15:26,470 --> 00:15:24,480  
space missions and others well maybe

488  
00:15:28,470 --> 00:15:26,480

even tune people's understanding who's

489

00:15:29,749 --> 00:15:28,480

genetically most adaptable for for

490

00:15:32,150 --> 00:15:29,759

long-duration missions and others this

491

00:15:34,150 --> 00:15:32,160

is one example in the in the in the uh

492

00:15:36,069 --> 00:15:34,160

in that world and it goes well beyond

493

00:15:38,310 --> 00:15:36,079

the genome today you know there's all

494

00:15:40,230 --> 00:15:38,320

these omics the proteome you can get 10

495

00:15:42,150 --> 00:15:40,240

000 biomarkers from a drop of blood

496

00:15:44,230 --> 00:15:42,160

there's the expose of where you've lived

497

00:15:45,910 --> 00:15:44,240

if you spent a year on space station or

498

00:15:47,670 --> 00:15:45,920

lived on a farm in idaho or by three

499

00:15:49,749 --> 00:15:47,680

mile canal you have different exposures

500

00:15:50,949 --> 00:15:49,759

radiation cancer risks others our cell

501  
00:15:52,629 --> 00:15:50,959  
phones know where we live they can

502  
00:15:54,790 --> 00:15:52,639  
measure that there's the idea of the

503  
00:15:56,710 --> 00:15:54,800  
microbiome we are made up of 10 times

504  
00:15:58,470 --> 00:15:56,720  
more bacterial cells than human cells

505  
00:16:00,150 --> 00:15:58,480  
and it turns out the microbiome

506  
00:16:01,350 --> 00:16:00,160  
particularly in our gut can play a

507  
00:16:03,189 --> 00:16:01,360  
really important role in everything from

508  
00:16:05,590 --> 00:16:03,199  
obesity to inflammatory bowel disease to

509  
00:16:07,509 --> 00:16:05,600  
psychiatric disorders about 14 000

510  
00:16:09,430 --> 00:16:07,519  
americans die every year

511  
00:16:11,910 --> 00:16:09,440  
from infections in the hospital and now

512  
00:16:14,069 --> 00:16:11,920  
we're learning at my old home base to do

513  
00:16:15,110 --> 00:16:14,079

fecal transplants not too sexy but it's

514

00:16:16,870 --> 00:16:15,120

going to be part of the therapies of the

515

00:16:18,790 --> 00:16:16,880

future where you take a microbiome

516

00:16:20,230 --> 00:16:18,800

cocktail to maybe replace an augment

517

00:16:21,749 --> 00:16:20,240

that when you have so that's not science

518

00:16:24,310 --> 00:16:21,759

fiction that's coming along and that's

519

00:16:26,230 --> 00:16:24,320

just one of several ohms

520

00:16:29,110 --> 00:16:26,240

so we all want personalized medicine and

521

00:16:31,189 --> 00:16:29,120

precision medicine it's often best i

522

00:16:32,790 --> 00:16:31,199

think in terms of systems medicine this

523

00:16:34,230 --> 00:16:32,800

idea that will be predictive will be

524

00:16:35,749 --> 00:16:34,240

sequenced at birth or sometimes even

525

00:16:37,269 --> 00:16:35,759

before birth that's possible now from a

526  
00:16:38,710 --> 00:16:37,279  
mother's blood you can sequence the

527  
00:16:39,829 --> 00:16:38,720  
entire child we can then take

528  
00:16:41,990 --> 00:16:39,839  
preventative steps that are more

529  
00:16:43,110 --> 00:16:42,000  
personalized and the final p i'll

530  
00:16:45,189 --> 00:16:43,120  
challenge all of you is to be

531  
00:16:46,710 --> 00:16:45,199  
participatory to share your own data

532  
00:16:48,389 --> 00:16:46,720  
when it's when it's realistic to do so

533  
00:16:50,069 --> 00:16:48,399  
to all become part of the future of

534  
00:16:52,629 --> 00:16:50,079  
health and medicine by becoming data

535  
00:16:54,230 --> 00:16:52,639  
donors as we move forward

536  
00:16:56,470 --> 00:16:54,240  
so another few exponentials that play

537  
00:16:57,910 --> 00:16:56,480  
imaging imaging now is incredible a lot

538  
00:16:59,670 --> 00:16:57,920

of this is spun off by the way from from

539

00:17:01,030 --> 00:16:59,680

nasa-based technologies we can see

540

00:17:02,710 --> 00:17:01,040

inside the body with incredible

541

00:17:04,390 --> 00:17:02,720

resolution and your surgeon or your

542

00:17:06,150 --> 00:17:04,400

interventional radiologist can now find

543

00:17:08,069 --> 00:17:06,160

the tumor and avoid the blood vessel

544

00:17:09,909 --> 00:17:08,079

that's all done on a tablet computer and

545

00:17:11,429 --> 00:17:09,919

reconstruct it in real time

546

00:17:12,630 --> 00:17:11,439

the world of neuroscience is really

547

00:17:14,150 --> 00:17:12,640

getting shaken up we can not only

548

00:17:15,590 --> 00:17:14,160

appreciate the amazing anatomy of our

549

00:17:17,669 --> 00:17:15,600

brains but what's often called the

550

00:17:19,909 --> 00:17:17,679

connectome how are we wired has to play

551  
00:17:21,990 --> 00:17:19,919  
a role in everything from autism to

552  
00:17:23,669 --> 00:17:22,000  
alzheimer's and speaking of being

553  
00:17:25,669 --> 00:17:23,679  
proactive alzheimer's we know a major

554  
00:17:27,110 --> 00:17:25,679  
challenge what if we instead of waiting

555  
00:17:28,789 --> 00:17:27,120  
for it to happen and not having much to

556  
00:17:30,470 --> 00:17:28,799  
do we could pick it up early well

557  
00:17:32,070 --> 00:17:30,480  
there's now some types of scans we can

558  
00:17:33,350 --> 00:17:32,080  
scan a patient and find that they're

559  
00:17:35,510 --> 00:17:33,360  
going to become likely to become an

560  
00:17:37,270 --> 00:17:35,520  
alzheimer's patient 10 years later

561  
00:17:39,750 --> 00:17:37,280  
or as published last year blood-based

562  
00:17:40,950 --> 00:17:39,760  
biomarkers or even visual eye tracking

563  
00:17:42,710 --> 00:17:40,960

tests you can do with a hundred dollar

564

00:17:44,150 --> 00:17:42,720

laptop and an eye tracker that can

565

00:17:46,230 --> 00:17:44,160

predict whether someone's going to

566

00:17:47,510 --> 00:17:46,240

develop alzheimer's and as of last month

567

00:17:49,110 --> 00:17:47,520

there's now a new drug that looks like

568

00:17:51,190 --> 00:17:49,120

it's coming along that can reverse or

569

00:17:52,710 --> 00:17:51,200

stop plaques so maybe we'll identify

570

00:17:54,230 --> 00:17:52,720

folks early and then give them some of

571

00:17:55,510 --> 00:17:54,240

these therapeutics before they ever

572

00:17:57,430 --> 00:17:55,520

develop symptoms what i like to call

573

00:17:58,789 --> 00:17:57,440

stage zero medicine that's just one

574

00:18:00,070 --> 00:17:58,799

example

575

00:18:01,909 --> 00:18:00,080

another area set to shift is

576

00:18:03,430 --> 00:18:01,919

cardiovascular medicine the number one

577

00:18:05,669 --> 00:18:03,440

killer what if instead of doing the

578

00:18:07,750 --> 00:18:05,679

cardiac angiogram which takes dye and a

579

00:18:10,470 --> 00:18:07,760

catheter up the groin you could do

580

00:18:11,510 --> 00:18:10,480

computationally a 30-second ct scan send

581

00:18:13,510 --> 00:18:11,520

that data to the cloud and now

582

00:18:15,270 --> 00:18:13,520

computationally characterize is your

583

00:18:17,110 --> 00:18:15,280

blood vessel narrow or not how narrow

584

00:18:19,510 --> 00:18:17,120

does that patient need a stent or a

585

00:18:21,270 --> 00:18:19,520

bypass what kind of stent what size

586

00:18:23,190 --> 00:18:21,280

maybe we'll even 3d print that stent for

587

00:18:24,870 --> 00:18:23,200

that patient in real time in the future

588

00:18:26,549 --> 00:18:24,880

all that's now being blended from the

589

00:18:28,549 --> 00:18:26,559

convergence of imaging cloud-based

590

00:18:29,990 --> 00:18:28,559

computation mathematics a lot of this

591

00:18:31,590 --> 00:18:30,000

was actually done from nasa ames based

592

00:18:33,350 --> 00:18:31,600

fluidics technology and now it's

593

00:18:35,270 --> 00:18:33,360

translating and this was just fda

594

00:18:37,190 --> 00:18:35,280

approved last month and i think we'll be

595

00:18:39,350 --> 00:18:37,200

replacing some of our angiograms in the

596

00:18:40,870 --> 00:18:39,360

next year or a company i advise called

597

00:18:42,870 --> 00:18:40,880

morpheus they can do a four-minute

598

00:18:44,549 --> 00:18:42,880

cardiac mri completely reconstruct the

599

00:18:45,990 --> 00:18:44,559

anatomy of your chest and all the

600

00:18:48,710 --> 00:18:46,000

functions of your heart kind of like a

601  
00:18:50,150 --> 00:18:48,720  
an echo and this will be faster cheaper

602  
00:18:52,310 --> 00:18:50,160  
and give us much higher resolution

603  
00:18:54,390 --> 00:18:52,320  
personalized data so a few examples of

604  
00:18:56,230 --> 00:18:54,400  
convergent technologies coming along

605  
00:18:58,230 --> 00:18:56,240  
but probably the most disruptive

606  
00:19:00,070 --> 00:18:58,240  
technology in the future of health

607  
00:19:02,710 --> 00:19:00,080  
medicine is you the individual the

608  
00:19:03,830 --> 00:19:02,720  
consumer the patient where we're all now

609  
00:19:05,270 --> 00:19:03,840  
you know this is the old school

610  
00:19:07,190 --> 00:19:05,280  
technology 10 years ago i had a palm

611  
00:19:09,110 --> 00:19:07,200  
pilot that was fancy and of course now

612  
00:19:10,789 --> 00:19:09,120  
we're in the smartphone era and now at

613  
00:19:12,390 --> 00:19:10,799

stanford my medical school every medical

614

00:19:13,909 --> 00:19:12,400

student gets an ipad their first day of

615

00:19:15,990 --> 00:19:13,919

school with their entire curriculum on

616

00:19:17,510 --> 00:19:16,000

it you're flying tablets now to iss and

617

00:19:19,029 --> 00:19:17,520

beyond that's changing the game for

618

00:19:21,510 --> 00:19:19,039

medicine almost every doc brings their

619

00:19:23,990 --> 00:19:21,520

own device to work i was just in india

620

00:19:25,190 --> 00:19:24,000

they now have 35 android tablets on sale

621

00:19:26,470 --> 00:19:25,200

for 35

622

00:19:28,070 --> 00:19:26,480

that's going to democratize everything

623

00:19:30,549 --> 00:19:28,080

from education to public health and

624

00:19:32,150 --> 00:19:30,559

beyond and in a few years the poorest of

625

00:19:34,789 --> 00:19:32,160

the planet remember 80 of the planet

626  
00:19:36,710 --> 00:19:34,799  
today has sms phones even the poorest

627  
00:19:38,549 --> 00:19:36,720  
billion individuals soon they're going

628  
00:19:40,070 --> 00:19:38,559  
to have the equivalent of our fancy

629  
00:19:41,990 --> 00:19:40,080  
smartphones that can really change

630  
00:19:43,110 --> 00:19:42,000  
things including in healthcare and it's

631  
00:19:44,230 --> 00:19:43,120  
meaning technology is sort of

632  
00:19:45,029 --> 00:19:44,240  
disappearing that used to be a hundred

633  
00:19:46,950 --> 00:19:45,039  
thousand dollars of different

634  
00:19:48,710 --> 00:19:46,960  
technologies now is essentially free you

635  
00:19:49,830 --> 00:19:48,720  
don't buy a gps device anymore you

636  
00:19:51,350 --> 00:19:49,840  
download it on your phone even the

637  
00:19:53,029 --> 00:19:51,360  
flashlights in your phone so we're

638  
00:19:54,870 --> 00:19:53,039

starting to have technology disappear

639

00:19:56,150 --> 00:19:54,880

and in some cases get cheaper better and

640

00:19:57,750 --> 00:19:56,160

more functional

641

00:19:59,190 --> 00:19:57,760

even google and their new smartphone is

642

00:20:00,630 --> 00:19:59,200

modular so you can put in different

643

00:20:02,149 --> 00:20:00,640

modules if you're a diabetic or need to

644

00:20:02,950 --> 00:20:02,159

track your ekg

645

00:20:05,029 --> 00:20:02,960

so

646

00:20:06,710 --> 00:20:05,039

the new drug is really you the empowered

647

00:20:09,190 --> 00:20:06,720

patient to own your information to say

648

00:20:10,710 --> 00:20:09,200

i'm the ceo of my own health if you have

649

00:20:12,390 --> 00:20:10,720

diabetes you can now get connected

650

00:20:13,669 --> 00:20:12,400

glucometers that will record your blood

651  
00:20:15,270 --> 00:20:13,679

sugar

652  
00:20:16,710 --> 00:20:15,280

send that to your clinical team they're

653  
00:20:18,950 --> 00:20:16,720

not patches that can transmit to your

654  
00:20:20,470 --> 00:20:18,960

smartphone real-time blood glucose and

655  
00:20:22,230 --> 00:20:20,480

if you are diabetic and you have a

656  
00:20:24,070 --> 00:20:22,240

dashboard of your own data you can be

657  
00:20:26,230 --> 00:20:24,080

much more on top of your care and your

658  
00:20:27,669 --> 00:20:26,240

physician as well this is a simple app

659  
00:20:29,110 --> 00:20:27,679

that they published a few years ago and

660  
00:20:30,950 --> 00:20:29,120

studied they were able to lower the

661  
00:20:32,310 --> 00:20:30,960

average hemoglobin a1c and diabetic

662  
00:20:34,230 --> 00:20:32,320

patients by two percentage points just

663  
00:20:35,830 --> 00:20:34,240

with the app and changing diet and

664

00:20:37,510 --> 00:20:35,840

tweaking the meds a bit this is now the

665

00:20:39,190 --> 00:20:37,520

first fda approved app that's getting

666

00:20:40,470 --> 00:20:39,200

paid for by insurance companies for

667

00:20:41,750 --> 00:20:40,480

diabetes

668

00:20:43,270 --> 00:20:41,760

so we're going to enter an error while

669

00:20:45,510 --> 00:20:43,280

prescribed united glucometer badou

670

00:20:46,630 --> 00:20:45,520

glucometer with the social network in it

671

00:20:50,470 --> 00:20:46,640

and

672

00:20:52,070 --> 00:20:50,480

i'll be prescribing you apps for instead

673

00:20:53,270 --> 00:20:52,080

of a drug and device you know after

674

00:20:56,149 --> 00:20:53,280

pregnancy pregnancy hasn't changed for a

675

00:20:57,350 --> 00:20:56,159

while uh pre-op apps post-op apps all

676

00:20:59,350 --> 00:20:57,360

these things are going to be kind of

677

00:21:00,549 --> 00:20:59,360

become embedded in our everyday health

678

00:21:01,669 --> 00:21:00,559

and medicine and

679

00:21:03,350 --> 00:21:01,679

just like i think you can send up

680

00:21:04,950 --> 00:21:03,360

checklists now by apps that sort of

681

00:21:06,870 --> 00:21:04,960

element will come along

682

00:21:08,789 --> 00:21:06,880

you can now make restaurant reservations

683

00:21:10,950 --> 00:21:08,799

like with opentable another company did

684

00:21:12,710 --> 00:21:10,960

that for doctors open zocdoc one of the

685

00:21:14,630 --> 00:21:12,720

most successful healthcare it companies

686

00:21:16,149 --> 00:21:14,640

making bringing that sensibility along

687

00:21:18,310 --> 00:21:16,159

even the pharmacies now allow you to

688

00:21:19,909 --> 00:21:18,320

scan your pill bottle and do a refill so

689

00:21:21,430 --> 00:21:19,919

this new application of medicine is

690

00:21:22,789 --> 00:21:21,440

quite powerful they're coming to our

691

00:21:24,630 --> 00:21:22,799

apple watches to remind you to take your

692

00:21:26,149 --> 00:21:24,640

meds which is important because 50 of

693

00:21:27,430 --> 00:21:26,159

folks don't take their medicines as they

694

00:21:29,909 --> 00:21:27,440

should and you might have an easy

695

00:21:31,990 --> 00:21:29,919

reminder we're seeing mayo clinic

696

00:21:33,350 --> 00:21:32,000

published that apps can reduce hospital

697

00:21:35,590 --> 00:21:33,360

readmissions

698

00:21:37,029 --> 00:21:35,600

dramatically so the lesson here is it's

699

00:21:38,310 --> 00:21:37,039

this integration of information

700

00:21:39,830 --> 00:21:38,320

technology and mobile that can really

701  
00:21:41,669 --> 00:21:39,840  
empower all of us whether you're a

702  
00:21:43,350 --> 00:21:41,679  
physician a patient a flight surgeon or

703  
00:21:45,270 --> 00:21:43,360  
what have you

704  
00:21:46,950 --> 00:21:45,280  
and we can make healthcare more engaging

705  
00:21:48,390 --> 00:21:46,960  
uh what if we make you know some people

706  
00:21:49,909 --> 00:21:48,400  
like points some of you have fitbits and

707  
00:21:51,350 --> 00:21:49,919  
compete with those technologies we can

708  
00:21:52,870 --> 00:21:51,360  
take off the shelf technologies like a

709  
00:21:54,149 --> 00:21:52,880  
microsoft connect that used to be you

710  
00:21:55,830 --> 00:21:54,159  
know millions of dollars now as

711  
00:21:57,190 --> 00:21:55,840  
consumerized and that can be used to

712  
00:21:58,549 --> 00:21:57,200  
help you track your physical therapy

713  
00:22:00,390 --> 00:21:58,559

make it more engaging and fun maybe

714

00:22:02,630 --> 00:22:00,400

folks will actually do it for a change

715

00:22:04,870 --> 00:22:02,640

right we can now digitize all this

716

00:22:06,789 --> 00:22:04,880

information this new ear is often called

717

00:22:08,950 --> 00:22:06,799

mobile health or connected health or

718

00:22:10,630 --> 00:22:08,960

digital health because now in my pocket

719

00:22:12,870 --> 00:22:10,640

i can have the equivalent of an entire

720

00:22:14,710 --> 00:22:12,880

you know clinic in the past i can attach

721

00:22:16,870 --> 00:22:14,720

to my smartphone a little otoscope and

722

00:22:18,710 --> 00:22:16,880

look in my kids ears and send that data

723

00:22:20,870 --> 00:22:18,720

back and prescribe that to to families

724

00:22:22,710 --> 00:22:20,880

with with kids with otitis media or eye

725

00:22:24,390 --> 00:22:22,720

exams and i know uh nasa's work with

726

00:22:25,510 --> 00:22:24,400

intra to do eye exams on your

727

00:22:26,870 --> 00:22:25,520

smartphone

728

00:22:28,310 --> 00:22:26,880

their first market was in the us

729

00:22:30,070 --> 00:22:28,320

actually or or nasa they were going to

730

00:22:31,909 --> 00:22:30,080

go to india where you could have very

731

00:22:33,510 --> 00:22:31,919

few eye doctors press a button and order

732

00:22:35,669 --> 00:22:33,520

your glasses and of last week this

733

00:22:37,350 --> 00:22:35,679

company spun off a different one called

734

00:22:38,870 --> 00:22:37,360

blink where new york a little team will

735

00:22:40,390 --> 00:22:38,880

come in a car like an uber and do your

736

00:22:42,470 --> 00:22:40,400

whole eye exam with these mobile devices

737

00:22:44,310 --> 00:22:42,480

and send you your glasses or contacts

738

00:22:46,789 --> 00:22:44,320

so new ways of bundling things are

739

00:22:48,070 --> 00:22:46,799

shifting entire industries

740

00:22:49,909 --> 00:22:48,080

one of my favorite examples is

741

00:22:51,669 --> 00:22:49,919

telemedicine was really invented here i

742

00:22:53,510 --> 00:22:51,679

mean here's uh buzz on runs actually

743

00:22:54,950 --> 00:22:53,520

actually uh buzz orders ekg when he

744

00:22:56,230 --> 00:22:54,960

landed on the moon and apollo 11 he had

745

00:22:57,669 --> 00:22:56,240

very fast out right i think neil is a

746

00:22:59,430 --> 00:22:57,679

little more chill but you were able to

747

00:23:01,430 --> 00:22:59,440

transmit an ekg from the moon why can't

748

00:23:03,430 --> 00:23:01,440

we do that on earth well finally you

749

00:23:04,549 --> 00:23:03,440

sort of can there's now uh a technology

750

00:23:06,950 --> 00:23:04,559

i have in my pocket i'll do the live

751  
00:23:08,950 --> 00:23:06,960  
demo a little smartphone case costs

752  
00:23:11,430 --> 00:23:08,960  
under ten dollars and it's going to

753  
00:23:12,710 --> 00:23:11,440  
stream an ekg directly on my phone i

754  
00:23:13,830 --> 00:23:12,720  
just hold this on my case i went to the

755  
00:23:15,669 --> 00:23:13,840  
live demo right here but it looks like

756  
00:23:16,789 --> 00:23:15,679  
this we could pass this around the room

757  
00:23:18,390 --> 00:23:16,799  
and probably detect people who have a

758  
00:23:20,630 --> 00:23:18,400  
heart issue or if someone collapses at a

759  
00:23:22,549 --> 00:23:20,640  
party a great party gift you can

760  
00:23:23,750 --> 00:23:22,559  
diagnose things or if someone has atrial

761  
00:23:24,950 --> 00:23:23,760  
fibrillation or you're on station and

762  
00:23:26,390 --> 00:23:24,960  
someone has a funny rhythm you don't

763  
00:23:27,750 --> 00:23:26,400

need to wire them up with twelve ekg say

764

00:23:29,270 --> 00:23:27,760

hold the phone boom that data is

765

00:23:31,430 --> 00:23:29,280

available immediately

766

00:23:32,630 --> 00:23:31,440

and the app itself now does analysis or

767

00:23:34,549 --> 00:23:32,640

you can press a button to have an actual

768

00:23:36,390 --> 00:23:34,559

cardiologist see that data so the

769

00:23:38,230 --> 00:23:36,400

ability to collect information and gain

770

00:23:39,750 --> 00:23:38,240

insights for it because my ekg on this

771

00:23:41,750 --> 00:23:39,760

is is particularly getting faster

772

00:23:42,710 --> 00:23:41,760

cheaper and easier

773

00:23:44,470 --> 00:23:42,720

now

774

00:23:46,470 --> 00:23:44,480

some of this came from this consumer

775

00:23:48,230 --> 00:23:46,480

movement often called the quantified

776

00:23:49,510 --> 00:23:48,240

self only about six years old how many

777

00:23:50,710 --> 00:23:49,520

folks you have a fitbit or any kind of

778

00:23:52,149 --> 00:23:50,720

self-tracker

779

00:23:53,990 --> 00:23:52,159

only a few of you i'm probably lost in

780

00:23:55,190 --> 00:23:54,000

the laundry or forgot the charger well

781

00:23:56,470 --> 00:23:55,200

um i'm wearing like six of them right

782

00:23:57,990 --> 00:23:56,480

now i won't show them all of them but

783

00:23:59,430 --> 00:23:58,000

that world now where we can connect are

784

00:24:01,029 --> 00:23:59,440

scales that can tweet your weight blood

785

00:24:03,430 --> 00:24:01,039

pressure cuffs and talk to each other

786

00:24:05,669 --> 00:24:03,440

our smartphones now right these have

787

00:24:07,350 --> 00:24:05,679

these are highly uh

788

00:24:10,390 --> 00:24:07,360

instrumented devices they can track your

789

00:24:11,669 --> 00:24:10,400

heart rate your steps other elements

790

00:24:12,950 --> 00:24:11,679

blood pressure some of you might have

791

00:24:14,310 --> 00:24:12,960

high blood pressure you can now for

792

00:24:16,390 --> 00:24:14,320

sixty dollars buy a connective blood

793

00:24:18,230 --> 00:24:16,400

pressure cuff and integrate that data

794

00:24:19,909 --> 00:24:18,240

back to your doctor because companies

795

00:24:21,029 --> 00:24:19,919

like google and samsung and apple are

796

00:24:23,190 --> 00:24:21,039

now integrating that through your

797

00:24:25,190 --> 00:24:23,200

consumer devices so now that information

798

00:24:26,950 --> 00:24:25,200

can seamlessly flow and potentially

799

00:24:27,830 --> 00:24:26,960

become actionable not just another data

800

00:24:29,830 --> 00:24:27,840

point

801

00:24:31,190 --> 00:24:29,840

oh by the way you can have this data

802

00:24:33,029 --> 00:24:31,200

sometimes you might need a coach to help

803

00:24:34,470 --> 00:24:33,039

you there's now coaching apps where you

804

00:24:35,909 --> 00:24:34,480

have a real coach but we're moving to

805

00:24:37,909 --> 00:24:35,919

the era of ai coaches here's a quick

806

00:24:39,750 --> 00:24:37,919

look of something coming soon

807

00:24:42,310 --> 00:24:39,760

meet the world's first artificial

808

00:24:45,669 --> 00:24:42,320

intelligence personal robot

809

00:24:47,909 --> 00:24:45,679

she's your welcome friend at any hour

810

00:24:49,750 --> 00:24:47,919

good morning thomas time to get up good

811

00:24:51,750 --> 00:24:49,760

morning it seems like you had a good

812

00:24:53,430 --> 00:24:51,760

night's sleep eight full hours and a

813

00:24:55,269 --> 00:24:53,440

good resting heart rate

814

00:24:57,590 --> 00:24:55,279

thank you your meeting with jane is at 9

815

00:25:00,230 --> 00:24:57,600

30. i put the coffee on she can

816

00:25:02,230 --> 00:25:00,240

interface with household devices and

817

00:25:03,110 --> 00:25:02,240

she's also a personal stylist what do

818

00:25:07,110 --> 00:25:03,120

you think

819

00:25:09,029 --> 00:25:07,120

why don't you try the blue tie with it

820

00:25:11,430 --> 00:25:09,039

good idea

821

00:25:14,230 --> 00:25:11,440

she's your world-class office assistant

822

00:25:16,230 --> 00:25:14,240

using that's coming along ai assistant

823

00:25:17,830 --> 00:25:16,240

um we can even wire our youngest uh

824

00:25:19,269 --> 00:25:17,840

patients this is my son leo about six

825

00:25:21,669 --> 00:25:19,279

months ago when he's wearing a connected

826

00:25:23,029 --> 00:25:21,679

onesie so he's donating his data to

827

00:25:24,870 --> 00:25:23,039

science and i don't need that to tell me

828

00:25:26,149 --> 00:25:24,880

he's waking up every two hours but what

829

00:25:27,350 --> 00:25:26,159

if you had a child in the neonatal

830

00:25:28,950 --> 00:25:27,360

intensive care unit you could send them

831

00:25:30,950 --> 00:25:28,960

out earlier with some of these connected

832

00:25:32,470 --> 00:25:30,960

technologies and some of them used to be

833

00:25:34,230 --> 00:25:32,480

you know very futuristic this is from

834

00:25:35,669 --> 00:25:34,240

the cover of wired uh the back page

835

00:25:37,909 --> 00:25:35,679

artifacts from the future the connected

836

00:25:39,269 --> 00:25:37,919

diaper well now as of last year huggies

837

00:25:40,549 --> 00:25:39,279

came out with

838

00:25:43,269 --> 00:25:40,559

tweet p you can figure out what that

839

00:25:46,870 --> 00:25:44,789

there's also data for number two

840

00:25:49,029 --> 00:25:46,880

sometimes too much information

841

00:25:51,110 --> 00:25:49,039

it's available all right okay

842

00:25:52,710 --> 00:25:51,120

um other ways to get connected now you

843

00:25:54,070 --> 00:25:52,720

know these sensors are pretty basic

844

00:25:55,269 --> 00:25:54,080

they're little accelerometers used to be

845

00:25:56,630 --> 00:25:55,279

million dollar seminars are now two

846

00:25:58,390 --> 00:25:56,640

dollars and can live in all of our

847

00:25:59,990 --> 00:25:58,400

devices so we're moving to all this

848

00:26:01,750 --> 00:26:00,000

internet of things it's coming to the

849

00:26:03,430 --> 00:26:01,760

internet of the body internet of pills

850

00:26:05,669 --> 00:26:03,440

or pills now that can track when and if

851  
00:26:07,750 --> 00:26:05,679  
you took them or not right there are now

852  
00:26:09,269 --> 00:26:07,760  
patches uh and clothes that are being

853  
00:26:10,310 --> 00:26:09,279  
embedded with wearable devices and you

854  
00:26:11,830 --> 00:26:10,320  
know when the astronauts fly they're

855  
00:26:13,510 --> 00:26:11,840  
very telemetered but these now come from

856  
00:26:15,669 --> 00:26:13,520  
a simple take on shirt they can be part

857  
00:26:16,870 --> 00:26:15,679  
of our cars digital tattoos have been

858  
00:26:18,870 --> 00:26:16,880  
developed that can monitor and track

859  
00:26:21,830 --> 00:26:18,880  
your vital signs i have in my pocket

860  
00:26:24,470 --> 00:26:21,840  
from a company oh no um

861  
00:26:25,830 --> 00:26:24,480  
technology fail let's see uh

862  
00:26:29,110 --> 00:26:25,840  
this sometimes happens on this it's okay

863  
00:26:30,230 --> 00:26:29,120

i've got a backup um

864

00:26:32,630 --> 00:26:30,240

we've seen now companies like this

865

00:26:36,230 --> 00:26:32,640

little patch i'll show you in a second

866

00:26:38,470 --> 00:26:36,240

are able to uh oh let's see

867

00:26:39,830 --> 00:26:38,480

let me get out of this for one second

868

00:26:41,830 --> 00:26:39,840

um

869

00:26:43,430 --> 00:26:41,840

we're seeing technologies like this

870

00:26:45,909 --> 00:26:43,440

smart patch i'll show you in a second if

871

00:26:48,149 --> 00:26:45,919

i can reboot this are really uh able now

872

00:26:50,149 --> 00:26:48,159

to stream what used to be intensive care

873

00:26:52,230 --> 00:26:50,159

unit level data

874

00:26:53,190 --> 00:26:52,240

right to our smartphone and into the

875

00:26:55,269 --> 00:26:53,200

cloud this would be something we're

876  
00:26:56,789 --> 00:26:55,279  
talking about this morning that could be

877  
00:27:00,310 --> 00:26:56,799  
flown on station today or in future

878  
00:27:01,830 --> 00:27:00,320  
missions um whereby you're able to uh

879  
00:27:02,870 --> 00:27:01,840  
have what's intentionally used to be an

880  
00:27:04,310 --> 00:27:02,880  
intensive care unit just with this

881  
00:27:06,390 --> 00:27:04,320  
little patch this little patch is gonna

882  
00:27:08,310 --> 00:27:06,400  
be about three dollars a day and you'll

883  
00:27:10,310 --> 00:27:08,320  
soon be able to wear this for sporting

884  
00:27:12,950 --> 00:27:10,320  
to optimize your uh

885  
00:27:15,669 --> 00:27:12,960  
activities but also be useful in a whole

886  
00:27:18,389 --> 00:27:15,679  
new realm of of activities to um

887  
00:27:20,389 --> 00:27:18,399  
to track uh and learn from so we have

888  
00:27:21,990 --> 00:27:20,399

billions of data points coming from our

889

00:27:23,990 --> 00:27:22,000

mobile devices the challenge is what do

890

00:27:24,950 --> 00:27:24,000

we do with this how do we make sense of

891

00:27:26,549 --> 00:27:24,960

all this information you want to be

892

00:27:29,190 --> 00:27:26,559

overwhelmed by 12 apps and 12 different

893

00:27:31,430 --> 00:27:29,200

devices so my favorite analogy would be

894

00:27:33,269 --> 00:27:31,440

the modern car your modern car today has

895

00:27:34,950 --> 00:27:33,279

300 sensors in it you don't care about

896

00:27:36,149 --> 00:27:34,960

any one sensor you care about when your

897

00:27:37,430 --> 00:27:36,159

check engine light comes on when your

898

00:27:38,950 --> 00:27:37,440

check engine glide comes on hopefully

899

00:27:41,750 --> 00:27:38,960

you do something about it just like when

900

00:27:43,510 --> 00:27:41,760

you have master warning switches on on

901  
00:27:45,830 --> 00:27:43,520  
shuttle or station you're able to make

902  
00:27:47,430 --> 00:27:45,840  
sense of those things in a proactive way

903  
00:27:49,430 --> 00:27:47,440  
so i think as we as we take this data

904  
00:27:50,950 --> 00:27:49,440  
into the future

905  
00:27:52,310 --> 00:27:50,960  
and this is what the streaming data

906  
00:27:54,710 --> 00:27:52,320  
looks like sorry for the technology

907  
00:27:55,750 --> 00:27:54,720  
issue here um this is what this data

908  
00:27:57,510 --> 00:27:55,760  
looks like streaming from that little

909  
00:27:58,950 --> 00:27:57,520  
patch and that can be done and probably

910  
00:28:01,990 --> 00:27:58,960  
flown tomorrow with the right right

911  
00:28:03,830 --> 00:28:02,000  
approvals we're going from wearables to

912  
00:28:05,029 --> 00:28:03,840  
uh insideables contact lenses that

913  
00:28:06,310 --> 00:28:05,039

google has developed google's developed

914

00:28:07,990 --> 00:28:06,320

contact lenses that can track your blood

915

00:28:09,830 --> 00:28:08,000

sugar and they partner with big pharma

916

00:28:11,350 --> 00:28:09,840

to bring that to market there's pills

917

00:28:13,510 --> 00:28:11,360

you can swallow that replace an upper

918

00:28:15,669 --> 00:28:13,520

endoscopy so the way we can collect data

919

00:28:16,870 --> 00:28:15,679

is changing and there's thousands of

920

00:28:18,710 --> 00:28:16,880

these on the market now i encourage you

921

00:28:20,549 --> 00:28:18,720

just to try one that you don't ideally

922

00:28:22,549 --> 00:28:20,559

lose and start to gain insights about

923

00:28:23,830 --> 00:28:22,559

your activity or sleep that can really

924

00:28:24,710 --> 00:28:23,840

be one of the most proactive things you

925

00:28:27,029 --> 00:28:24,720

do

926

00:28:28,470 --> 00:28:27,039

that goes well beyond our blood our

927

00:28:31,350 --> 00:28:28,480

vital signs now our blood work we can

928

00:28:33,750 --> 00:28:31,360

now shrink a laboratory onto a chip this

929

00:28:35,350 --> 00:28:33,760

world of microfluidics a single drop of

930

00:28:37,190 --> 00:28:35,360

blood now can give you a hundred

931

00:28:39,269 --> 00:28:37,200

thousand biomarkers potentially and that

932

00:28:40,789 --> 00:28:39,279

can be done for pennies on the dollar we

933

00:28:43,110 --> 00:28:40,799

now have the ability to do what i often

934

00:28:44,310 --> 00:28:43,120

call a blood biopsy i'm an oncologist if

935

00:28:46,070 --> 00:28:44,320

we can get a biopsy of your blood

936

00:28:47,750 --> 00:28:46,080

instead of the tissue we can pick up

937

00:28:49,510 --> 00:28:47,760

disease early and treat it in smarter

938

00:28:50,630 --> 00:28:49,520

ways even simple things like a

939

00:28:51,830 --> 00:28:50,640

urinalysis you know the internal

940

00:28:53,510 --> 00:28:51,840

analysis strip you look at it that can

941

00:28:55,190 --> 00:28:53,520

be appaified here on the left you see a

942

00:28:56,630 --> 00:28:55,200

little dipstick with a qr code you dip

943

00:28:58,070 --> 00:28:56,640

it in the urine and you take a picture

944

00:29:00,230 --> 00:28:58,080

of your smartphone and it sends the data

945

00:29:02,149 --> 00:29:00,240

immediatly up to your clinician uh to

946

00:29:03,750 --> 00:29:02,159

the cdc to the nsa whoever wants the

947

00:29:06,070 --> 00:29:03,760

data all right

948

00:29:07,350 --> 00:29:06,080

or it's flu season right flu season you

949

00:29:08,470 --> 00:29:07,360

spit in the tube and the line show up

950

00:29:10,549 --> 00:29:08,480

kind of like a pregnancy test you take a

951  
00:29:12,149 --> 00:29:10,559  
picture of the app it can diagnose your

952  
00:29:14,630 --> 00:29:12,159  
your respiratory infection whether it's

953  
00:29:16,789 --> 00:29:14,640  
influenza or maybe ebola and speaking of

954  
00:29:18,310 --> 00:29:16,799  
things like ebola we can even now print

955  
00:29:20,389 --> 00:29:18,320  
at the point of care lab tests which

956  
00:29:22,149 --> 00:29:20,399  
might be useful on long duration or on

957  
00:29:23,750 --> 00:29:22,159  
station you can print the lab test on

958  
00:29:25,909 --> 00:29:23,760  
demand in this case one developed by

959  
00:29:27,909 --> 00:29:25,919  
harvard to pick up ebola from saliva so

960  
00:29:29,750 --> 00:29:27,919  
lots of ways to get this data now and

961  
00:29:32,470 --> 00:29:29,760  
the implications are we can help stem

962  
00:29:34,470 --> 00:29:32,480  
pandemic disease by blending information

963  
00:29:36,149 --> 00:29:34,480

we can essentially do what you've been

964

00:29:37,990 --> 00:29:36,159

doing in orbit for a long time a digital

965

00:29:39,990 --> 00:29:38,000

checkup you can pick up the vital sign

966

00:29:41,430 --> 00:29:40,000

information you can pick up the lab data

967

00:29:42,710 --> 00:29:41,440

you can communicate not with you know

968

00:29:44,070 --> 00:29:42,720

the flight doc but you're actually your

969

00:29:46,149 --> 00:29:44,080

own physician there's now a whole slew

970

00:29:48,310 --> 00:29:46,159

of apps you can download and do a

971

00:29:49,269 --> 00:29:48,320

telemedicine visit and so we're really

972

00:29:50,789 --> 00:29:49,279

going to enter an era where you're going

973

00:29:52,710 --> 00:29:50,799

to be able to connect in new empowering

974

00:29:55,510 --> 00:29:52,720

ways and bring smarter less expensive

975

00:29:57,190 --> 00:29:55,520

and more proactive healthcare

976  
00:29:58,870 --> 00:29:57,200  
and ideally remember technology is just

977  
00:30:00,789 --> 00:29:58,880  
an enabler i don't think we should we

978  
00:30:02,310 --> 00:30:00,799  
can't scale empathy this is all just to

979  
00:30:03,990 --> 00:30:02,320  
hopefully enable your own health and the

980  
00:30:05,510 --> 00:30:04,000  
patient doctor relationship and beyond

981  
00:30:07,269 --> 00:30:05,520  
ideally this technology gets out of the

982  
00:30:08,789 --> 00:30:07,279  
way and makes these things much more

983  
00:30:11,029 --> 00:30:08,799  
streamlined

984  
00:30:12,870 --> 00:30:11,039  
medical trials drug trials for example

985  
00:30:14,549 --> 00:30:12,880  
are still a big issue it takes a billion

986  
00:30:16,389 --> 00:30:14,559  
dollars 10 years

987  
00:30:18,310 --> 00:30:16,399  
half the drugs fail what if i could push

988  
00:30:19,590 --> 00:30:18,320

you an app with an actual trial on it

989

00:30:21,110 --> 00:30:19,600

maybe it's for parkinson's and i could

990

00:30:23,990 --> 00:30:21,120

use one of these trackers to track the

991

00:30:25,669 --> 00:30:24,000

the shaking well ucsf one of my

992

00:30:27,909 --> 00:30:25,679

institutions has developed a platform

993

00:30:29,590 --> 00:30:27,919

for cardiac disease on a smartphone and

994

00:30:31,590 --> 00:30:29,600

then two months ago apple came out with

995

00:30:33,190 --> 00:30:31,600

research kit you today can go down on if

996

00:30:34,549 --> 00:30:33,200

you have an apple phone and download

997

00:30:36,789 --> 00:30:34,559

clinical trials for heart disease

998

00:30:38,149 --> 00:30:36,799

parkinson's asthma and be part of a

999

00:30:40,470 --> 00:30:38,159

clinical trial just by downloading that

1000

00:30:42,070 --> 00:30:40,480

on your smartphone new ways of engaging

1001  
00:30:44,149 --> 00:30:42,080  
and empowering and connecting clinical

1002  
00:30:45,510 --> 00:30:44,159  
trials this is my device this is the app

1003  
00:30:47,430 --> 00:30:45,520  
i downloaded for

1004  
00:30:48,870 --> 00:30:47,440  
for cardiac they signed up five thousand

1005  
00:30:50,470 --> 00:30:48,880  
patients in their very first day it

1006  
00:30:52,470 --> 00:30:50,480  
would have taken a year to do otherwise

1007  
00:30:54,630 --> 00:30:52,480  
and it almost was free so think about

1008  
00:30:56,710 --> 00:30:54,640  
the democratization there and just

1009  
00:30:58,310 --> 00:30:56,720  
briefly when we think about medicine and

1010  
00:30:59,990 --> 00:30:58,320  
therapy we're going to go beyond pills

1011  
00:31:01,509 --> 00:31:00,000  
we're now earning the real error of gene

1012  
00:31:02,870 --> 00:31:01,519  
therapy where we can start to actually

1013  
00:31:04,470 --> 00:31:02,880

correct a gene

1014

00:31:06,389 --> 00:31:04,480

like for sickle cell or thalassemia and

1015

00:31:08,070 --> 00:31:06,399

have long-term cures so that's coming

1016

00:31:10,630 --> 00:31:08,080

into the clinic now and in five years

1017

00:31:12,230 --> 00:31:10,640

will be i think quite commonplace

1018

00:31:13,750 --> 00:31:12,240

so part of the lesson here as you start

1019

00:31:15,909 --> 00:31:13,760

to think exponentially and convergently

1020

00:31:17,750 --> 00:31:15,919

it's a layering of technologies that has

1021

00:31:19,350 --> 00:31:17,760

challenges the new pacemakers are

1022

00:31:21,430 --> 00:31:19,360

smaller easier to implant and they all

1023

00:31:22,870 --> 00:31:21,440

have ip addresses so what happens when

1024

00:31:25,029 --> 00:31:22,880

someone hacks your pacemaker or your

1025

00:31:26,470 --> 00:31:25,039

insulin pump or publishes your dna from

1026

00:31:28,230 --> 00:31:26,480

the cup that you had for lunch right

1027

00:31:29,909 --> 00:31:28,240

interesting implications there who owns

1028

00:31:31,110 --> 00:31:29,919

the data from our own bodies sometimes

1029

00:31:32,389 --> 00:31:31,120

the companies who make the devices don't

1030

00:31:34,549 --> 00:31:32,399

give that data away

1031

00:31:36,389 --> 00:31:34,559

so really interesting challenges there

1032

00:31:37,830 --> 00:31:36,399

one of the other challenges is there's

1033

00:31:39,590 --> 00:31:37,840

this massive amount of data how do we

1034

00:31:40,789 --> 00:31:39,600

make sense of it our brains haven't had

1035

00:31:42,950 --> 00:31:40,799

an upgrade but our technology and our

1036

00:31:44,549 --> 00:31:42,960

spacecraft getting up kept upgraded so

1037

00:31:46,230 --> 00:31:44,559

we need new tools to improve our

1038

00:31:49,190 --> 00:31:46,240

cognition and our ability to make sense

1039

00:31:50,950 --> 00:31:49,200

of this and that is already here ai

1040

00:31:52,710 --> 00:31:50,960

artificial intelligence some of you

1041

00:31:53,990 --> 00:31:52,720

might remember ibm watson beating the

1042

00:31:55,590 --> 00:31:54,000

champions of jeopardy and just beat them

1043

00:31:57,590 --> 00:31:55,600

and really beat them that was three

1044

00:31:59,269 --> 00:31:57,600

years ago ibm watson has now gone to

1045

00:32:01,029 --> 00:31:59,279

medical school and that threatened some

1046

00:32:02,630 --> 00:32:01,039

doctors oh yeah a robot ai is going to

1047

00:32:06,389 --> 00:32:02,640

take over so i like to reframe it not as

1048

00:32:07,750 --> 00:32:06,399

ai but as i a intelligence augmentation

1049

00:32:08,950 --> 00:32:07,760

and that is going to infuse everything

1050

00:32:10,630 --> 00:32:08,960

we do from

1051

00:32:12,789 --> 00:32:10,640

complex missions to how we staff a

1052

00:32:14,389 --> 00:32:12,799

hospital how we do diagnostics how we

1053

00:32:15,909 --> 00:32:14,399

pick the right therapy and we can

1054

00:32:17,190 --> 00:32:15,919

connect to watson now through our mobile

1055

00:32:19,190 --> 00:32:17,200

devices so soon you're going to have

1056

00:32:21,430 --> 00:32:19,200

like siri blended with watson on your

1057

00:32:22,950 --> 00:32:21,440

smartphone in fact ibm apple and

1058

00:32:23,830 --> 00:32:22,960

medtronic announced a partnership last

1059

00:32:25,990 --> 00:32:23,840

week where they're going to blend these

1060

00:32:27,269 --> 00:32:26,000

together so it's a really powerful time

1061

00:32:28,710 --> 00:32:27,279

and the lessons from ai i think

1062

00:32:30,870 --> 00:32:28,720

certainly apply to all the complex

1063

00:32:32,310 --> 00:32:30,880

missions that you guys build so here's

1064

00:32:34,070 --> 00:32:32,320

that check engine light idea i think

1065

00:32:35,669 --> 00:32:34,080

kind of like the ge cars have the onstar

1066

00:32:37,110 --> 00:32:35,679

for the body i think we're gonna have

1067

00:32:39,029 --> 00:32:37,120

our own check engine lights our own sort

1068

00:32:41,509 --> 00:32:39,039

of onstar that can help let us know when

1069

00:32:42,630 --> 00:32:41,519

to be proactive and be connected

1070

00:32:44,230 --> 00:32:42,640

so where does this come together a lot

1071

00:32:46,230 --> 00:32:44,240

of it's been inspired by the space world

1072

00:32:47,830 --> 00:32:46,240

and some truckies here i'm sure right

1073

00:32:49,509 --> 00:32:47,840

remember the bones mccooy with the

1074

00:32:51,110 --> 00:32:49,519

tricorder that used to be science

1075

00:32:52,470 --> 00:32:51,120

friction but now they're 100 000

1076

00:32:54,870 --> 00:32:52,480

ultrasounds that fit in your pocket and

1077

00:32:56,230 --> 00:32:54,880

do the same thing right we've seen now

1078

00:32:57,990 --> 00:32:56,240

i'm sure not many of you know the x

1079

00:32:59,990 --> 00:32:58,000

prize peter diamandis co-founded that

1080

00:33:01,830 --> 00:33:00,000

that sent spaceship one up to space

1081

00:33:03,509 --> 00:33:01,840

about 10 11 years ago there's now an x

1082

00:33:05,269 --> 00:33:03,519

prize i've been helping it with called a

1083

00:33:07,110 --> 00:33:05,279

medical tricorder x prize a 10 million

1084

00:33:09,509 --> 00:33:07,120

dollar prize to bring folks together to

1085

00:33:10,950 --> 00:33:09,519

build an actual medical tricorder and

1086

00:33:12,549 --> 00:33:10,960

one of the teams started at singularity

1087

00:33:14,070 --> 00:33:12,559

university this is actually it right

1088

00:33:15,669 --> 00:33:14,080

here this is a device you hold it to

1089

00:33:16,870 --> 00:33:15,679

your forehead as the patient at home and

1090

00:33:18,230 --> 00:33:16,880

it collects your heart rate your

1091

00:33:20,070 --> 00:33:18,240

temperature oxygen saturation your blood

1092

00:33:21,430 --> 00:33:20,080

pressure it calculates it it understands

1093

00:33:23,350 --> 00:33:21,440

your baseline it'll communicate that to

1094

00:33:25,509 --> 00:33:23,360

your clinician and what's interesting

1095

00:33:28,230 --> 00:33:25,519

about this is they crowdfunded this like

1096

00:33:29,590 --> 00:33:28,240

1.6 million dollars and 10 10 000 of

1097

00:33:31,350 --> 00:33:29,600

these shipped in the last month or so as

1098

00:33:32,310 --> 00:33:31,360

part of the trial so in a year or two i

1099

00:33:33,830 --> 00:33:32,320

expect you'll have something like this

1100

00:33:35,669 --> 00:33:33,840

in your own home which will help you

1101

00:33:37,430 --> 00:33:35,679

track your information and this has

1102

00:33:39,430 --> 00:33:37,440

design thinking built in i introduced

1103

00:33:41,269 --> 00:33:39,440

this company to ideo and we made this

1104

00:33:43,110 --> 00:33:41,279

little movie of the near future of all

1105

00:33:48,310 --> 00:33:43,120

these technologies coming together take

1106

00:33:53,509 --> 00:33:50,549

technology has given us an unprecedented

1107

00:33:55,990 --> 00:33:53,519

window into the human body

1108

00:33:59,830 --> 00:33:56,000

but on a day-to-day basis we're still in

1109

00:33:59,840 --> 00:34:03,269

we are changing that

1110

00:34:06,149 --> 00:34:04,870

what if instead of fearing the worst

1111

00:34:08,149 --> 00:34:06,159

when you noticed something out of the

1112

00:34:12,310 --> 00:34:08,159

ordinary you could identify the

1113

00:34:16,629 --> 00:34:14,149

getting the right diagnosis would save

1114

00:34:19,349 --> 00:34:16,639

you worry says it's roseola

1115

00:34:22,069 --> 00:34:19,359

and an unnecessary doctor's visit

1116

00:34:23,669 --> 00:34:22,079

rest at home it's okay

1117

00:34:26,069 --> 00:34:23,679

instead of hearing about a viral

1118

00:34:27,829 --> 00:34:26,079

outbreak on the news imagine you got an

1119

00:34:32,550 --> 00:34:27,839

alert

1120

00:34:38,710 --> 00:34:34,389

it would also give you advice about what

1121

00:34:43,190 --> 00:34:40,470

what if you had a way to identify what

1122

00:34:45,829 --> 00:34:43,200

was wrong right away

1123

00:34:47,589 --> 00:34:45,839

it says it's 103.8 a way to get all of

1124

00:34:56,230 --> 00:34:47,599

the information you need to understand

1125

00:34:59,589 --> 00:34:57,990

and in serious cases

1126

00:35:06,630 --> 00:34:59,599

you would know when and where to seek

1127

00:35:10,230 --> 00:35:08,470

we're building a way for people to check

1128

00:35:12,550 --> 00:35:10,240

their bodies as often as they check

1129

00:35:14,310 --> 00:35:12,560

their email

1130

00:35:16,950 --> 00:35:14,320

it's all possible

1131

00:35:18,550 --> 00:35:16,960

and it's only the beginning

1132

00:35:20,150 --> 00:35:18,560

but this technology is coming those you

1133

00:35:21,750 --> 00:35:20,160

like to measure your data and in fact

1134

00:35:23,190 --> 00:35:21,760

again they funded this they crowdfunded

1135

00:35:25,750 --> 00:35:23,200

the clinical trial for this so new ways

1136

00:35:27,510 --> 00:35:25,760

of funding innovation are here as well

1137

00:35:28,630 --> 00:35:27,520

and that means we're all not just silos

1138

00:35:29,990 --> 00:35:28,640

we're not individuals we're all part of

1139

00:35:32,390 --> 00:35:30,000

a connected system whether you're part

1140

00:35:34,550 --> 00:35:32,400

of a crew or a family or a community our

1141

00:35:36,150 --> 00:35:34,560

social networks play a huge role in our

1142

00:35:37,829 --> 00:35:36,160

health whether it's depression or

1143

00:35:39,349 --> 00:35:37,839

obesity and we're learning that our

1144

00:35:41,589 --> 00:35:39,359

behaviors are much more impactful than

1145

00:35:43,109 --> 00:35:41,599

our baseline genetics if we can moderate

1146

00:35:45,109 --> 00:35:43,119

our behaviors we can have a huge impact

1147

00:35:46,550 --> 00:35:45,119

on our costs of care for example and

1148

00:35:47,829 --> 00:35:46,560

there are new ways to do that if you're

1149

00:35:48,870 --> 00:35:47,839

pre-diabetic and you're discovering

1150

00:35:50,390 --> 00:35:48,880

you're about to become a diabetic and

1151  
00:35:52,150 --> 00:35:50,400  
have a lot of costly and expensive

1152  
00:35:54,069 --> 00:35:52,160  
medical issues you can now download an

1153  
00:35:55,430 --> 00:35:54,079  
app called armada health and be part of

1154  
00:35:56,710 --> 00:35:55,440  
a social network and learn to turn

1155  
00:35:58,630 --> 00:35:56,720  
around pre-diabetes so you're not

1156  
00:36:00,390 --> 00:35:58,640  
diabetic anymore that's a new way of

1157  
00:36:01,910 --> 00:36:00,400  
prescribing behavior change or what if

1158  
00:36:03,910 --> 00:36:01,920  
you could see future you you look in the

1159  
00:36:05,109 --> 00:36:03,920  
mirror and you see future you right

1160  
00:36:07,349 --> 00:36:05,119  
that's going to inspire some folks that

1161  
00:36:09,430 --> 00:36:07,359  
we might re write your brain or if you

1162  
00:36:11,589 --> 00:36:09,440  
keep having donuts for breakfast future

1163  
00:36:12,790 --> 00:36:11,599

you right that might inspire you and you

1164

00:36:14,069 --> 00:36:12,800

don't need to wait for the magic mirror

1165

00:36:15,270 --> 00:36:14,079

you can download an app here's me now

1166

00:36:17,109 --> 00:36:15,280

here's me a thousand donuts later

1167

00:36:19,670 --> 00:36:17,119

featuring me you know so i vote the

1168

00:36:20,870 --> 00:36:19,680

donut or if you have a kid or a patient

1169

00:36:22,310 --> 00:36:20,880

who smokes two packs a day you can show

1170

00:36:23,910 --> 00:36:22,320

them what their skin's gonna look like

1171

00:36:24,710 --> 00:36:23,920

that might change your perceptions or if

1172

00:36:26,069 --> 00:36:24,720

you're spending too much time on

1173

00:36:28,150 --> 00:36:26,079

facebook you know lots of ways to see

1174

00:36:29,990 --> 00:36:28,160

the future

1175

00:36:31,510 --> 00:36:30,000

including now this amazing world of

1176  
00:36:32,630 --> 00:36:31,520  
augmented reality you know many of the

1177  
00:36:34,710 --> 00:36:32,640  
astronauts are training with augmented

1178  
00:36:36,390 --> 00:36:34,720  
reality that's a three that company was

1179  
00:36:37,910 --> 00:36:36,400  
acquired for three billion dollars and

1180  
00:36:38,870 --> 00:36:37,920  
google said hi we can build one of those

1181  
00:36:40,150 --> 00:36:38,880  
for ten dollars this is the cardboard

1182  
00:36:41,750 --> 00:36:40,160  
cardboard-based version you slot your

1183  
00:36:43,030 --> 00:36:41,760  
smartphone and you're in a virtual world

1184  
00:36:44,310 --> 00:36:43,040  
that can do everything from from

1185  
00:36:46,150 --> 00:36:44,320  
training on missions and maintaining

1186  
00:36:48,390 --> 00:36:46,160  
currency on space flight to learning

1187  
00:36:49,349 --> 00:36:48,400  
anatomy to treating ptsd to being all

1188  
00:36:50,950 --> 00:36:49,359

sorts of new environments we're gonna

1189

00:36:53,349 --> 00:36:50,960

see a lot happen with augmented and

1190

00:36:54,710 --> 00:36:53,359

virtual reality especially in healthcare

1191

00:36:56,470 --> 00:36:54,720

and especially as you want situational

1192

00:36:58,230 --> 00:36:56,480

awareness if you're a pilot a physician

1193

00:37:00,230 --> 00:36:58,240

a surgeon or a patient think about how

1194

00:37:02,230 --> 00:37:00,240

that's going to integrate in your lives

1195

00:37:03,589 --> 00:37:02,240

and we can be telepresent as well not

1196

00:37:04,710 --> 00:37:03,599

just with wearables but telepresent

1197

00:37:06,950 --> 00:37:04,720

robotics we can already round in

1198

00:37:08,790 --> 00:37:06,960

hospitals with special robots i was

1199

00:37:09,750 --> 00:37:08,800

actually on a panel meet dr droid i

1200

00:37:11,510 --> 00:37:09,760

couldn't be there in person so i showed

1201  
00:37:13,270 --> 00:37:11,520  
up on the left in the panel on the robot

1202  
00:37:15,109 --> 00:37:13,280  
new ways to be telepresently

1203  
00:37:16,550 --> 00:37:15,119  
localized you guys do all that already

1204  
00:37:18,950 --> 00:37:16,560  
in orbit but that's going to change

1205  
00:37:21,670 --> 00:37:18,960  
health care we have robots delivering

1206  
00:37:23,910 --> 00:37:21,680  
labs and x-rays in hospitals we have

1207  
00:37:25,910 --> 00:37:23,920  
robots enabling the disabled one of the

1208  
00:37:27,270 --> 00:37:25,920  
most exciting areas now is

1209  
00:37:29,270 --> 00:37:27,280  
enabling the disabled with things like

1210  
00:37:31,190 --> 00:37:29,280  
brain computer interface this is my alma

1211  
00:37:32,630 --> 00:37:31,200  
mater brown university's work a small

1212  
00:37:34,150 --> 00:37:32,640  
chip on the motor cortex of a woman

1213  
00:37:36,310 --> 00:37:34,160

who's quadriplegic can't move from the

1214

00:37:38,630 --> 00:37:36,320

neck down just enables her now to think

1215

00:37:40,390 --> 00:37:38,640

and she's able now to control a drink of

1216

00:37:42,069 --> 00:37:40,400

give herself her first coffee in 16

1217

00:37:43,829 --> 00:37:42,079

years that's transformative and we're

1218

00:37:45,750 --> 00:37:43,839

going to see brain computer interface

1219

00:37:47,510 --> 00:37:45,760

completely change how the disabled get

1220

00:37:49,270 --> 00:37:47,520

around and also enable us super enable

1221

00:37:50,710 --> 00:37:49,280

us maybe the folks uh you know when

1222

00:37:51,670 --> 00:37:50,720

they're on mars will have a chip on

1223

00:37:53,430 --> 00:37:51,680

their brain which enables them to

1224

00:37:55,510 --> 00:37:53,440

control things this is coming

1225

00:37:58,390 --> 00:37:55,520

and this also blends with health and

1226  
00:37:59,829 --> 00:37:58,400  
prevention yoga meditation ancient

1227  
00:38:01,430 --> 00:37:59,839  
practices can be

1228  
00:38:03,589 --> 00:38:01,440  
really good for you what if we can now

1229  
00:38:05,430 --> 00:38:03,599  
use brain computer interface to track

1230  
00:38:07,670 --> 00:38:05,440  
that for yourself well you don't need to

1231  
00:38:10,150 --> 00:38:07,680  
have a a version like that you can now

1232  
00:38:11,910 --> 00:38:10,160  
buy one for 200 wear this headset it can

1233  
00:38:13,829 --> 00:38:11,920  
track your brain waves here's my mind

1234  
00:38:15,589 --> 00:38:13,839  
being calm for a few minutes actually we

1235  
00:38:16,950 --> 00:38:15,599  
can prescribe meditation or mindfulness

1236  
00:38:18,470 --> 00:38:16,960  
that can lower depression or anxiety

1237  
00:38:19,990 --> 00:38:18,480  
might be useful on long-duration

1238  
00:38:21,190 --> 00:38:20,000

missions all sorts of ways you might

1239

00:38:23,030 --> 00:38:21,200

think about using these in your daily

1240

00:38:24,470 --> 00:38:23,040

life it's even being used to train kids

1241

00:38:26,069 --> 00:38:24,480

who have attention attention deficit

1242

00:38:27,990 --> 00:38:26,079

disorder to get focused they learn to

1243

00:38:29,190 --> 00:38:28,000

focus with headset and when they're done

1244

00:38:30,829 --> 00:38:29,200

they don't need they get off of their

1245

00:38:32,870 --> 00:38:30,839

riddle and other

1246

00:38:35,349 --> 00:38:32,880

medications we're even learning to use

1247

00:38:36,790 --> 00:38:35,359

video games for good changing your main

1248

00:38:38,710 --> 00:38:36,800

your wiring of your brain using gaming

1249

00:38:41,109 --> 00:38:38,720

and headsets are going to be shown to be

1250

00:38:43,030 --> 00:38:41,119

very beneficial in many modalities

1251

00:38:44,390 --> 00:38:43,040

all right wearable robotics something

1252

00:38:45,750 --> 00:38:44,400

and robotics has been used in the space

1253

00:38:47,589 --> 00:38:45,760

program for years but now it's coming to

1254

00:38:49,990 --> 00:38:47,599

the disabled to enable someone who's

1255

00:38:51,190 --> 00:38:50,000

paralyzed uh to walk in this case you

1256

00:38:53,510 --> 00:38:51,200

have a woman who's wearing an

1257

00:38:54,710 --> 00:38:53,520

exoskeleton and she's able to walk and

1258

00:38:56,870 --> 00:38:54,720

what's really interesting about that is

1259

00:38:59,109 --> 00:38:56,880

part of that is 3d printed to match her

1260

00:39:00,790 --> 00:38:59,119

own personalized anatomy so we're going

1261

00:39:02,710 --> 00:39:00,800

to see a lot of changes

1262

00:39:04,470 --> 00:39:02,720

not just in treating spinal cord injury

1263

00:39:05,750 --> 00:39:04,480

with robots what about curing it my

1264

00:39:07,349 --> 00:39:05,760

field of stem cells and regenerative

1265

00:39:09,750 --> 00:39:07,359

medicine the gentleman on my left there

1266

00:39:11,430 --> 00:39:09,760

won the nobel prize two years ago for

1267

00:39:13,030 --> 00:39:11,440

now we can take a skin cell and

1268

00:39:14,790 --> 00:39:13,040

reprogram that to be your own

1269

00:39:16,390 --> 00:39:14,800

pluripotent stem cell

1270

00:39:17,990 --> 00:39:16,400

and we're blending stem cell biology

1271

00:39:19,750 --> 00:39:18,000

with the world of 3d printing something

1272

00:39:21,030 --> 00:39:19,760

many of you work with all the time but

1273

00:39:22,870 --> 00:39:21,040

3d printing is actually starting to

1274

00:39:24,630 --> 00:39:22,880

impact healthcare in powerful ways from

1275

00:39:26,310 --> 00:39:24,640

neurosurgical devices to making a

1276

00:39:28,790 --> 00:39:26,320

prosthetic limb that matches the missing

1277

00:39:30,310 --> 00:39:28,800

leg to making braces and crutches that

1278

00:39:32,470 --> 00:39:30,320

might match your own arm here i have a

1279

00:39:34,150 --> 00:39:32,480

little 3d printed uh brace for my hand

1280

00:39:35,430 --> 00:39:34,160

for example that can be printed out at

1281

00:39:37,109 --> 00:39:35,440

the point of care

1282

00:39:39,190 --> 00:39:37,119

we're seeing those for scoliosis we're

1283

00:39:40,630 --> 00:39:39,200

seeing them make new knee and hip

1284

00:39:42,790 --> 00:39:40,640

implants that completely match the

1285

00:39:44,310 --> 00:39:42,800

patient's anatomy we can see them being

1286

00:39:45,349 --> 00:39:44,320

used for surgical planning and actual

1287

00:39:46,390 --> 00:39:45,359

surgeries

1288

00:39:47,829 --> 00:39:46,400

and you can even take something like a

1289

00:39:49,030 --> 00:39:47,839

microsoft connect and print yourself

1290

00:39:51,270 --> 00:39:49,040

i've got many of me in my pocket he's

1291

00:39:52,550 --> 00:39:51,280

kind of cute and small doesn't eat much

1292

00:39:53,829 --> 00:39:52,560

but what if i have a patient who's lost

1293

00:39:55,589 --> 00:39:53,839

part of his face from cancer we can make

1294

00:39:56,950 --> 00:39:55,599

a prosthetic that matches so really

1295

00:39:58,550 --> 00:39:56,960

powerful ways of moving there and i was

1296

00:39:59,670 --> 00:39:58,560

just at the ted conference and they

1297

00:40:01,510 --> 00:39:59,680

announced their

1298

00:40:03,270 --> 00:40:01,520

motive doing that a thousand a hundred a

1299

00:40:04,950 --> 00:40:03,280

thousand times faster in terms of

1300

00:40:07,109 --> 00:40:04,960

printing actual objects so watch that

1301

00:40:08,710 --> 00:40:07,119

space we'll be on station or on mars and

1302

00:40:09,910 --> 00:40:08,720

able to press a button and really print

1303

00:40:11,670 --> 00:40:09,920

something within minutes this is a bit

1304

00:40:13,750 --> 00:40:11,680

of a spit up version but this is coming

1305

00:40:16,069 --> 00:40:13,760

uh really quickly and is disrupting even

1306

00:40:17,109 --> 00:40:16,079

the 3d printing industry itself

1307

00:40:18,309 --> 00:40:17,119

all right

1308

00:40:20,069 --> 00:40:18,319

and what we're going to blend 3d

1309

00:40:21,829 --> 00:40:20,079

printing with tissue biology whether

1310

00:40:23,589 --> 00:40:21,839

it's the early days of making tracheas

1311

00:40:25,270 --> 00:40:23,599

and bladders all the way to making more

1312

00:40:26,470 --> 00:40:25,280

complex organs like kidneys livers and

1313

00:40:28,069 --> 00:40:26,480

hearts which are in the early stages

1314

00:40:29,430 --> 00:40:28,079

today but might be in the clinic within

1315

00:40:31,510 --> 00:40:29,440

10 years

1316

00:40:33,750 --> 00:40:31,520

so why am i talking to you as a

1317

00:40:35,990 --> 00:40:33,760

as a former nasa jsc medical student and

1318

00:40:37,190 --> 00:40:36,000

hemoglobin transplant doctor well i've

1319

00:40:39,030 --> 00:40:37,200

been sharing the medicine track at

1320

00:40:41,589 --> 00:40:39,040

singularity university since it started

1321

00:40:43,430 --> 00:40:41,599

in 2009 we bring amazing folks together

1322

00:40:45,589 --> 00:40:43,440

to cross-train in medicine biotech

1323

00:40:47,270 --> 00:40:45,599

robotics ai 3d printing space and beyond

1324

00:40:48,630 --> 00:40:47,280

co-founded by peter dumanis from xprize

1325

00:40:50,230 --> 00:40:48,640

and ray kurzweil who's now the director

1326

00:40:51,589 --> 00:40:50,240

of engineering at google our head of

1327

00:40:53,190 --> 00:40:51,599

faculty for the first few years was

1328

00:40:55,349 --> 00:40:53,200

astronaut physician dan barry who some

1329

00:40:57,510 --> 00:40:55,359

of you might remember uh great guys

1330

00:40:58,630 --> 00:40:57,520

still involved in our faculty and we we

1331

00:41:00,069 --> 00:40:58,640

start to ask the question how do you

1332

00:41:02,150 --> 00:41:00,079

take these technologies to address grand

1333

00:41:04,390 --> 00:41:02,160

challenges in in space exploration

1334

00:41:06,150 --> 00:41:04,400

energy poverty global health and we've

1335

00:41:07,589 --> 00:41:06,160

had some amazing innovations come from

1336

00:41:09,430 --> 00:41:07,599

using drones to deliver drugs and

1337

00:41:10,950 --> 00:41:09,440

vaccines already now doing this uh

1338

00:41:12,230 --> 00:41:10,960

piloting this in the developing world

1339

00:41:13,670 --> 00:41:12,240

and speaking of drones you can have one

1340

00:41:14,950 --> 00:41:13,680

in your pocket now right there are

1341

00:41:17,030 --> 00:41:14,960

drones that are being delivering

1342

00:41:18,069 --> 00:41:17,040

defibrillators even in san francisco

1343

00:41:19,829 --> 00:41:18,079

there's a company that wants to deliver

1344

00:41:20,950 --> 00:41:19,839

your drugs by drone not sure what kind

1345

00:41:23,589 --> 00:41:20,960

of drugs in san francisco but they're

1346

00:41:24,870 --> 00:41:23,599

delivered by drone drones in your pocket

1347

00:41:26,630 --> 00:41:24,880

so lots is happening there from

1348

00:41:27,589 --> 00:41:26,640

telepresent gloves and beyond and

1349

00:41:29,430 --> 00:41:27,599

because

1350

00:41:30,870 --> 00:41:29,440

3d printing is interesting one of our

1351  
00:41:32,950 --> 00:41:30,880  
student teams one of our student teams

1352  
00:41:35,030 --> 00:41:32,960  
from three years ago flew with you guys

1353  
00:41:37,109 --> 00:41:35,040  
made in space just this fall the first

1354  
00:41:38,950 --> 00:41:37,119  
3d printer went to space station and i

1355  
00:41:40,390 --> 00:41:38,960  
think that has amazing implications

1356  
00:41:42,069 --> 00:41:40,400  
including one of our other colleagues

1357  
00:41:43,270 --> 00:41:42,079  
was the first to 3d print on the ground

1358  
00:41:44,790 --> 00:41:43,280  
medical instruments so what do you have

1359  
00:41:47,030 --> 00:41:44,800  
a medical case on station or beyond and

1360  
00:41:48,550 --> 00:41:47,040  
you can print devices medical devices on

1361  
00:41:49,670 --> 00:41:48,560  
demand i think that's coming and that's

1362  
00:41:51,109 --> 00:41:49,680  
something that came out of singularity

1363  
00:41:52,630 --> 00:41:51,119

university

1364

00:41:53,910 --> 00:41:52,640

so because so many folks were interested

1365

00:41:55,829 --> 00:41:53,920

in health care and the blending of

1366

00:41:57,349 --> 00:41:55,839

technologies i put together a program

1367

00:41:59,109 --> 00:41:57,359

called exponential medicine we have it

1368

00:42:00,829 --> 00:41:59,119

every fall now it's at the hotel del

1369

00:42:02,390 --> 00:42:00,839

coronado please come join us

1370

00:42:04,550 --> 00:42:02,400

exponentialmedicine.com is the website

1371

00:42:05,990 --> 00:42:04,560

and it's that thinking now of different

1372

00:42:08,069 --> 00:42:06,000

technologies thinking exponentially

1373

00:42:09,670 --> 00:42:08,079

thinking convergently it helps bring us

1374

00:42:11,190 --> 00:42:09,680

to this future right and it's new

1375

00:42:13,510 --> 00:42:11,200

thinking it's not just

1376

00:42:14,950 --> 00:42:13,520

docs and drug device people it's

1377

00:42:16,550 --> 00:42:14,960

robotics folks all you folks have

1378

00:42:18,309 --> 00:42:16,560

amazing skills that might be applied to

1379

00:42:19,670 --> 00:42:18,319

spaceflight but also apply to healthcare

1380

00:42:22,309 --> 00:42:19,680

so i encourage you to get involved in

1381

00:42:23,910 --> 00:42:22,319

hackathons and startup incubators and

1382

00:42:25,430 --> 00:42:23,920

bring folks here from other worlds to

1383

00:42:26,390 --> 00:42:25,440

help you innovate the future space

1384

00:42:28,390 --> 00:42:26,400

flight

1385

00:42:30,069 --> 00:42:28,400

even designers play a role right design

1386

00:42:32,150 --> 00:42:30,079

thinking can infuse everything from how

1387

00:42:33,990 --> 00:42:32,160

you design a cane to the future of a

1388

00:42:36,230 --> 00:42:34,000

hospital room to the future of a crew

1389

00:42:37,190 --> 00:42:36,240

cabin all that requires new integrative

1390

00:42:38,790 --> 00:42:37,200

thinking

1391

00:42:41,510 --> 00:42:38,800

and since i've been a pilot since since

1392

00:42:42,870 --> 00:42:41,520

college i love the idea of lessons from

1393

00:42:43,910 --> 00:42:42,880

aviation and space flight applied to

1394

00:42:44,870 --> 00:42:43,920

health healthcare because you know if

1395

00:42:45,910 --> 00:42:44,880

you fly in virgin america it's a

1396

00:42:47,589 --> 00:42:45,920

different experience than others that's

1397

00:42:48,710 --> 00:42:47,599

the design of the whole flight

1398

00:42:50,550 --> 00:42:48,720

experience

1399

00:42:53,829 --> 00:42:50,560

and um thanks to one of the former

1400

00:42:55,190 --> 00:42:53,839

flight surgeons here uh oh gosh

1401

00:42:57,670 --> 00:42:55,200

pat mcgenis i joined the air national

1402

00:42:59,430 --> 00:42:57,680

guard as a flight surgeon

1403

00:43:01,910 --> 00:42:59,440

when i was a resident at mass general

1404

00:43:03,750 --> 00:43:01,920

and what i learned there is technology

1405

00:43:05,270 --> 00:43:03,760

sometimes fails us

1406

00:43:07,990 --> 00:43:05,280

but

1407

00:43:11,270 --> 00:43:08,000

flight surgeon i've had some amazing

1408

00:43:13,109 --> 00:43:11,280

experiences flying into f-16s and f-15s

1409

00:43:15,270 --> 00:43:13,119

and the lessons from there uh are

1410

00:43:16,550 --> 00:43:15,280

powerful right many of you uh developed

1411

00:43:18,950 --> 00:43:16,560

them yourself here's some fun flying

1412

00:43:20,710 --> 00:43:18,960

photos but lessons from aviation and

1413

00:43:22,150 --> 00:43:20,720

medicine so one of them that you all use

1414

00:43:24,150 --> 00:43:22,160

every day are checklists checklists have

1415

00:43:25,349 --> 00:43:24,160

now transformed the operating room we

1416

00:43:28,069 --> 00:43:25,359

don't cut off the wrong leg which has

1417

00:43:30,390 --> 00:43:28,079

happened right um and uh whether the

1418

00:43:32,309 --> 00:43:30,400

checklist on shuttle or checklist for a

1419

00:43:33,910 --> 00:43:32,319

patient this is changing the way we do

1420

00:43:35,670 --> 00:43:33,920

healthcare and those checklists can now

1421

00:43:36,870 --> 00:43:35,680

be personalized and tuned to the

1422

00:43:38,550 --> 00:43:36,880

individual to you you can have your own

1423

00:43:39,990 --> 00:43:38,560

personal checklist we're seeing lessons

1424

00:43:42,069 --> 00:43:40,000

from simulation something you guys do

1425

00:43:43,589 --> 00:43:42,079

really well has made space flight safer

1426  
00:43:45,670 --> 00:43:43,599  
is now coming to the operating room and

1427  
00:43:48,069 --> 00:43:45,680  
every medical student now trains on uh

1428  
00:43:50,309 --> 00:43:48,079  
not cadavers but on on simulation this

1429  
00:43:51,750 --> 00:43:50,319  
is the sim center at stanford here we go

1430  
00:43:53,109 --> 00:43:51,760  
and now we bring teams together just

1431  
00:43:54,950 --> 00:43:53,119  
like you bring crews together to train

1432  
00:43:56,950 --> 00:43:54,960  
on procedures and dramatically improves

1433  
00:43:58,150 --> 00:43:56,960  
outcomes we can even simulate organs on

1434  
00:43:59,430 --> 00:43:58,160  
chips

1435  
00:44:01,750 --> 00:43:59,440  
a couple last lessons i've got two

1436  
00:44:04,470 --> 00:44:01,760  
minutes left is heads up display how do

1437  
00:44:06,150 --> 00:44:04,480  
we see data differently you know the old

1438  
00:44:07,910 --> 00:44:06,160

round dials now we're in the glass

1439

00:44:09,750 --> 00:44:07,920

cockpit era that gives the pilot and the

1440

00:44:11,270 --> 00:44:09,760

crew situational awareness how do we

1441

00:44:13,270 --> 00:44:11,280

bring situational awareness to the

1442

00:44:14,630 --> 00:44:13,280

intensive care unit lockheed martin the

1443

00:44:16,309 --> 00:44:14,640

fighter pilot company

1444

00:44:18,309 --> 00:44:16,319

is working with hopkins to make the new

1445

00:44:20,230 --> 00:44:18,319

intensive care unit how do we think take

1446

00:44:22,230 --> 00:44:20,240

the heads up display of the of the

1447

00:44:24,230 --> 00:44:22,240

flying world and bring it down and how

1448

00:44:25,510 --> 00:44:24,240

do we bring the other clues like like

1449

00:44:26,390 --> 00:44:25,520

bitching bob or bitching betty tells you

1450

00:44:27,750 --> 00:44:26,400

to pull up and you're about to hit a

1451  
00:44:29,670 --> 00:44:27,760  
mountain

1452  
00:44:31,030 --> 00:44:29,680  
right outside we bring that sensibility

1453  
00:44:32,390 --> 00:44:31,040  
to our health care because we need

1454  
00:44:34,630 --> 00:44:32,400  
different data if we're landing in bad

1455  
00:44:35,910 --> 00:44:34,640  
weather or we're in a dog fight

1456  
00:44:37,190 --> 00:44:35,920  
and we have dashboards already that

1457  
00:44:39,430 --> 00:44:37,200  
influence our behavior in some of our

1458  
00:44:41,670 --> 00:44:39,440  
cars we can drive to hit the right speed

1459  
00:44:43,990 --> 00:44:41,680  
uh an element and we want our own

1460  
00:44:46,069 --> 00:44:44,000  
personal gps to be like daniel go right

1461  
00:44:47,109 --> 00:44:46,079  
to the gym not let the mcdonald's all

1462  
00:44:48,309 --> 00:44:47,119  
right that's going to come you can have

1463  
00:44:50,069 --> 00:44:48,319

a gps that's going to help guide you

1464

00:44:51,910 --> 00:44:50,079

through your your life based on your own

1465

00:44:53,349 --> 00:44:51,920

information not too much data starbucks

1466

00:44:55,109 --> 00:44:53,359

squirrels be a little overwhelmed you

1467

00:44:56,870 --> 00:44:55,119

need to tune that to the individual as

1468

00:44:57,750 --> 00:44:56,880

we go

1469

00:44:59,589 --> 00:44:57,760

and we're going to see the world

1470

00:45:01,910 --> 00:44:59,599

differently we're already in the era of

1471

00:45:03,430 --> 00:45:01,920

basically bionic eyes

1472

00:45:05,030 --> 00:45:03,440

but even those who are lucky what those

1473

00:45:06,470 --> 00:45:05,040

of us are lucky to see normally we're

1474

00:45:07,750 --> 00:45:06,480

going to see augmented vision contact

1475

00:45:10,150 --> 00:45:07,760

lenses that can bring the internet to

1476  
00:45:11,829 --> 00:45:10,160  
our eyeball which also has a dark side

1477  
00:45:12,710 --> 00:45:11,839  
some interesting applications here's a

1478  
00:45:13,990 --> 00:45:12,720  
vision of the future you have your

1479  
00:45:15,510 --> 00:45:14,000  
contact lens on and you're on a tough

1480  
00:45:20,470 --> 00:45:15,520  
date you so you bring up some little

1481  
00:45:22,390 --> 00:45:21,589  
you can figure out what that does so

1482  
00:45:24,550 --> 00:45:22,400  
there's a dark side of these

1483  
00:45:25,750 --> 00:45:24,560  
technologies but these sorts of ways of

1484  
00:45:27,190 --> 00:45:25,760  
seeing the world differently are already

1485  
00:45:29,190 --> 00:45:27,200  
transforming healthcare google glass has

1486  
00:45:30,550 --> 00:45:29,200  
had a bit of a bad rap but one of its

1487  
00:45:32,390 --> 00:45:30,560  
best applications and this is still like

1488  
00:45:34,150 --> 00:45:32,400

a version 1.0 remember

1489

00:45:35,589 --> 00:45:34,160

is in healthcare so your doctor can know

1490

00:45:37,190 --> 00:45:35,599

you and some more information about you

1491

00:45:38,150 --> 00:45:37,200

when they see them or the surgeon can

1492

00:45:40,230 --> 00:45:38,160

have the right information as they're

1493

00:45:41,510 --> 00:45:40,240

operating on you or the anesthesiologist

1494

00:45:43,270 --> 00:45:41,520

has vital sign data sort of this

1495

00:45:45,030 --> 00:45:43,280

heads-up display in our environment can

1496

00:45:46,230 --> 00:45:45,040

be used in all sorts of ways and this

1497

00:45:47,670 --> 00:45:46,240

again this is the very early days of

1498

00:45:49,430 --> 00:45:47,680

this sort of technology we're going to

1499

00:45:51,109 --> 00:45:49,440

see it become ubiquitous to the point

1500

00:45:52,870 --> 00:45:51,119

where you see your breakfast in one way

1501  
00:45:54,390 --> 00:45:52,880  
maybe you've seen a different way and

1502  
00:45:55,670 --> 00:45:54,400  
maybe a little warning before you dive

1503  
00:45:57,829 --> 00:45:55,680  
in

1504  
00:46:02,870 --> 00:45:57,839  
pull up pull up

1505  
00:46:04,309 --> 00:46:02,880  
would be radar when we fly

1506  
00:46:05,430 --> 00:46:04,319  
we are we're on air traffic control we

1507  
00:46:06,550 --> 00:46:05,440  
know where all the airplanes are what if

1508  
00:46:08,790 --> 00:46:06,560  
you knew where all the patients were

1509  
00:46:10,470 --> 00:46:08,800  
like you or if part of a clinical trial

1510  
00:46:11,589 --> 00:46:10,480  
what if we could crowdsource our medical

1511  
00:46:13,670 --> 00:46:11,599  
data just like we crowdsource our

1512  
00:46:14,870 --> 00:46:13,680  
driving data you give up a little

1513  
00:46:16,069 --> 00:46:14,880

privacy when you drive with google by

1514

00:46:17,750 --> 00:46:16,079

the way they know your speed and

1515

00:46:19,829 --> 00:46:17,760

location and from that you can build in

1516

00:46:21,829 --> 00:46:19,839

this case a map of rome this is waze

1517

00:46:23,109 --> 00:46:21,839

this is just from driver data and you

1518

00:46:24,790 --> 00:46:23,119

now know the best drop to work how to

1519

00:46:26,309 --> 00:46:24,800

avoid the traffic that's crowd source

1520

00:46:28,710 --> 00:46:26,319

information i think we can apply that

1521

00:46:30,230 --> 00:46:28,720

same thinking health medicine and even

1522

00:46:32,470 --> 00:46:30,240

the future space flight crowdsourcing

1523

00:46:34,150 --> 00:46:32,480

the wisdom of the crowd and changes from

1524

00:46:35,349 --> 00:46:34,160

this era of flying seat of the pants

1525

00:46:36,710 --> 00:46:35,359

where we have limited data we're

1526

00:46:38,630 --> 00:46:36,720

practicing medicine it's the art of

1527

00:46:39,990 --> 00:46:38,640

medicine where we can use all these new

1528

00:46:42,390 --> 00:46:40,000

technologies and bring them together in

1529

00:46:44,470 --> 00:46:42,400

smart ways even our social networks can

1530

00:46:45,750 --> 00:46:44,480

give us clues as to who's healthy and

1531

00:46:47,349 --> 00:46:45,760

who's not healthy in what particular

1532

00:46:48,309 --> 00:46:47,359

neighborhood just by people's google

1533

00:46:50,069 --> 00:46:48,319

searches

1534

00:46:51,829 --> 00:46:50,079

or their social network data and believe

1535

00:46:53,910 --> 00:46:51,839

it or not you can mine facebook now and

1536

00:46:55,829 --> 00:46:53,920

say who might you want to avoid shaking

1537

00:46:57,990 --> 00:46:55,839

hands with that day that data's there uh

1538

00:47:00,150 --> 00:46:58,000

just not accessible quite yet

1539

00:47:01,430 --> 00:47:00,160

so just like you have dashboards with

1540

00:47:03,510 --> 00:47:01,440

many of your day-to-day jobs we have

1541

00:47:05,750 --> 00:47:03,520

dashboards for our health for our entire

1542

00:47:07,829 --> 00:47:05,760

life missions that can apply obviously

1543

00:47:09,270 --> 00:47:07,839

to the to the aviation space world we

1544

00:47:11,430 --> 00:47:09,280

can take these wearable devices now and

1545

00:47:13,270 --> 00:47:11,440

crowdsource data this is a wearable

1546

00:47:14,870 --> 00:47:13,280

jawbone and we can tell

1547

00:47:16,150 --> 00:47:14,880

near an earthquake this was in napa last

1548

00:47:17,670 --> 00:47:16,160

summer who woke up folks near the

1549

00:47:18,950 --> 00:47:17,680

earthquake woke up you can tell that you

1550

00:47:20,950 --> 00:47:18,960

can tell from this crowd source data

1551  
00:47:23,349 --> 00:47:20,960  
where folks go to sleep at what time on

1552  
00:47:25,349 --> 00:47:23,359  
average so new ways of gathering

1553  
00:47:27,349 --> 00:47:25,359  
information and being more proactive and

1554  
00:47:29,430 --> 00:47:27,359  
hitting disease and picking it up before

1555  
00:47:30,950 --> 00:47:29,440  
it becomes a problem so i'd encourage

1556  
00:47:32,069 --> 00:47:30,960  
you to start thinking in a contextual

1557  
00:47:34,309 --> 00:47:32,079  
form you already do that with space

1558  
00:47:36,230 --> 00:47:34,319  
flight in terms of systems in terms of

1559  
00:47:38,309 --> 00:47:36,240  
design thinking as we go

1560  
00:47:40,470 --> 00:47:38,319  
and thinking exponentially layering

1561  
00:47:42,390 --> 00:47:40,480  
these technologies together and thinking

1562  
00:47:43,589 --> 00:47:42,400  
about how they overlap and as we invent

1563  
00:47:45,030 --> 00:47:43,599

the future don't just think about

1564

00:47:47,349 --> 00:47:45,040

technology today move to where it's

1565

00:47:48,549 --> 00:47:47,359

going to be and if we do that we can

1566

00:47:50,790 --> 00:47:48,559

move from this era where we've been

1567

00:47:52,950 --> 00:47:50,800

stuck in healthcare since 1846 or beyond

1568

00:47:53,990 --> 00:47:52,960

very episodic and reactive to one that's

1569

00:47:55,829 --> 00:47:54,000

much more

1570

00:47:57,030 --> 00:47:55,839

continual and proactive and you can all

1571

00:47:58,069 --> 00:47:57,040

start doing that today with your own

1572

00:47:59,109 --> 00:47:58,079

health and that of your friends and

1573

00:48:00,630 --> 00:47:59,119

family

1574

00:48:02,630 --> 00:48:00,640

and i think as you think into the future

1575

00:48:04,790 --> 00:48:02,640

of space flight these lessons apply

1576

00:48:06,630 --> 00:48:04,800

whether it's taking being an organ or

1577

00:48:09,270 --> 00:48:06,640

blood donor and being a data donor

1578

00:48:11,030 --> 00:48:09,280

sharing data between issa and nasa and

1579

00:48:11,829 --> 00:48:11,040

others how we can think differently

1580

00:48:13,670 --> 00:48:11,839

about

1581

00:48:14,950 --> 00:48:13,680

not just the overlap but looking at to

1582

00:48:16,390 --> 00:48:14,960

where the puck is going the wayne

1583

00:48:18,069 --> 00:48:16,400

gretzky code skate to where the puck is

1584

00:48:19,589 --> 00:48:18,079

going to be as you're designing systems

1585

00:48:20,950 --> 00:48:19,599

for 2020

1586

00:48:22,549 --> 00:48:20,960

take a look at the trend of where

1587

00:48:24,710 --> 00:48:22,559

moore's law will take smartphones and

1588

00:48:25,910 --> 00:48:24,720

mobile and i would encourage all of us

1589

00:48:28,150 --> 00:48:25,920

again then to start thinking

1590

00:48:30,710 --> 00:48:28,160

exponentially in the context of

1591

00:48:33,270 --> 00:48:30,720

integration and realize that like with

1592

00:48:34,630 --> 00:48:33,280

many of the technologies in my pocket

1593

00:48:36,470 --> 00:48:34,640

they're actually already here they're

1594

00:48:38,630 --> 00:48:36,480

just not evenly distributed and it's up

1595

00:48:40,470 --> 00:48:38,640

to us whether it's the future of space

1596

00:48:42,390 --> 00:48:40,480

or medicine not to just predict the

1597

00:48:43,990 --> 00:48:42,400

future but go out there and create it

1598

00:48:45,750 --> 00:48:44,000

together so with that

1599

00:48:46,870 --> 00:48:45,760

huge thanks real honor to be here i'm

1600

00:48:47,990 --> 00:48:46,880

happy to help out in any ways with

1601  
00:48:49,109 --> 00:48:48,000  
anything you're doing in the future you

1602  
00:48:51,589 --> 00:48:49,119  
can reach me

1603  
00:48:53,829 --> 00:48:51,599  
through that email or download my

1604  
00:49:07,670 --> 00:48:53,839  
ask for the presentation and

1605  
00:49:10,630 --> 00:49:08,950  
yeah i think we have time for a couple

1606  
00:49:12,790 --> 00:49:10,640  
of questions if there's some mics up

1607  
00:49:14,710 --> 00:49:12,800  
here if any of you uh have a question

1608  
00:49:16,390 --> 00:49:14,720  
you'd like to ask daniel and

1609  
00:49:18,710 --> 00:49:16,400  
he'll also be around this afternoon in a

1610  
00:49:19,910 --> 00:49:18,720  
variety of places but um i think we have

1611  
00:49:21,349 --> 00:49:19,920  
time for a couple of questions before

1612  
00:49:22,390 --> 00:49:21,359  
the one o'clock meetings start if

1613  
00:49:24,069 --> 00:49:22,400

anybody

1614

00:49:25,109 --> 00:49:24,079

wants to ask questions debate there's

1615

00:49:26,390 --> 00:49:25,119

you know there's a lot happening there

1616

00:49:29,190 --> 00:49:26,400

that was sort of overwhelming you with

1617

00:49:31,990 --> 00:49:29,200

things again a lot of those elements uh

1618

00:49:33,910 --> 00:49:32,000

can cross over between fields so um

1619

00:49:35,430 --> 00:49:33,920

love to sort of hear any any thoughts or

1620

00:49:37,109 --> 00:49:35,440

questions yeah

1621

00:49:41,510 --> 00:49:37,119

very

1622

00:49:43,190 --> 00:49:41,520

i'm not sure that i'd want my children

1623

00:49:45,510 --> 00:49:43,200

or my grandchildren have a chip on their

1624

00:49:48,309 --> 00:49:45,520

neck right and as i read more and more

1625

00:49:50,309 --> 00:49:48,319

things about internet being hacked and i

1626  
00:49:52,470 --> 00:49:50,319  
don't file my taxes

1627  
00:49:53,190 --> 00:49:52,480  
online

1628  
00:50:06,870 --> 00:49:53,200  
i

1629  
00:50:08,230 --> 00:50:06,880  
those get hacked we haven't stopped

1630  
00:50:09,270 --> 00:50:08,240  
using credit cards i think we do know

1631  
00:50:11,109 --> 00:50:09,280  
need to pay a lot of attention to

1632  
00:50:12,630 --> 00:50:11,119  
medical privacy let people opt in and

1633  
00:50:14,309 --> 00:50:12,640  
use smarter ways to lock down our

1634  
00:50:15,750 --> 00:50:14,319  
medical information but also enable it

1635  
00:50:17,670 --> 00:50:15,760  
to be connected in smart ways in a

1636  
00:50:19,430 --> 00:50:17,680  
de-identified manner but clearly that's

1637  
00:50:21,109 --> 00:50:19,440  
a huge issue i mean i could literally

1638  
00:50:22,069 --> 00:50:21,119

sequence your dna from shaking your hand

1639

00:50:23,270 --> 00:50:22,079

today

1640

00:50:24,390 --> 00:50:23,280

or i could potentially you know hack

1641

00:50:26,549 --> 00:50:24,400

your smartphone and know where you've

1642

00:50:28,390 --> 00:50:26,559

been so just i think there's a blend

1643

00:50:30,309 --> 00:50:28,400

between being mindful of that and also

1644

00:50:32,150 --> 00:50:30,319

enabling these technologies to take us

1645

00:50:34,390 --> 00:50:32,160

forward but it's a great point

1646

00:50:36,630 --> 00:50:34,400

it's a great lecture thank you thank you

1647

00:50:37,910 --> 00:50:36,640

yes

1648

00:50:40,549 --> 00:50:37,920

all right well i think you have one