



Refraction Standard
Flat Earth Night
Side View Show Gradient
Eye Level
Debug
Viewer Height (feet) 14
Viewer Offset (feet) 0
Viewer Vertical FOV 0.1
Viewer Tilt Angle 0.05
Image Files Wallace bridge.png Wallace marker.png Man-in-boat-20
Target to Edit Two-discs target
Target dist (miles) 8
Target height (feet) 178
Multiple Gap
Show Every N lines 10
Wavelength (nm) 550
RH % 60 Edit RH
RELOAD

[PERMALINK](#) [PresetLink](#) [\(Reset\)](#) [Expert](#)
Preset Bedford Level Wallace
[Metabunk Refraction Simulator by Mick West](#)



1
00:00:03,949 --> 00:00:02,180
hi this is my quest on Medibank dot org

2
00:00:07,190 --> 00:00:03,959
and we're having a look at the meta

3
00:00:09,919 --> 00:00:07,200
bunker refraction simulator I wrote this

4
00:00:12,589 --> 00:00:09,929
refraction simulator over the last who

5
00:00:16,460 --> 00:00:12,599
would have know several months based on

6
00:00:19,040 --> 00:00:16,470
a view of Toronto this is Toronto here

7
00:00:21,019 --> 00:00:19,050
and this is the CN Tower and this white

8
00:00:25,279 --> 00:00:21,029
thing here next to it is the Rogers

9
00:00:27,620 --> 00:00:25,289
Center and this view is from Fort

10
00:00:32,299 --> 00:00:27,630
Niagara which is across the lake on the

11
00:00:33,490 --> 00:00:32,309
other side of the lake ontario and from

12
00:00:35,270 --> 00:00:33,500
that site from that position

13
00:00:36,770 --> 00:00:35,280

theoretically you shouldn't be able to

14

00:00:38,900 --> 00:00:36,780

see the Rogers Center cause it should be

15

00:00:41,240 --> 00:00:38,910

hidden behind the curve but you can see

16

00:00:44,299 --> 00:00:41,250

it because of the refraction lifting it

17

00:00:45,979 --> 00:00:44,309

up beyond the curve and you know this

18

00:00:48,170 --> 00:00:45,989

confuses people so I wrote this

19

00:00:49,910 --> 00:00:48,180

refraction and simulated to explain

20

00:00:52,040 --> 00:00:49,920

what's going on enough to demonstrate

21

00:00:54,490 --> 00:00:52,050

what's going on first of all let me just

22

00:00:55,610 --> 00:00:54,500

show you real quick watch this is

23

00:00:57,920 --> 00:00:55,620

beautiful

24

00:01:00,200 --> 00:00:57,930

there's a checkbox over here on the left

25

00:01:01,970 --> 00:01:00,210

where you can turn refraction off so if

26

00:01:03,799 --> 00:01:01,980

I turn it off this is what you would

27

00:01:05,810 --> 00:01:03,809

expect to see if there was no

28

00:01:07,670 --> 00:01:05,820

atmospheric refraction it did this all

29

00:01:10,160 --> 00:01:07,680

these buildings down here a hidden but

30

00:01:12,289 --> 00:01:10,170

when there is refraction it pops into

31

00:01:13,910 --> 00:01:12,299

view now of course refraction isn't a

32

00:01:17,090 --> 00:01:13,920

constant so I had to make it editable

33

00:01:21,469 --> 00:01:17,100

and over here on the upper left hand

34

00:01:23,149 --> 00:01:21,479

side is the temperature profile the

35

00:01:25,490 --> 00:01:23,159

temperature on celcius is along the

36

00:01:28,429 --> 00:01:25,500

bottom and the height above the water

37

00:01:31,100 --> 00:01:28,439

level in feet is on the left I'm kind of

38

00:01:33,499 --> 00:01:31,110

mixing my metric and imperial units and

39

00:01:35,990 --> 00:01:33,509

this is a curve editor and this curve

40

00:01:39,260 --> 00:01:36,000

represents what the temperature is at a

41

00:01:41,270 --> 00:01:39,270

particular altitude say at 60 feet here

42

00:01:42,770 --> 00:01:41,280

it's 15 and a half degrees so I can grab

43

00:01:45,440 --> 00:01:42,780

that and I can move it around and you

44

00:01:49,550 --> 00:01:45,450

can see this has a quite dramatic effect

45

00:01:51,499 --> 00:01:49,560

on what you actually see this curve

46

00:01:52,850 --> 00:01:51,509

editor you control by moving these

47

00:01:55,760 --> 00:01:52,860

points around you can change the shape

48

00:01:57,289 --> 00:01:55,770

of the curve with the green and you can

49

00:01:59,330 --> 00:01:57,299

change the actual data points by moving

50

00:02:00,649 --> 00:01:59,340

the black ones around you can add new

51
00:02:02,870 --> 00:02:00,659
points if you want to make the more

52
00:02:05,330 --> 00:02:02,880
complicated curve by just clicking in

53
00:02:07,670 --> 00:02:05,340
any empty space and it will make new

54
00:02:11,180 --> 00:02:07,680
points you can delete points by left

55
00:02:12,620 --> 00:02:11,190
clicking and that will remove a point so

56
00:02:15,200 --> 00:02:12,630
you can create all kinds of interest

57
00:02:19,100 --> 00:02:15,210
effects that are things that you can see

58
00:02:22,550 --> 00:02:19,110
in real life you can see for example you

59
00:02:24,410 --> 00:02:22,560
can see big compression near the horizon

60
00:02:28,550 --> 00:02:24,420
here and you can see the Roger Center

61
00:02:30,650 --> 00:02:28,560
being lifted up if you have the water

62
00:02:32,630 --> 00:02:30,660
temperature of the lower down

63
00:02:33,950 --> 00:02:32,640

temperature a lot hotter than the upper

64

00:02:36,110 --> 00:02:33,960

temperature you will create a kind of

65

00:02:38,840 --> 00:02:36,120

mirror eyes effects where you get this

66

00:02:41,240 --> 00:02:38,850

this mirroring which kind of looks like

67

00:02:43,460 --> 00:02:41,250

what you see sometimes on a hot road

68

00:02:46,310 --> 00:02:43,470

when the road is very hot compared to

69

00:02:48,950 --> 00:02:46,320

the air you get this reflection this

70

00:02:51,680 --> 00:02:48,960

kind of total reflection a reflection

71

00:02:55,220 --> 00:02:51,690

from refraction so you can mess around

72

00:02:57,770 --> 00:02:55,230

with this temperature curve and see the

73

00:02:59,900 --> 00:02:57,780

various effects now of course it would

74

00:03:01,700 --> 00:02:59,910

be a bit boring if we just did Toronto

75

00:03:04,010 --> 00:03:01,710

so I made it very very configurable and

76

00:03:07,280 --> 00:03:04,020

you can actually look at lots of

77

00:03:08,840 --> 00:03:07,290

different places in the world and lots

78

00:03:10,100 --> 00:03:08,850

of different situations you can even set

79

00:03:12,770 --> 00:03:10,110

up your own so that's just go for your

80

00:03:15,410 --> 00:03:12,780

your food let's go through a few things

81

00:03:17,690 --> 00:03:15,420

right now I'm gonna look at the controls

82

00:03:19,700 --> 00:03:17,700

over here and I'm just going to reset

83

00:03:23,140 --> 00:03:19,710

this we click on preset link it will

84

00:03:26,510 --> 00:03:23,150

load the last that's preset that you had

85

00:03:29,210 --> 00:03:26,520

the viewer height here is in feet you

86

00:03:30,800 --> 00:03:29,220

can just move this up and down if you

87

00:03:32,450 --> 00:03:30,810

let go or pop back to the middle and

88

00:03:33,860 --> 00:03:32,460

kind of reset so you have to keep

89

00:03:35,600 --> 00:03:33,870

dragging it and you can get higher and

90

00:03:38,480 --> 00:03:35,610

higher as you expect as you get higher

91

00:03:41,050 --> 00:03:38,490

you can see more and more I'm just going

92

00:03:43,280 --> 00:03:41,060

to reset that again if you click on

93

00:03:45,980 --> 00:03:43,290

refraction on and off it's fairly

94

00:03:48,800 --> 00:03:45,990

straightforward standard refraction just

95

00:03:50,660 --> 00:03:48,810

makes the temperature profile be a

96

00:03:52,880 --> 00:03:50,670

straight line just getting colder as you

97

00:03:54,890 --> 00:03:52,890

get higher which it's gonna let the

98

00:03:57,890 --> 00:03:54,900

standard atmosphere so it gives you like

99

00:04:00,470 --> 00:03:57,900

it since we can average refraction if

100

00:04:02,330 --> 00:04:00,480

you look at my curve calculator this

101

00:04:06,500 --> 00:04:02,340

amount of refraction is what you're

102

00:04:08,150 --> 00:04:06,510

seeing when I'm calculating what how

103

00:04:10,130 --> 00:04:08,160

much you should be visible with standard

104

00:04:11,540 --> 00:04:10,140

refraction I can to the refraction on

105

00:04:13,490 --> 00:04:11,550

and off vegan you can see this is the

106

00:04:14,960 --> 00:04:13,500

effect of standard refraction if you

107

00:04:16,460 --> 00:04:14,970

don't stand it off you get the curve

108

00:04:18,140 --> 00:04:16,470

back again and you can edit the curve or

109

00:04:21,770 --> 00:04:18,150

you can get the more interesting effects

110

00:04:24,680 --> 00:04:21,780

from refraction

111

00:04:26,990 --> 00:04:24,690

the series click on a level it will show

112

00:04:30,830 --> 00:04:27,000

you where your eye level is which is

113

00:04:33,170 --> 00:04:30,840

like zero degrees basically relative to

114

00:04:35,240 --> 00:04:33,180

the local vertical and you see in this

115

00:04:38,960 --> 00:04:35,250

situation the horizon is below eye level

116

00:04:40,130 --> 00:04:38,970

and if we turn off refraction this is

117

00:04:41,960 --> 00:04:40,140

like it's you know essentially in no

118

00:04:44,780 --> 00:04:41,970

atmosphere you can see it's below there

119

00:04:48,080 --> 00:04:44,790

and with standard refraction turned on

120

00:04:49,550 --> 00:04:48,090

it's below and in with this you know you

121

00:04:51,290 --> 00:04:49,560

can see that the rear the reflection

122

00:04:53,390 --> 00:04:51,300

that we're getting in situations like

123

00:04:56,270 --> 00:04:53,400

this is actually happening below higher

124

00:04:58,310 --> 00:04:56,280

level or Engler to reset things again

125

00:04:59,450 --> 00:04:58,320

because I'm messing up fewer offsets

126
00:05:01,220 --> 00:04:59,460
just a simple thing you can move things

127
00:05:03,050 --> 00:05:01,230
left and right it's going to useful to

128
00:05:06,590 --> 00:05:03,060
you know to set up a nice scene like

129
00:05:09,020 --> 00:05:06,600
saying I wanted to do this so you can

130
00:05:11,090 --> 00:05:09,030
see this know what this window actually

131
00:05:13,910 --> 00:05:11,100
is I should probably explain that this

132
00:05:16,790 --> 00:05:13,920
window is essentially the side view it's

133
00:05:19,730 --> 00:05:16,800
greatly compressed left to right this is

134
00:05:22,160 --> 00:05:19,740
showing you the curve of the earth this

135
00:05:24,080 --> 00:05:22,170
is where your camera is and this is

136
00:05:26,360 --> 00:05:24,090
where the target is so this represents

137
00:05:27,920 --> 00:05:26,370
the full height of the target image and

138
00:05:30,140 --> 00:05:27,930

you can see where this yellow line is

139

00:05:32,240 --> 00:05:30,150

here and where the yellow line is there

140

00:05:34,190 --> 00:05:32,250

like it's touching the top of the CN

141

00:05:36,560 --> 00:05:34,200

Tower that's the top of those clouds

142

00:05:38,720 --> 00:05:36,570

which is where the top of the images the

143

00:05:40,130 --> 00:05:38,730

red and the blue lines that registry

144

00:05:42,100 --> 00:05:40,140

presenta lines that are going up the

145

00:05:45,430 --> 00:05:42,110

blue represent lines that are going down

146

00:05:49,130 --> 00:05:45,440

from your point of view so you can see

147

00:05:52,850 --> 00:05:49,140

if we turn on high level yeah you can

148

00:05:55,850 --> 00:05:52,860

see that right here between the red and

149

00:05:57,290 --> 00:05:55,860

the blue is where your eye level is if

150

00:05:58,880 --> 00:05:57,300

you turn off refraction you can see it's

151
00:06:02,180 --> 00:05:58,890
just gonna be perfectly straight there

152
00:06:05,630 --> 00:06:02,190
with the red going up and the blue lines

153
00:06:08,830 --> 00:06:05,640
going down and this is more apparent if

154
00:06:11,200 --> 00:06:08,840
you increase the viewer height to be a

155
00:06:15,990 --> 00:06:11,210
much higher altitude

156
00:06:20,970 --> 00:06:17,610
the next thing to look at is the

157
00:06:24,270 --> 00:06:20,980
vertical Buell vertical fov which is

158
00:06:25,890 --> 00:06:24,280
perhaps a little of a long-winded way of

159
00:06:29,159 --> 00:06:25,900
putting things but this is basically the

160
00:06:34,310 --> 00:06:29,169
field of view vertically for the entire

161
00:06:37,350 --> 00:06:34,320
screen and here it's set to 1.5 degrees

162
00:06:39,450 --> 00:06:37,360
this is essentially the zoom on a camera

163
00:06:42,510 --> 00:06:39,460

but I'm expressing in terms of field of

164

00:06:46,379 --> 00:06:42,520

view I should perhaps there also put the

165

00:06:49,830 --> 00:06:46,389

millimeter equivalent zoom there a p900

166

00:06:53,370 --> 00:06:49,840

Nikon P 900 is about point 6 vertically

167

00:06:57,830 --> 00:06:53,380

so this would be the maximum zoom of a

168

00:07:00,600 --> 00:06:57,840

nikon p900 for this particular scene

169

00:07:02,220 --> 00:07:00,610

yeah let's see if your tilt you can just

170

00:07:03,930 --> 00:07:02,230

tilt the scene up and down let's just

171

00:07:06,210 --> 00:07:03,940

just you can get into a good position

172

00:07:10,920 --> 00:07:06,220

doesn't really change what it actually

173

00:07:13,830 --> 00:07:10,930

looks like then here there's a field

174

00:07:15,300 --> 00:07:13,840

called what's the image files this

175

00:07:17,940 --> 00:07:15,310

allows you to put in your own image

176
00:07:22,350 --> 00:07:17,950
files you could go to Google Images and

177
00:07:26,219 --> 00:07:22,360
I could do something like type in Tower

178
00:07:29,940 --> 00:07:26,229
Bridge find a nice straight on picture

179
00:07:35,650 --> 00:07:29,950
of Terra bridge here we go and let me

180
00:07:39,460 --> 00:07:35,660
just see I can do a copy image address

181
00:07:40,890 --> 00:07:39,470
and stick this in here I'm not sure this

182
00:07:44,140 --> 00:07:40,900
is going to work on that

183
00:07:46,420 --> 00:07:44,150
BAM there you go so you'd have to

184
00:07:48,670 --> 00:07:46,430
actually once you've put in a target

185
00:07:51,370 --> 00:07:48,680
file then you have to put in the target

186
00:07:54,400 --> 00:07:51,380
height it's 2,000 here I think Tower

187
00:07:55,540 --> 00:07:54,410
Bridge is probably more like 800 feet or

188
00:07:58,870 --> 00:07:55,550

something like that and for less than

189

00:08:02,290 --> 00:07:58,880

let's say 500 feet not even that or is

190

00:08:04,120 --> 00:08:02,300

it like 300 feet anyway sir you would

191

00:08:06,670 --> 00:08:04,130

have to look that up you can see it's

192

00:08:08,380 --> 00:08:06,680

hidden behind the horizon there now a

193

00:08:10,300 --> 00:08:08,390

target distance is the distance to the

194

00:08:11,620 --> 00:08:10,310

hook to that target so I can bring it a

195

00:08:14,770 --> 00:08:11,630

little bit closer good bit more

196

00:08:17,050 --> 00:08:14,780

realistic looking this is in miles

197

00:08:19,380 --> 00:08:17,060

target height as in feet I kind of mix

198

00:08:22,960 --> 00:08:19,390

the units a little bit sorry about that

199

00:08:26,440 --> 00:08:22,970

next two things multiple you can

200

00:08:29,200 --> 00:08:26,450

actually make multiple versions of an

201
00:08:32,890 --> 00:08:29,210
image so if I put in four and then put

202
00:08:35,680 --> 00:08:32,900
in say like 3000 feet

203
00:08:37,120 --> 00:08:35,690
it makes four copies of this particular

204
00:08:38,620 --> 00:08:37,130
image you can actually see them though

205
00:08:42,339 --> 00:08:38,630
cuz they're all behind one another I

206
00:08:43,779 --> 00:08:42,349
think if I change the offset you might

207
00:08:45,670 --> 00:08:43,789
be able to see how they do

208
00:08:49,570 --> 00:08:45,680
behind each other has changed this gap

209
00:08:50,950 --> 00:08:49,580
to 10,000 yeah yep you can see them

210
00:08:53,350 --> 00:08:50,960
going off into the distance so you can

211
00:08:56,770 --> 00:08:53,360
set up with multiple multiple images

212
00:08:58,360 --> 00:08:56,780
this your en lines is just the density

213
00:09:00,940 --> 00:08:58,370

of lines here it's not very important

214

00:09:03,160 --> 00:09:00,950

wavelength is the wavelength of light

215

00:09:04,870 --> 00:09:03,170

that I assume for the calculations if

216

00:09:07,090 --> 00:09:04,880

you want you could try changing it to

217

00:09:09,160 --> 00:09:07,100

something else like for example infrared

218

00:09:10,960 --> 00:09:09,170

lights it's going to be around 1500 and

219

00:09:12,490 --> 00:09:10,970

nanometers so you can change that you

220

00:09:14,860 --> 00:09:12,500

can see it makes a very very slight

221

00:09:17,260 --> 00:09:14,870

difference to what you're actually

222

00:09:21,240 --> 00:09:17,270

seeing now probably the more interesting

223

00:09:25,330 --> 00:09:21,250

thing here is all the different presets

224

00:09:27,730 --> 00:09:25,340

right for example see Catalina from

225

00:09:30,550 --> 00:09:27,740

Santa Monica this is a have a classic

226

00:09:33,850 --> 00:09:30,560

view this is the view from six feet on

227

00:09:35,980 --> 00:09:33,860

the beach Santa Monica and it's based on

228

00:09:38,140 --> 00:09:35,990

photographs that I took well when I

229

00:09:43,300 --> 00:09:38,150

visited a few years ago you get this

230

00:09:45,850 --> 00:09:43,310

very nice hidden part of Catalina now I

231

00:09:47,410 --> 00:09:45,860

have a flat earth view you can click on

232

00:09:49,480 --> 00:09:47,420

Flat Earth it will show you what it will

233

00:09:51,269 --> 00:09:49,490

look like if the earth is flat

234

00:09:54,009 --> 00:09:51,279

and this is what it should look like

235

00:09:56,049 --> 00:09:54,019

from six feet if the earth is flatter

236

00:09:57,280 --> 00:09:56,059

this is actually with refraction down

237

00:09:59,559 --> 00:09:57,290

refraction of people actually look like

238

00:10:01,720 --> 00:09:59,569

that you see there's a huge amount of

239

00:10:04,090 --> 00:10:01,730

Catalina Island down here this is twin

240

00:10:06,340 --> 00:10:04,100

harbors down here just gonna behind this

241

00:10:08,199 --> 00:10:06,350

this thing here but what you actually

242

00:10:12,040 --> 00:10:08,209

see and what you see in my photographs

243

00:10:16,299 --> 00:10:12,050

is the nun flutter of view of the view

244

00:10:17,980 --> 00:10:16,309

with myth refraction I should turn a

245

00:10:21,759 --> 00:10:17,990

standard refraction this is what you'll

246

00:10:23,049 --> 00:10:21,769

expect if it's just a flat curve this is

247

00:10:24,970 --> 00:10:23,059

what you actually see from Santa Monica

248

00:10:26,769 --> 00:10:24,980

beach where it's gonna you know pretty

249

00:10:28,900 --> 00:10:26,779

much by yourself just proves that's the

250

00:10:30,850 --> 00:10:28,910

you know the ocean is curved there's a

251

00:10:37,269 --> 00:10:30,860

very very big difference between that

252

00:10:39,429 --> 00:10:37,279

and this anyway that aside and I'm

253

00:10:42,639 --> 00:10:39,439

explaining how to use it not what is

254

00:10:45,999 --> 00:10:42,649

proof what is proving Chicago view of

255

00:10:47,859 --> 00:10:46,009

Chicago and let's see there's a more

256

00:10:51,970 --> 00:10:47,869

interesting one the Bedford level

257

00:10:54,669 --> 00:10:51,980

experiments here is the classic Bedford

258

00:10:58,210 --> 00:10:54,679

level this is a six mile stretch of

259

00:10:59,619 --> 00:10:58,220

canal and hopes is showing it as a open

260

00:11:02,319 --> 00:10:59,629

ocean but you can think of it as it

261

00:11:04,829 --> 00:11:02,329

being a canal obviously six miles away

262

00:11:07,090 --> 00:11:04,839

is this bridge now we have to get the

263

00:11:08,889 --> 00:11:07,100

field of view all the way down to zero

264

00:11:11,470 --> 00:11:08,899

point one here so we can zoom in so

265

00:11:13,900 --> 00:11:11,480

that's a very powerful zoom p900 view

266

00:11:15,730 --> 00:11:13,910

would be more like like this in the full

267

00:11:17,230 --> 00:11:15,740

frame so yeah you still be able to see

268

00:11:20,590 --> 00:11:17,240

it you probably want to use the digital

269

00:11:22,809 --> 00:11:20,600

zoom to see it all the way so we've got

270

00:11:26,319 --> 00:11:22,819

two things here we have this target

271

00:11:29,739 --> 00:11:26,329

which is set halfway along and we've got

272

00:11:32,379 --> 00:11:29,749

this guy in a boat and we've got our

273

00:11:36,549 --> 00:11:32,389

viewer height set at 14 feet which is

274

00:11:39,879 --> 00:11:36,559

about the height of this target itself

275

00:11:42,400 --> 00:11:39,889

in the middle and this is type height of

276

00:11:43,539 --> 00:11:42,410

this bridge itself and this is a classic

277

00:11:46,960 --> 00:11:43,549

experiment that's done it's a little

278

00:11:48,340 --> 00:11:46,970

hard to visualize perhaps but if it was

279

00:11:50,410 --> 00:11:48,350

there flat earth and I can actually

280

00:11:53,439 --> 00:11:50,420

share that let's turn off refraction go

281

00:11:55,299 --> 00:11:53,449

to Flat Earth view then this this one

282

00:11:57,579 --> 00:11:55,309

here is actually at the top of the

283

00:11:59,799 --> 00:11:57,589

bridge this one here is quite a bit

284

00:12:02,409 --> 00:11:59,809

below because he's looking straight at

285

00:12:03,160 --> 00:12:02,419

it but if we go to the none Flat Earth

286

00:12:04,809 --> 00:12:03,170

view

287

00:12:07,539 --> 00:12:04,819

then this one is above the top of the

288

00:12:09,840 --> 00:12:07,549

bridge completely different and this

289

00:12:11,799 --> 00:12:09,850

kind of is a very good demonstration I

290

00:12:14,379 --> 00:12:11,809

someone care to repeat this we could be

291

00:12:16,179 --> 00:12:14,389

great it's good demonstration of the

292

00:12:19,479 --> 00:12:16,189

curve of the earth and you can play

293

00:12:21,249 --> 00:12:19,489

around with this an interesting thing to

294

00:12:25,960 --> 00:12:21,259

do is you go to the different version of

295

00:12:28,509 --> 00:12:25,970

this the Bedford level boat this has the

296

00:12:32,289 --> 00:12:28,519

viewer heights at a four feet and this

297

00:12:34,869 --> 00:12:32,299

guy in the boat you can actually see

298

00:12:37,509 --> 00:12:34,879

this the this field here target to it it

299

00:12:39,039 --> 00:12:37,519

shows the different targets here so the

300

00:12:41,439 --> 00:12:39,049

Tuda Stargate the main the boat of the

301
00:12:43,539 --> 00:12:41,449
bridge check the men in the boat one we

302
00:12:45,699 --> 00:12:43,549
can change his distance so we can bring

303
00:12:48,729 --> 00:12:45,709
him closer so this is him just a mile

304
00:12:50,109 --> 00:12:48,739
away and you can see he keeps going

305
00:12:51,549 --> 00:12:50,119
further and further and further away but

306
00:12:53,289 --> 00:12:51,559
he doesn't know he disappear even though

307
00:12:54,849 --> 00:12:53,299
he gets all the way to the bridge over

308
00:12:57,579 --> 00:12:54,859
there you can see him now this was a

309
00:13:00,519 --> 00:12:57,589
classic experiment that was done in the

310
00:13:00,909 --> 00:13:00,529
1800s and it was thought by the guy who

311
00:13:03,429 --> 00:13:00,919
did it

312
00:13:04,960 --> 00:13:03,439
Samuel Robbo from that he demonstrated

313
00:13:07,840 --> 00:13:04,970

that the earth was flat because he could

314

00:13:08,710 --> 00:13:07,850

see this guy all the way down to the

315

00:13:10,960 --> 00:13:08,720

bridge where he should actually

316

00:13:12,609 --> 00:13:10,970

disappeared if I turn refraction off you

317

00:13:15,460 --> 00:13:12,619

can see what you would expect to see

318

00:13:18,369 --> 00:13:15,470

which is the guy disappearing smoothly

319

00:13:20,859 --> 00:13:18,379

over the horizon and be completely

320

00:13:22,569 --> 00:13:20,869

invisible at about five miles but he

321

00:13:25,090 --> 00:13:22,579

didn't see any sewage visible the whole

322

00:13:28,479 --> 00:13:25,100

way because they were at was atmospheric

323

00:13:32,470 --> 00:13:28,489

refraction so he was mistakenly assuming

324

00:13:34,059 --> 00:13:32,480

that the earth was in fact flat because

325

00:13:36,519 --> 00:13:34,069

he wouldn't give you vastly distorted

326

00:13:38,739 --> 00:13:36,529

and he wouldn't be able to see him now

327

00:13:40,869 --> 00:13:38,749

another thing that brings up is low

328

00:13:43,900 --> 00:13:40,879

level humidity we can actually edit the

329

00:13:46,749 --> 00:13:43,910

humidity I say to 50% by defaults but we

330

00:13:49,749 --> 00:13:46,759

can edit it using a curve using the same

331

00:13:52,269 --> 00:13:49,759

same curve editor type thing as we do

332

00:13:53,970 --> 00:13:52,279

for a temperature and it's actually

333

00:13:57,100 --> 00:13:53,980

interesting for something like this the

334

00:13:59,259 --> 00:13:57,110

humidity has a quite large effect on

335

00:14:01,059 --> 00:13:59,269

small things that are very close to the

336

00:14:04,150 --> 00:14:01,069

horizon he doesn't have much of an

337

00:14:05,879 --> 00:14:04,160

effect for large scenes but something

338

00:14:07,470 --> 00:14:05,889

like they say can have quite a dramatic

339

00:14:10,059 --> 00:14:07,480

effect

340

00:14:12,400 --> 00:14:10,069

firstly I'm not sure how realistic this

341

00:14:14,799 --> 00:14:12,410

curve is but I'm letting people edit it

342

00:14:18,090 --> 00:14:14,809

and perhaps they'll figure out what the

343

00:14:22,510 --> 00:14:18,100

actual limits to refraction should be

344

00:14:27,040 --> 00:14:22,520

another classic a modern classic is Lake

345

00:14:28,180 --> 00:14:27,050

Pontchartrain I call these pylons in in

346

00:14:32,470 --> 00:14:28,190

England's we call electrical

347

00:14:37,030 --> 00:14:32,480

transmission towers pylons and this uses

348

00:14:39,670 --> 00:14:37,040

the multiple thing here we've got these

349

00:14:41,260 --> 00:14:39,680

targets electrical towers and boats so

350

00:14:43,420 --> 00:14:41,270

this one here has a multiple of 80

351
00:14:45,640 --> 00:14:43,430
targets with a gap of nine hundred and

352
00:14:48,060 --> 00:14:45,650
seventy nine feet in between each one

353
00:14:51,100 --> 00:14:48,070
and I think that this is just the first

354
00:14:53,020 --> 00:14:51,110
target here first target distances in

355
00:14:54,880 --> 00:14:53,030
miles and the subsequent gaps are in

356
00:14:57,790 --> 00:14:54,890
feet again I apologize for mixing the

357
00:14:59,320 --> 00:14:57,800
units and this is a boat which I just

358
00:15:01,840 --> 00:14:59,330
stuck in just to give you something else

359
00:15:04,360 --> 00:15:01,850
to look at you can change the distance

360
00:15:07,630 --> 00:15:04,370
to that one this is a classic because

361
00:15:09,370 --> 00:15:07,640
you can see the curve quite clearly you

362
00:15:11,830 --> 00:15:09,380
can move around from left or right as if

363
00:15:13,930 --> 00:15:11,840

you're moving along the freeway so you

364

00:15:17,110 --> 00:15:13,940

can take this and interesting things we

365

00:15:21,240 --> 00:15:17,120

can do here is that we can actually mess

366

00:15:24,760 --> 00:15:21,250

around with the temperature gradient and

367

00:15:27,250 --> 00:15:24,770

actually kind of flatten out the curve

368

00:15:29,200 --> 00:15:27,260

by moving it this way

369

00:15:30,910 --> 00:15:29,210

and we can actually raise it up and

370

00:15:32,620 --> 00:15:30,920

there's a there's a photograph that

371

00:15:36,720 --> 00:15:32,630

shares this kind of condition we have

372

00:15:39,790 --> 00:15:36,730

very very cold water relative to the air

373

00:15:42,850 --> 00:15:39,800

it can actually make the curve of

374

00:15:44,440 --> 00:15:42,860

refraction go around the earth that's

375

00:15:46,780 --> 00:15:44,450

you know very similar curve to the

376

00:15:50,410 --> 00:15:46,790

actual earth itself and so it actually

377

00:15:51,730 --> 00:15:50,420

makes it look flat which is kind of kind

378

00:15:53,320 --> 00:15:51,740

of annoying when you want to demonstrate

379

00:15:55,360 --> 00:15:53,330

these things but yeah it really works

380

00:15:56,890 --> 00:15:55,370

with things that are fairly close to the

381

00:15:59,470 --> 00:15:56,900

horizon because you need this kind of

382

00:16:01,600 --> 00:15:59,480

steep temperature gradient which you

383

00:16:03,970 --> 00:16:01,610

only really get when it's closer to

384

00:16:05,680 --> 00:16:03,980

water things like distant mountains it

385

00:16:09,310 --> 00:16:05,690

doesn't really work of they're

386

00:16:13,410 --> 00:16:09,320

interesting things this is a simulation

387

00:16:17,710 --> 00:16:13,420

of a fata morgana which is caused by a

388

00:16:20,560 --> 00:16:17,720

steep inversion at this point 100 feet

389

00:16:22,510 --> 00:16:20,570

up the temperature's going down normally

390

00:16:24,510 --> 00:16:22,520

then it suddenly increases as a warmer

391

00:16:27,160 --> 00:16:24,520

layer just yeah two and a half degrees

392

00:16:29,770 --> 00:16:27,170

but that is enough to create this quite

393

00:16:31,840 --> 00:16:29,780

dramatic effects by moving it around you

394

00:16:34,840 --> 00:16:31,850

can see how quickly it can change with

395

00:16:38,470 --> 00:16:34,850

just a very small amount of variation in

396

00:16:40,270 --> 00:16:38,480

these these values this is something I

397

00:16:42,720 --> 00:16:40,280

actually observed from santa monica and

398

00:16:46,120 --> 00:16:42,730

this country duplicate the same thing

399

00:16:50,040 --> 00:16:46,130

and i think it kind of covers a lot of

400

00:16:52,990 --> 00:16:50,050

things over sir there's one flag that's

401
00:16:55,900 --> 00:16:53,000
distant laser spot 3 feet above the

402
00:16:57,220 --> 00:16:55,910
water level and what's interesting is

403
00:16:59,380 --> 00:16:57,230
you can see the laser but you've no idea

404
00:17:01,450 --> 00:16:59,390
what's really going on what that's

405
00:17:04,210 --> 00:17:01,460
because I have this night flag turned on

406
00:17:06,040 --> 00:17:04,220
if you turn off the night flag you can

407
00:17:07,990 --> 00:17:06,050
see you've got this ridiculous amount of

408
00:17:09,760 --> 00:17:08,000
refraction and you just happen to be

409
00:17:12,370 --> 00:17:09,770
able to see this laser just kind of

410
00:17:14,290 --> 00:17:12,380
poking through it and if i zoom out a

411
00:17:14,950 --> 00:17:14,300
bit you're gonna see more what's going

412
00:17:18,280 --> 00:17:14,960
on here

413
00:17:20,170 --> 00:17:18,290

the lasers down here somewhere and if I

414

00:17:22,330 --> 00:17:20,180

move this around you can see us you just

415

00:17:26,410 --> 00:17:22,340

random with it it happened to bump into

416

00:17:28,900 --> 00:17:26,420

view there is again laser down here but

417

00:17:30,310 --> 00:17:28,910

yeah this just shows how difficult it is

418

00:17:33,280 --> 00:17:30,320

to see what's going on when you do

419

00:17:34,800 --> 00:17:33,290

experiments at night I was just white

420

00:17:37,550 --> 00:17:34,810

he's out the way I did this particular

421

00:17:39,410 --> 00:17:37,560

particular configuration

422

00:17:40,910 --> 00:17:39,420

oh I think I pretty much covered

423

00:17:43,700 --> 00:17:40,920

everything that was obvious is a bunch

424

00:17:46,340 --> 00:17:43,710

of different examples in there that you

425

00:17:48,140 --> 00:17:46,350

can look at this is this is this pose is

426

00:17:51,080 --> 00:17:48,150

actually in my book escaping the rabbit

427

00:17:54,890 --> 00:17:51,090

hole and you can do things like select

428

00:17:57,440 --> 00:17:54,900

the book the boat sailboat here and move

429

00:18:00,530 --> 00:17:57,450

it closer or further away and you'll see

430

00:18:03,140 --> 00:18:00,540

it disappear Hey yes this is a situation

431

00:18:04,280 --> 00:18:03,150

I just had a fairly boring temperature

432

00:18:07,250 --> 00:18:04,290

curve you can actually make it more

433

00:18:10,340 --> 00:18:07,260

dramatic cold the water is what normally

434

00:18:12,980 --> 00:18:10,350

happens and see what happens just mess

435

00:18:14,480 --> 00:18:12,990

around with it see what effect cooling

436

00:18:16,980 --> 00:18:14,490

things down as you can see it there for

437

00:18:19,799 --> 00:18:16,990

longer and you see more compression

438

00:18:21,690 --> 00:18:19,809

and I think yeah I think I pretty much

439

00:18:24,149 --> 00:18:21,700

covered it well like it was how to use

440

00:18:28,039 --> 00:18:24,159

it now you might want to set up your own

441

00:18:31,500 --> 00:18:28,049

things you can add a new target and you

442

00:18:33,570 --> 00:18:31,510

will it just basically duplicates the

443

00:18:35,760 --> 00:18:33,580

pre-existing target I'm gonna expand

444

00:18:38,430 --> 00:18:35,770

this later so you can select which image

445

00:18:39,000 --> 00:18:38,440

to use it doesn't really let you do that

446

00:18:41,310 --> 00:18:39,010

right now

447

00:18:44,850 --> 00:18:41,320

and you can do various multiples of

448

00:18:46,590 --> 00:18:44,860

things if you want to if you get a nice

449

00:18:49,320 --> 00:18:46,600

set up so you know you think I want to

450

00:18:53,909 --> 00:18:49,330

share this with people this particular

451
00:18:56,730 --> 00:18:53,919
scene you can click on permalink and it

452
00:18:58,830 --> 00:18:56,740
will give you a link on the top here

453
00:19:00,389 --> 00:18:58,840
very long a link but you can still just

454
00:19:03,049 --> 00:19:00,399
take it and post it you can post it in a

455
00:19:05,899 --> 00:19:03,059
forum post so it usually works on

456
00:19:08,610 --> 00:19:05,909
youtube or on Facebook or even Twitter

457
00:19:10,620 --> 00:19:08,620
and this will take them directly to this

458
00:19:13,980 --> 00:19:10,630
scene you just reload that now it takes

459
00:19:15,510 --> 00:19:13,990
you to the exact same scene which is

460
00:19:18,840 --> 00:19:15,520
quite handy for sharing it there's

461
00:19:24,299 --> 00:19:18,850
another button here export which will

462
00:19:27,330 --> 00:19:24,309
create a text version of the data which

463
00:19:29,760 --> 00:19:27,340

I can then like stick into my code so if

464

00:19:32,220 --> 00:19:29,770

you have a nice set up then I can take

465

00:19:36,899 --> 00:19:32,230

that and put it into the code as a

466

00:19:40,019 --> 00:19:36,909

preset this link here will take you to

467

00:19:42,539 --> 00:19:40,029

the discussion thread and I think I

468

00:19:46,350 --> 00:19:42,549

think that is pretty much everything so

469

00:19:50,639 --> 00:19:46,360

yeah I if you've got any suggestions I

470

00:19:52,320 --> 00:19:50,649

would be happy to add things to this a

471

00:19:54,269 --> 00:19:52,330

couple things I didn't say you can turn

472

00:19:56,730 --> 00:19:54,279

this side view on and off you can also

473

00:19:59,549 --> 00:19:56,740

make it turn off the gradient so you can

474

00:20:01,380 --> 00:19:59,559

see the lines a bit easier ignore this

475

00:20:03,260 --> 00:20:01,390

debug thing it's meaningless is just a

476

00:20:06,260 --> 00:20:03,270

test thing for me

477

00:20:08,240 --> 00:20:06,270

yeah yeah so if you have any suggestions

478

00:20:12,140 --> 00:20:08,250

just let me know and I will be happy to

479

00:20:13,340 --> 00:20:12,150

add it given time over the next weeks

480

00:20:15,620 --> 00:20:13,350

and months because I'm actually quite

481

00:20:18,440 --> 00:20:15,630

enjoying messing around with it and