IS IT MOVING?

1
00:00:04,150 --> 00:00:03,350
i'm going to do an experiment and i need

2
00:00:06,150 --> 00:00:04,160
your help

3
00:00:07,829 --> 00:00:06,160
i'm going to show you two videos and

4
00:00:10,390 --> 00:00:07,839
this is the first one

5
00:00:11,110 --> 00:00:10,400
look at it carefully it shows a white

6
00:00:13,190 --> 00:00:11,120
object

7
00:00:15,110 --> 00:00:13,200
shaped like a tic tac moving over a

8
00:00:18,070 --> 00:00:15,120
background or fence

9
00:00:19,990 --> 00:00:18,080
but is it moving what's actually moving

10
00:00:22,390 --> 00:00:20,000
left and right up and down here

11
00:00:23,590 --> 00:00:22,400
is it the object the camera or maybe

12
00:00:25,670 --> 00:00:23,600
both

13
00:00:27,269 --> 00:00:25,680

obviously the camera is rotating to

14
00:00:28,230 --> 00:00:27,279
track the object but is the camera

15
00:00:34,790 --> 00:00:28,240
moving

16
00:00:38,950 --> 00:00:37,430
now the second video is the same object

17
00:00:40,150 --> 00:00:38,960
but this time we're looking down over

18
00:00:42,150 --> 00:00:40,160
the water

19
00:00:44,310 --> 00:00:42,160
again the camera rotates to track the

20
00:00:47,350 --> 00:00:44,320
object but what's moving left

21
00:00:48,150 --> 00:00:47,360
right up and down here the camera the

22
00:00:51,189 --> 00:00:48,160
object

23
00:00:52,790 --> 00:00:51,199
or both can you even tell

24
00:00:54,790 --> 00:00:52,800
think about what your answer is before

25
00:00:56,470 --> 00:00:54,800
continuing with the video

26
00:00:58,630 --> 00:00:56,480
feel free to write down your answers for

27
00:01:00,549 --> 00:00:58,640
both videos in the comments before

28
00:01:03,189 --> 00:01:00,559
continuing

29
00:01:04,710 --> 00:01:03,199
okay spoiler alert make sure you have

30
00:01:06,310 --> 00:01:04,720
your answers because i'm about to pull

31
00:01:09,350 --> 00:01:06,320
back the curtain

32
00:01:12,630 --> 00:01:09,360
the answer is the camera is moving

33
00:01:14,390 --> 00:01:12,640
but the object is not

34
00:01:15,749 --> 00:01:14,400
i shot both videos with an iphone

35
00:01:17,670 --> 00:01:15,759
mounted on a gimbal

36
00:01:19,190 --> 00:01:17,680
the gimbal is set to track the object so

37
00:01:20,070 --> 00:01:19,200
it remains fixed in the middle of the

38
00:01:22,230 --> 00:01:20,080

screen

39
00:01:23,670 --> 00:01:22,240
i cropped the scene to remove 3d objects

40
00:01:25,670 --> 00:01:23,680
that would give the game away

41
00:01:27,670 --> 00:01:25,680
and i added a bit more stabilization

42
00:01:29,510 --> 00:01:27,680
using adobe after effects to lock the

43
00:01:31,270 --> 00:01:29,520
object in the middle

44
00:01:32,789 --> 00:01:31,280
in both cases the model was about

45
00:01:35,830 --> 00:01:32,799
halfway between the camera and the

46
00:01:39,749 --> 00:01:38,069
i asked about this on twitter with this

47
00:01:41,270 --> 00:01:39,759
exact same videos and i got some

48
00:01:42,950 --> 00:01:41,280
interesting replies

49
00:01:44,469 --> 00:01:42,960
with the fence experiment most people

50
00:01:45,670 --> 00:01:44,479
seem to think that both camera and

51
00:01:46,789 --> 00:01:45,680
tic-tac were moving

52
00:01:48,310 --> 00:01:46,799
although i might have messed up the

53
00:01:49,109 --> 00:01:48,320
question there by suggesting it was a

54
00:01:51,510 --> 00:01:49,119
real tic tac

55
00:01:52,789 --> 00:01:51,520
it's actually two inches long for the

56
00:01:54,630 --> 00:01:52,799
pool experiment

57
00:01:56,389 --> 00:01:54,640
which are worded a bit better there was

58
00:01:59,350 --> 00:01:56,399
quite a mixed set of responses

59
00:02:01,030 --> 00:01:59,360
and rationales for those responses but a

60
00:02:01,749 --> 00:02:01,040
majority of people thought the object

61
00:02:03,109 --> 00:02:01,759
was moving

62
00:02:05,030 --> 00:02:03,119
some thought both the object and the

63
00:02:08,309 --> 00:02:05,040

camera were moving and a few people got

64
00:02:09,589 --> 00:02:08,319
the correct answer

65
00:02:11,350 --> 00:02:09,599
what i was trying to demonstrate was

66
00:02:13,110 --> 00:02:11,360
just how compelling the illusion of

67
00:02:14,630 --> 00:02:13,120
motion can be if you don't know how far

68
00:02:16,470 --> 00:02:14,640
away an object is

69
00:02:18,550 --> 00:02:16,480
the pool example is particularly

70
00:02:20,309 --> 00:02:18,560
compelling i was surprised that there

71
00:02:21,910 --> 00:02:20,319
was a real sense of the object moving

72
00:02:24,229 --> 00:02:21,920
around even without cropping and

73
00:02:25,990 --> 00:02:24,239
stabilizing the image

74
00:02:27,510 --> 00:02:26,000
so there's a general point of don't let

75
00:02:28,550 --> 00:02:27,520
your brain trust what your eyes are

76
00:02:30,390 --> 00:02:28,560
telling you

77
00:02:31,910 --> 00:02:30,400
but there's a more specific point about

78
00:02:34,550 --> 00:02:31,920
camera systems that track

79
00:02:36,630 --> 00:02:34,560
objects parallax can be a very

80
00:02:37,670 --> 00:02:36,640
compelling illusion with an object

81
00:02:40,550 --> 00:02:37,680
tracking camera

82
00:02:42,150 --> 00:02:40,560
even an undetectable illusion you can

83
00:02:44,229 --> 00:02:42,160
make things look like they are moving in

84
00:02:46,630 --> 00:02:44,239
a direction that they are not

85
00:02:48,390 --> 00:02:46,640
we see this with various ufo videos like

86
00:02:50,630 --> 00:02:48,400
gimbal and go fast

87
00:02:52,790 --> 00:02:50,640
but i think you can also apply to direct

88
00:02:54,390 --> 00:02:52,800

visual observations

89
00:02:56,229 --> 00:02:54,400
if you don't know how big something is

90
00:02:57,830 --> 00:02:56,239
then you can't judge distance

91
00:03:00,229 --> 00:02:57,840
like with this model over the pool the

92
00:03:01,830 --> 00:03:00,239
natural impression is that it's low and

93
00:03:03,190 --> 00:03:01,840
close to the water when it's actually

94
00:03:05,030 --> 00:03:03,200
much higher

95
00:03:07,110 --> 00:03:05,040
this is a very natural and

96
00:03:08,790 --> 00:03:07,120
understandable illusion that anyone in a

97
00:03:10,949 --> 00:03:08,800
particular position above an object of

98
00:03:13,030 --> 00:03:10,959
unknown size might make

99
00:03:15,030 --> 00:03:13,040
in a plane in that position with two

100
00:03:15,990 --> 00:03:15,040
pilots both pilots would see the same

101
00:03:18,070 --> 00:03:16,000
illusion

102
00:03:19,670 --> 00:03:18,080
and if there was another plane higher up

103
00:03:20,550 --> 00:03:19,680
they might see a different version of

104
00:03:22,390 --> 00:03:20,560
the illusion

105
00:03:23,910 --> 00:03:22,400
but still not say things as they really

106
00:03:25,110 --> 00:03:23,920
are

107
00:03:27,190 --> 00:03:25,120
it's something to keep in mind when

108
00:03:28,470 --> 00:03:27,200
looking at accounts of normal objects of

109
00:03:30,309 --> 00:03:28,480
unknown size

110
00:03:31,670 --> 00:03:30,319
if you don't know where it is how do you

111
00:03:35,110 --> 00:03:31,680
know how big it is

112
00:03:37,110 --> 00:03:35,120
do you know how far away it is

113
00:03:39,270 --> 00:03:37,120

and if you don't know where it is or how

114
00:03:41,190 --> 00:03:39,280
big it is and you are moving

115
00:03:43,470 --> 00:03:41,200
then how do you know if the object is