Math 107

Introduction to Hypothesis Tests
(Sections 4.1-4.4)

Does drinking beer make you more attractive to mosquitos?

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PLoS one

Beer Consumption [redacted] Human Attractiveness to Malaria Mosquitoes

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Abstract

Background: Malaria and alcohol consumption both represent major public health problems. Alcohol consumption is rising in developing countries and, as efforts to manage malaria are expanded, understanding the links between malaria and alcohol consumption becomes crucial. Our aim was to ascertain the effect of beer consumption on human attractiveness to malaria mosquitoes in semi field conditions in Burkina Faso.

Background

"Malaria and alcohol consumption both represent major public health problems. Alcohol consumption is rising in developing countries and, as efforts to manage malaria are expanded, understanding the links between malaria and alcohol consumption becomes crucial. Our aim was to ascertain the effect of beer consumption on human attractiveness to malaria mosquitoes in semi field conditions in Burkina Faso."

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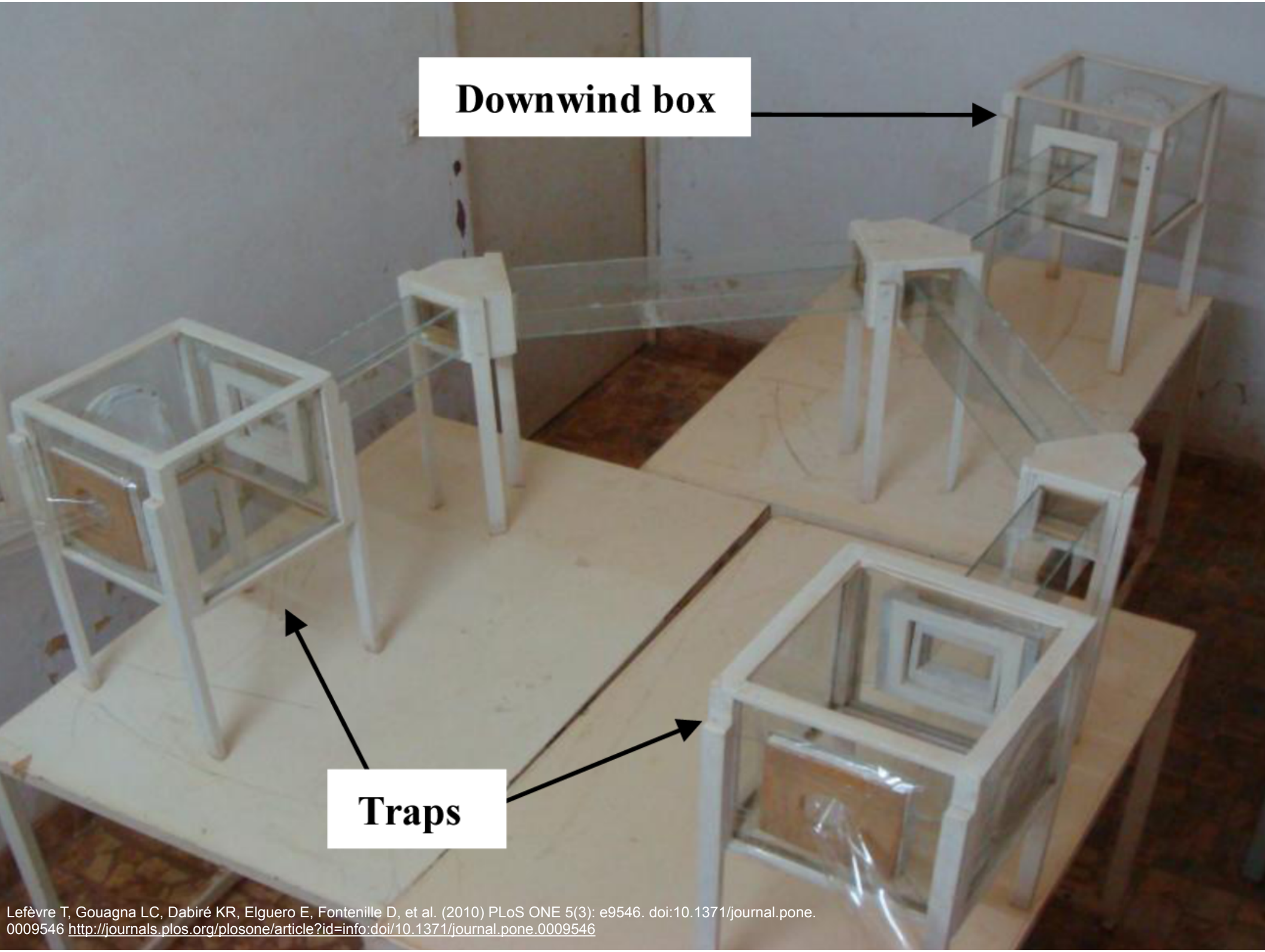
Methodology

- Study performed in Burkina Faso, Africa
- 25 volunteers consumed a liter of beer
- 18 volunteers consumed a liter of water
- Attractiveness of mosquitos to volunteer tested before and after consumption
- Mosquitos released and caught in traps as they approached the volunteers



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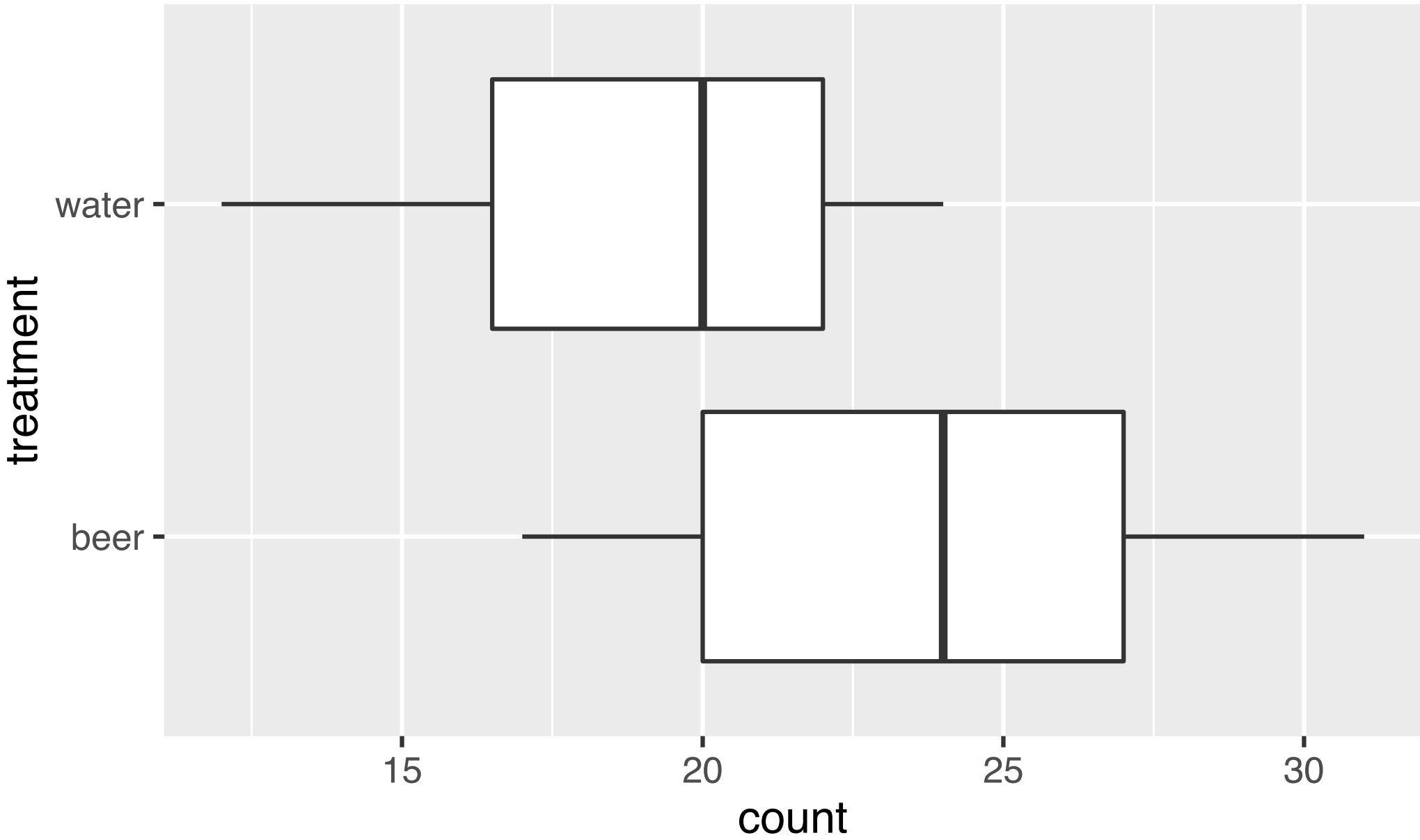
Your Turn

- Is this an experiment or an observational study?

Beer			Water	
27	26	24	21	12
19	28	29	19	24
20	20	21	13	24
20	27	21	22	21
23	19	18	15	19
17	25	27	22	18
21	31	20	15	16
24	24		22	23
31	28		20	20


water
beer
treatment
15
20
25
30
count

Your Turn

- What's the parameter in this situation?
- What's the statistic?

Your Turn

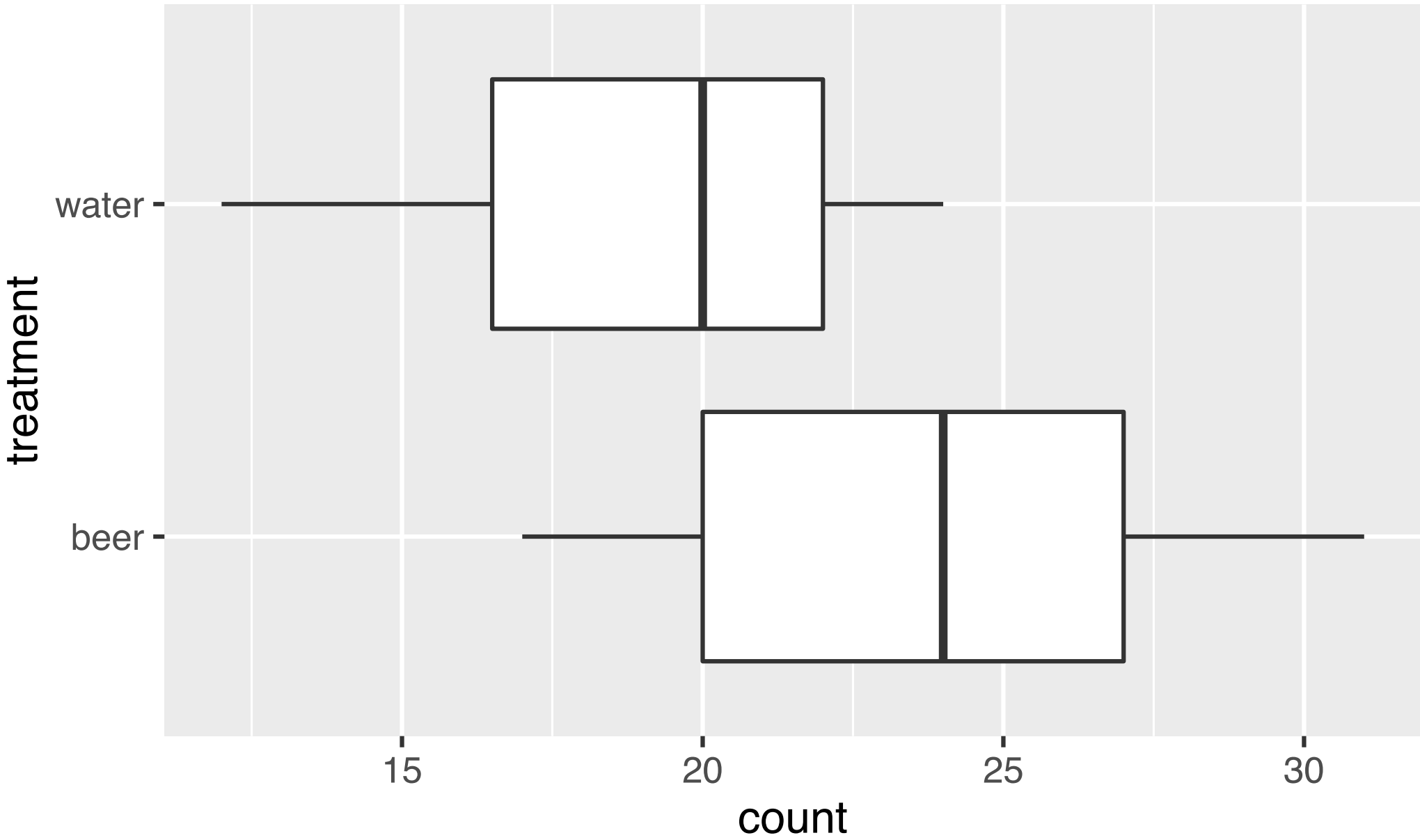
- Is a mean difference of 4.4 mosquitos enough evidence that beer consumption increases human attractiveness to mosquitos? Or was this due to random chance?
- If not, why?
- How could this be determined?

Logic of hypothesis testing

Framework

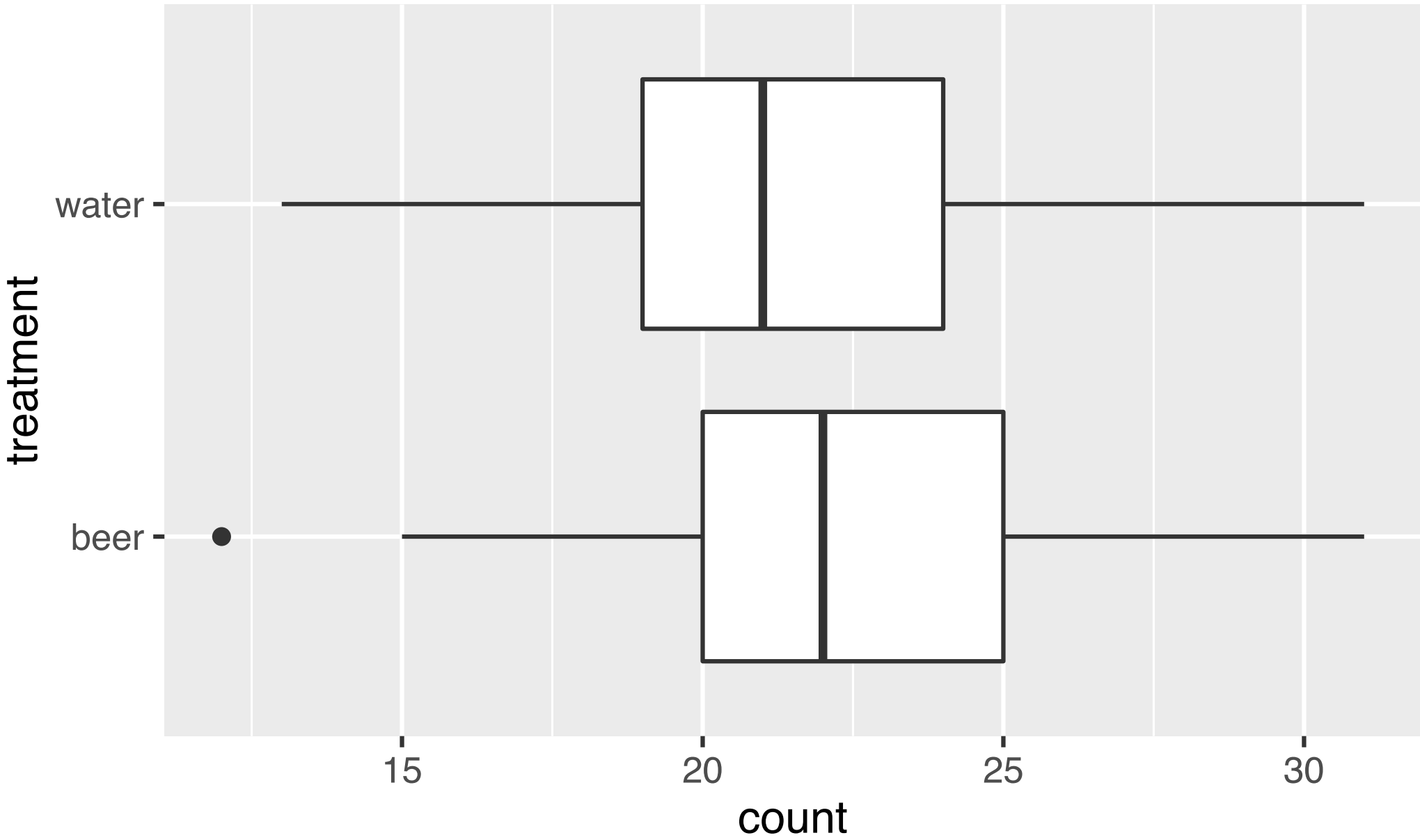
1. Formulate two competing hypotheses
2. Calculate a statistic summarizing the relevant information to the claims
3. Look at the behavior of the statistic assuming that the “initial claim” is true
4. Compare the observed statistic to the distribution created in step 3 to determine whether it is “extreme”

Beer			Water	
27	26	24	21	12
19	28	29	19	24
20	20	21	13	24
20	27	21	22	21
23	19	18	15	19
17	25	27	22	18
21	31	20	15	16
24	24		22	23
31	28		20	20

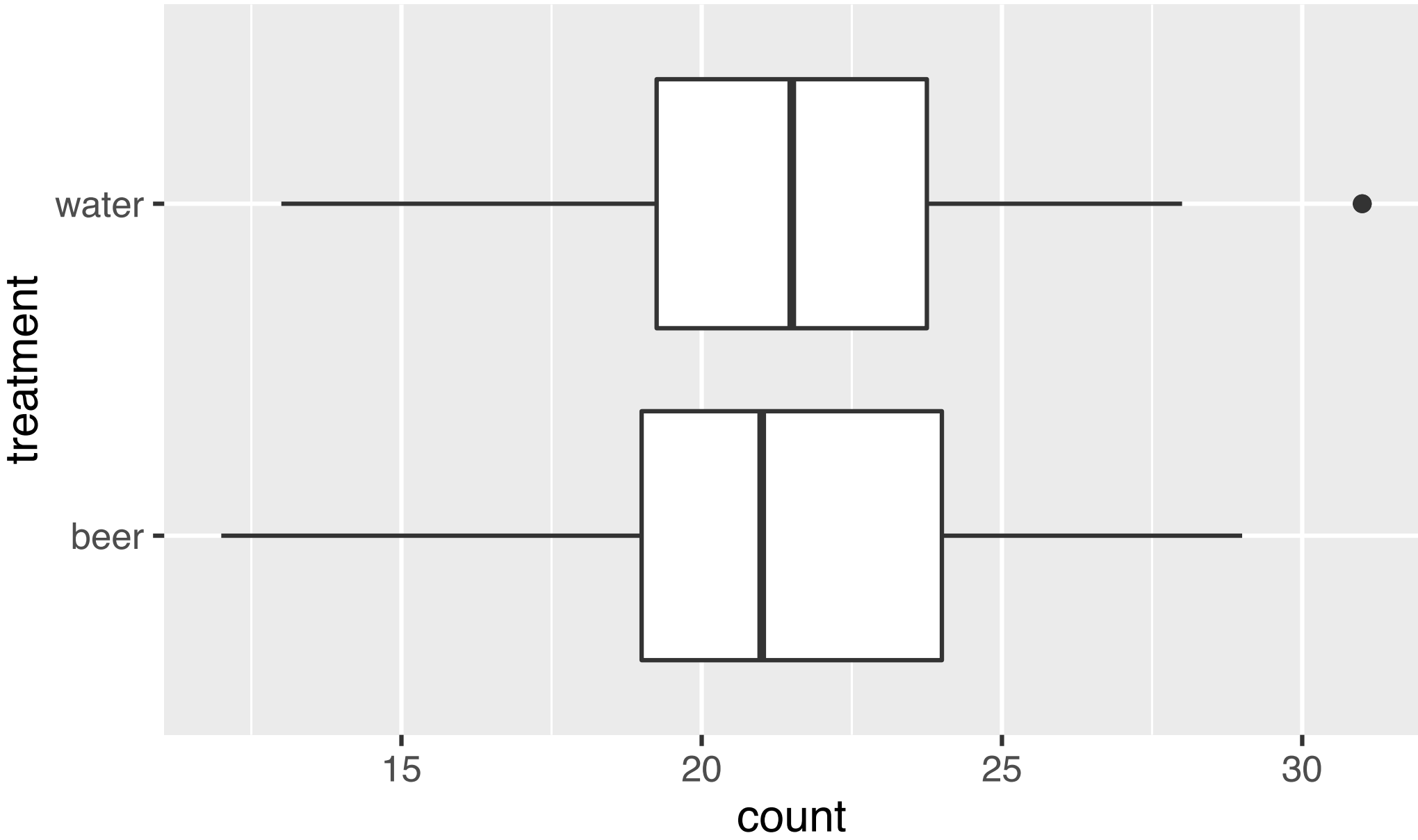

water
beer
treatment
15
20
25
30
count

Beer			Water	
27	26	24	21	12
19	28	29	19	24
20	20	21	13	24
20	27	21	22	21
23	19	18	15	19
17	25	27	22	18
21	31	20	15	16
24	24		22	23
31	28		20	20

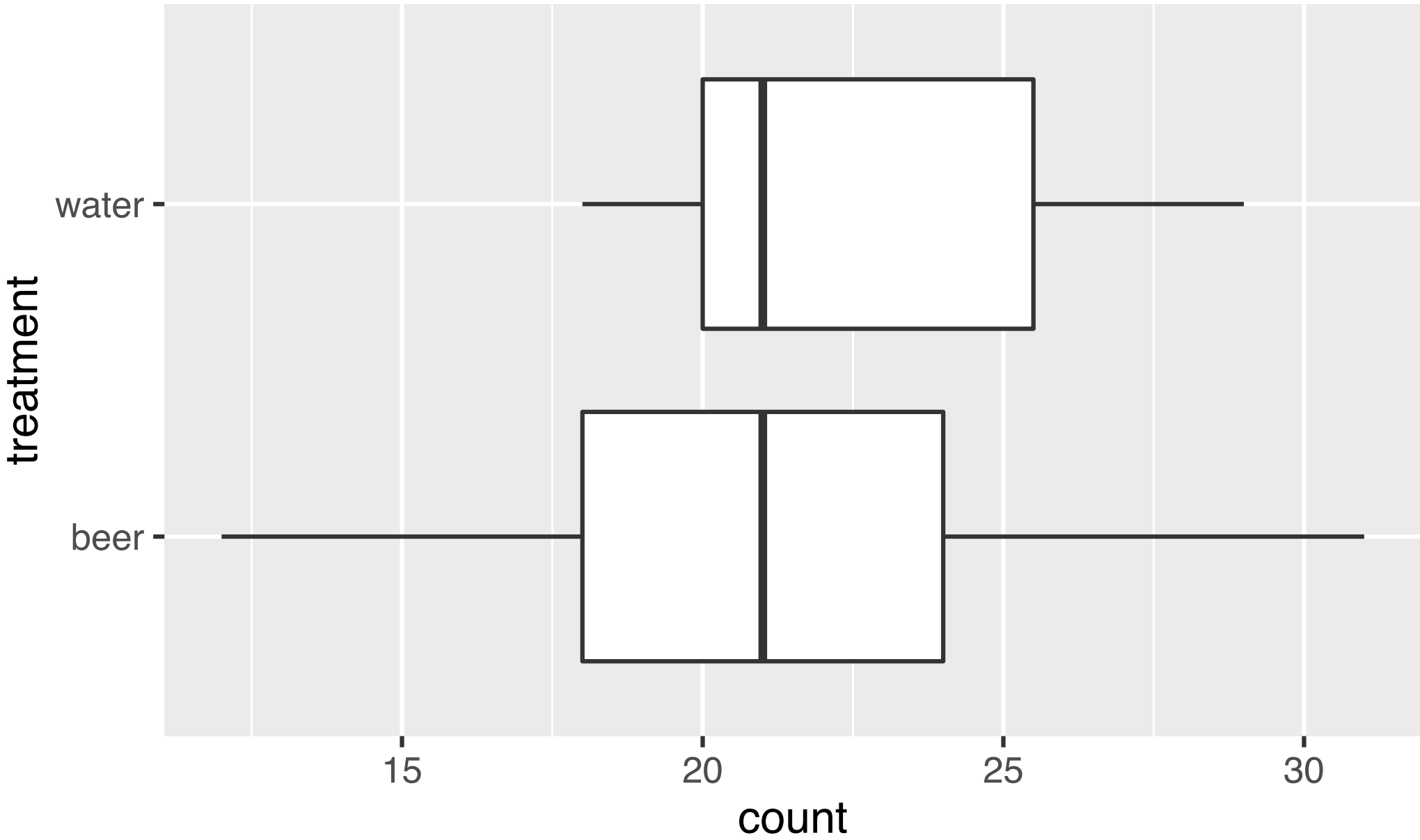
Beer			Water	
27	21	20	13	24
20	20	24	19	15
19	22	31	28	23
26	16	22	21	18
25	21	20	19	24
23	18	15	27	24
22	12	29	20	21
27	24		21	20
17	28		31	19


water
beer
treatment
15
20
25
30
count

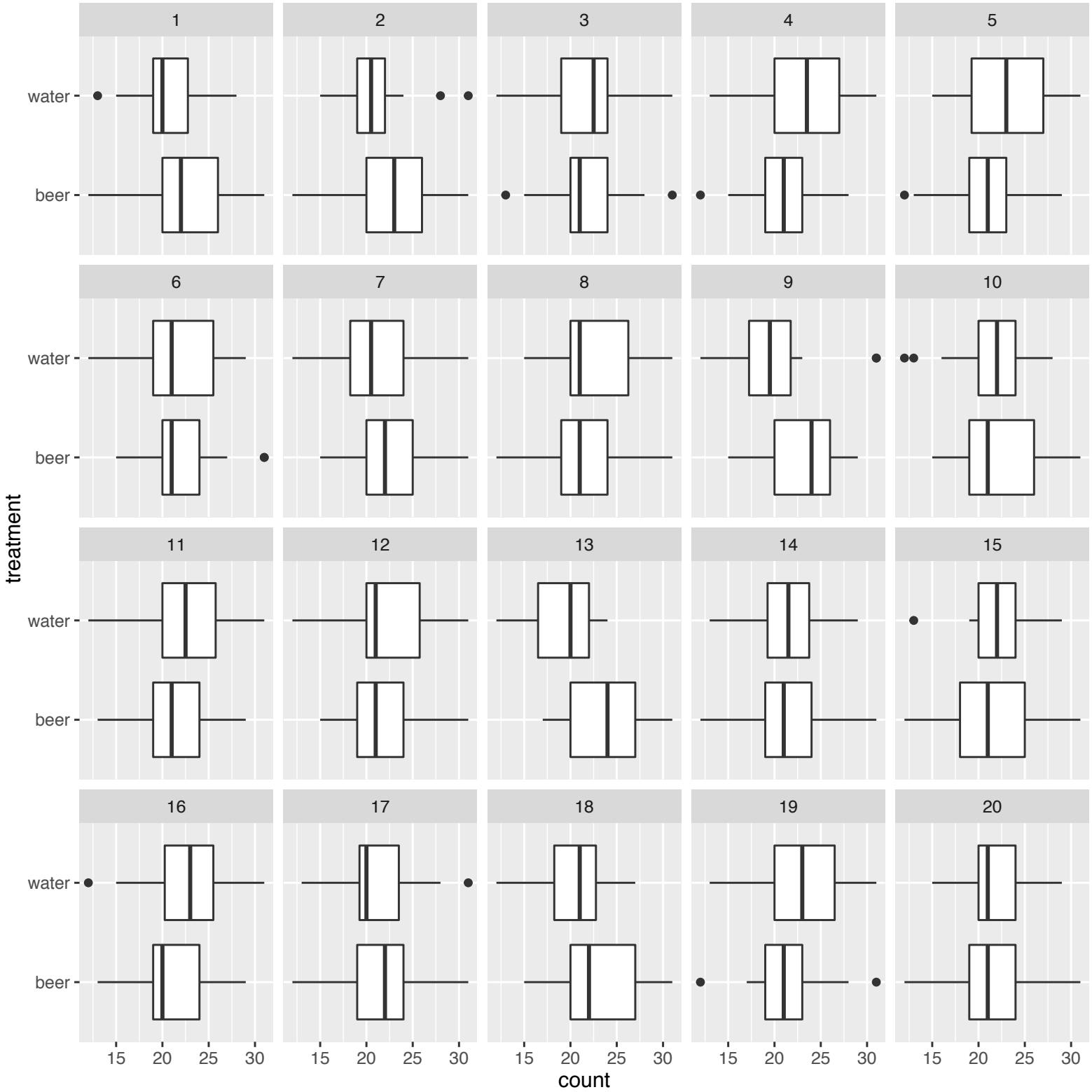
Beer			Water	
21	19	19	19	31
21	24	17	20	28
24	16	15	23	15
29	24	20	21	18
20	24	22	23	13
25	28	18	21	19
26	20	27	22	24
12	27		31	20
20	21		27	22


water
beer
treatment
15
20
25
30
count

Beer			Water	
24	28	23	20	27
13	22	21	24	21
19	15	21	20	27
16	31	23	18	20
27	15	25	26	20
19	22	18	21	19
20	31	24	21	28
17	12		24	19
24	20		29	22


water
beer
treatment
15
20
25
30
count

Compare the observed to behavior under the null hypothesis


1
2
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13
14
15
16
17
18
19
20
water
beer
treatment
15
20
25
30
count

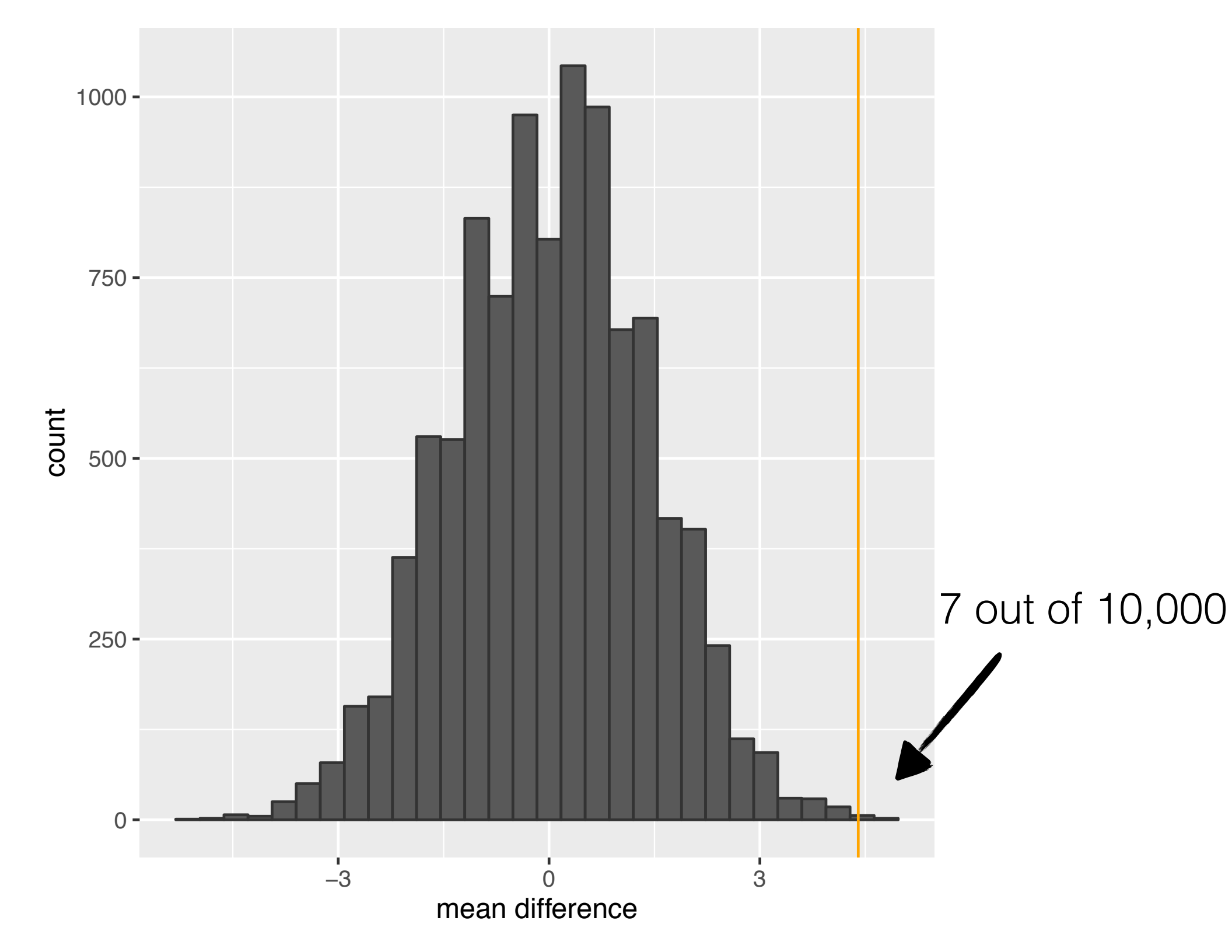
Radomization (i.e. permutation) tests

Beer				Water	
27	26	24		21	12
19	28	29		19	24
20	20	21		13	24
20	27	21		22	21
23	19	18	Diff: 4.4	15	19
17	25	27		22	18
21	31	20		15	16
24	24			22	23
31	28			20	20
Mean: 23.6				Mean: 19.2	

Beer				Water	
27	21	20		13	24
20	20	24		19	15
19	22	31		28	23
26	16	22	Diff: 0.5	21	18
25	21	20		19	24
23	18	15		27	24
22	12	29		20	21
27	24			21	20
17	28			31	19
Mean: 22				Mean: 21.5	

Beer				Water	
21	19	19		19	31
21	24	17		20	28
24	16	15		23	15
29	24	20	Diff: -0.5	21	18
20	24	22		23	13
25	28	18		21	19
26	20	27		22	24
12	27			31	20
20	21			27	22
Mean: 21.6				Mean: 22.1	

Beer				Water	
24	28	23		20	27
13	22	21		24	21
19	15	21		20	27
16	31	23		18	20
27	15	25	Diff: -1.4	26	20
19	22	18		21	19
20	31	24		21	28
17	12			24	19
24	20			29	22
Mean: 21.2				Mean: 22.6	


1000
750
500
250
0
count
–3
0
3
mean difference
7 out of 10,000