What are Type I and Type II errors and why should we care?

Week 2 HRA1

Hotel Management School Maastricht

What was a hypothesis again?

- H_0 and alternative H_A (or H_1)
- Expectation goes into H_A (or H_1)
- H_0 = no change
- MECE: mutually exclusive and collectively exhaustive

What you should remember

Statistics are based on probability theory

	Null Hypothesis is True	Null Hypothesis is False
Reject Null Hypothesis	Type – 1 Error (False Positive)	Correct Outcome (True Positive)
Fails to Reject Null Hypothesis	Correct Outcome (True Negative)	Type – 2 Error (False Negative)

We always run a ***risk*** of being wrong

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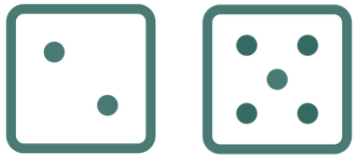
Data generating process

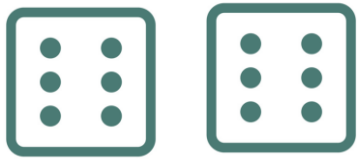
1/6 1/6 1/6 1/6 1/6 1/6 [Added = 1]

1*1/6 + 2*1/6 + 3*1/6 + 4*1/6 + 5*1/6 + 6*1/6 = 3.5

What we observe:



What we might also observe:



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We always run a ***risk*** of being wrong

DOUBLE EAGLE

What a type I error looks like

Data generating process

1/6 1/6 1/6 1/6 1/6 1/6 [Added = 1]

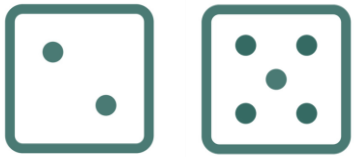
1*1/6 + 2*1/6 + 3*1/6 + 4*1/6 + 5*1/6 + 6*1/6 = 3.5

FAIR

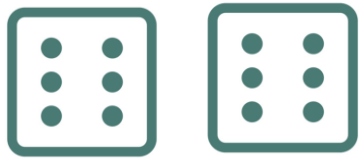
$H_0: \mu = 3.5$

$H_1: \mu \neq 3.5$

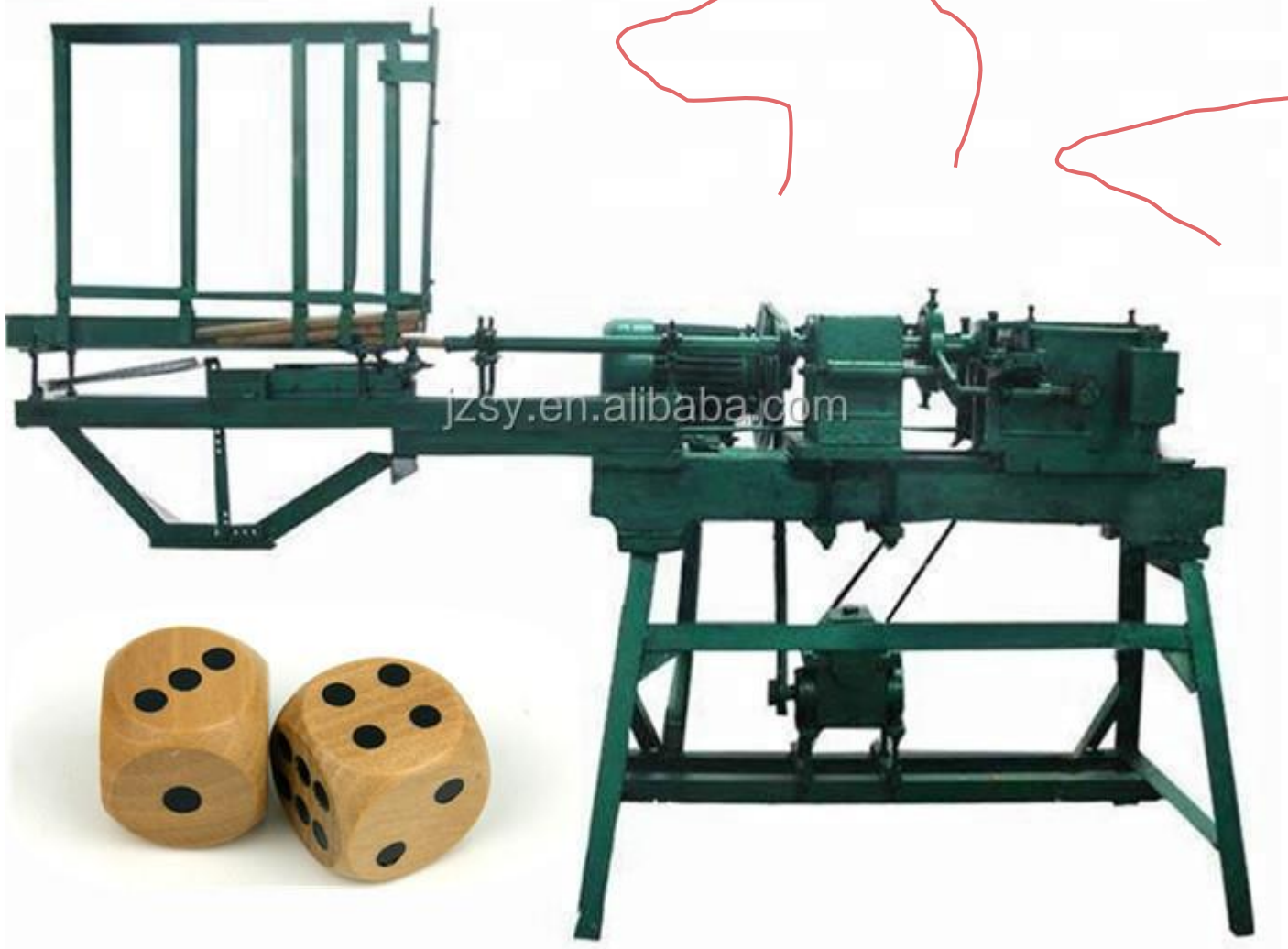
What we could observe:



What we might also observe:



DOUBLE EAGLE



What a type II error looks like

Data generating process

1/6 1/6 1/6 1/6 1/6 1/6 [Added = 1]

1*1/6 + 2*1/6 + 3*1/6 + 1*1/6 + 5*1/6 + 6*1/6 = 3

$H_0: \mu = 3.5$
$H_1: \mu \neq 3.5$

What we could observe:

What we might also observe:

Type I and Type II errors: summarized

		True State of Nature	
		H_0(Innocent)	H_1 (Guilty)
Conclusion Drawn	H_0 (Innocent)	Correct	Type II Error
	H_1(Guilty)	Type I Error	Correct

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Practical

When you use statistics, you will run a risk of drawing the wrong conclusion (Type I and Type II errors) even though you interpreted your data correctly.

HRA meeting 2 of this week:

- You will run even more risk of being wrong (collecting your observations)

HRA meeting 2 week 3:

- How big are the risks? And what can I do to minimize this?
- When do we reject or accept our hypothesis?