

Mistakes

We all make them. Even statistical analysts



But first...Let's go on a holiday!





No Jellyfish here!!

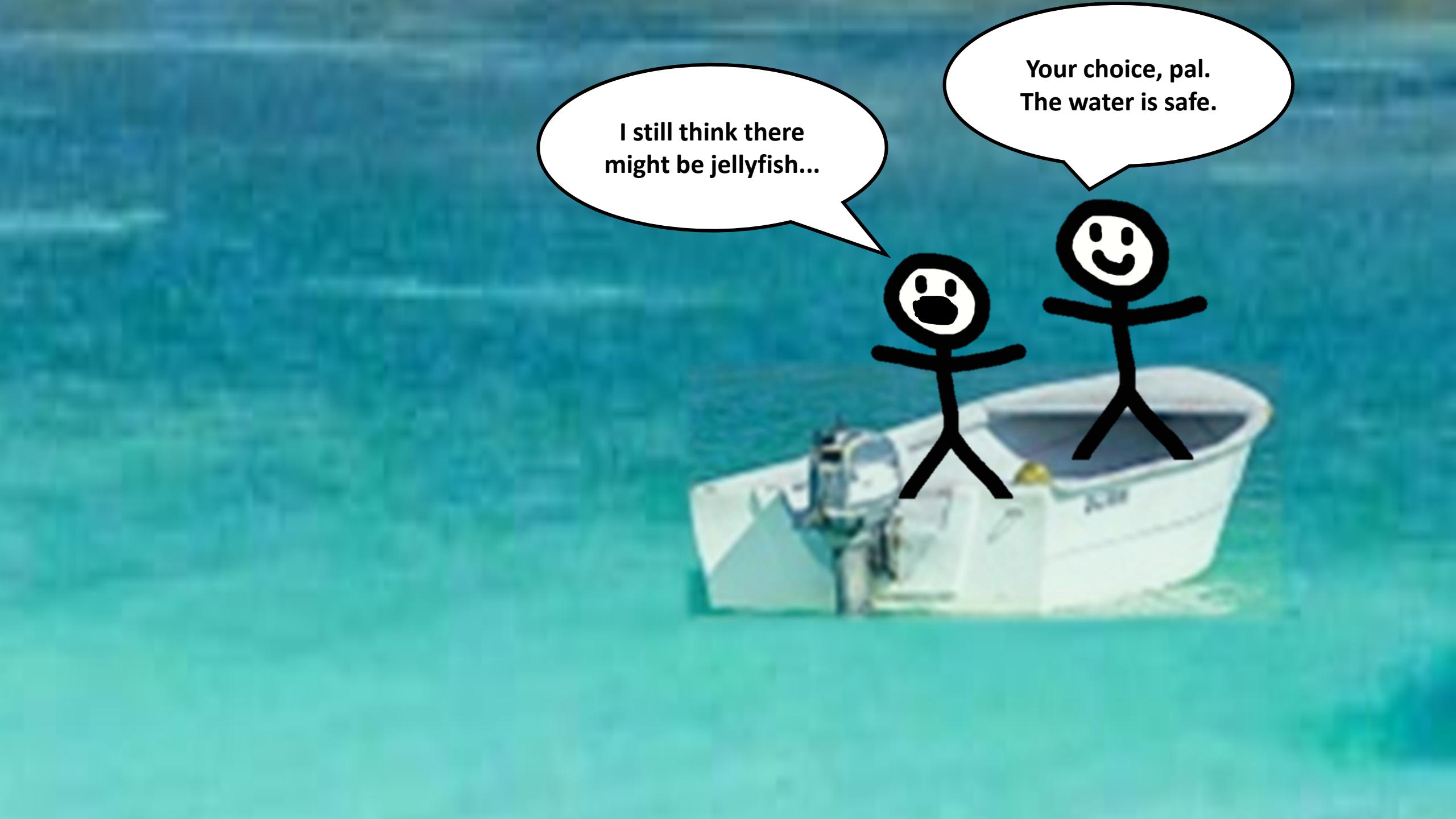
Jellyfish?

In the boat, we are forming a hypothesis and a null hypothesis

H₀ = There are no jellyfish in the water. Going swimming will not lead to getting stung

H₁= There will be jellyfish in the water. Going swimming may lead to getting stung.





I still think there
might be jellyfish...

Your choice, pal.
The water is safe.

Oh no...we made an error. A type 1 error

We rejected the null hypothesis when it was true! We could have gone swimming and been safe from the jelly fish.

P.S. Rejecting the null hypothesis when it is true means the same thing as accepting the Alternate hypothesis when it is false!
Moving on...





No Jellyfish here!!

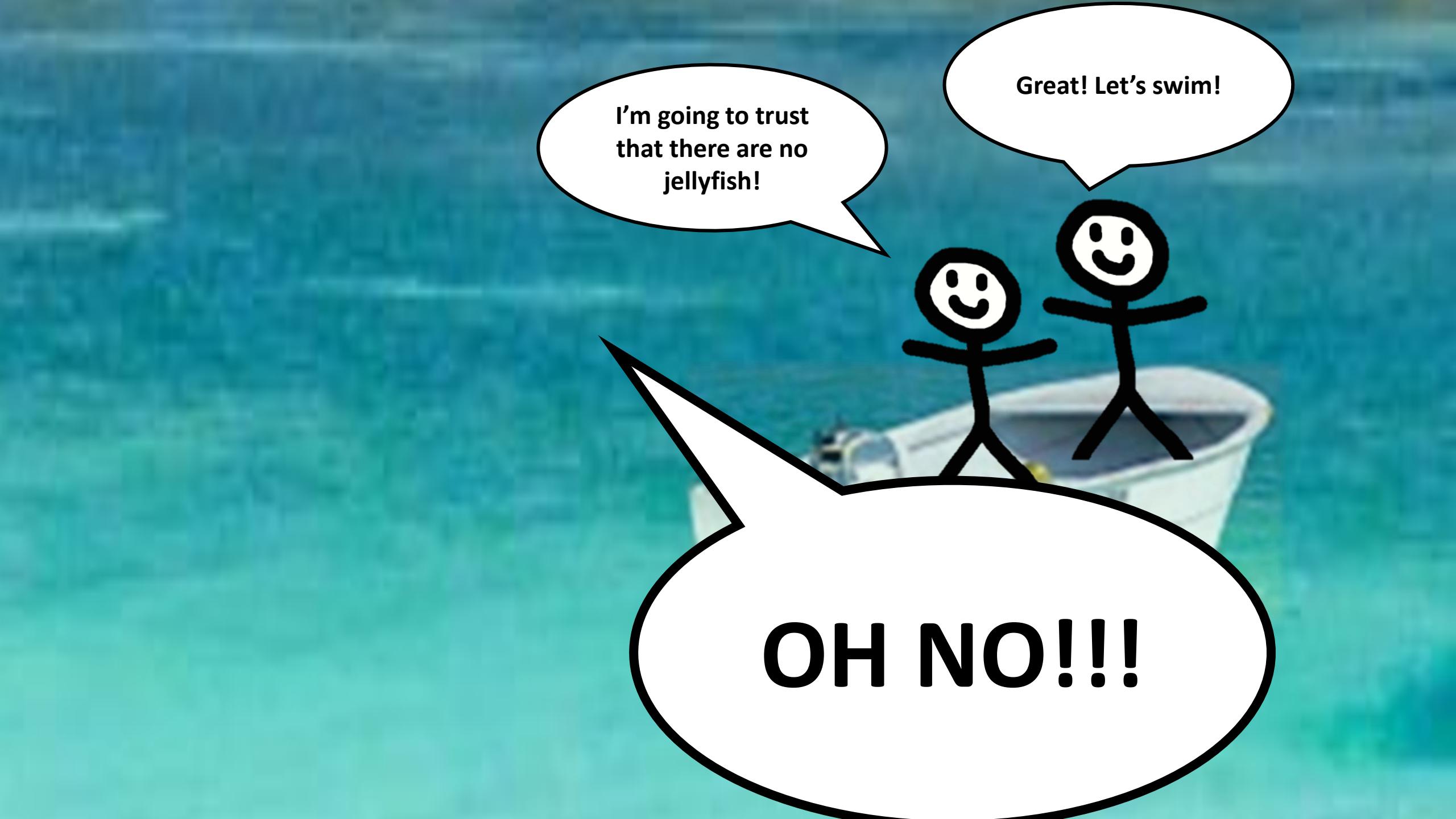
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I'm going to trust
that there are no
jellyfish!

Great! Let's swim!

OH NO!!!

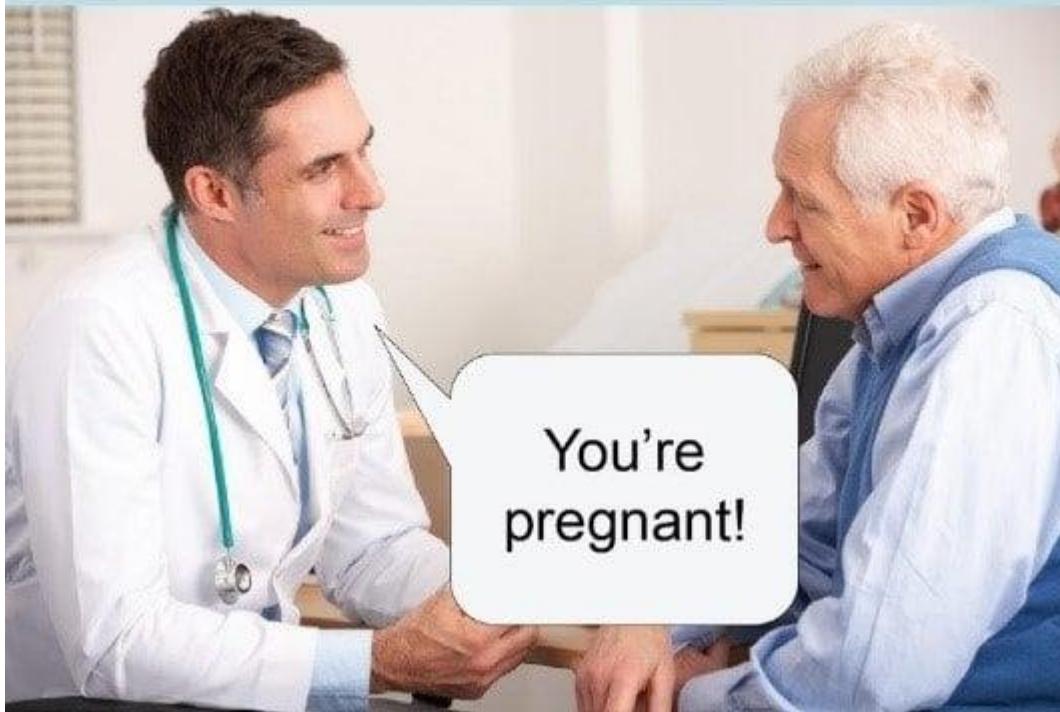
Oh no...we made an error. A type 2 error

We rejected the alternate hypothesis when it was true! We went swimming and got stung! Ouch!



Side by side visualization

Type I Error



Type II Error



Let's look at a HR
example!





We need to improve the level of English in our company. Please ensure all new hires are competent in the language.

How can we do this?

You decide that the hiring process will now include a written English test



In the office, you are forming a hypothesis
and a null hypothesis

H₀ = The written test will have no impact on
the selection of candidates with proficient
English.

H₁= The written test will have a positive
impact on the selection candidates with
proficient English





**omdat ik een
job nodig
heb.**

**Vertel ons waarom
we jou zouden
moeten aannemen.**

**But then you
conduct your
interview in
Dutch!**

You end up
with new
hires who
cannot speak
English
proficiently!
Whoops!

A Type 1 error has occurred. We rejected our null hypothesis even though it was true!

H₀ = The written test will have no impact on the selection of candidates with proficient English.

A Type 1 error is caused either by random chance or poor study design. It is a FALSE POSITIVE

In this case, the study design is the problem.

You decide to change tactics...



**We'll have an English portion in
the interview too!**

**But only 3 people apply for the job. 2 fail the
written English test, and 1 passes. You invite
them all for an interview.**

A cartoon illustration of a job interview. On the left, a man with brown hair and glasses, wearing a dark brown sweater over a yellow collared shirt, sits in a large brown office chair at a wooden desk. He is looking towards a woman on the right. The woman has brown hair and is wearing a red dress with a white collar and a small name tag. She is seated in a grey office chair, facing the man. A laptop is open on the desk between them.

Well this job will be very hard given I don't know what I am doing.

You're asking for a very high salary when you have no experience...

All of the candidates speak English well at the interview...

A cartoon illustration of two people at a desk during an interview. On the left, a man with brown hair and glasses, wearing a dark brown sweater over a yellow collared shirt, sits in a brown office chair, facing right. On the right, a woman with brown hair, wearing a red dress with a white collar and a small name tag, sits in a grey office chair, facing left. They are positioned behind a light-colored wooden desk. A laptop is open on the desk between them.

**My weakness is that I always
speak my mind.**

**Please tell me some of your
weaknesses.**

**And you end up
hiring someone
who failed the
written test....**

But it turns out
that his English
isn't as good as
it appeared in
the interview,
especially when
it comes to
paperwork.

A type 2 error has occurred! We rejected our alternate hypothesis even though it was true!

H1= The written test will have a positive impact for selecting candidates with proficient English

A **Type 2 error** is caused by not enough statistical power (replicates, candidates, sample size etc). It is a **FALSE NEGATIVE**

We needed more candidates than 3 in order to validate this hypothesis

To summarize

There are two kinds of Errors: Type 1 and Type 2

Type 1 is a FALSE POSITIVE.

A researcher accepts H1 when they should have accepted H0.

Something that is not significant is reported to be significant

Type 2 is a FALSE NEGATIVE

A researcher accepts H0 when they should have accepted H1.

Something that is actually significant is not reported