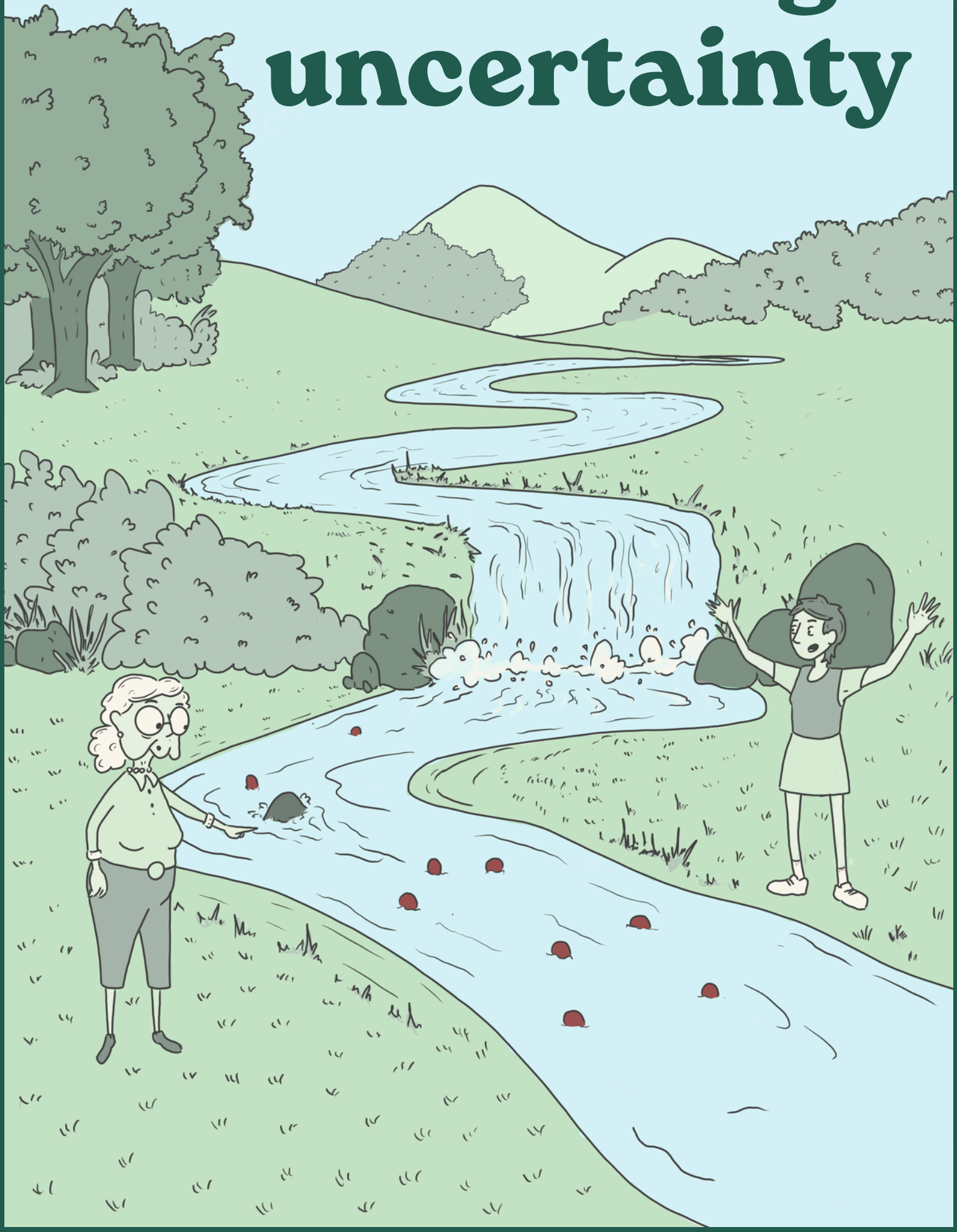
A walk through uncertainty



This comic has been created by the Barcelona Supercomputing Center for the EU-funded RESCUE project.

Comic designed by Inés Martín del Real.

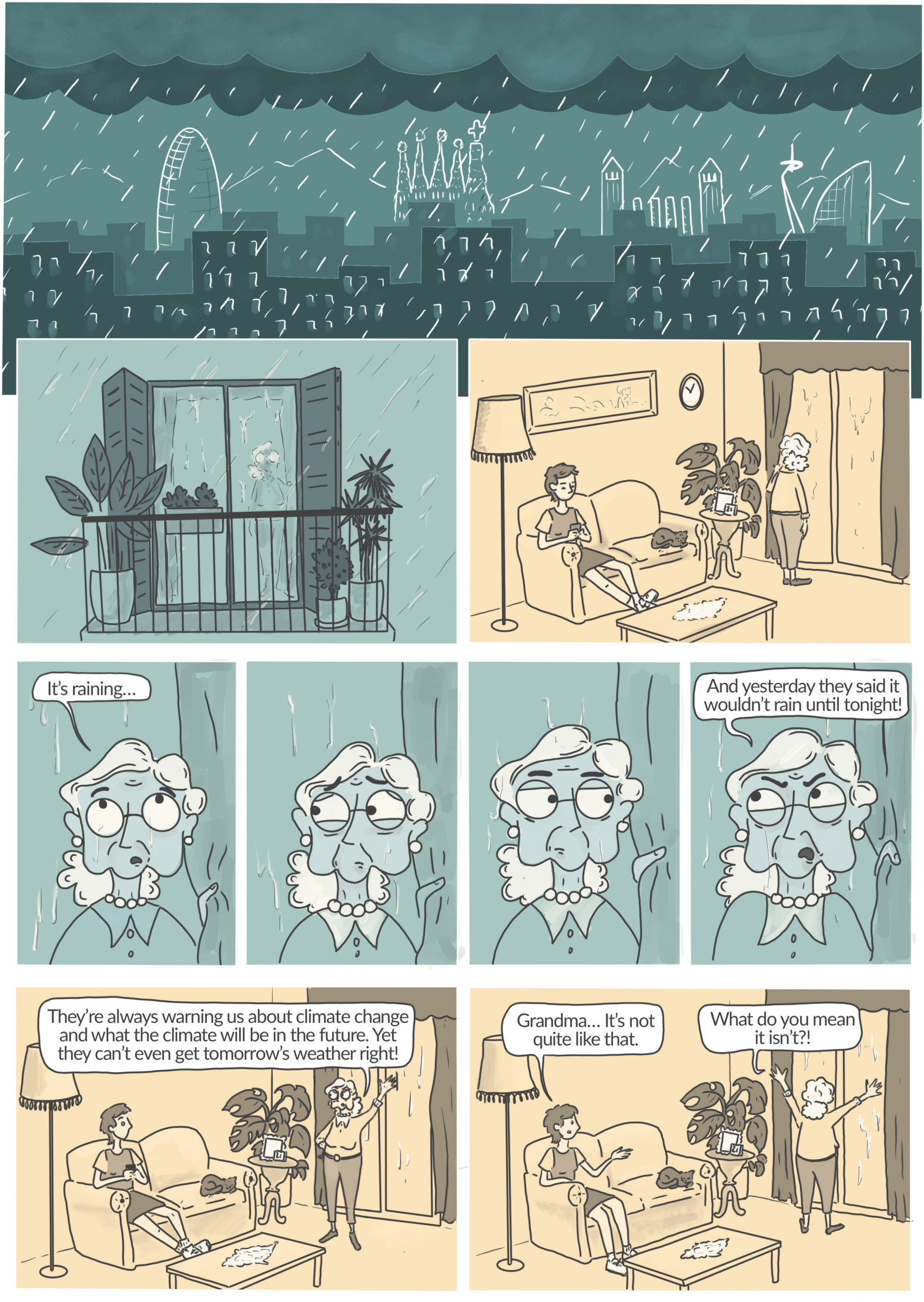
Additional resources:

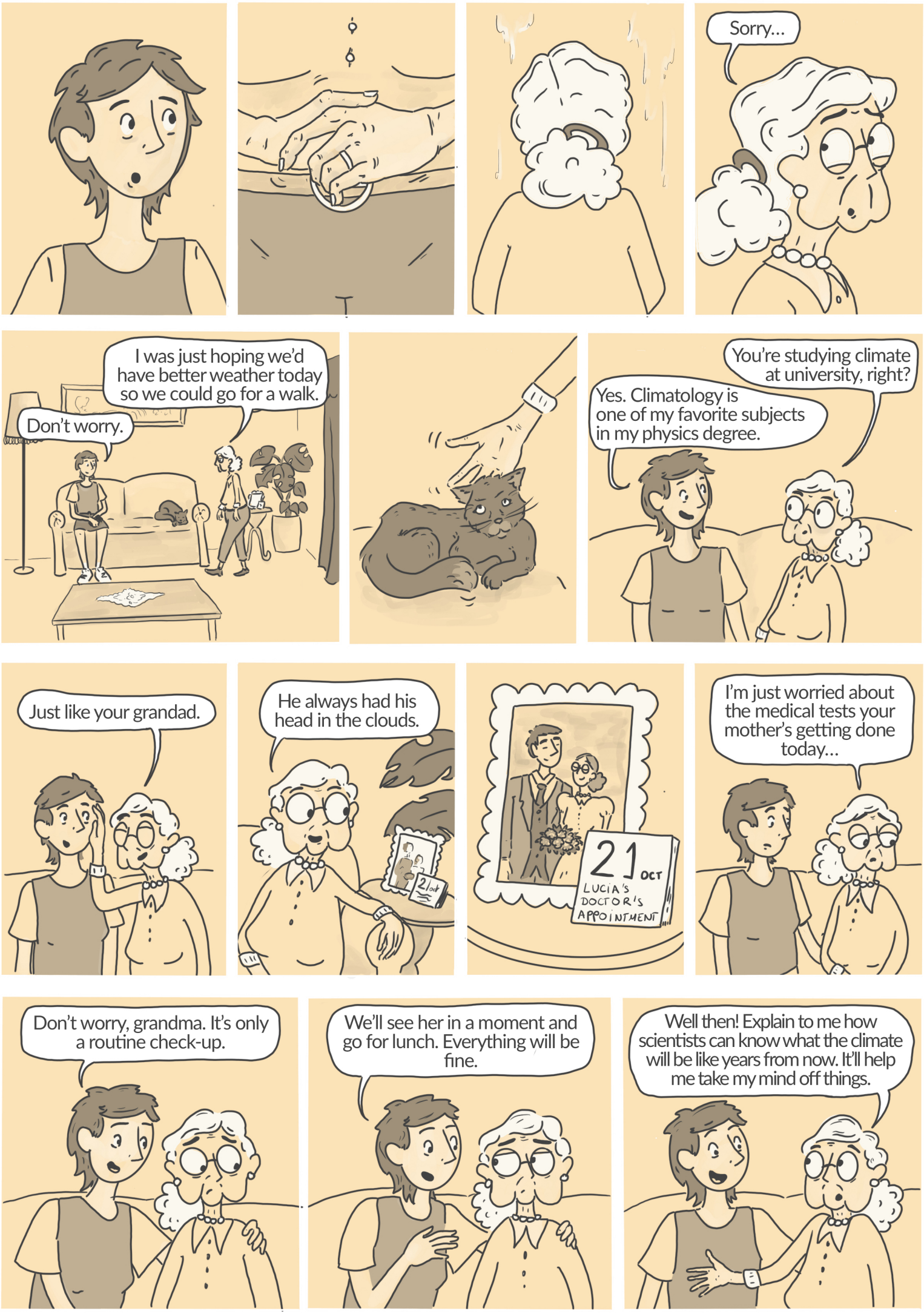
- Confidence and uncertainty in weather forecasting, Met Office - Learn About Weather, YouTube
- Uncertainty in Climate Projections, Climatedata.ca
- Understanding uncertainty in climate change predictions, commonslibrary.parliament.uk

RESCUE climate
rescueclimate.bsky.social
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Barcelona Supercomputing Center, 2026

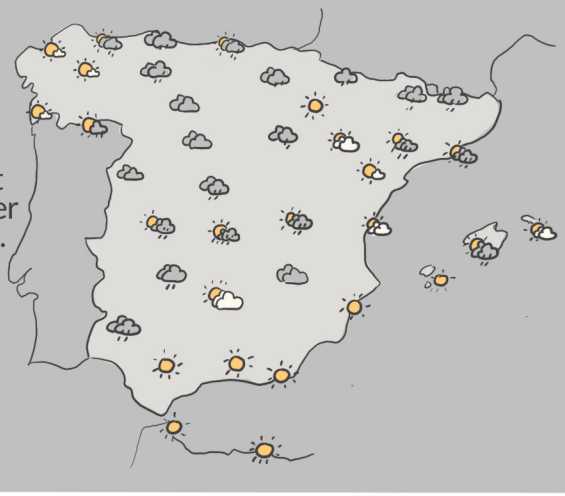
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It's raining...
And yesterday they said it wouldn't rain until tonight!
They're always warning us about climate change and what the climate will be in the future. Yet they can't even get tomorrow's weather right!
Grandma... It's not quite like that.
What do you mean it isn't?!


Sorry...
I was just hoping we'd have better weather today so we could go for a walk.
Don't worry.
You're studying climate at university, right?
Yes. Climatology is one of my favorite subjects in my physics degree.
Just like your grandad.
He always had his head in the clouds.
21 OCT
LUCIA'S DOCTOR'S APPOINTMENT
I'm just worried about the medical tests your mother's getting done today...
Don't worry, grandma. It's only a routine check-up.
We'll see her in a moment and go for lunch. Everything will be fine.
Well then! Explain to me how scientists can know what the climate will be like years from now. It'll help me take my mind off things.

Well, first of all, it's important to understand that weather and climate are not the same thing.

Weather is the state of the atmosphere in a particular place at the moment or over the next few days.

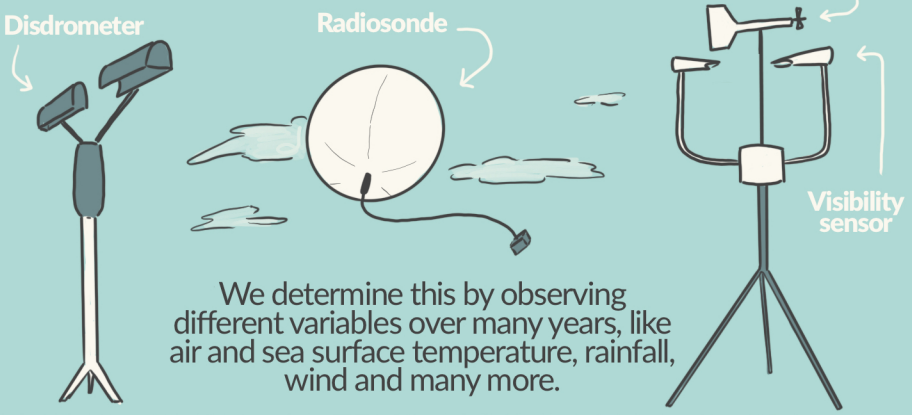


Weather forecasts are never absolute certainties, but rather predictions based on probabilities.

So, even when they tell us the most likely outcome, they can sometimes be wrong.

Well, dear, we've certainly been unlucky.

Climate, on the other hand, describes the usual atmospheric conditions of a place.



We determine this by observing different variables over many years, like air and sea surface temperature, rainfall, wind and many more.

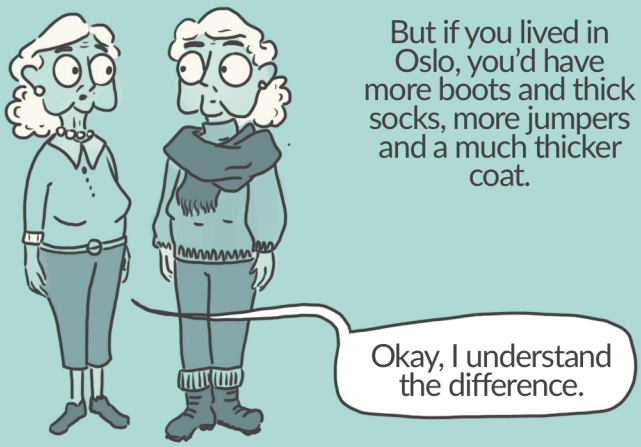
Put another way, weather is the information you'd check to decide whether you should take an umbrella, depending on the chance of rain.



But the climate is what determines your whole wardrobe.



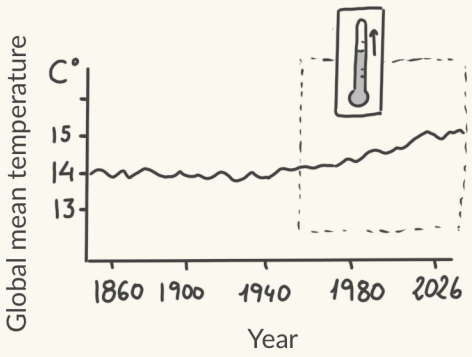
As someone who lives in Barcelona, you have lots of sandals, short-sleeved dresses, a few jumpers and a light coat.



But if you lived in Oslo, you'd have more boots and thick socks, more jumpers and a much thicker coat.

But that only tells me how we describe the current climate. How do scientists know it's going to change?

Well, to begin with, observations over the last few decades confirm that the climate is changing compared with older records.



But a very important tool for analysing what the future climate might be like are climate models.

Oh dear...

That sounds complicated. I don't even know what a climate model is.

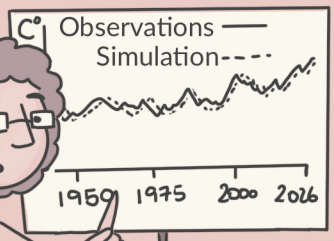
Thanks to research over the last few decades, we know that the climate is the result of constant interaction between the atmosphere, the oceans, the land and the ice.

This knowledge has allowed scientists to build virtual models that simulate these interactions and how the climate could evolve under different levels of greenhouse gases in the atmosphere.

And can we trust that these models work properly?

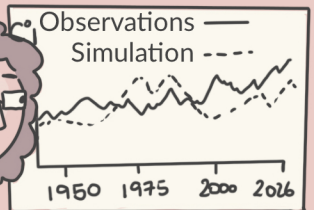
Yes.

Before they're used to make future predictions, scientists test whether they can accurately reproduce the climate we already know.



This model reproduces the past temperature very well.

If a model can't represent past or present climate well enough, it's improved or discarded. There are also many different climate models, each with its own strengths. That's why scientists usually compare the results from many models instead of relying on just one.

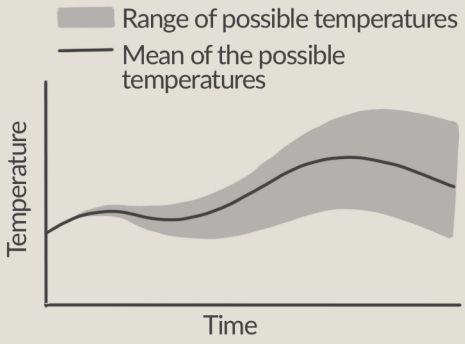


This one doesn't reproduce the observed past temperature well enough.

So, if scientists have studied the climate so much and understand it so well, why can't they say exactly what it will be like in the future?

Because climate projections always involve uncertainty

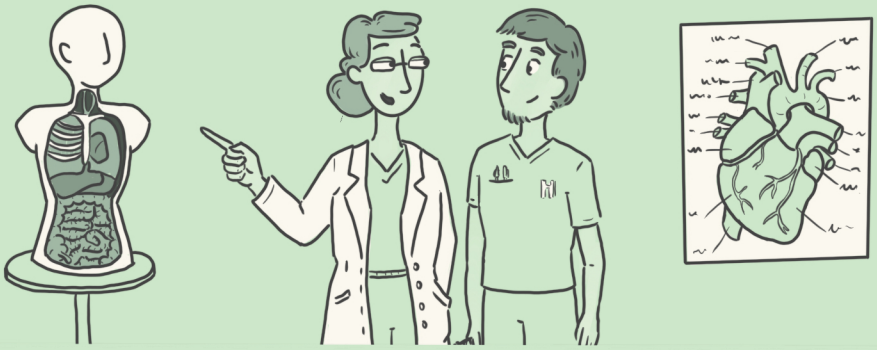
In other words, rather than giving a single exact temperature for a particular time in the future, they can provide a range of possibilities.



So they'll have to study it further… That way they'll be able to be more accurate.

Grandma, uncertainty doesn't mean we lack knowledge.

There are many other areas of life where uncertainty exists, but which we accept more easily. Take medicine, for example.



Doctors understand the human body very well. They know how a healthy body works and what causes disease.

But every person is different. When someone has an illness or an infection, doctors recommend medication or surgery.



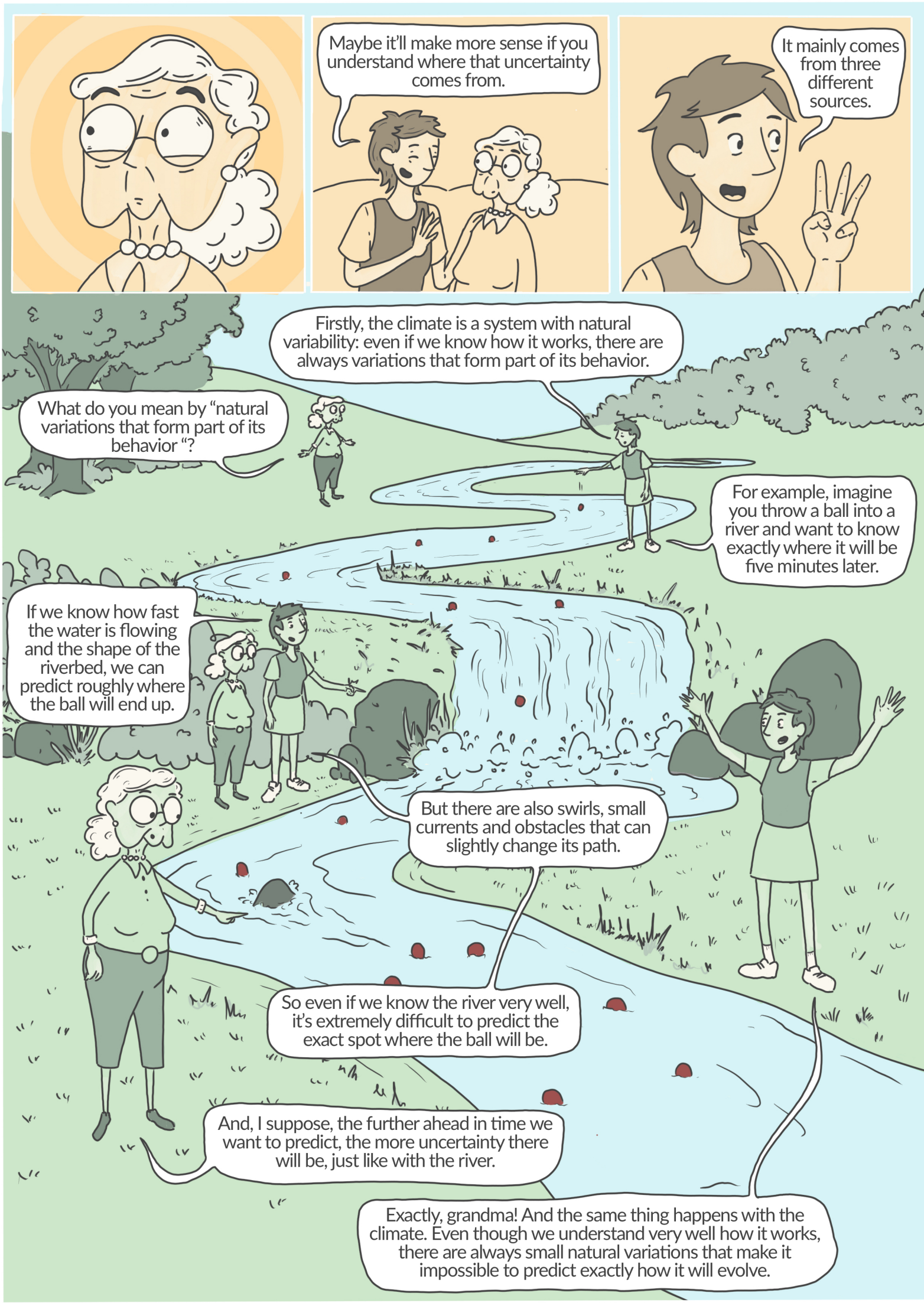
But they can't promise that you'll make a full recovery, whether the illness will come back, or exactly how long it will take you to recover.

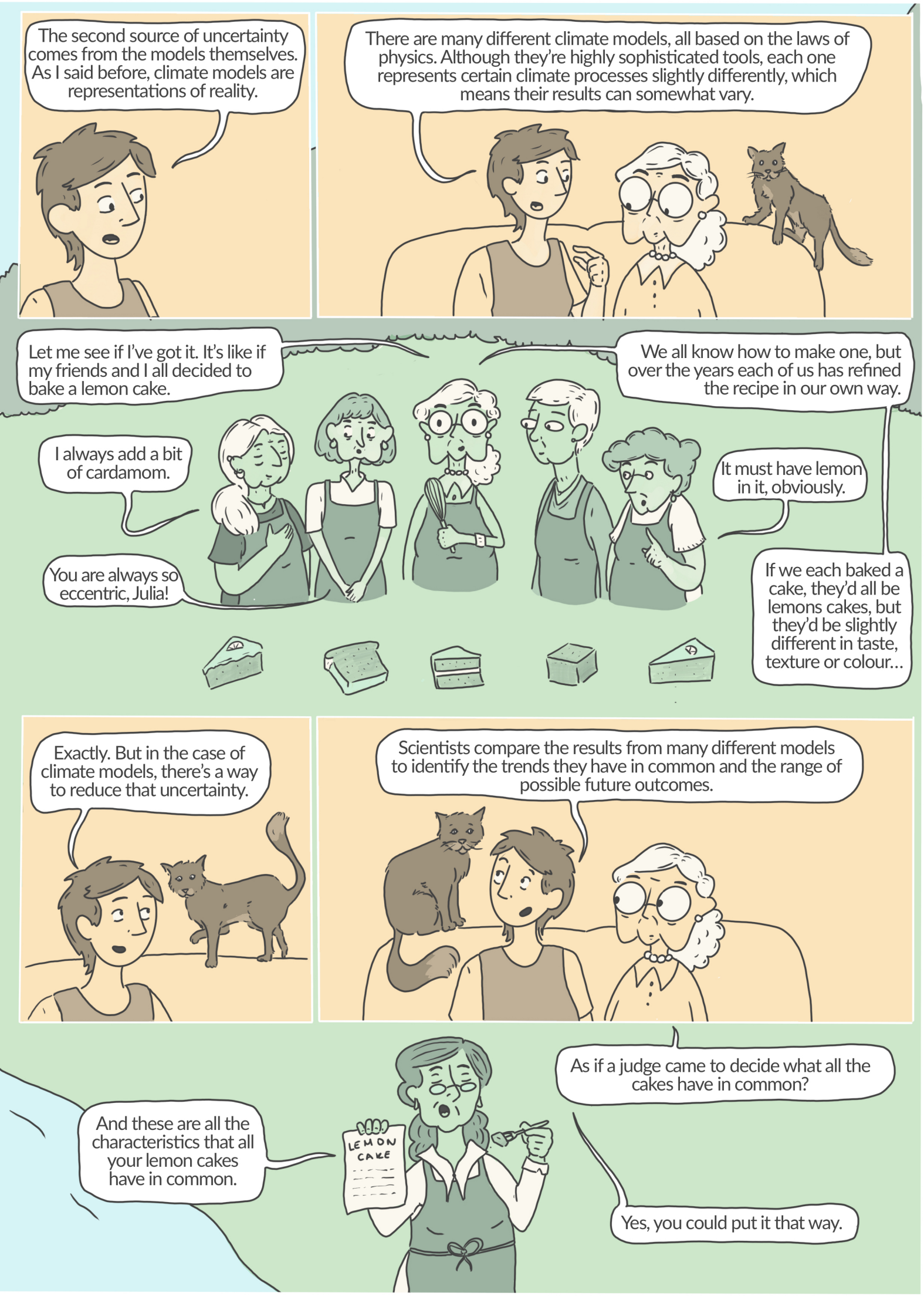
Even so, we still trust that they know what they are doing.

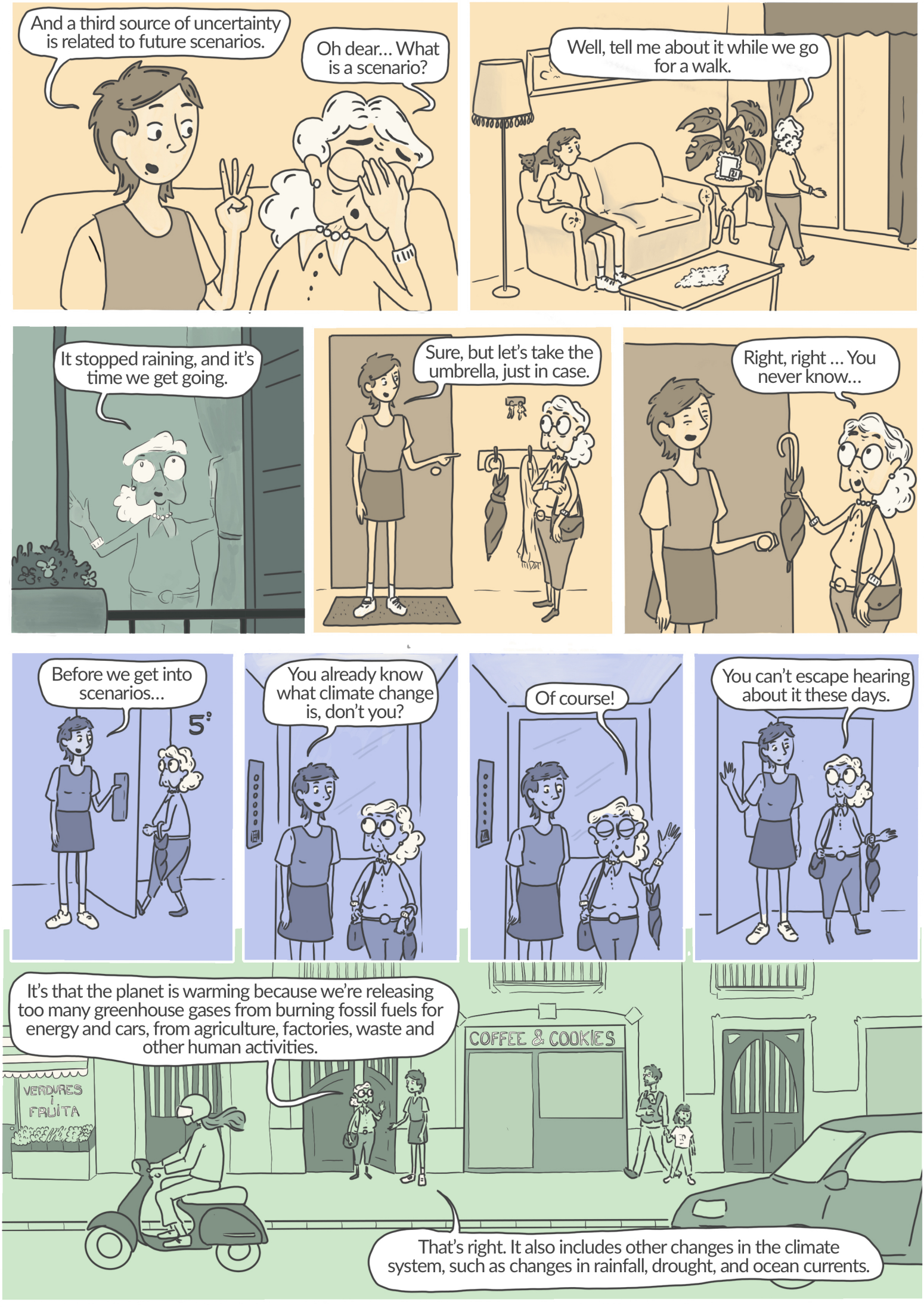


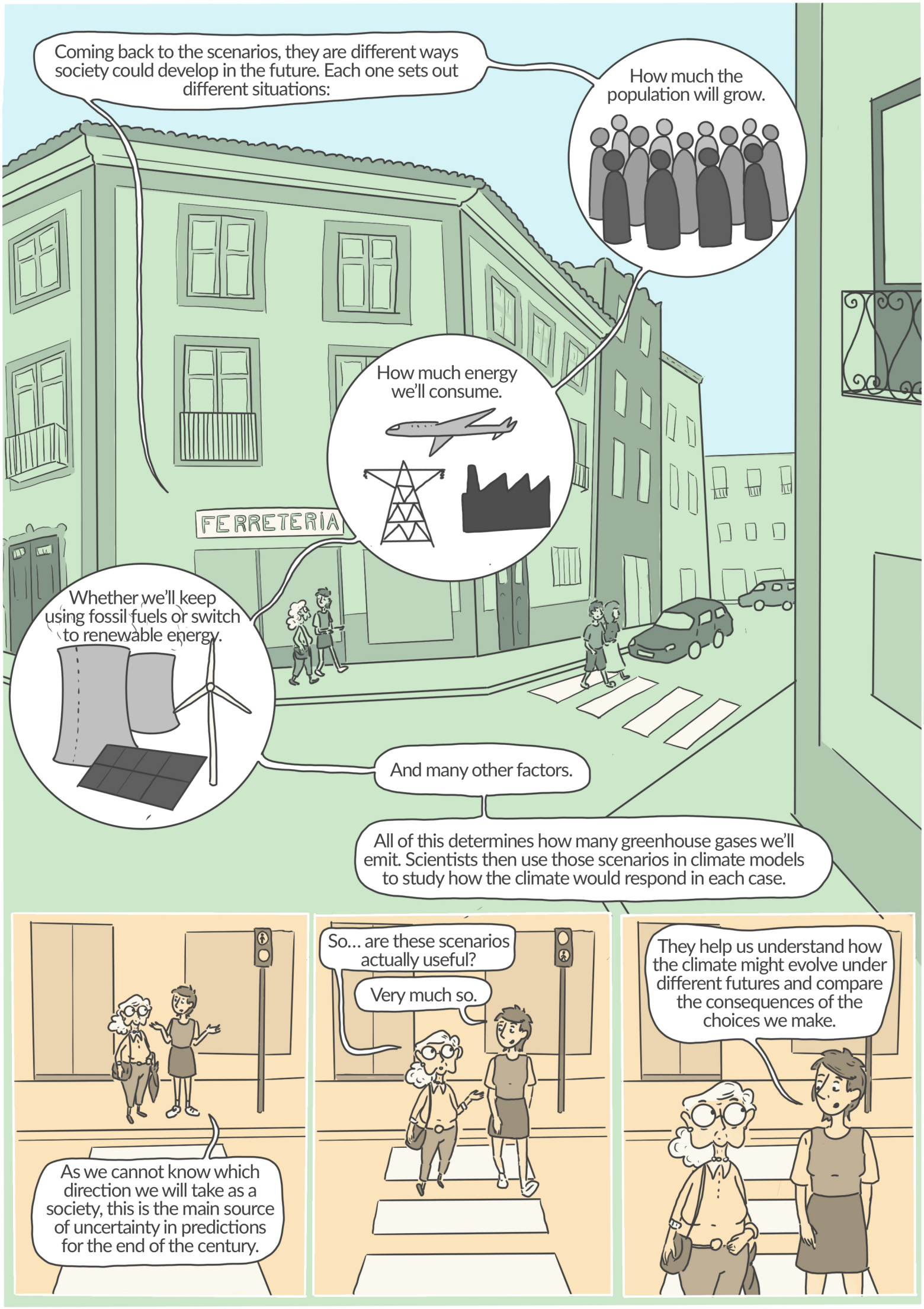
So, uncertainty doesn't mean doctors don't understand how the human body works, nor does it make their knowledge any less valuable.

In the same way, uncertainty in climate predictions means we understand the limits of what can be predicted, and why those limits exist. It's not that we don't understand climate.


Maybe it'll make more sense if you understand where that uncertainty comes from.
It mainly comes from three different sources.
Firstly, the climate is a system with natural variability: even if we know how it works, there are always variations that form part of its behavior.
What do you mean by "natural variations that form part of its behavior "?
For example, imagine you throw a ball into a river and want to know exactly where it will be five minutes later.
If we know how fast the water is flowing and the shape of the riverbed, we can predict roughly where the ball will end up.
But there are also swirls, small currents and obstacles that can slightly change its path.
So even if we know the river very well, it's extremely difficult to predict the exact spot where the ball will be.
And, I suppose, the further ahead in time we want to predict, the more uncertainty there will be, just like with the river.
Exactly, grandma! And the same thing happens with the climate. Even though we understand very well how it works, there are always small natural variations that make it impossible to predict exactly how it will evolve.


The second source of uncertainty comes from the models themselves. As I said before, climate models are representations of reality.
There are many different climate models, all based on the laws of physics. Although they're highly sophisticated tools, each one represents certain climate processes slightly differently, which means their results can somewhat vary.
Let me see if I've got it. It's like if my friends and I all decided to bake a lemon cake.
We all know how to make one, but over the years each of us has refined the recipe in our own way.
I always add a bit of cardamom.
It must have lemon in it, obviously.
You are always so eccentric, Julia!
If we each baked a cake, they'd all be lemons cakes, but they'd be slightly different in taste, texture or colour…
Exactly. But in the case of climate models, there's a way to reduce that uncertainty.
Scientists compare the results from many different models to identify the trends they have in common and the range of possible future outcomes.
As if a judge came to decide what all the cakes have in common?
And these are all the characteristics that all your lemon cakes have in common.
LEMON CAKE
Yes, you could put it that way.

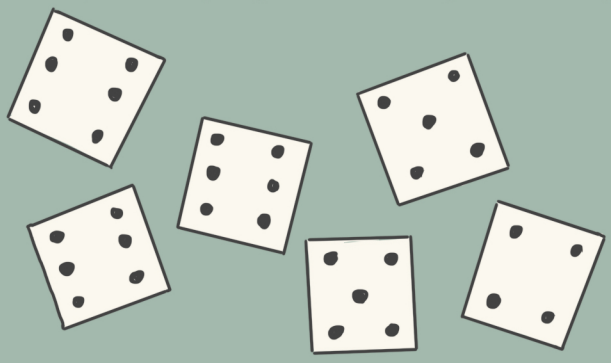

And a third source of uncertainty is related to future scenarios.
Oh dear... What is a scenario?
Well, tell me about it while we go for a walk.
It stopped raining, and it's time we get going.
Sure, but let's take the umbrella, just in case.
Right, right ... You never know...
Before we get into scenarios...
5°
You already know what climate change is, don't you?
Of course!
You can't escape hearing about it these days.
It's that the planet is warming because we're releasing too many greenhouse gases from burning fossil fuels for energy and cars, from agriculture, factories, waste and other human activities.
COFFEE & COOKIES
VERDURES I FRUITA
That's right. It also includes other changes in the climate system, such as changes in rainfall, drought, and ocean currents.


Coming back to the scenarios, they are different ways society could develop in the future. Each one sets out different situations:
How much the population will grow.
How much energy we'll consume.
FERRETERIA
Whether we'll keep using fossil fuels or switch to renewable energy.
And many other factors.
All of this determines how many greenhouse gases we'll emit. Scientists then use those scenarios in climate models to study how the climate would respond in each case.
As we cannot know which direction we will take as a society, this is the main source of uncertainty in predictions for the end of the century.
So... are these scenarios actually useful?
Very much so.
They help us understand how the climate might evolve under different futures and compare the consequences of the choices we make.

Imagine you have two different dice.

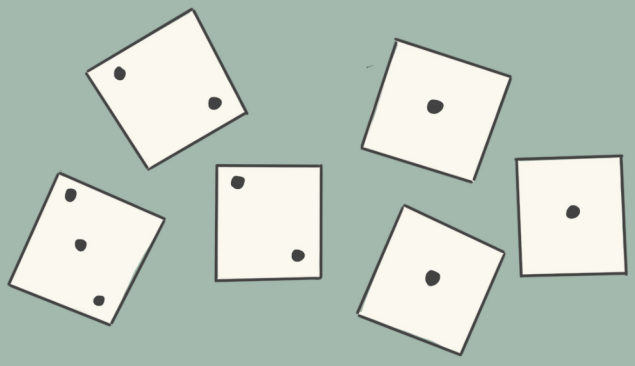


One is a loaded die: it has three sixes, two fives, and one four. It represents a future where we keep emitting large amounts of greenhouse gases.



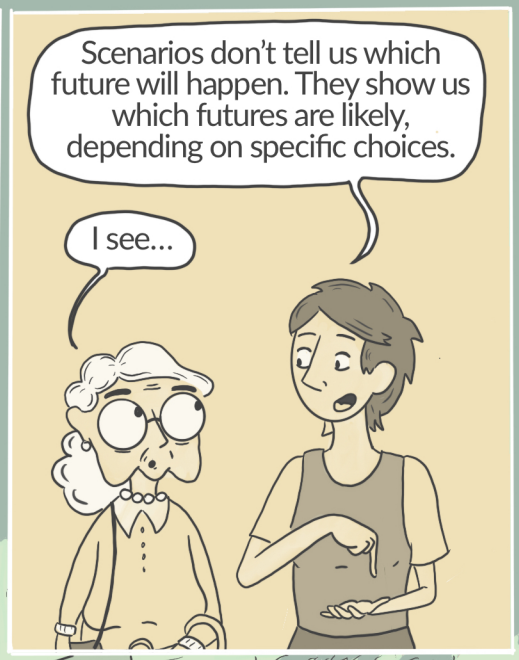


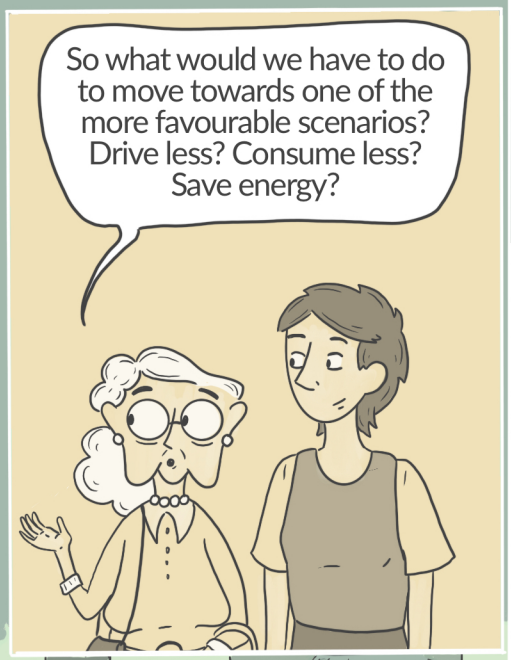
The other one has three ones, two twos, and one three. It represents a future where we drastically reduce emissions.



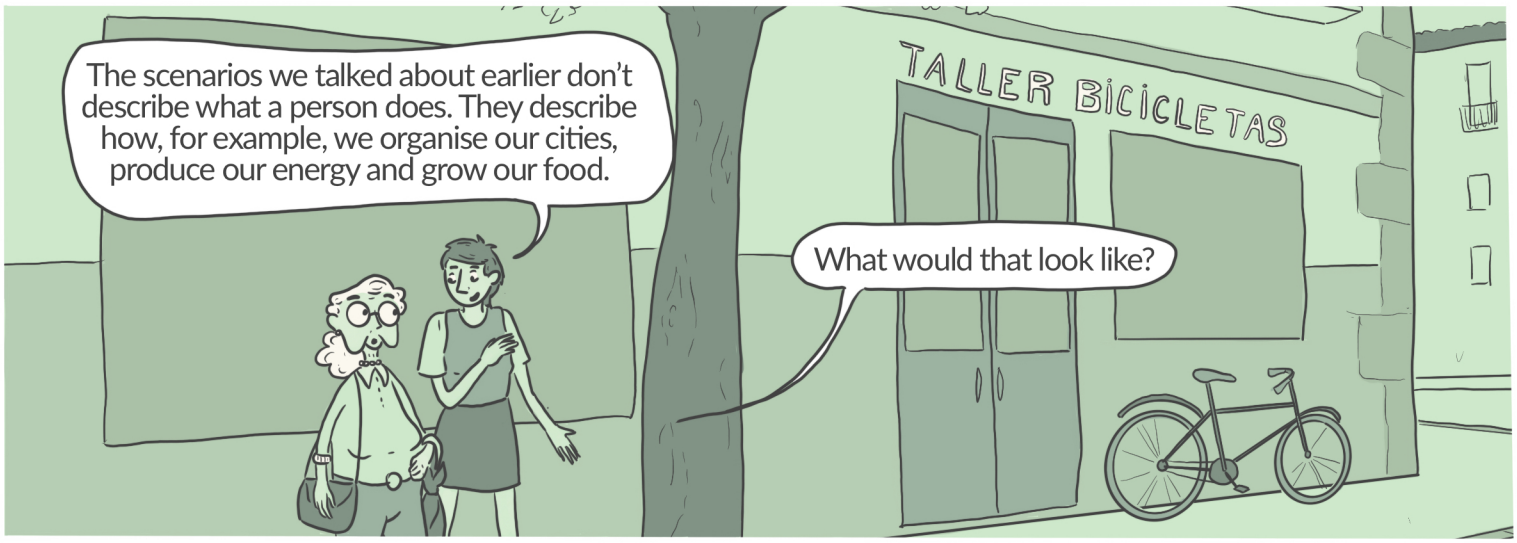
We can't know exactly which number will come up when we roll the dice. That's the uncertainty. But we know that, depending on which die we're rolling, some outcomes are far more likely than others.

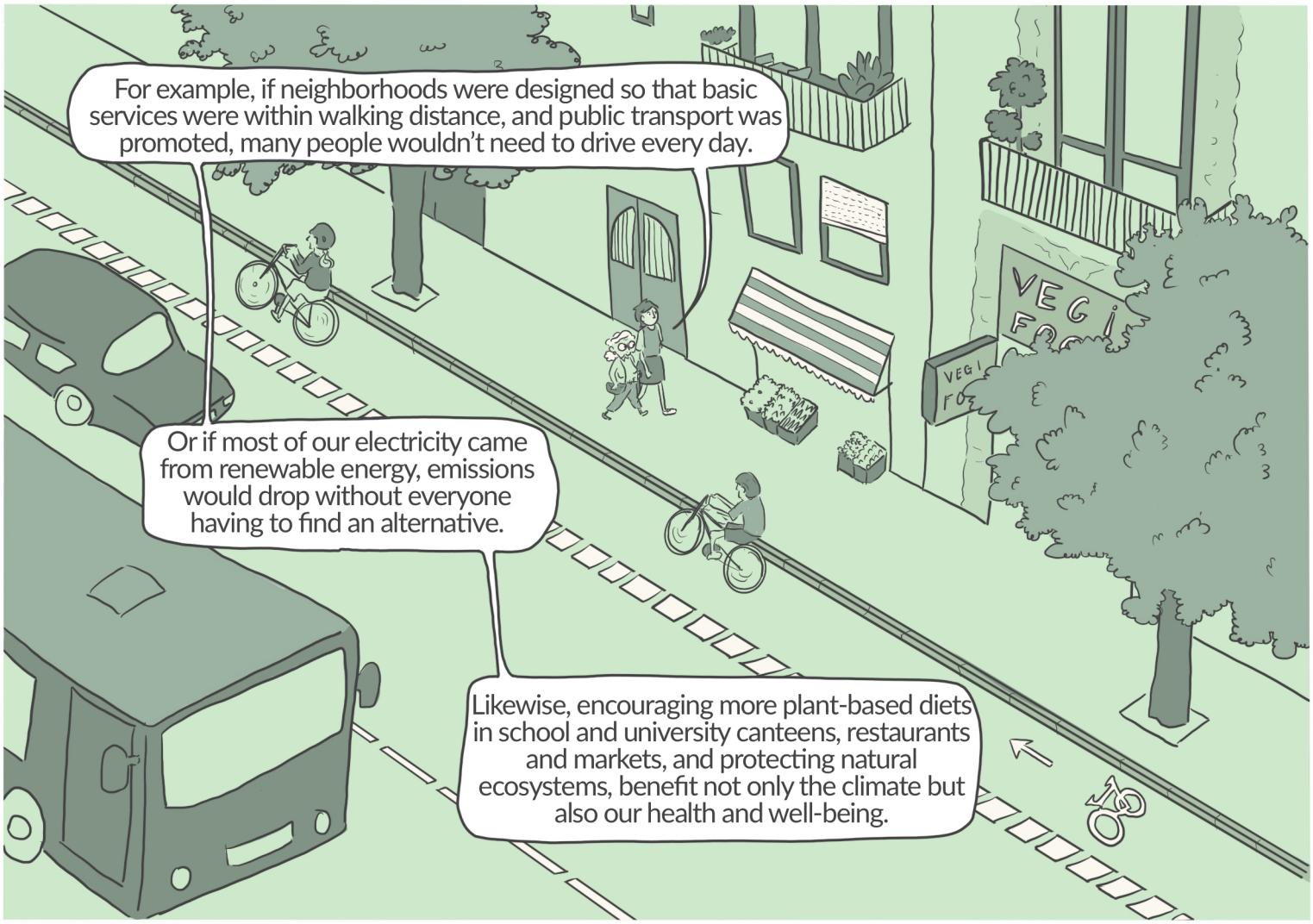


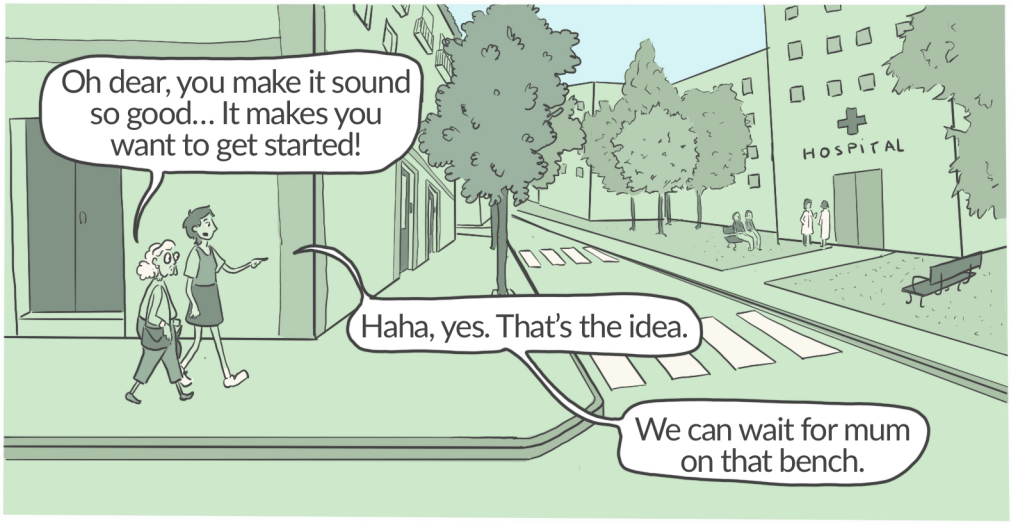






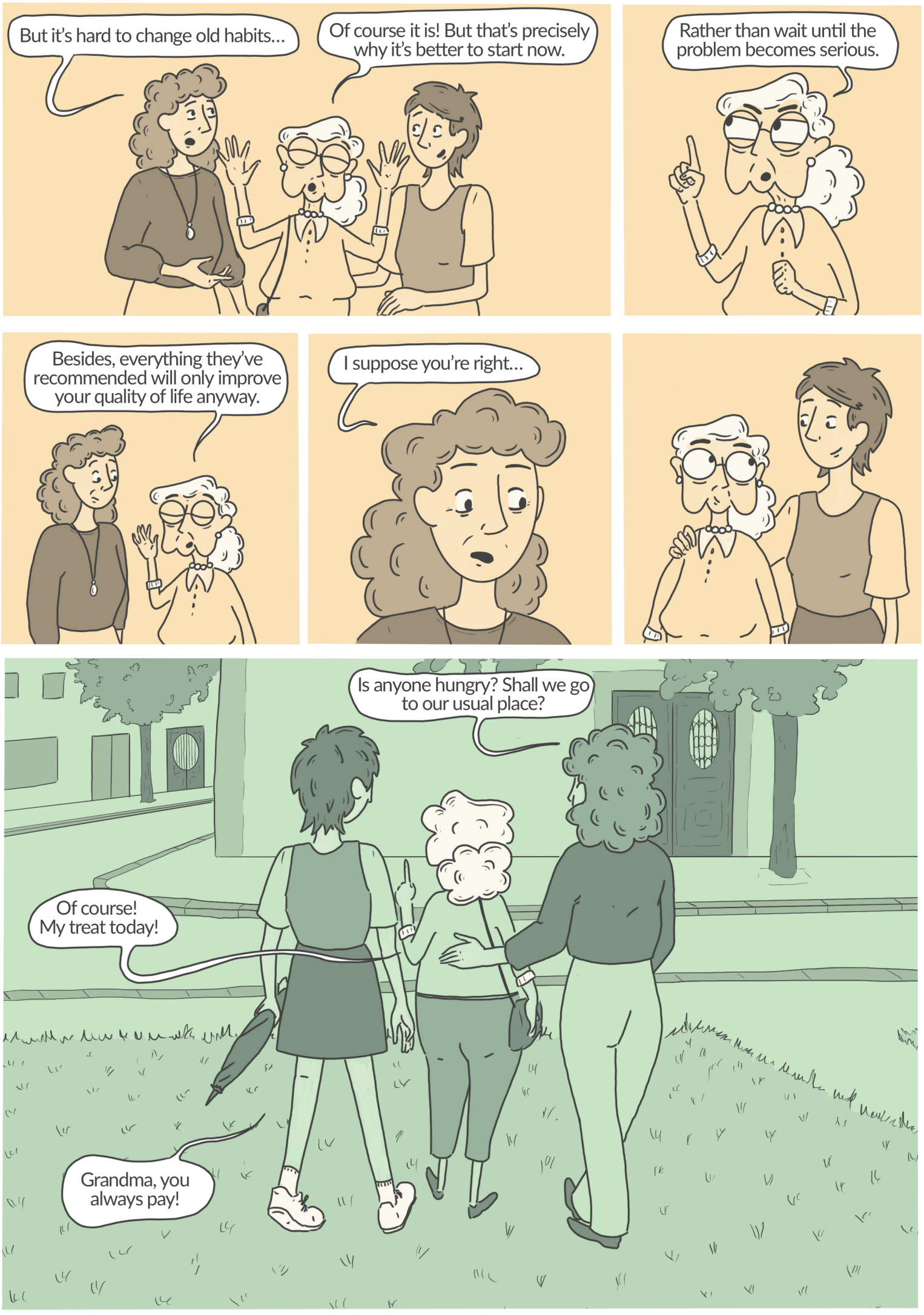

The scenarios we talked about earlier don't describe what a person does. They describe how, for example, we organise our cities, produce our energy and grow our food.
TALLER BICICLETAS
What would that look like?


For example, if neighborhoods were designed so that basic services were within walking distance, and public transport was promoted, many people wouldn't need to drive every day.
Or if most of our electricity came from renewable energy, emissions would drop without everyone having to find an alternative.
Likewise, encouraging more plant-based diets in school and university canteens, restaurants and markets, and protecting natural ecosystems, benefit not only the climate but also our health and well-being.


Oh dear, you make it sound so good... It makes you want to get started!
HOSPITAL
Haha, yes. That's the idea.
We can wait for mum on that bench.


She should be coming out any minute now.


I do hope everything is alright...
It's only a few tests, Grandma. Everything will be fine.
I know... But your Grandad started with some harmless tests too.
And bit by bit everything got more complicated...
HOSPITAL
Don't worry, Grandma... Look! There she is!
Hi!
I wasn't sure you'd come to pick me up, with all that rain.
Grandma was a bit worried.
Well, well... What did they say?
Nothing serious, Mum, so don't worry.
They didn't find anything to worry about. But, given our family history, they've recommended that I exercise more and...
Above all, quit smoking ...
Well then, you better listen to them, do you hear me?
I know, Mum...


But it's hard to change old habits...
Of course it is! But that's precisely why it's better to start now.
Rather than wait until the problem becomes serious.
Besides, everything they've recommended will only improve your quality of life anyway.
I suppose you're right...
Is anyone hungry? Shall we go to our usual place?
Of course! My treat today!
Grandma, you always pay!

A comic by:

RESCUE

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the European Union

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