

Butterfly Flo and the Everything Effect

Written by
Niraj Lal

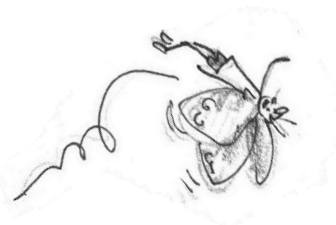
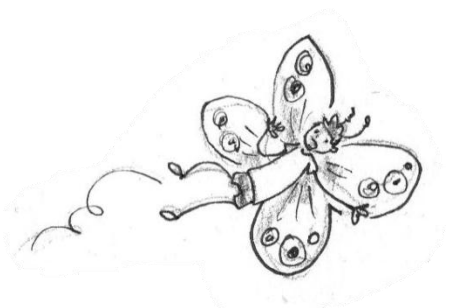
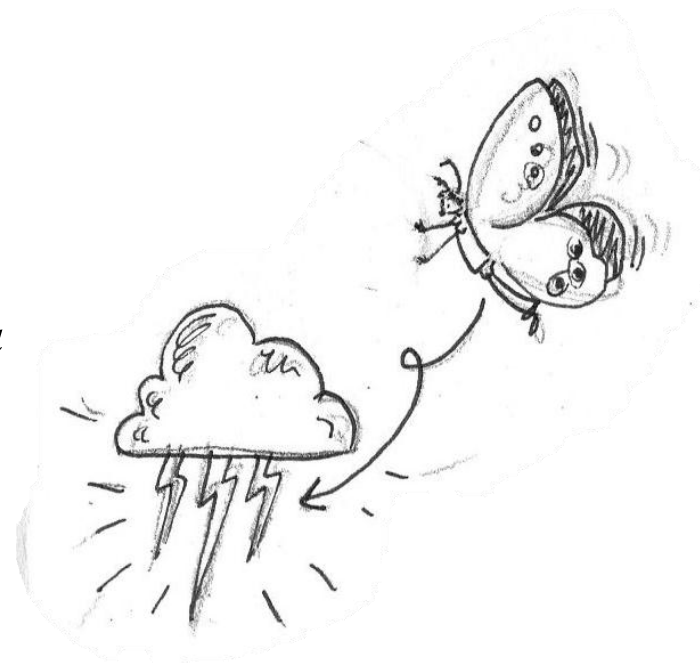
Illustrated by
Garance Monfort

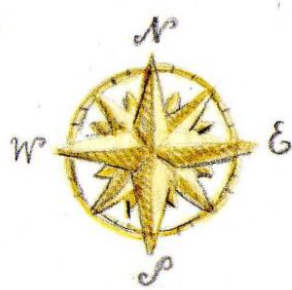


$$z_{n+1} = z_n^2 + c$$



For Jayan and Didda





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|---|--|---|
|  grey clouds |  sunny spells |  rain |
|  fog |  sunshine |  thunderstorms |
|  lightning |  strong winds |  cloudy |
|  snowshowers |  trade winds |  hurricanes |

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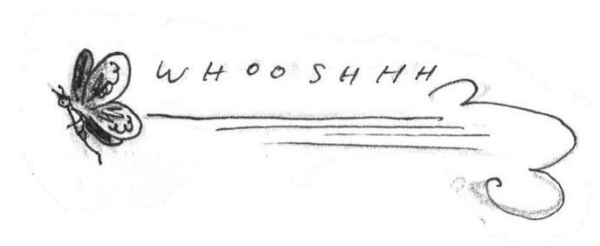
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Chapter One

Chaos theory



It was a scorching summer's day when Flo learnt he could make hurricanes. The air was so hot that it felt like the sun was shining through a giant magnifying glass in the sky. The old scribbly barked gum trees looked like they were about to melt, and the ground looked like a cake that had baked for too long in an oven. But the heat didn't matter to Flo when he learnt he could change the weather.

Flo was a Meadow Argus butterfly with shining dots, brown wings, and a long left antenna he could never quite keep straight. This antenna was especially crooked the day his teacher, Mr. Higgott, told the class about The Butterfly Effect. 'The Butterfly Effect,' Mr. Higgott explained in a gruff voice that boomed through the air, 'is a way of explaining the weather.' Flo was trying to stay awake, Mr. Higgott was known for breaking into song unexpectedly – he was a possum who played harmonica with his band Bushytales during moonlit nights and experimented with new musical material during lessons at unexpected times.

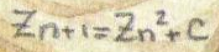
But the thick afternoon air was curling Flo's antennae towards sleep. "The Butterfly Effect is part of a subject in mathematics called 'Chaos', but the idea is simple." Mr Higgott was saying to the dozing class, 'Chaos theory says that Things that are quick to change can be hard to predict.' Eyelids were drooping in the afternoon heat. Jim the magpie was throwing gumnuts out the window and Wombat Wally's sniffly nose was sounding more like a snore. Mr. Higgott looked at the class, hopped onto his other foot and twitched his whiskers.

"The world is full of chaos!" Mr. Higgott jumped on the table with a bang. Jim choked on his gumnut and Wally woke with a sneeze. "Chaos is the science behind how something as small as a horseshoe nail can defeat a whole kingdom". And he pulled out his harmonica and started to sing:

*"For want of a nail, a shoe was lost;
For want of a shoe, a horse was lost;
For want of a horse, a rider was lost;
For want of a rider, a battle was lost;
For want of a battle, a kingdom was lost!"*



$$\frac{dL}{dx} = \frac{d}{dt} \frac{dL}{dx}$$



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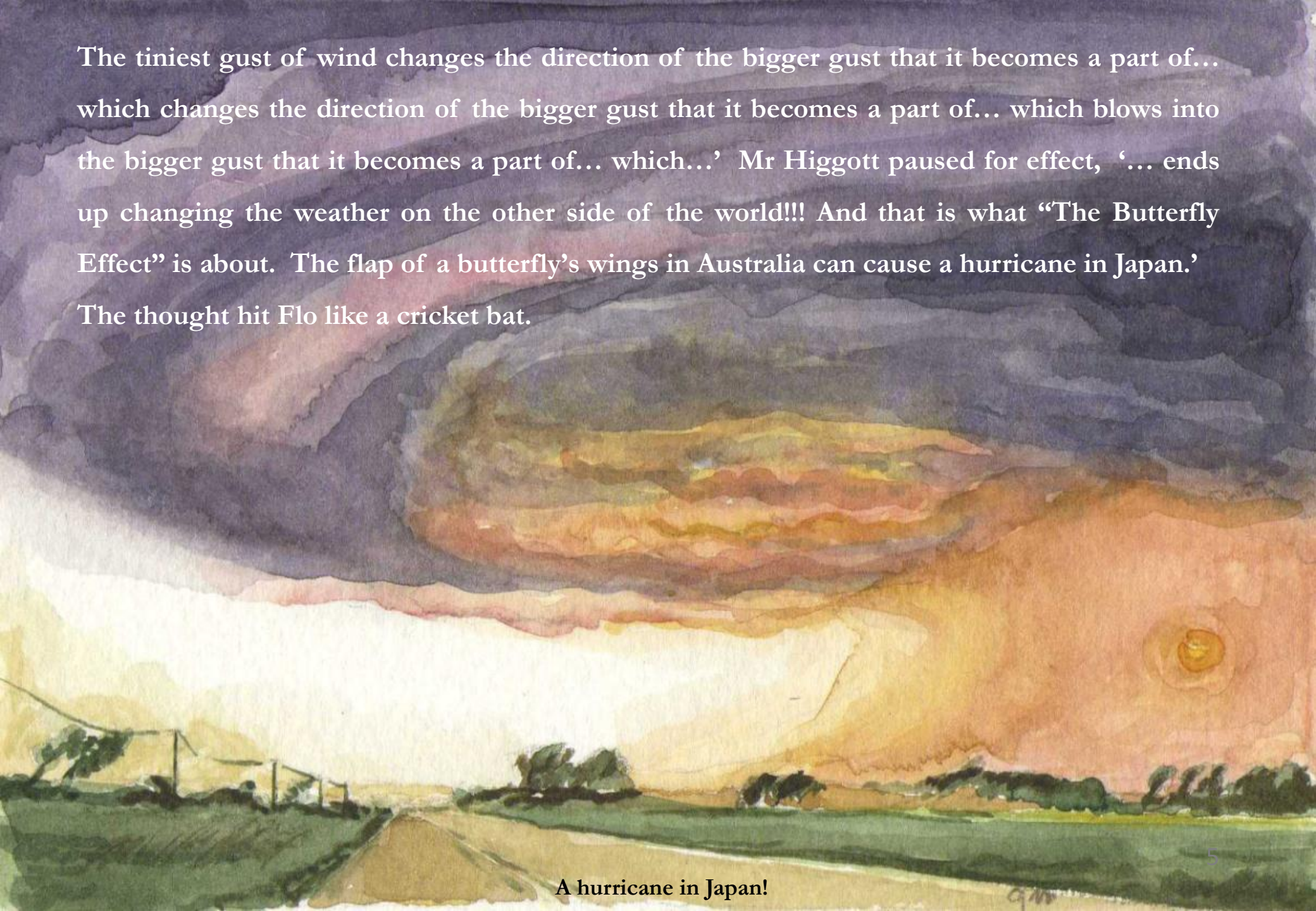
‘And Chaos can be found everywhere,’ Mr Higgott, put his harmonica in his pocket and continued as if nothing had happened. But the class was now awake. ‘Chaos can be seen in a flock of birds that changes direction in a second. And chaotic maths can be found in a fern branch that has the same shape as its tiniest leaf. Chaos can even be heard in our own heartbeats, which never follow an exact steady rhythm...’ But!’ the teacher paused, looked around the class and lowered his voice to a whisper, ‘one of the most chaotic things of all is something that is always around us...
... It’s the weather!!!’ Mr. Higgott finished triumphantly.

Flo looked outside at the wilting trees and the baking shimmering ground and the beaming unstoppable sun – there didn’t seem to be a breath of wind anywhere. ‘It doesn’t look too chaotic to me’ Flo whispered to Peter, a yellow-footed rock wallaby sitting next to him.

‘The weather is incredibly chaotic!’ Mr. Higgott yelled. His tail was thumping the desk behind him. ‘We have no idea if it’s going to be sunny in two weeks from now, or when the drought will break, or even which direction the wind’s going to come from next Monday! That’s because every single, tiny, piddly, diddly, squiddly puff of wind makes an ABSOLUTELY GINORMOUS difference later on!

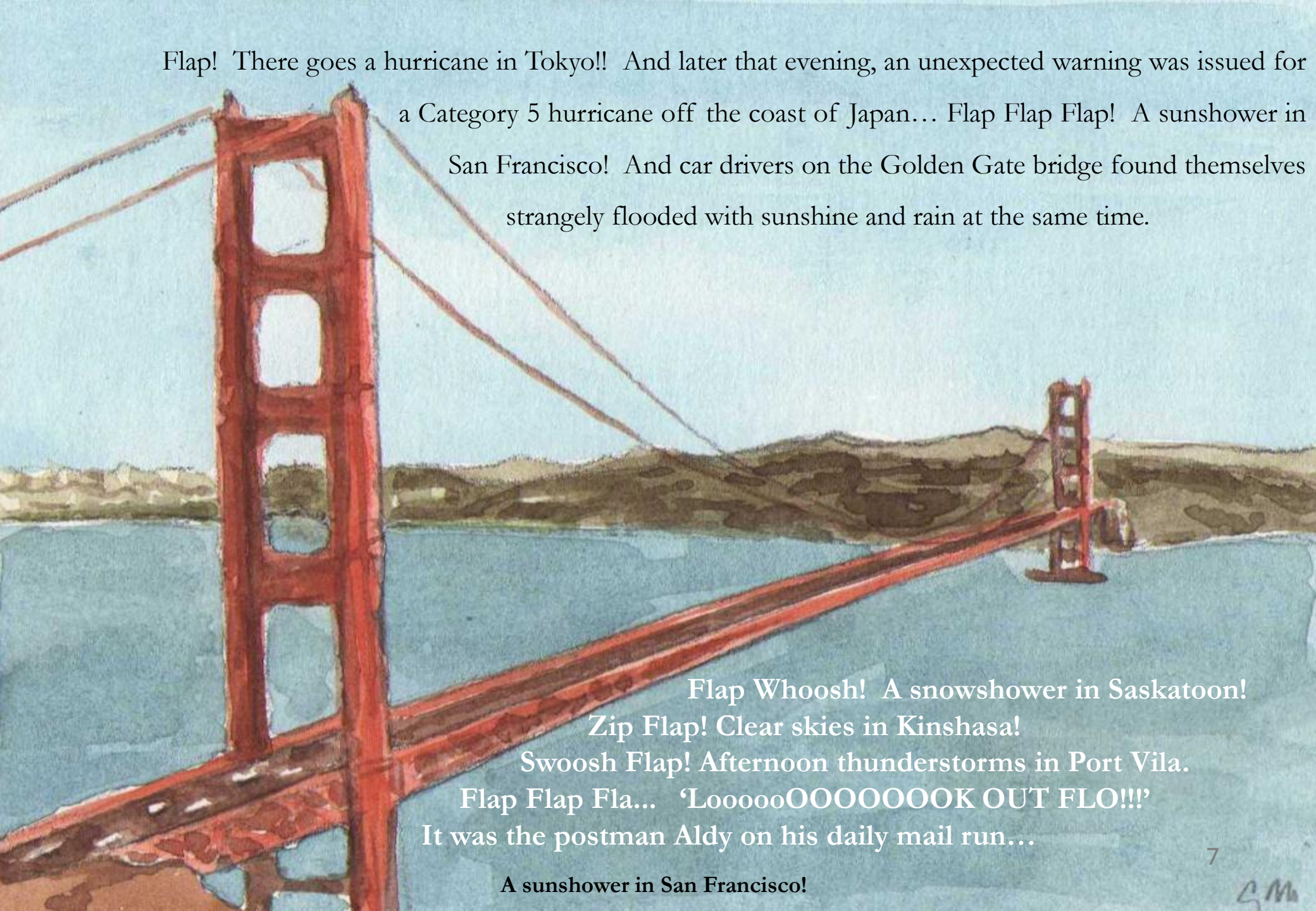


The tiniest gust of wind changes the direction of the bigger gust that it becomes a part of... which changes the direction of the bigger gust that it becomes a part of... which blows into the bigger gust that it becomes a part of... which...’ Mr Higgott paused for effect, ‘... ends up changing the weather on the other side of the world!!! And that is what “The Butterfly Effect” is about. The flap of a butterfly’s wings in Australia can cause a hurricane in Japan.’ The thought hit Flo like a cricket bat.



A hurricane in Japan!

Had he heard right? He could make hurricanes with his wings? Japanese hurricanes depend on butterflies Australia? He could change the weather? He felt a slow crinkly, shivery wave of electricity start from the back of his neck, shoot through his shoulders and spread across his whole body, tingling its way from the top of his crooked left antenna to the tips of his wings. Mr. Higgott's tail was still thumping the desk as he explained more about the weather, but Flo was in shock. He began to imagine all the hurricanes he had caused since he started flying. And all the rainy days... and sunny days... and all the days in between. He looked at his wings, which he had always wished to be a little bigger, with newfound respect. Flo wondered whose wings had caused this week's hot weather...and where the butterfly was that was responsible for last year's hailstorm on Christmas Eve... and if his own wings could do anything about climate change... or if his Uncle Argus was the butterfly who... 'Oi Flo!' said Peter, waking him from his daydreams, reminding him to write down the homework Mr Higgott was writing on the board. The bell soon rang and Flo said goodbye to friends and started to fly home. He felt very powerful and quite important.



Flap! There goes a hurricane in Tokyo!! And later that evening, an unexpected warning was issued for a Category 5 hurricane off the coast of Japan... Flap Flap Flap! A sunshower in San Francisco! And car drivers on the Golden Gate bridge found themselves strangely flooded with sunshine and rain at the same time.

Flap Whoosh! A snowshower in Saskatoon!
Zip Flap! Clear skies in Kinshasa!
Swoosh Flap! Afternoon thunderstorms in Port Vila.
Flap Flap Fla... 'LoooooOOOOOOOOK OUT FLO!!!'
It was the postman Aldy on his daily mail run...

A sunshower in San Francisco!

