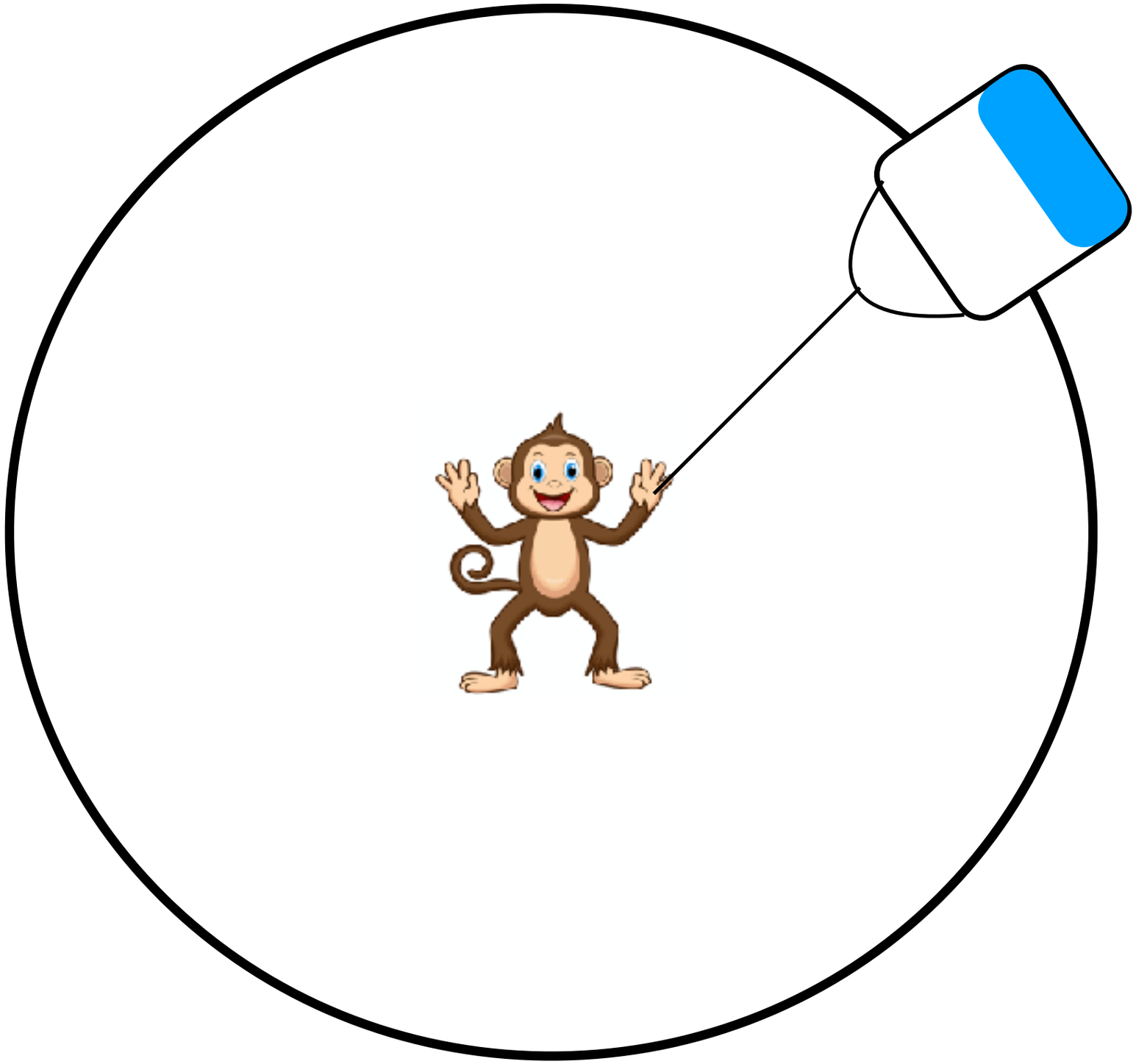
Let’s learn **VERTICAL** circular motion by spinning a bucket of water



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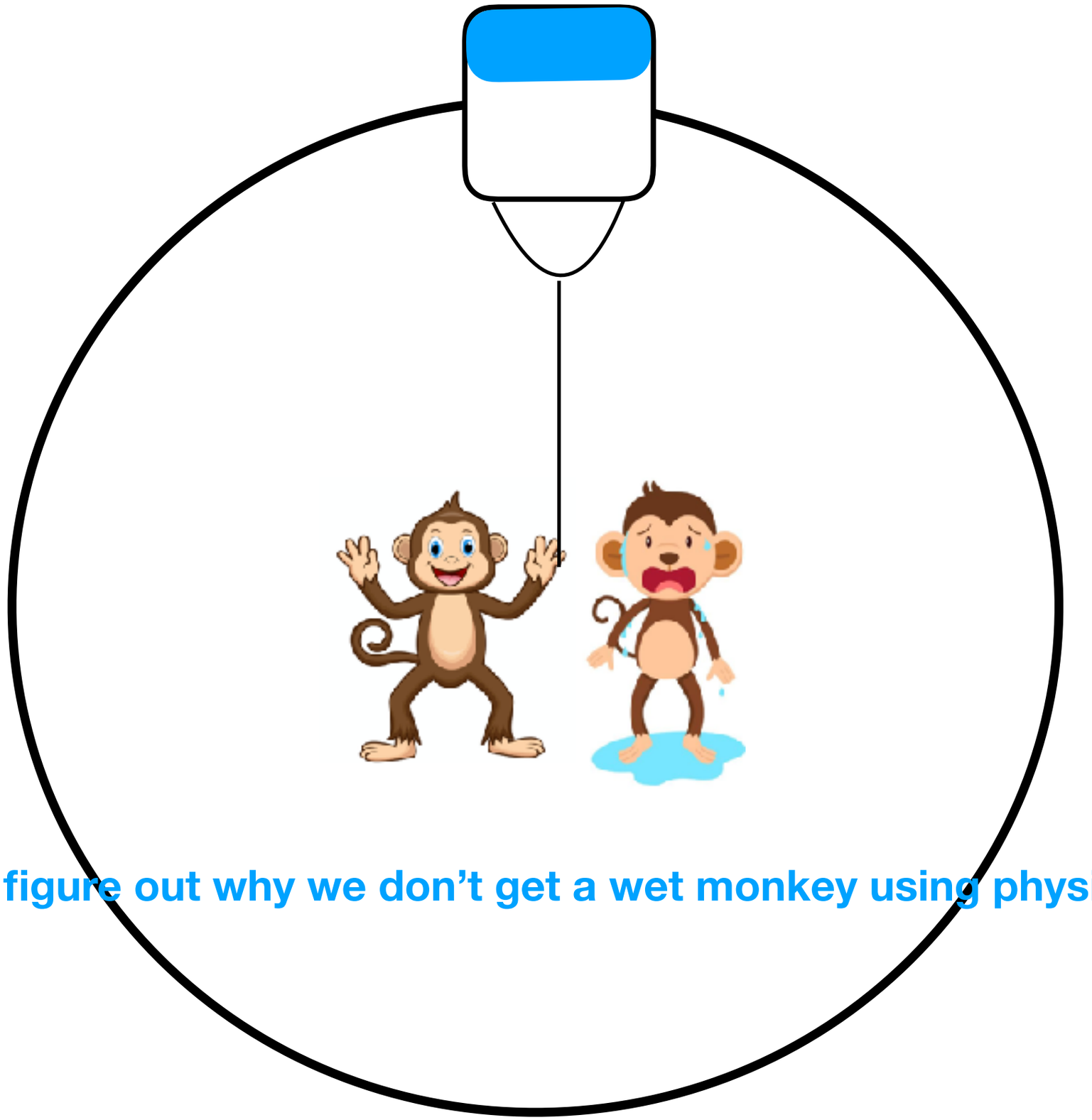

Can we figure out why we don’t get a wet monkey using physics we know?

https://youtu.be/ZuIw5bQ18Kk?t=16

If we were to draw a free body diagram at a given snapshot in time, what are the forces we need to consider?

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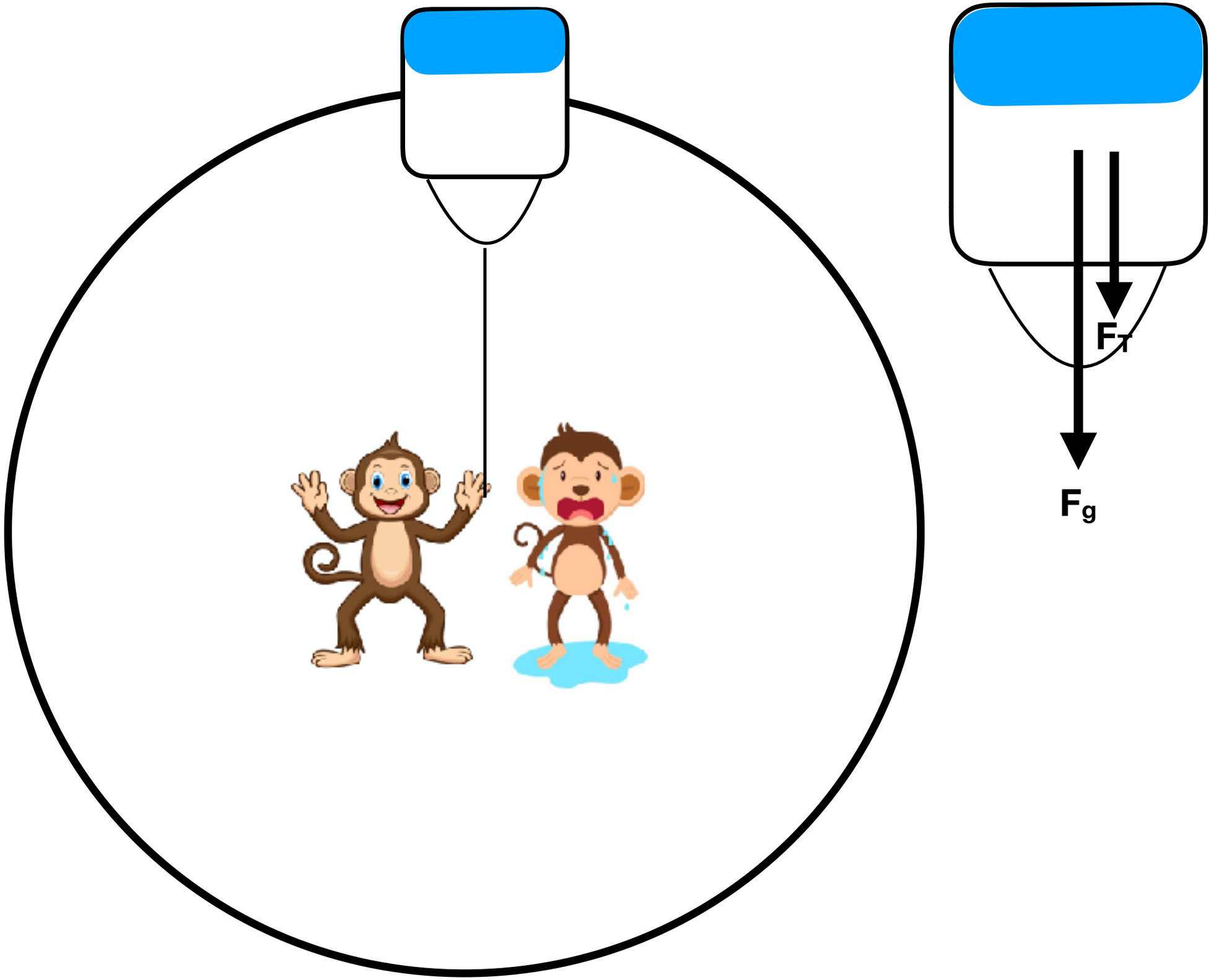
1. Force due to gravity F_g
2. Force due to tension F_T

Free Body Diagrams (FBD)



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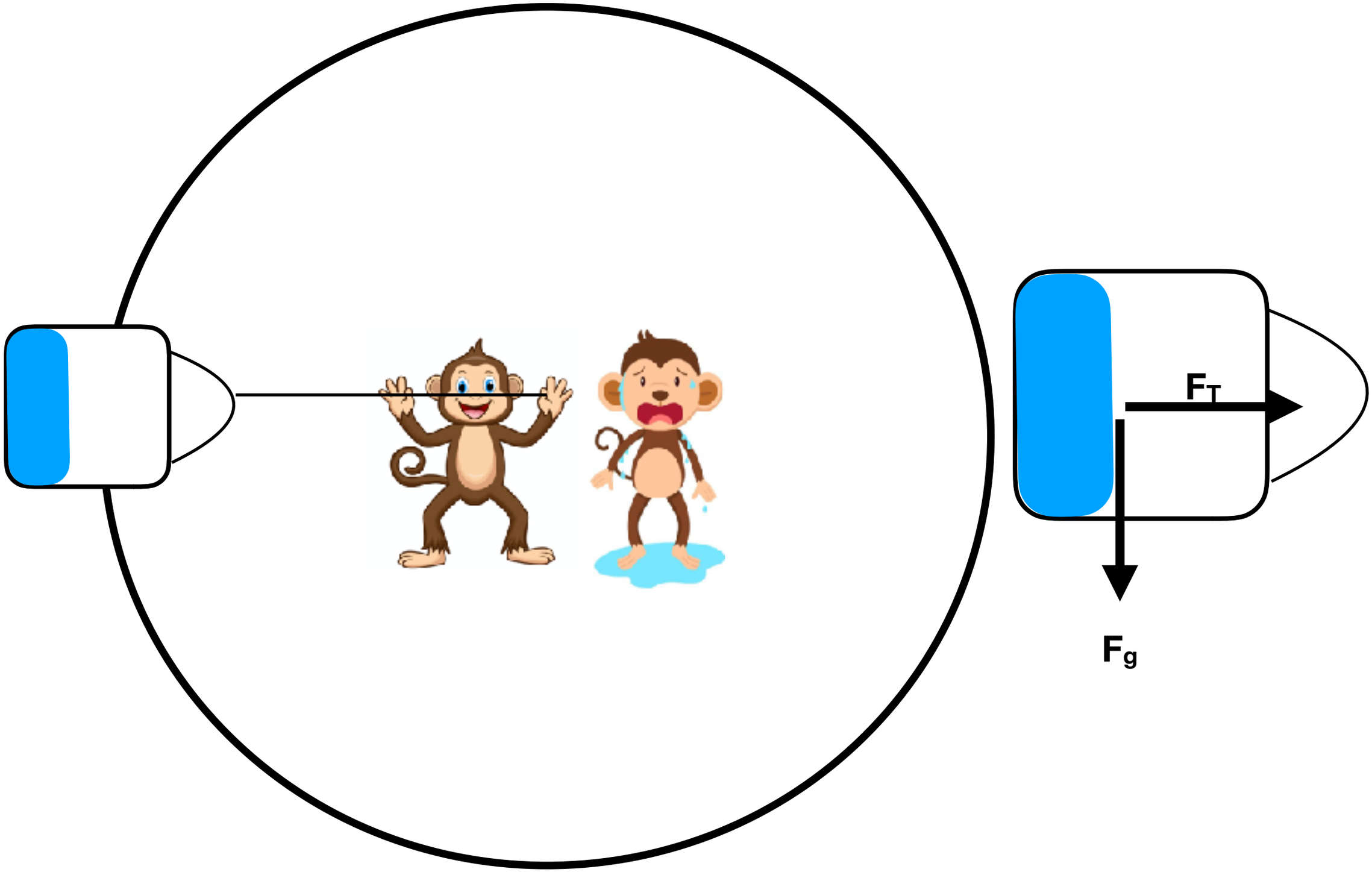

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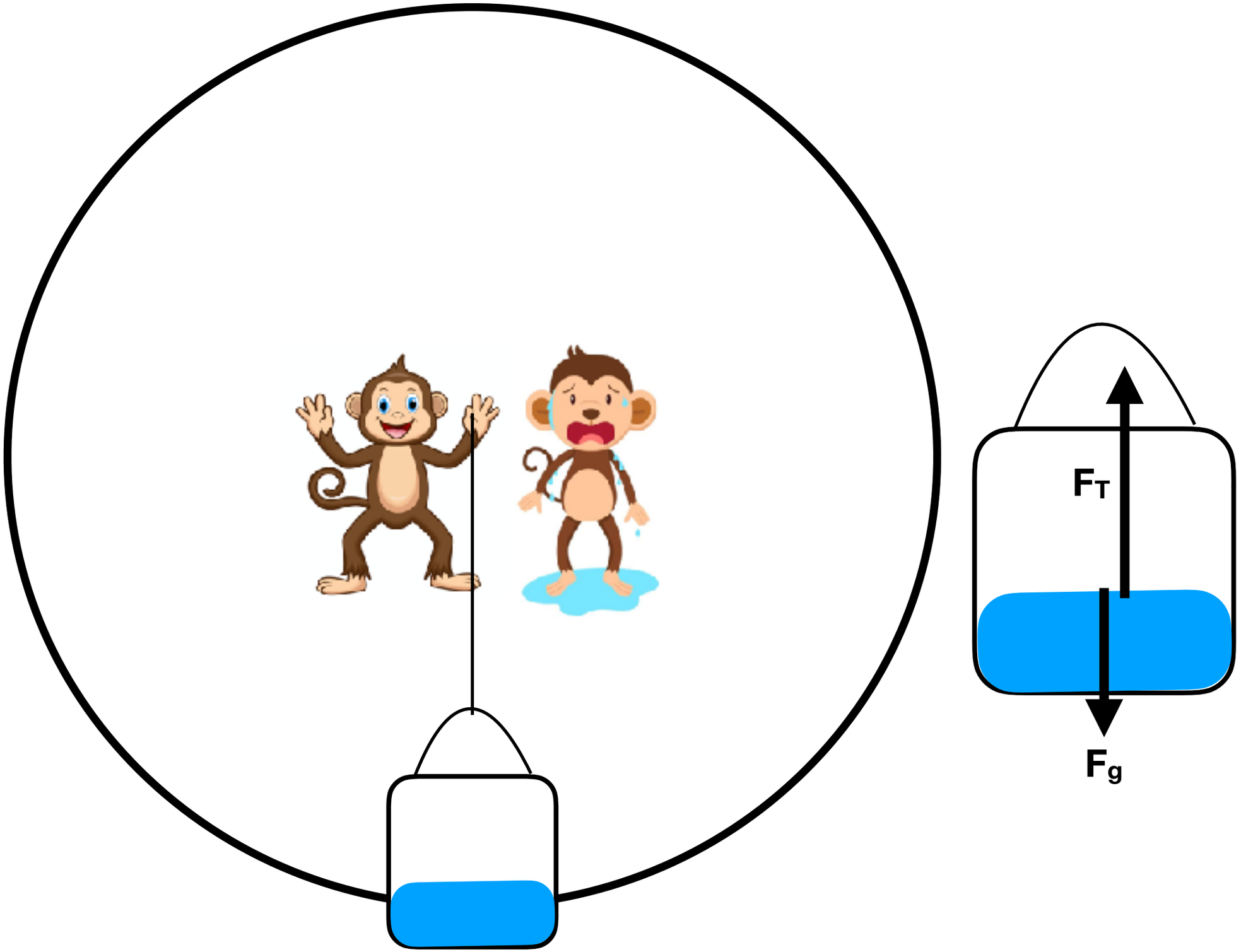
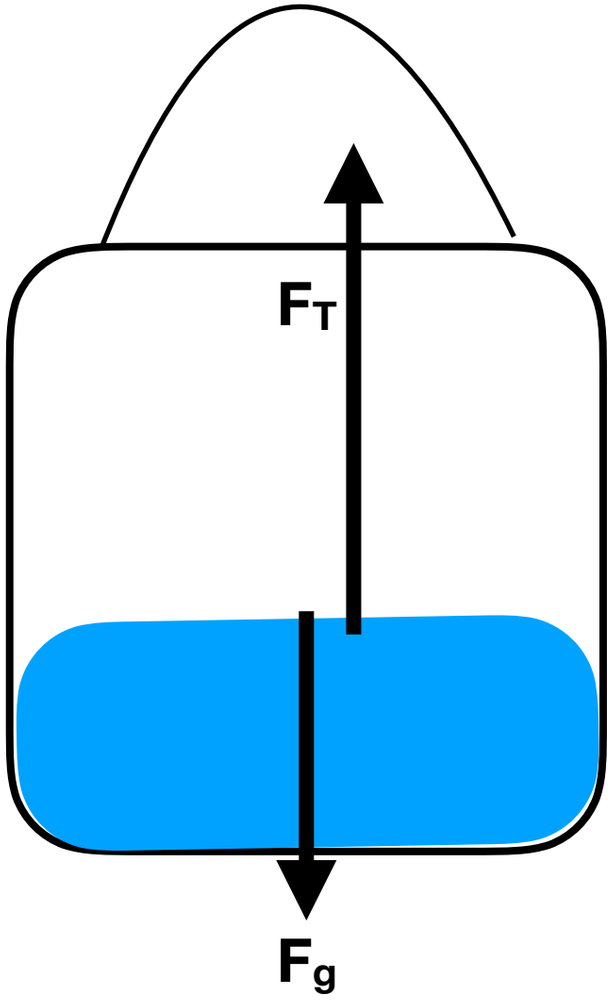


In groups of 2….



1. **What is the net force?**
2. **What does our knowledge of circular motion tell us the net force equals (think Newton! Assume you know m & ω)**
3. **Why did I draw the length of F_T greater than that of F_g? (think about limiting cases, like if they were equal)**

$$\Sigma F = F_T - mg = m\omega^2 r$$

What happens if we increase the angular rotation speed?

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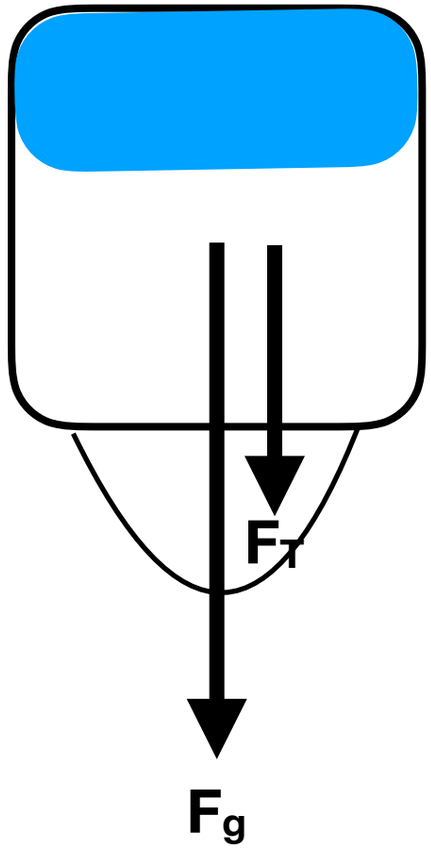

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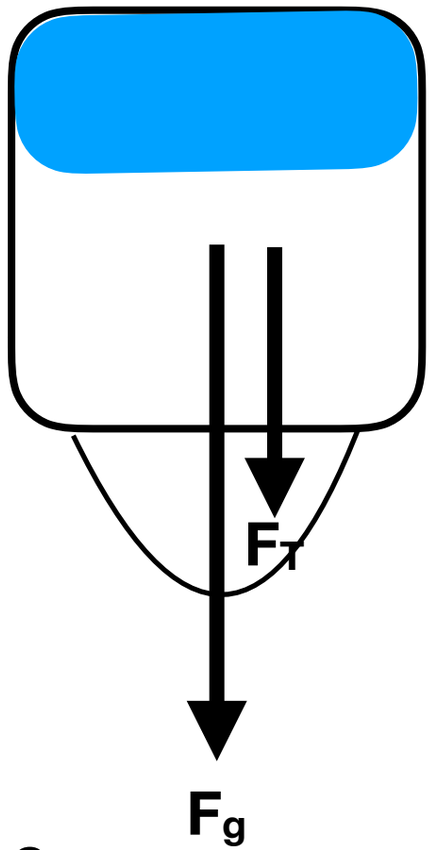

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Where do we go from here? Let's think about the water at the top, and it's trajectory

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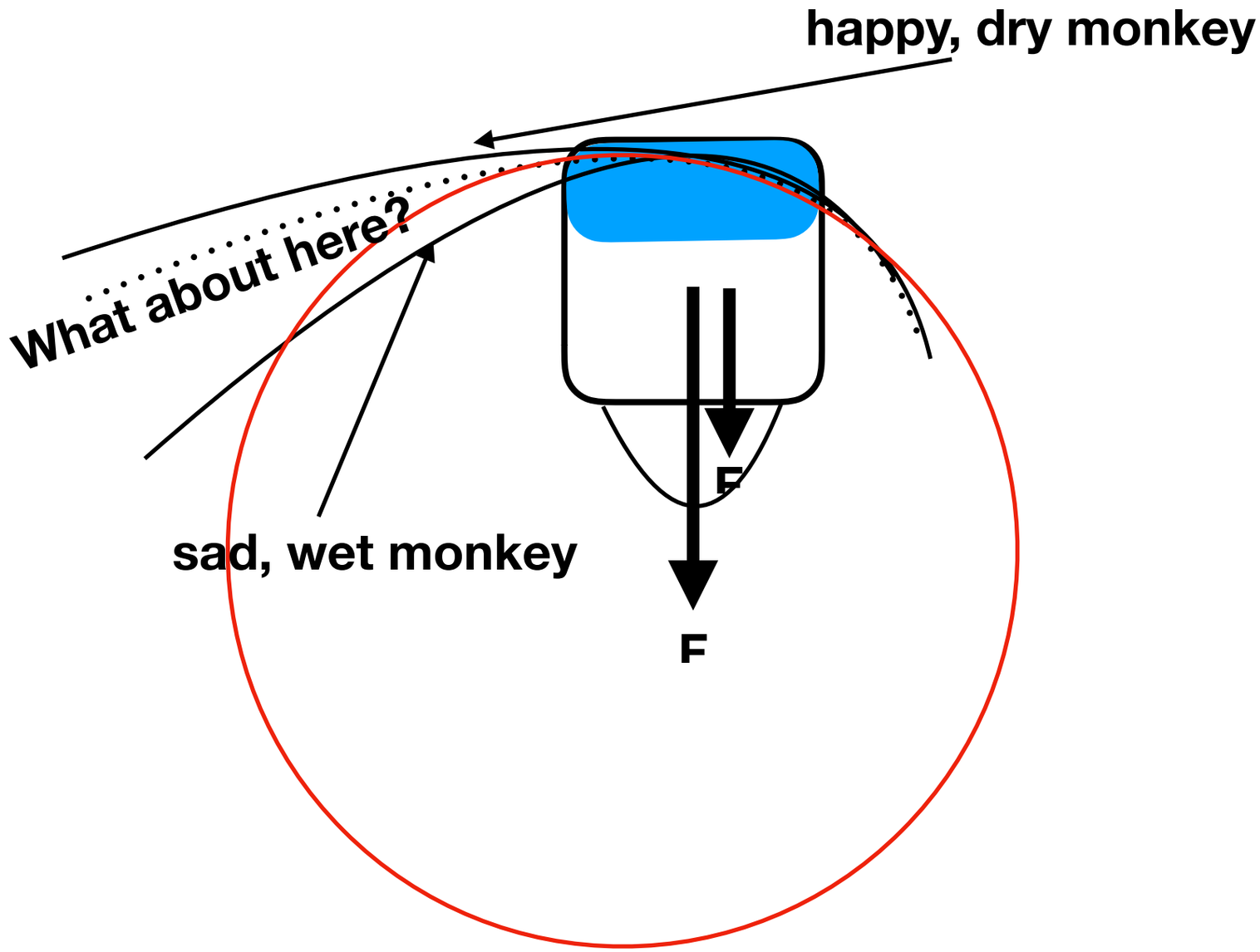

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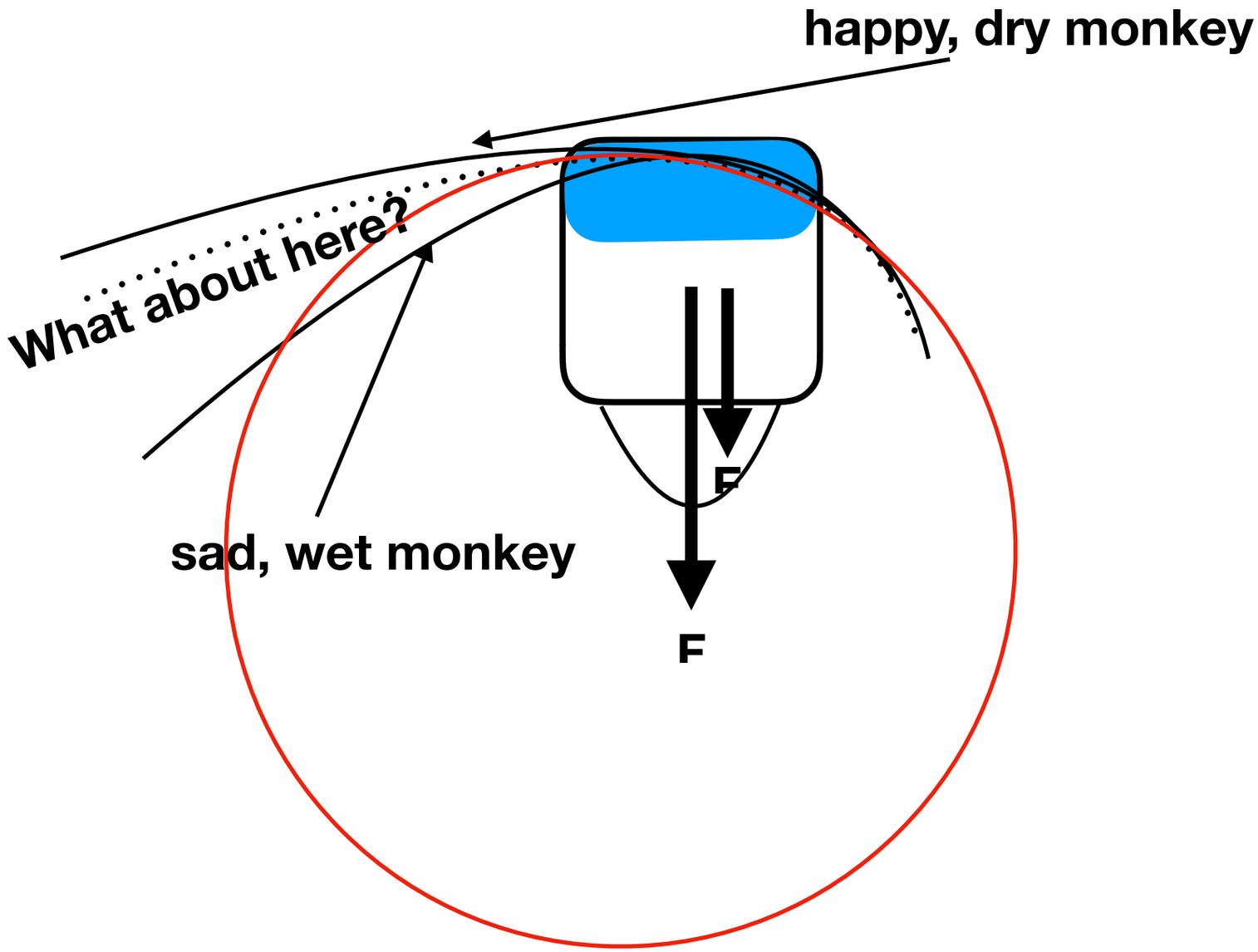


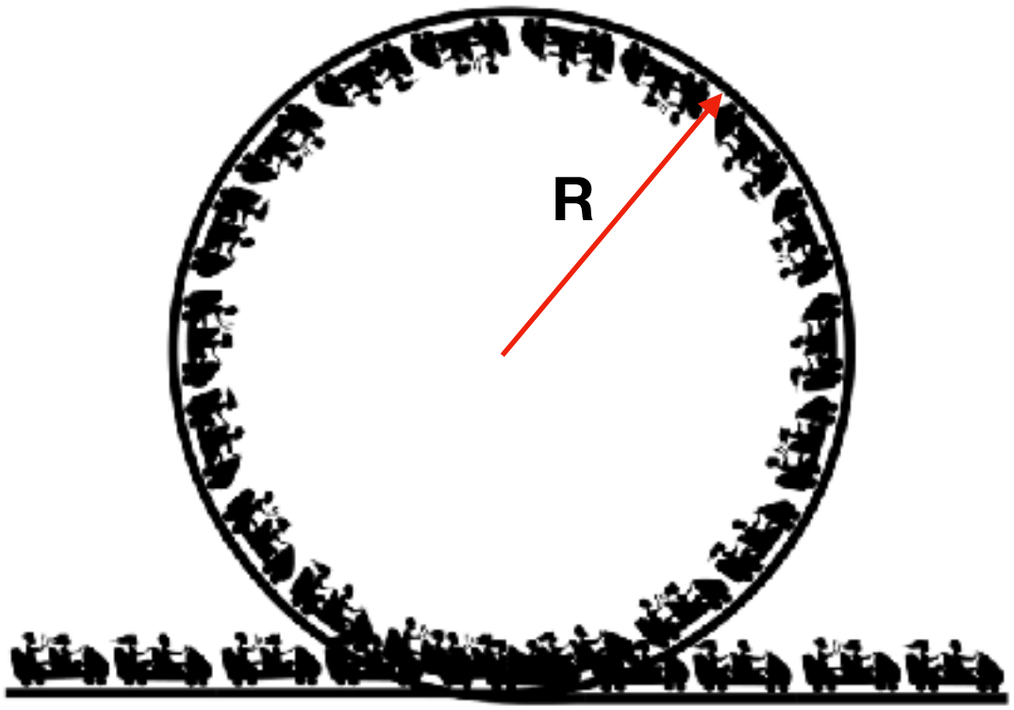
$$\Sigma F = \cancel{F_T} + mg = m\omega^2 r$$

0

$$\omega = \sqrt{(g/r)}$$

This is the minimum rotational speed necessary to keep the water in the bucket

And one for the road



1. Using what we've learned, where on this loop-de-loop would you feel weightless? Why?
2. Where would you feel "heaviest"? Why?
3. What is the minimum velocity v you need to make it around the loop-de-loop?