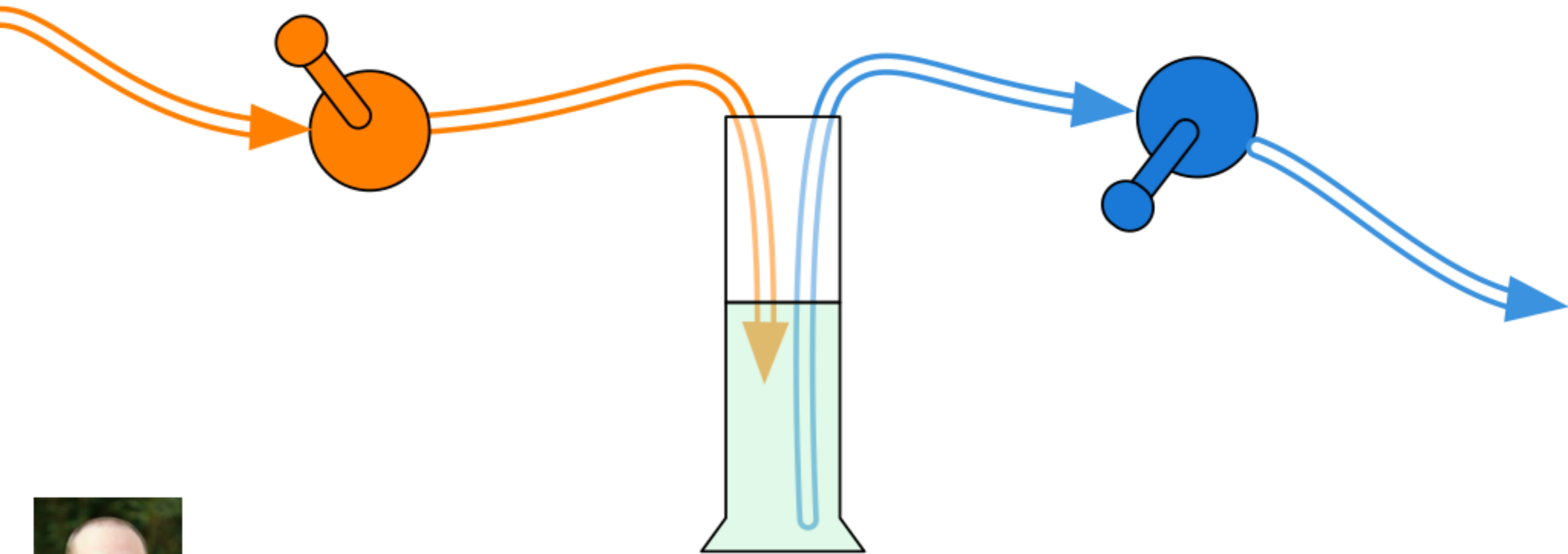


# Building Better Mental Models with Physical Analogues

## Tubs & Pumps

A Hands-On Activity



Conference Theme: Educating the Next Generation  
Chris Browne, Barry Newell & Paul Compston  
Australian National University

## **Context**

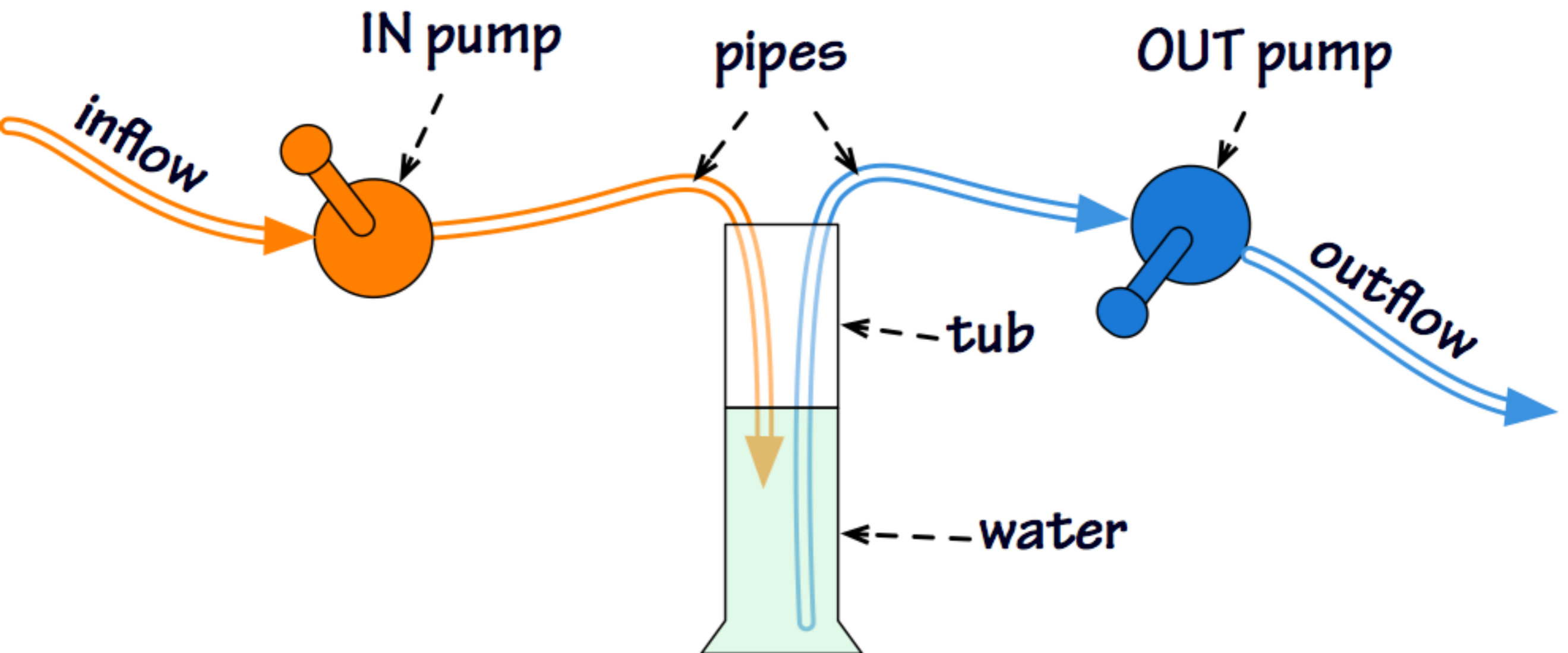
It can be hard to understand cause-and-effect structures in complex problems.

Simple Models provide insights that can build understanding.

A Physical Analogue provides a shared conceptual metaphor to navigate complex problems.

## Activity

We are using Tubs & Pumps as a physical analogue to educate, explore and construct knowledge about stock-and-flow structures.

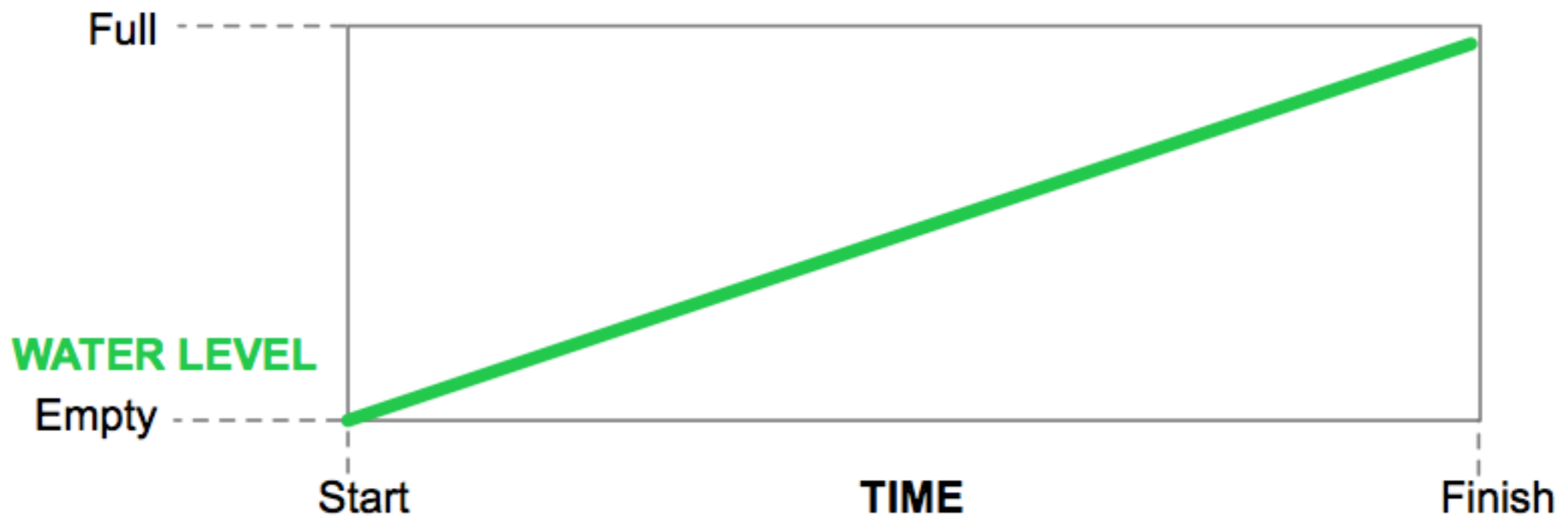


## For Example

If the pumps go like this...

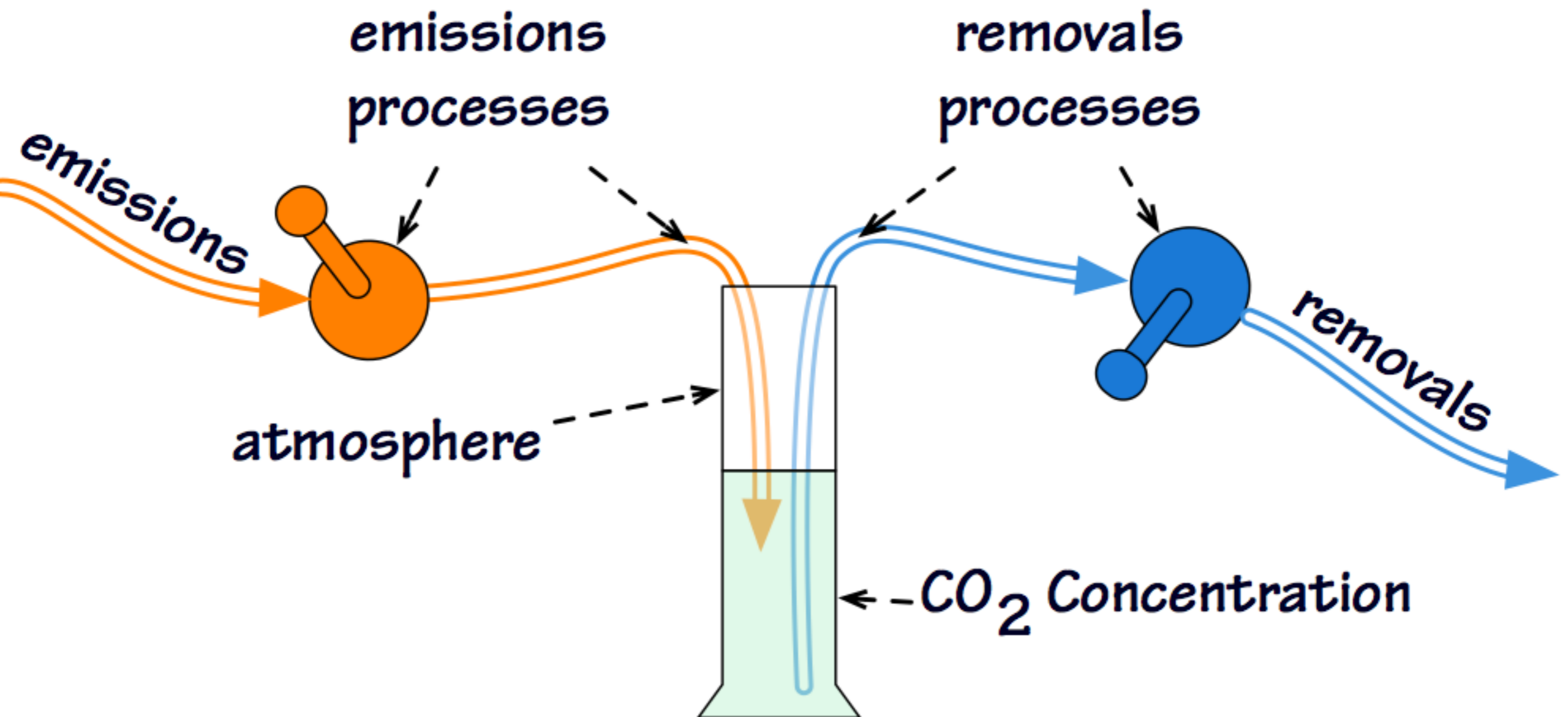


Then the level of the water in the cylinder should go like this...



## Exploring

Tubs & Pumps are the conceptual source domain to explore complex problems, such as carbon in the atmosphere.



## Problem Solving

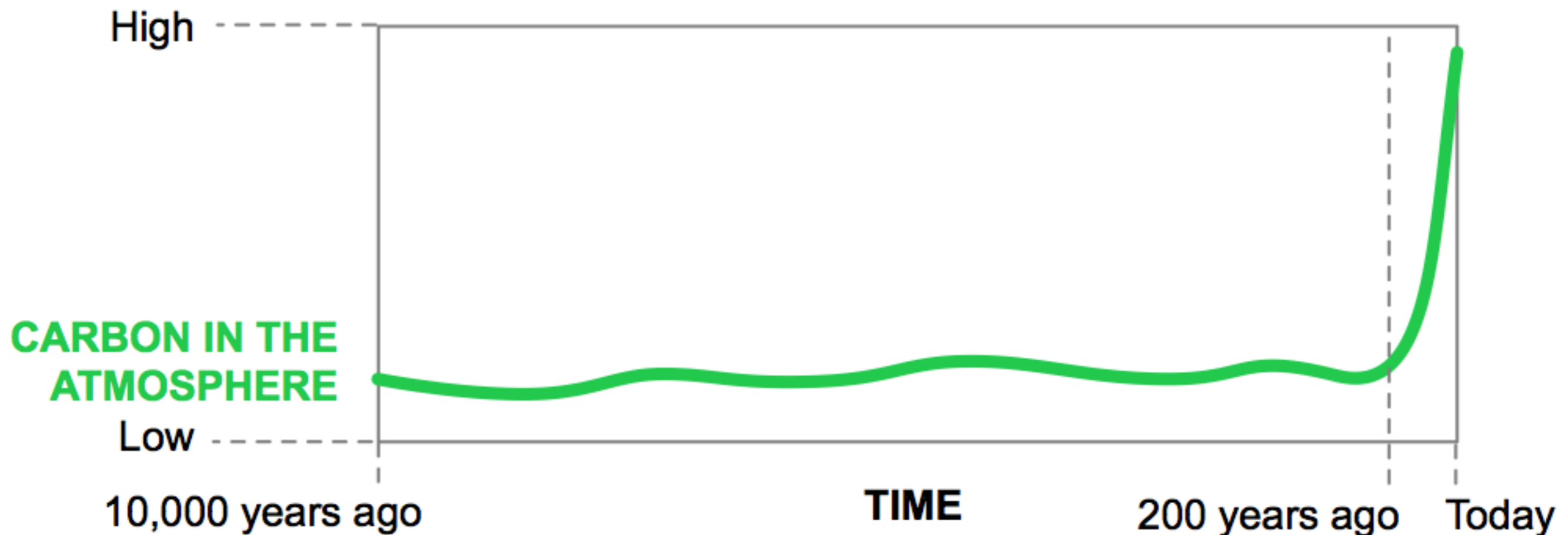
# The Physical Analogue

allows participants to explore scenarios...

### Task - Present Day

Now think about the role of humans burning Fossil Fuels over the last 200 or so years. Remember that the natural cycle is approximately in dynamic equilibrium.

Change your Tubs & Pumps system to try and match the historical trend for the last 200 years. You can add parts to the system if you like.



## Activity

..and becomes a shared conceptual metaphor for discussion and further exploration.

### Task - The Future

Q. If your system keeps going as it is, what do you think is going to happen?

*If anthropogenic emissions keep increasing, what will happen?*

Q. What could you do with system to stabilise the water level?

*What needs to happen to stabilise carbon in the atmosphere?*

Q. What could you do with the system to decrease the water level?

*What needs to happen to decrease carbon in the atmosphere?*

## **Further Information**

Workshop at

the 2013 International System Dynamics Conference:

<http://conference.systemdynamics.org/2013/ts.html>

View the orientation video for the exercise:

<http://youtu.be/kw-Cxq3zjHM>

## **References**

Newell, B., 2012, Simple models, powerful ideas:

Towards effective integrative practice,

Global Environmental Change, 22, 776-783.



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