AnyLogic 9 Workshop cheat sheet

Running a pub with two beer brands

This cheat sheet is available online at
https://www.anylogic.com/files/alc23/pubcheatsheet.pdf

Andrei Borshchev, CEO & CTO
Nikolay Churkov, Principal Software Engineer

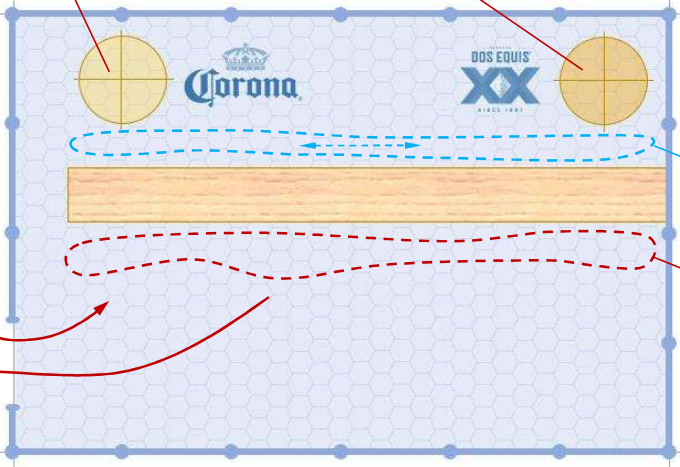
AnyLogic Conference 2023
September 5-6
Nashville, TN

THE AnyLogic COMPANY

You are running a pub with two beer brands:

How many bartenders do you need to keep everyone happy?

Beer is sold from 20-liter kegs
It takes 2 min 20 sec to replace a keg



200 beer drinkers per hour

Bartenders move behind the counter serving beer

Beer is sold at the counter only by pints (1 pint = 0.473 liters)
There is one tap per brand, taps work at 0.1 liter / sec
It takes about 1 minute to pay
And 10 minutes to drink a pint

After any pint, a guest leaves with 40% probability feeling happy

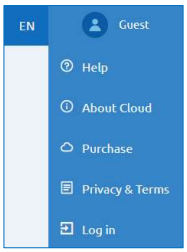
However, if a guest cannot get a hold of a bartender within 5 minutes, he leaves angry

70% of guests start with Corona™
30% start with Dos Equis™
After 3 pints of Corona™ a guest, if continues drinking, switches to Dos Equis™, reverse switch never happens

How much Corona™ and Dos Equis™ do you need in stock for to keep going for 5 hours?

Log in to AnyLogic Cloud and create a new model

① Navigate to cloud.anylogic.com

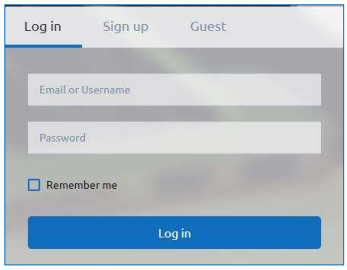


If you are logged in as a subscriber, skip steps 2 and 3; otherwise:
② Log out if needed; click on the Guest icon and choose Log in

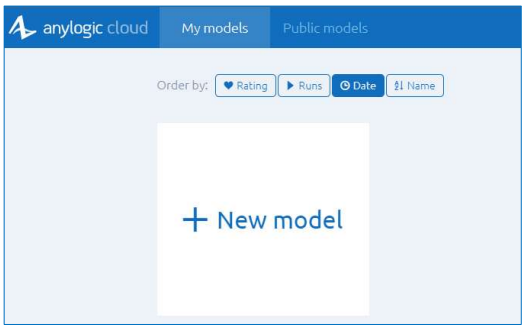
③ Enter your credentials

Login: alcXX@anylogic.com

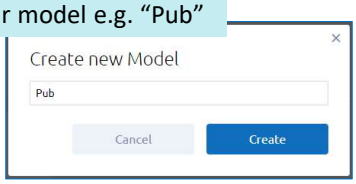
Password: XXXXXXXX



④ In My models tab click on "+ New Model"



⑤ Name your model e.g. "Pub"



As always, we will be solving the problem iteratively

1. Pub floor markup. Simplistic beer drinkers flow
2. Bartenders
3. Corona™ beer flow
4. Beer drinking behavior
5. Simulation and Variation experiments in AnyLogic Cloud

If we manage to cover this part during the workshop, we're great!

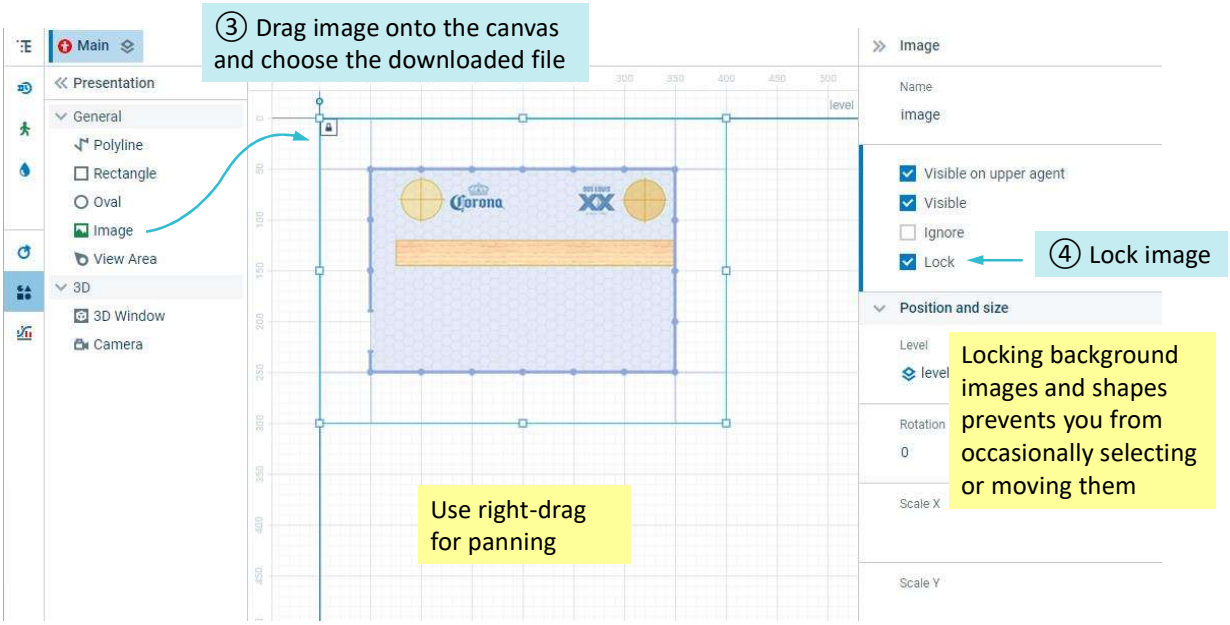
6. [optional] Download results, Compare runs
7. [homework] Add Dos Equis™ – the second beer

Phase 1

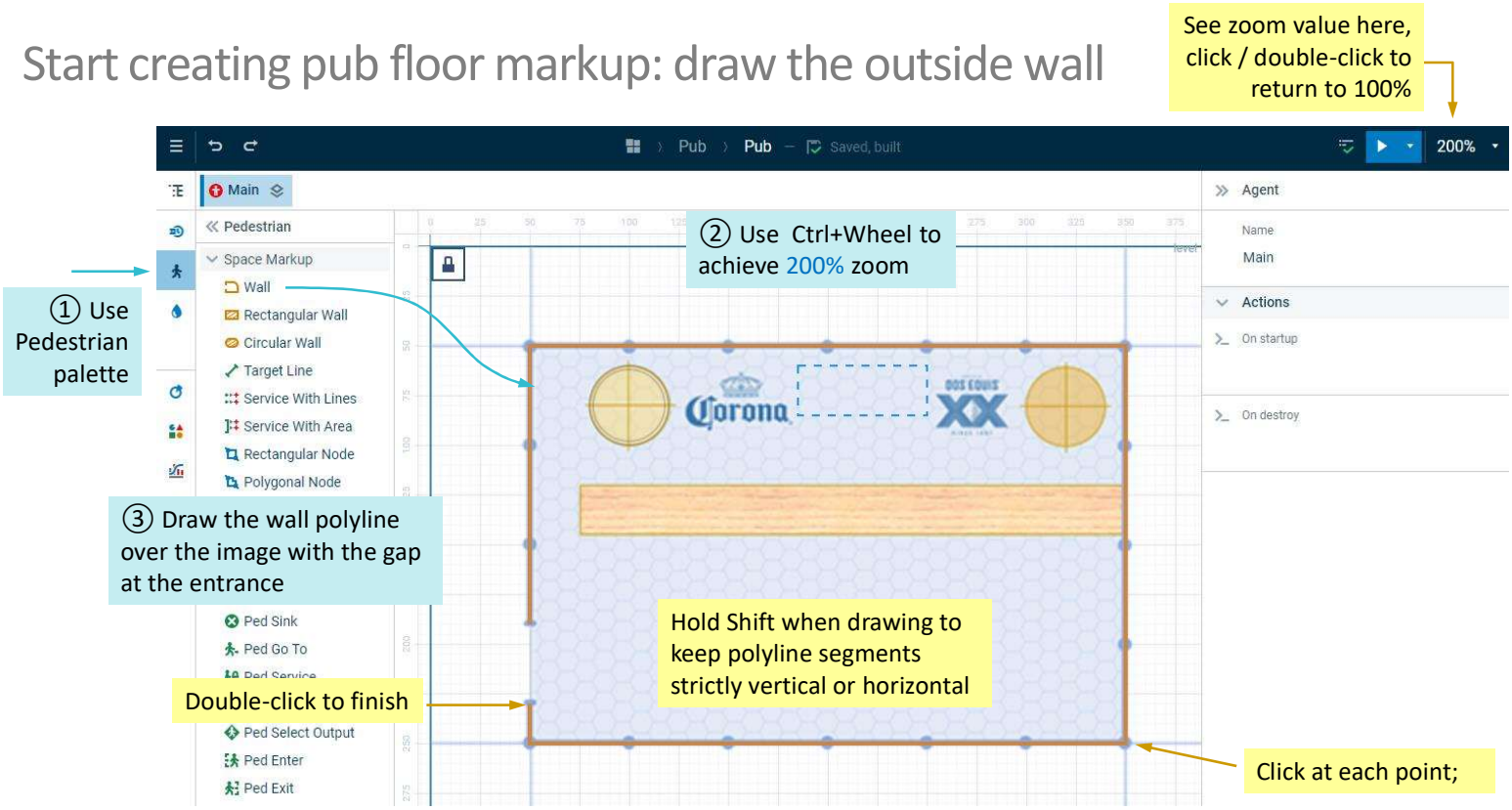
Pub floor markup.
Simplistic beer drinkers flow

Download the pub floor plan, place it on the canvas, and lock

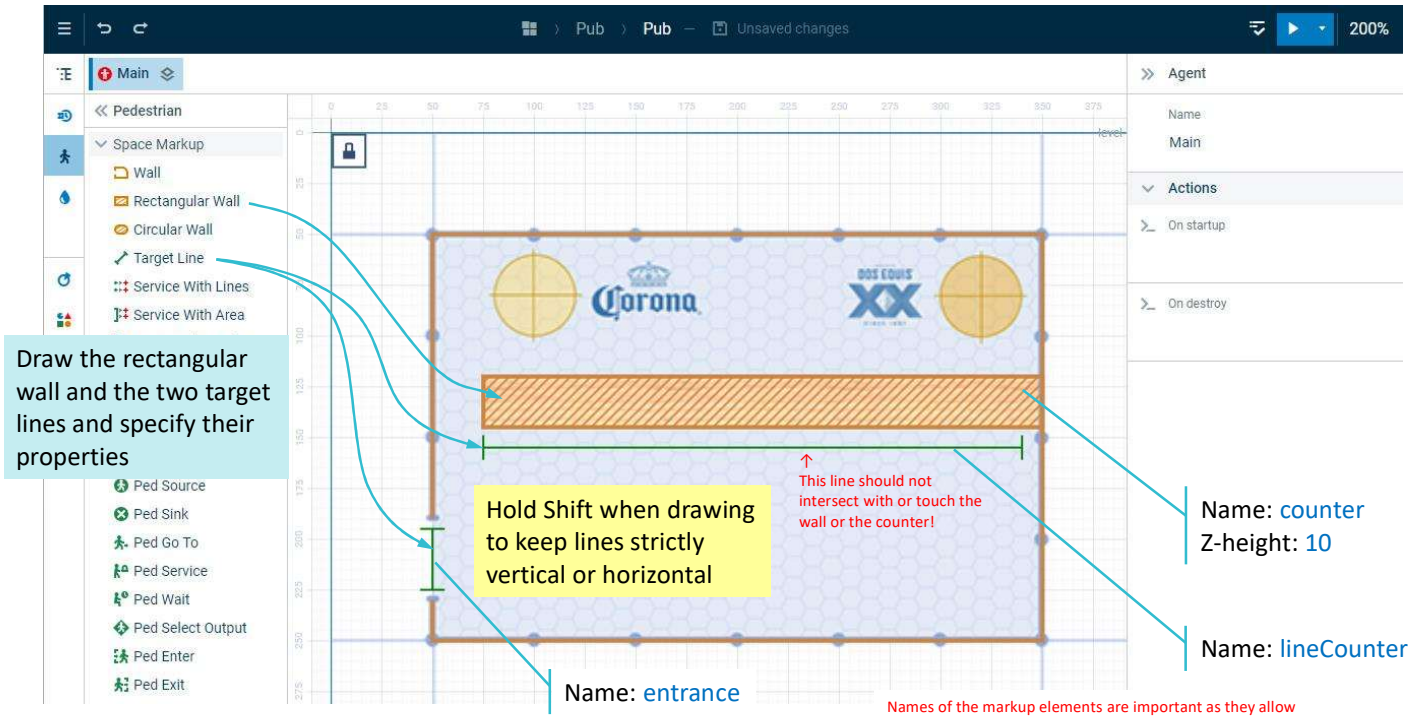
① Download the floor plan from https://www.anylogic.com/files/alc23/pubfloorplan.png



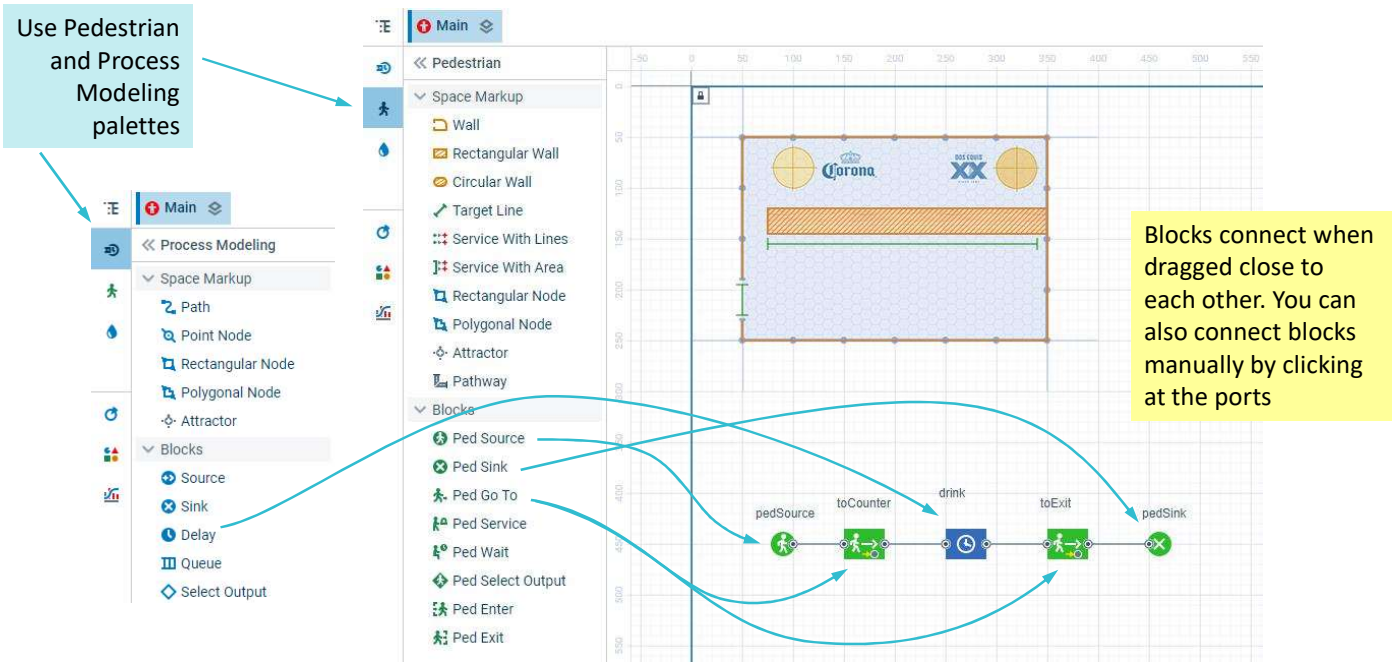
Start creating pub floor markup: draw the outside wall



Continue pub floor markup: entrance and counter



Create simplistic guest flow



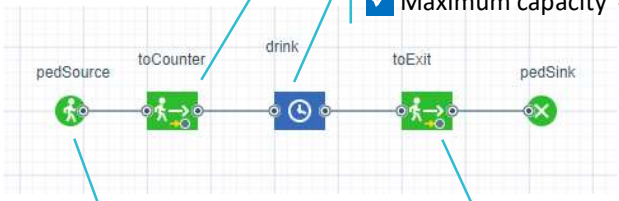
Parameterize guest flow

You can rename a block either in its properties, or by double-clicking it on the canvas

Name: toCounter
Target line: lineCounter

Name: drink
Delay time: triangular(5,10,15) units: minutes
☑ Maximum capacity ← This ensures multiple guests can drink at the same time

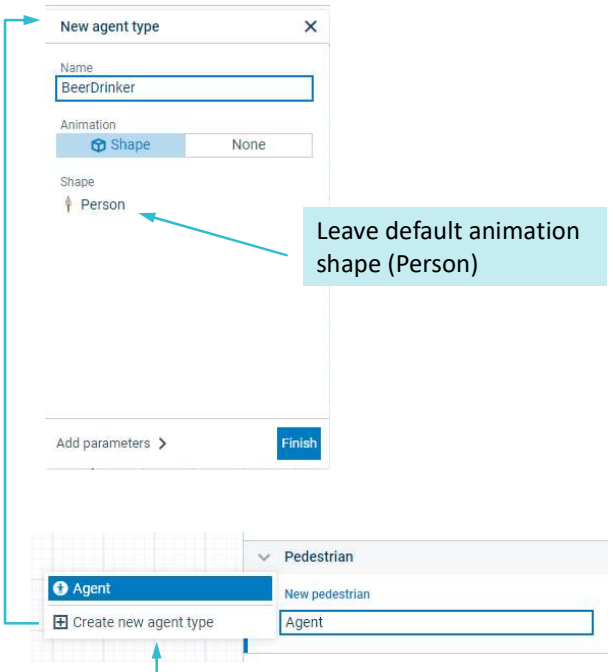
Don't forget to change units to minutes



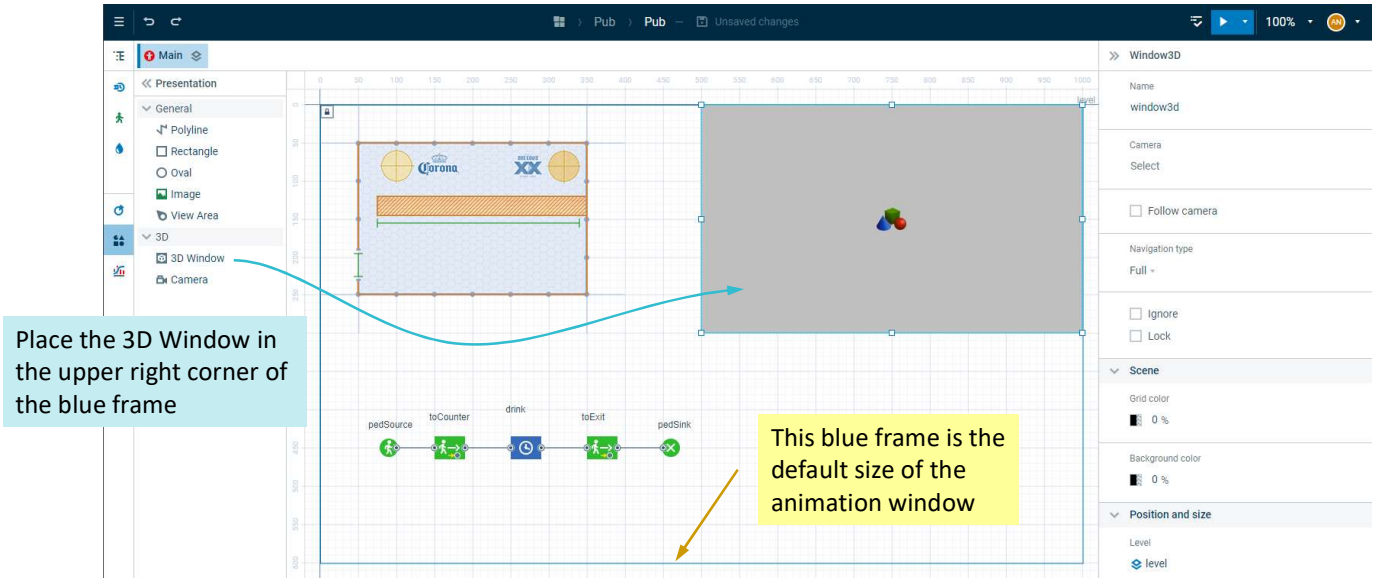
Target line: entrance
Arrival rate: 200 per hour
New pedestrian: BeerDrinker

Name: toExit
Target line: entrance

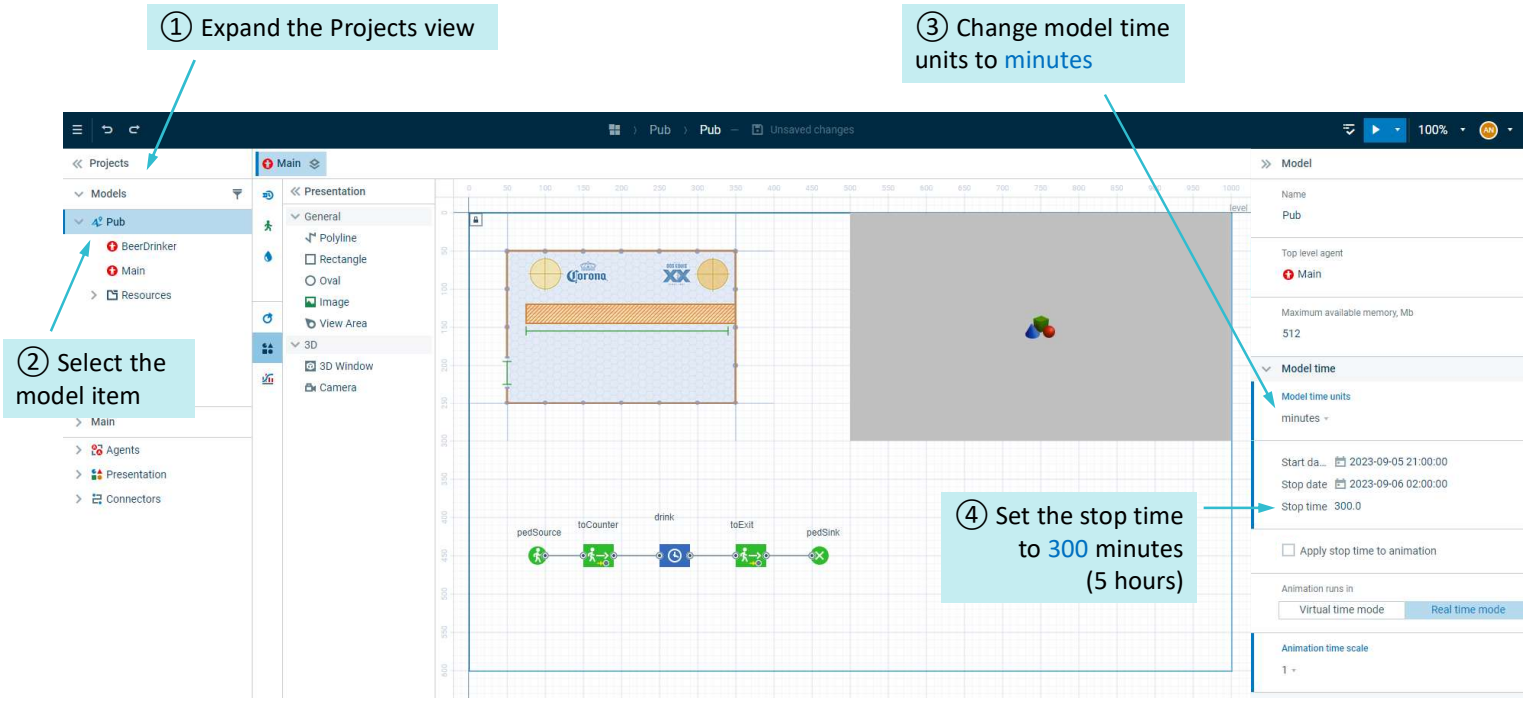
Select Create new agent and then follow the wizard to create a BeerDrinker



Add 3D window

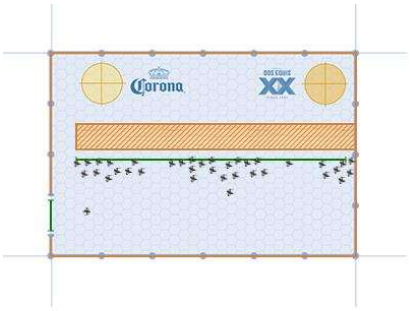


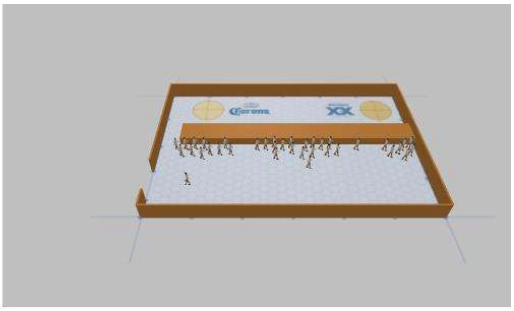
Before running, open model properties and adjust time units / stop time



Run

Press here to run animated simulation over the editor window





Frequent mistake: make sure there is more than one person drinking, if not, you have probably forgot to specify Maximum capacity in this block

You may need to increase the speed to see more happening

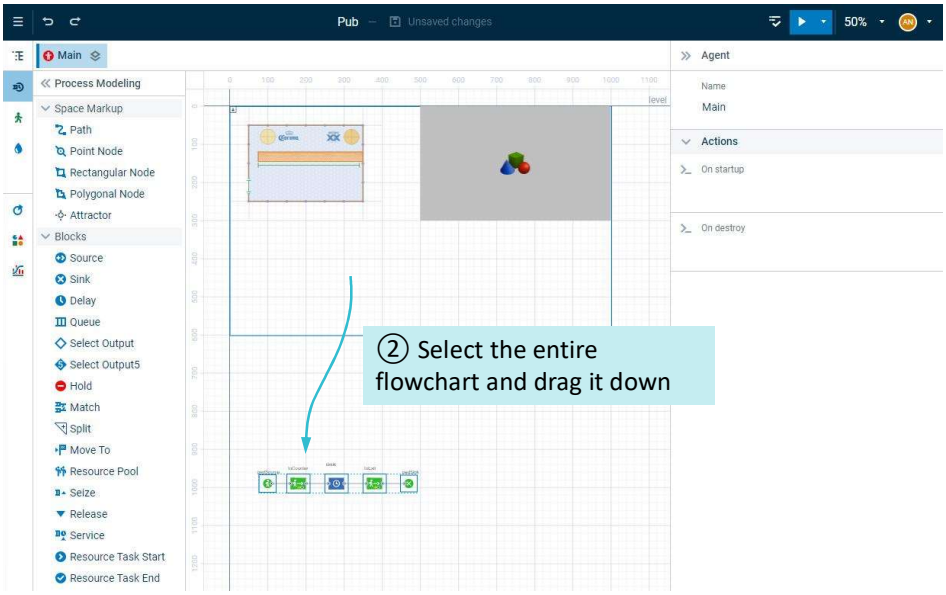
Full screen mode is available

Phase 2

Bartenders

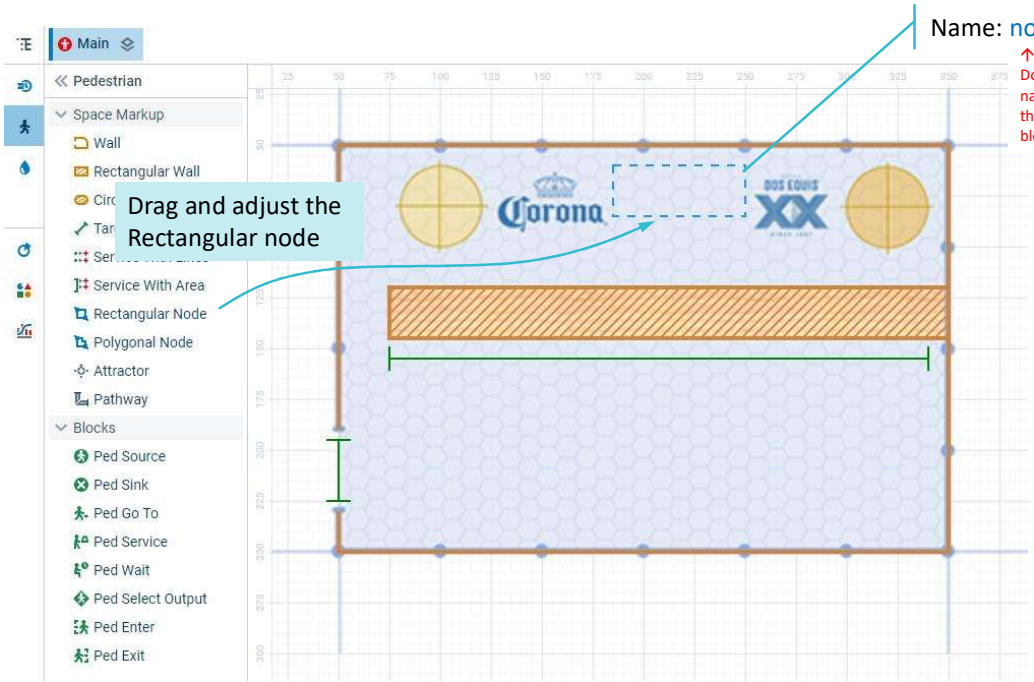
Move the flowchart down to have more space

① Use Ctrl+Wheel to achieve 50% zoom

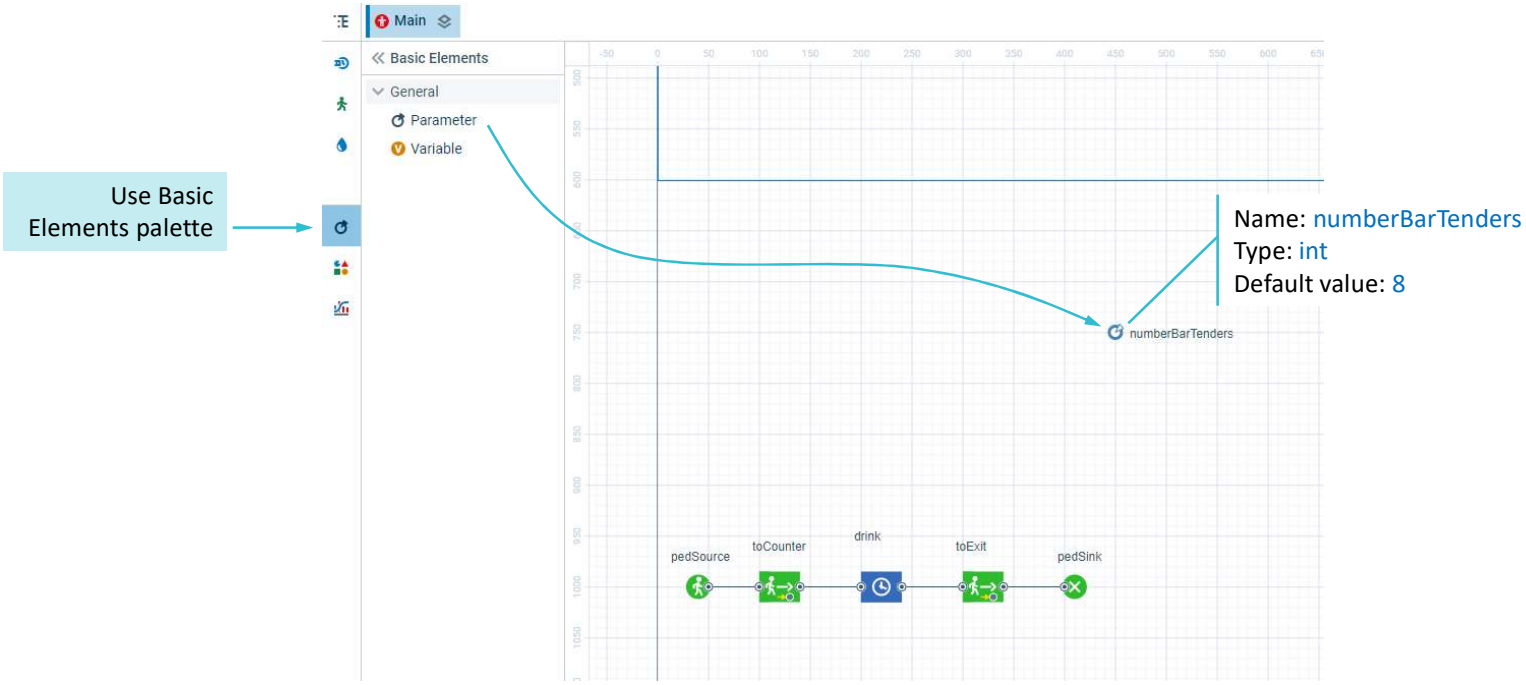


Add home location for bartenders

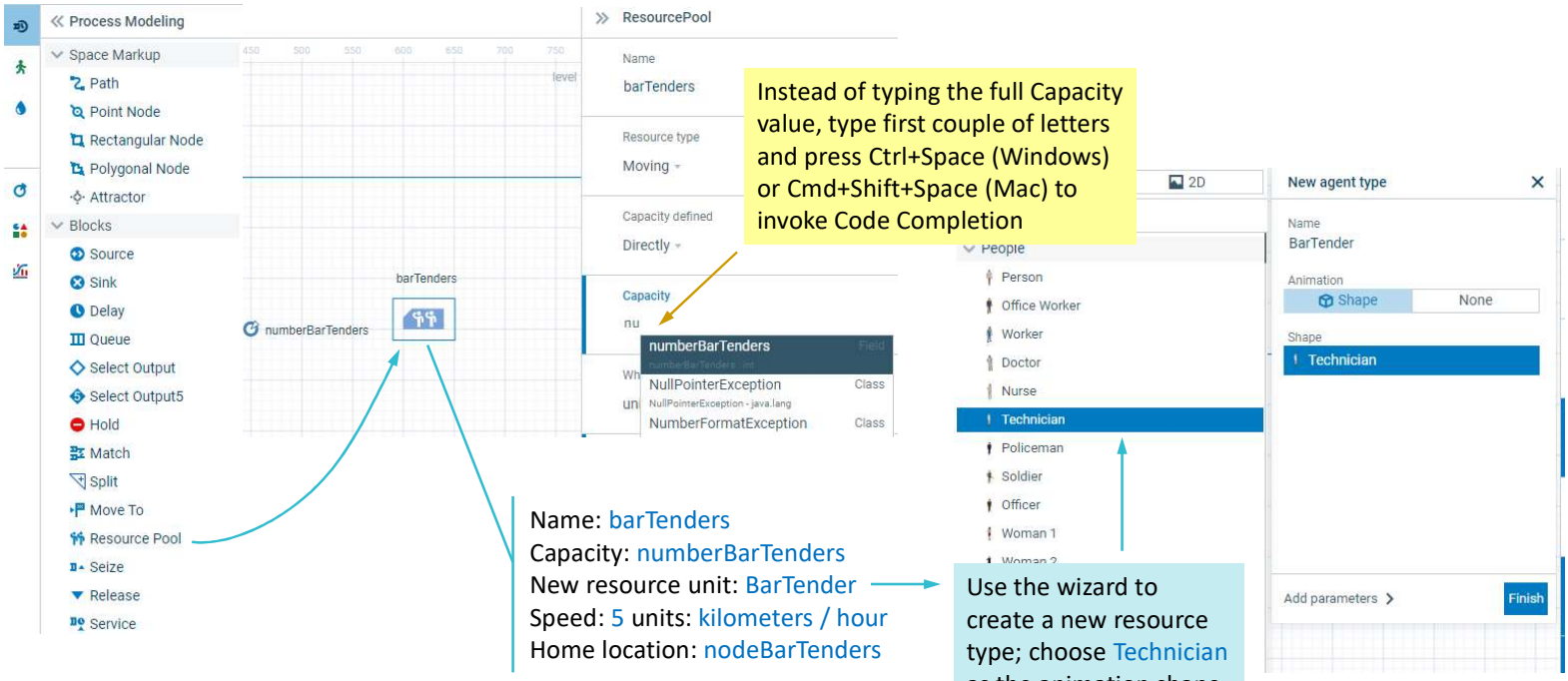
Use Pedestrian palette



Add a parameter

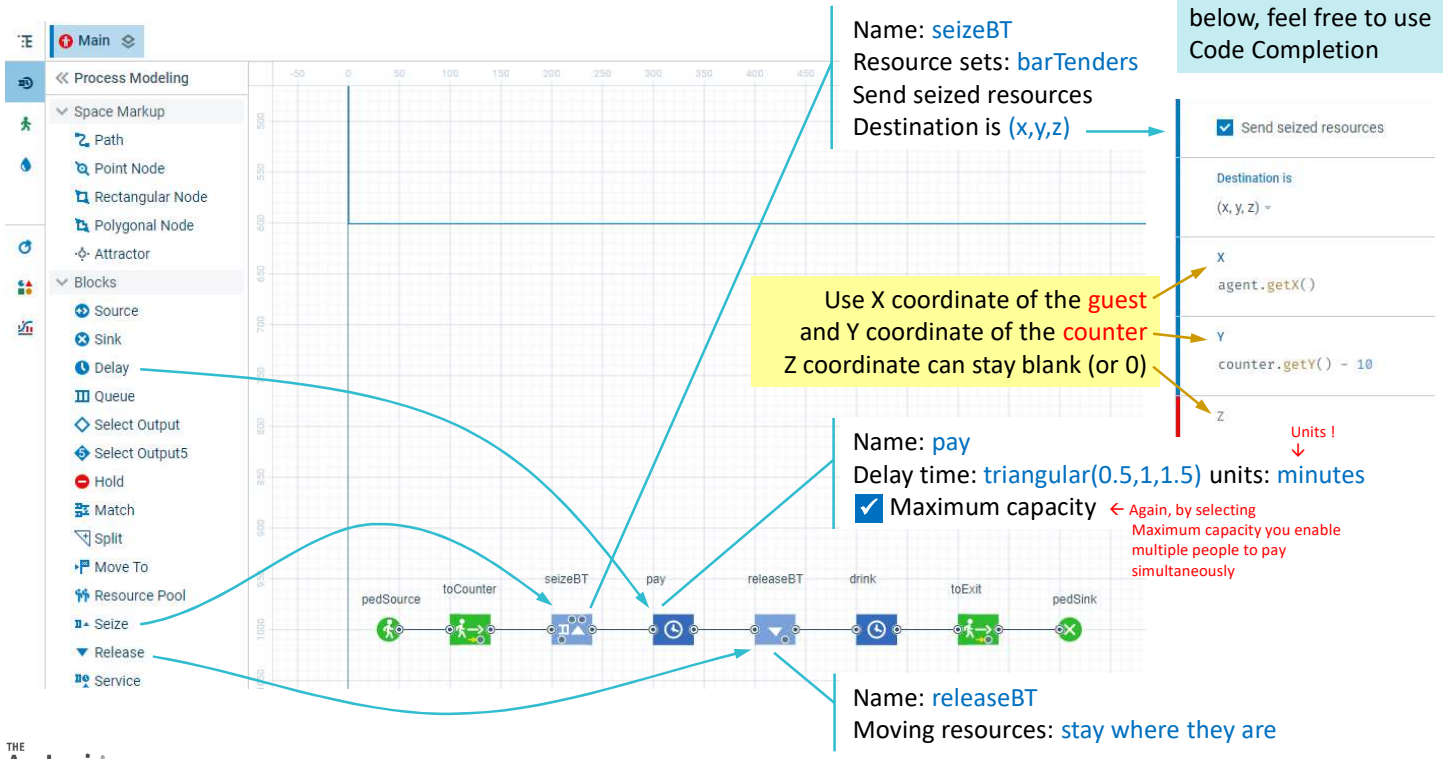


Add bartenders resource pool



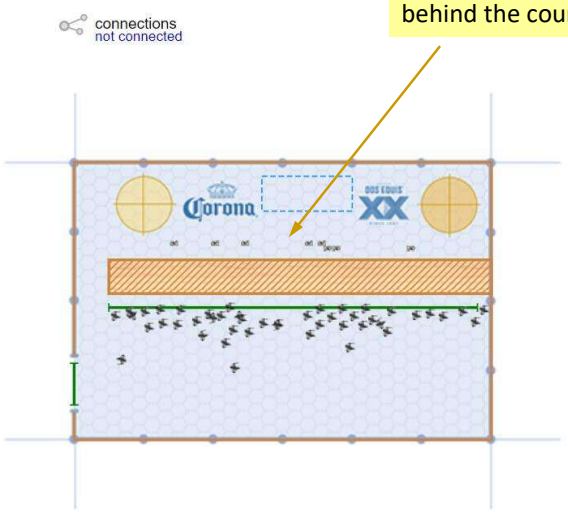
Extend the flowchart to seize / release bartenders

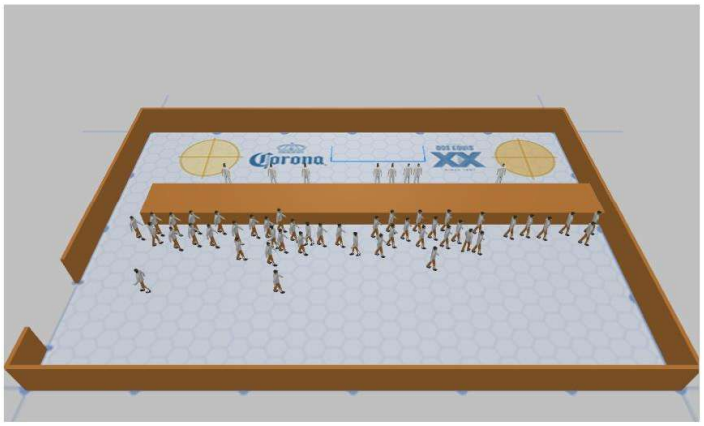
Specify x and y coordinates as shown below, feel free to use Code Completion



Run

You should now see the bartenders moving behind the counter serving guests



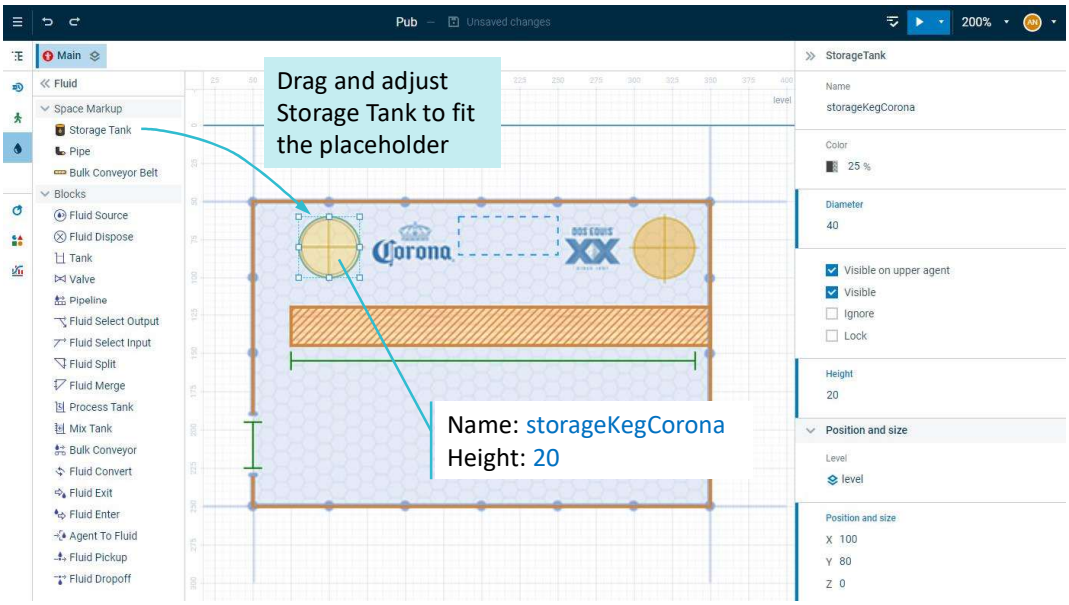


Phase 3

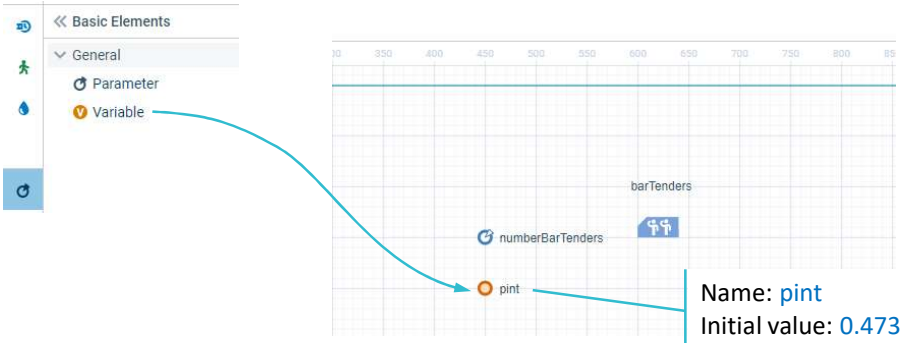
Add Corona™ beer flow

Add Corona™ keg storage tank

Use Fluid palette



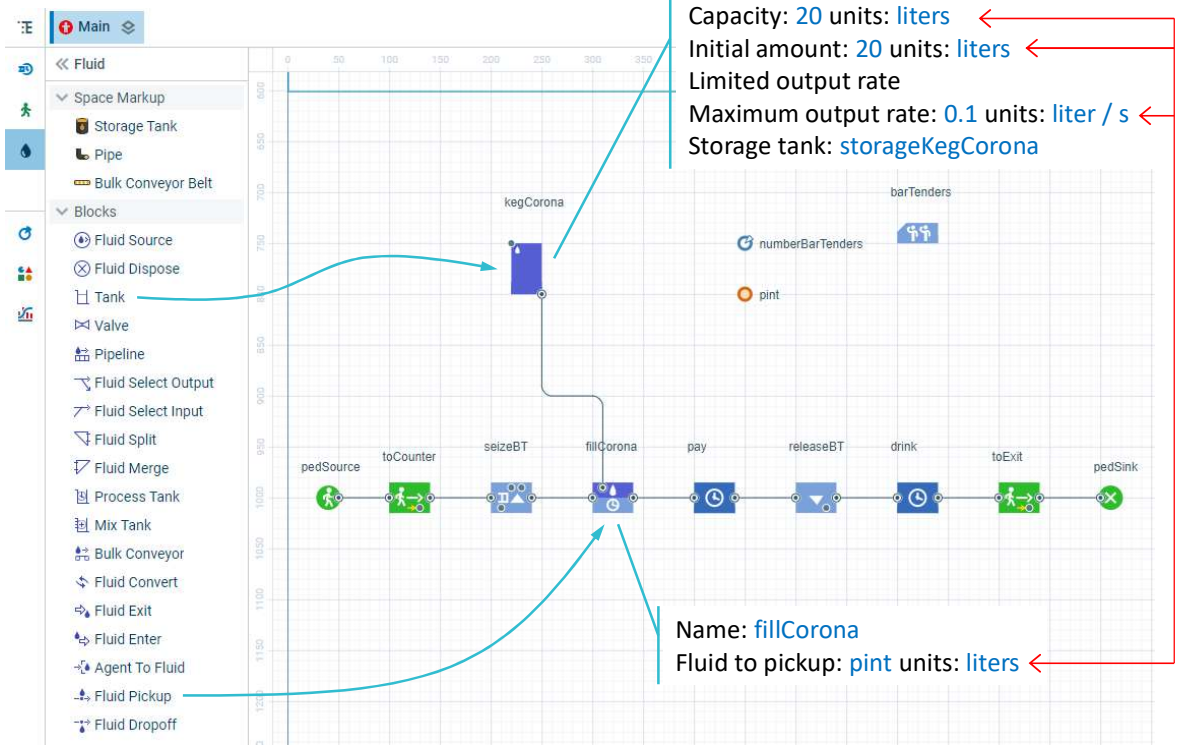
Add pint constant (1 pint = 0.473 liters)



Name: pint
Initial value: 0.473
Constant

Turning a variable into a Constant prevents you from changing its value at runtime

Add Corona™ beer flow



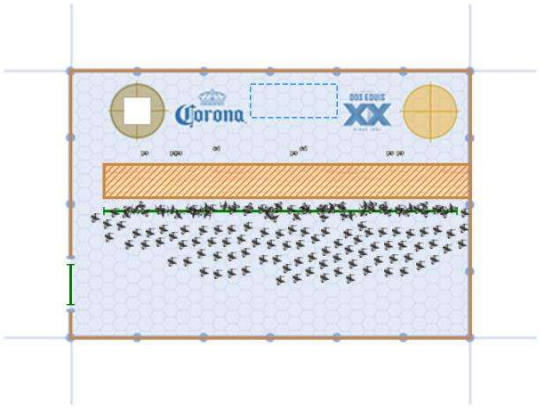
Name: kegCorona
Capacity: 20 units: liters
Initial amount: 20 units: liters
Limited output rate
Maximum output rate: 0.1 units: liter / s
Storage tank: storageKegCorona

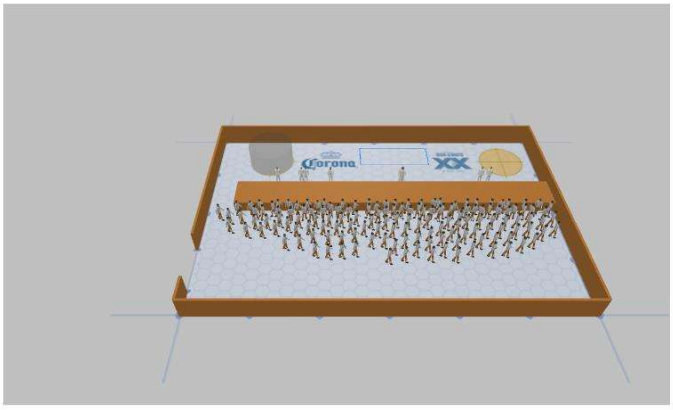
Name: fillCorona
Fluid to pickup: pint units: liters

In the fluid models, it is important to have the units consistent within the same flow. In this model, we will be using liters and liters per second

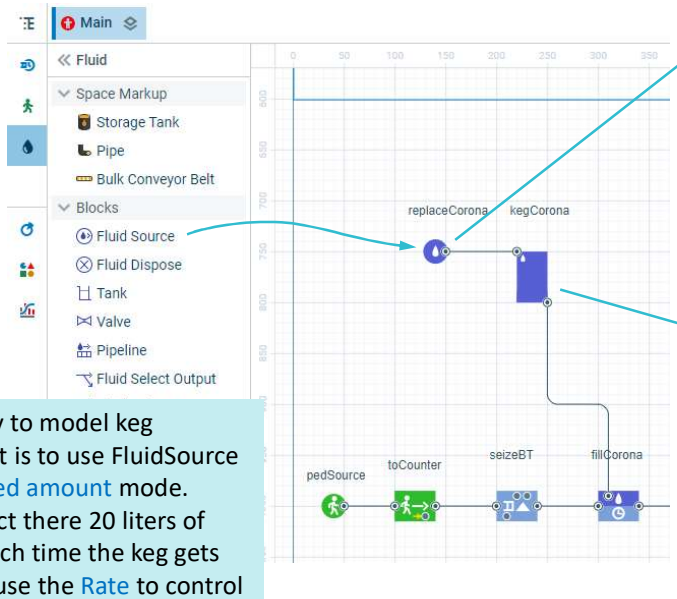
Run

Now you should see the angry crowd waiting for beer after the keg has been emptied





Model keg replacement



An easy way to model keg replacement is to use FluidSource in the Limited amount mode. We will inject there 20 liters of Corona™ each time the keg gets empty and use the Rate to control the keg replacement time.

Name: replaceCorona
Rate: 0.1 units: liter / s
Mode: Limited amount, call inject() to refill
Initial amount: 0 units: liters
Custom batch
Batch: "Corona"
Custom batch color
Batch color:

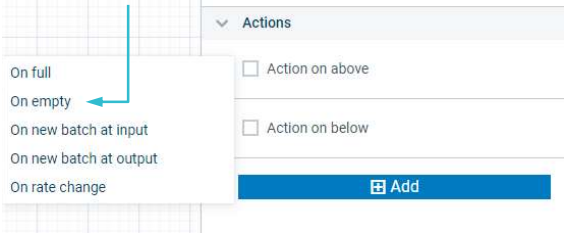
Units!

Choose some light-yellow color for Corona™, we will then use a darker color for Dos Equis™

On empty: replaceCorona.inject(20, LITER)

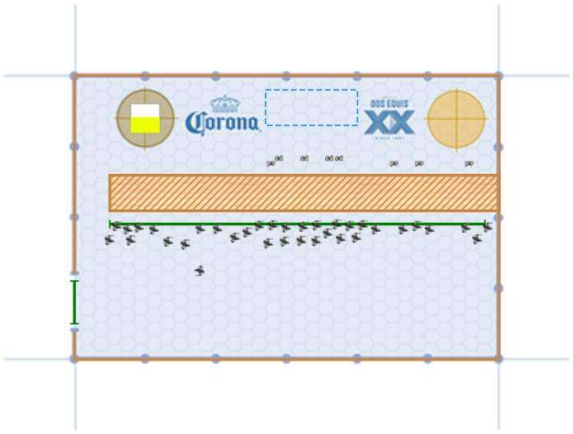
And here as well!

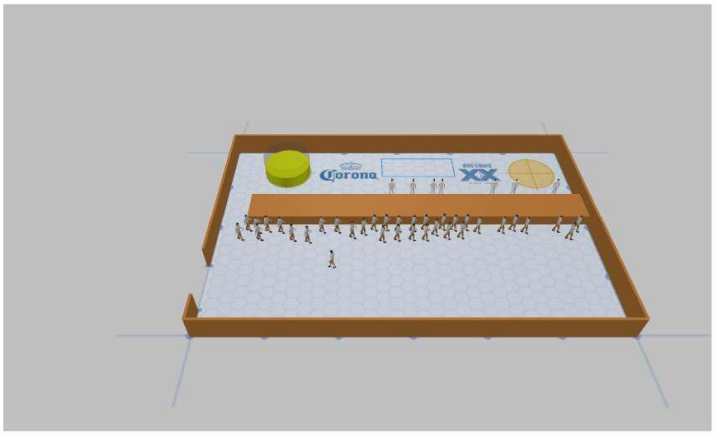
To specify On empty action, click Add and choose On empty in the list of possible actions



Run

The atmosphere in the pub should look better now, as kegs are being replaced!

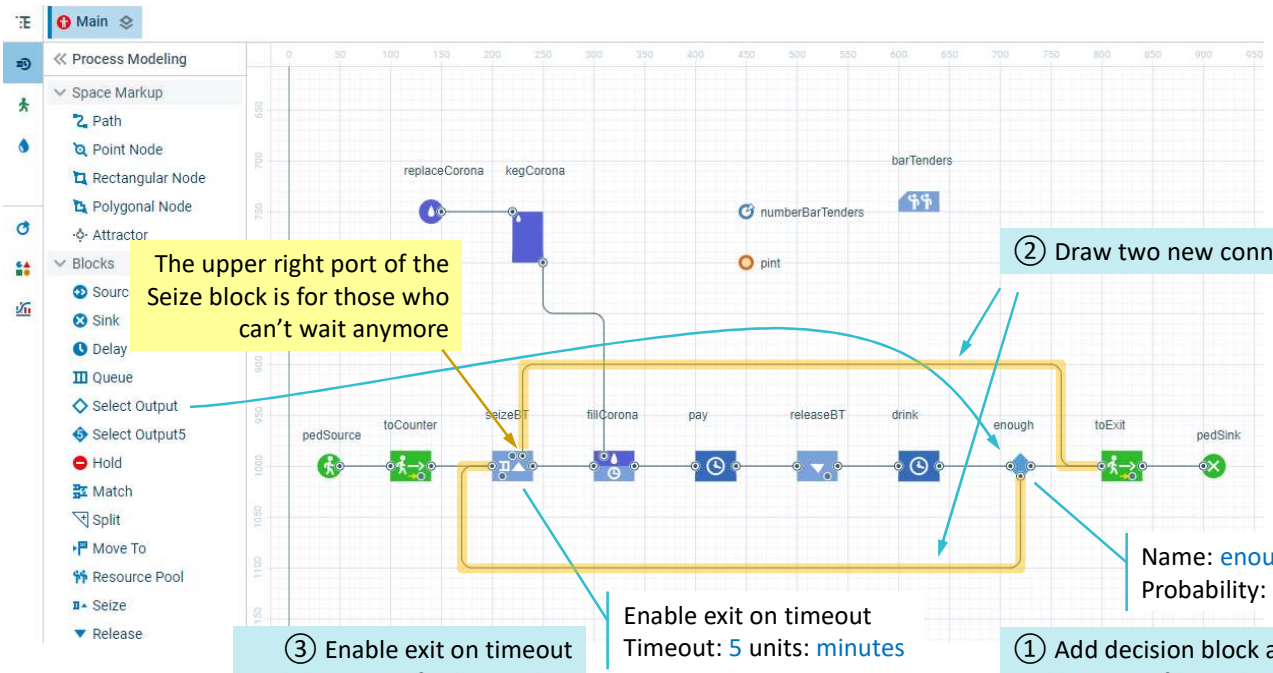




Phase 4

Beer drinking behavior

Have more pints! And don't wait for the bartender more than 5 minutes



The upper right port of the Seize block is for those who can't wait anymore

② Draw two new connectors

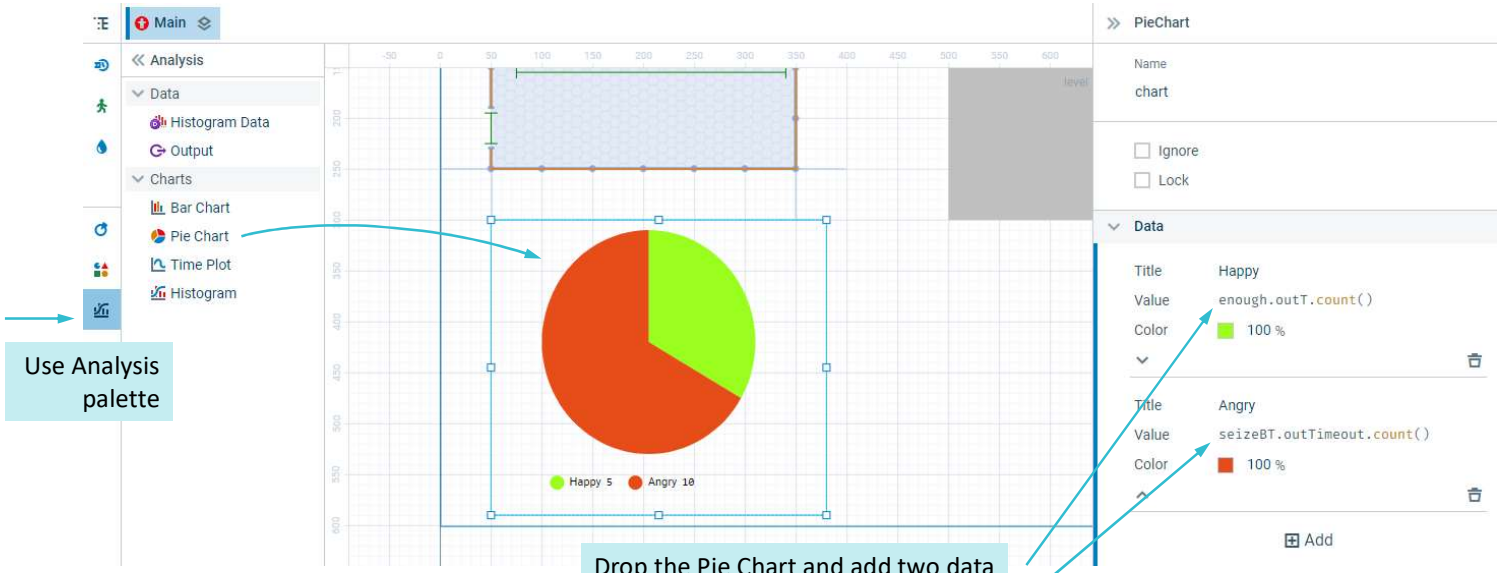
Name: enough
Probability: 0.4

Enable exit on timeout
Timeout: 5 units: minutes

③ Enable exit on timeout while waiting for bartenders

① Add decision block after drink block and let 40% of beer drinkers leave and 60% stay

Count angry beer drinkers

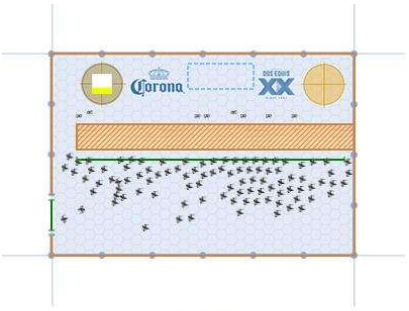


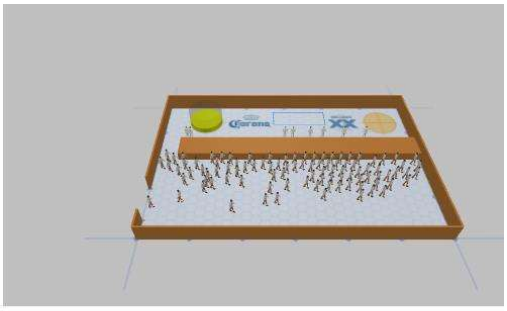
Use Analysis palette

Drop the Pie Chart and add two data items for the number of guests leaving happy and leaving angry. Use the port counters of enough and seizeBT blocks as shown here

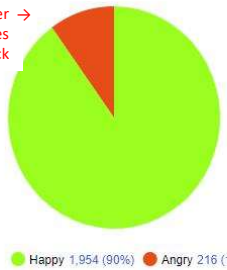
Use Code Completion to minimize typing mistakes!

Run





Frequent mistake: if there are no angry beer drinkers, make sure you have specified minutes as time units in the pay block →

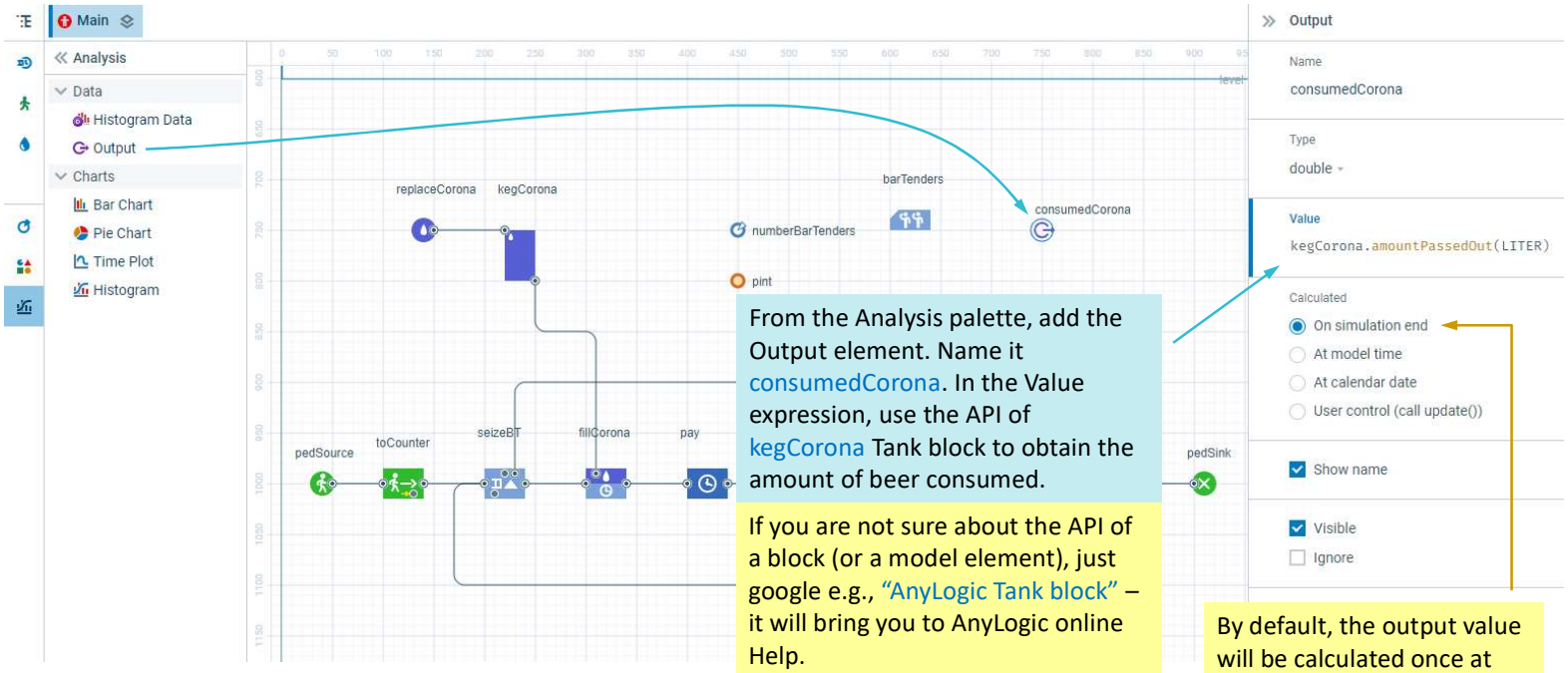


Now, if you run the model long enough, you should see that not everybody is happy with the service! You may run in Virtual mode to make things happen faster

Phase 5

Simulation and Variation experiments in AnyLogic Cloud

Calculate amount of Corona™ consumed



From the Analysis palette, add the Output element. Name it consumedCorona. In the Value expression, use the API of kegCorona Tank block to obtain the amount of beer consumed.

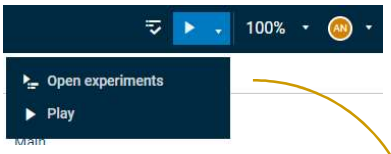
If you are not sure about the API of a block (or a model element), just google e.g., "AnyLogic Tank block" – it will bring you to AnyLogic online Help.

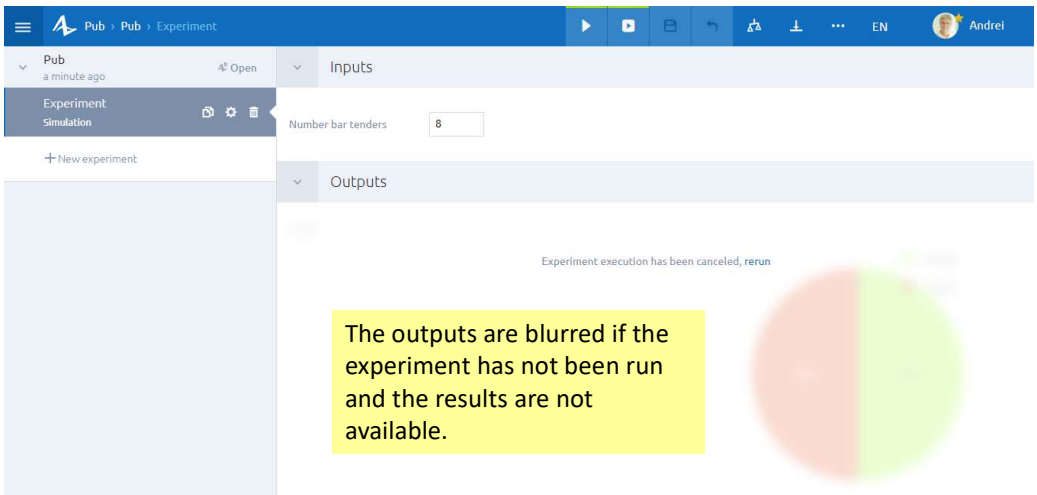
By default, the output value will be calculated once at the end of a simulation run

Open experiments

In the dropdown list at the Run icon choose Open experiments

This closes the editor and brings you to the AnyLogic Cloud interface where you can design and run experiments.
Initially, there is one Simulation experiment with some default dashboard.

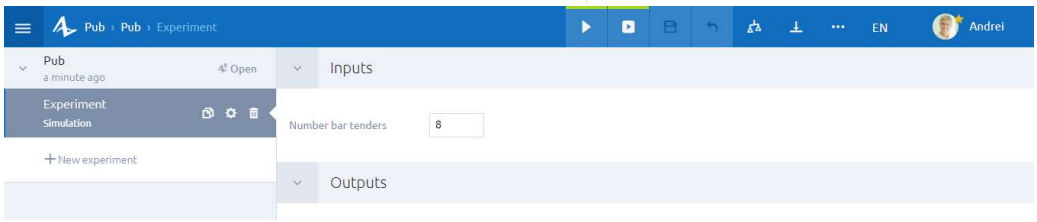


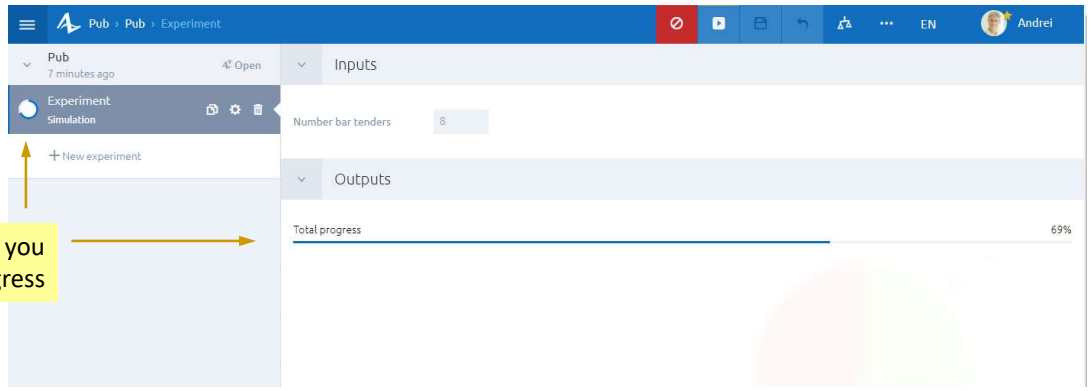


The outputs are blurred if the experiment has not been run and the results are not available.

Run the Simulation experiment

Press the Run button to run experiment without animation



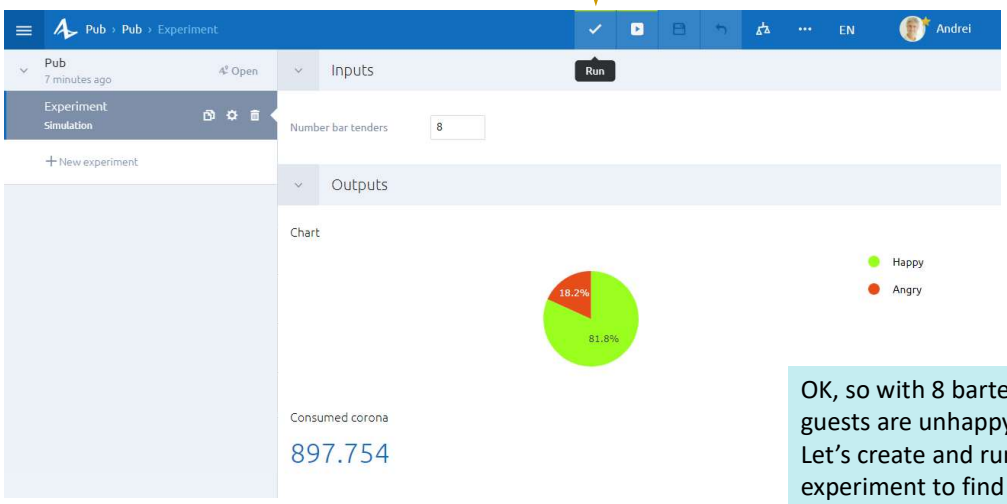


As the model is running, you can see the progress

After the run has been completed, you should see the outputs

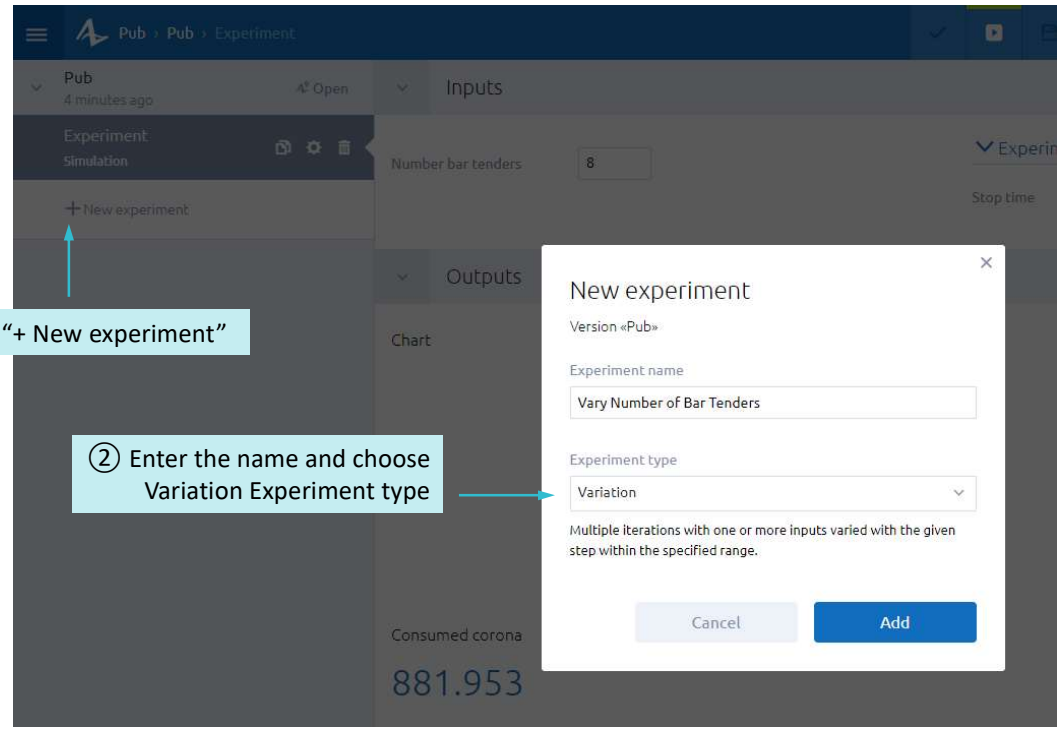
If the experiment with the current parameters and settings has been run, the Run button turns into ✓; the results are stored in the cloud, and you don't need to run it anymore

Only animation-less run results are remembered in the Cloud: when running with animation, you can potentially interact with the model, thus making results irreproducible



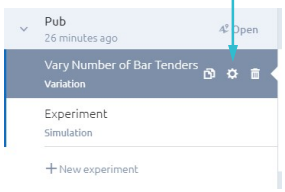
OK, so with 8 bartenders many guests are unhappy and leave. Let's create and run Variation experiment to find out how many bartenders we need!

Add Variation experiment

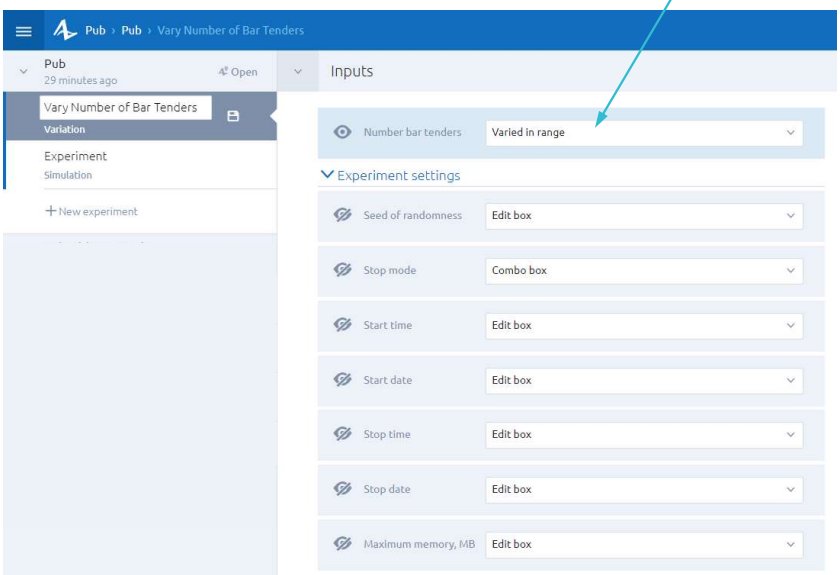


Setup Variation experiment inputs

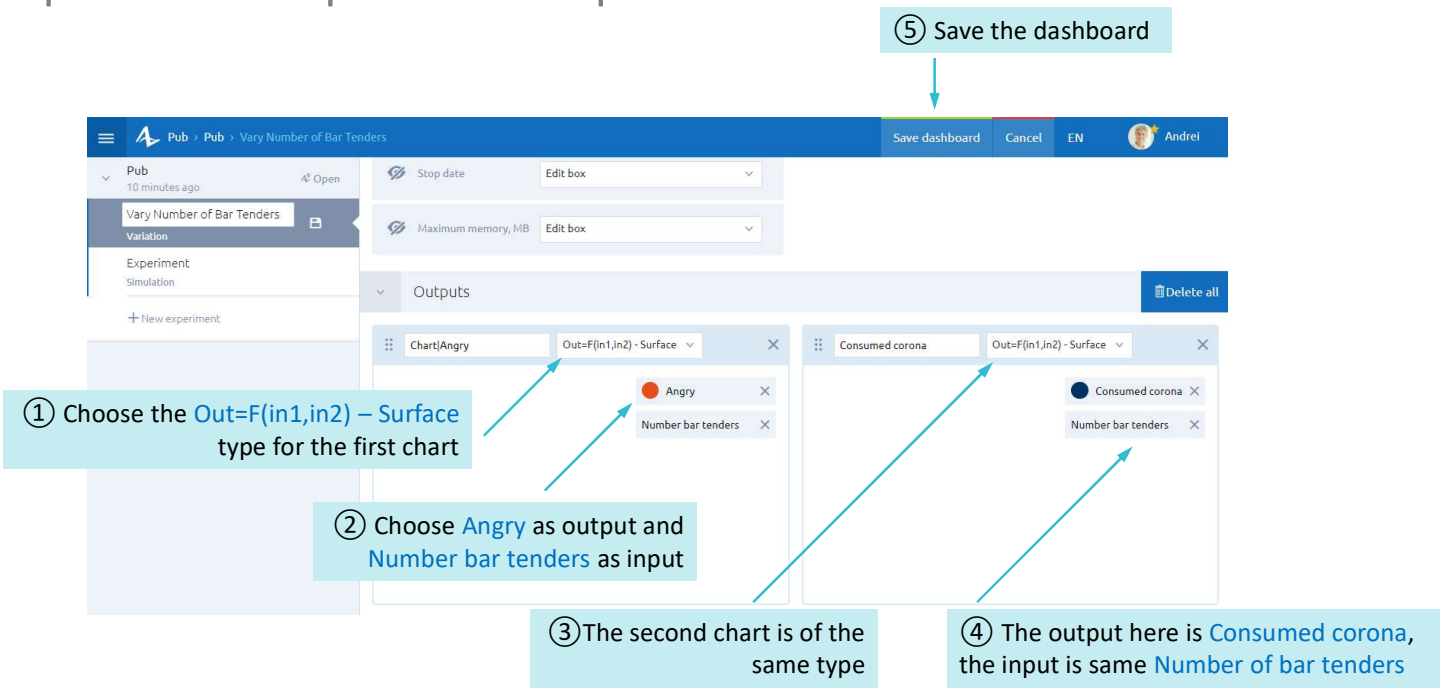
① Click the Gear icon to invoke the dashboard editor of the newly created Variation experiment



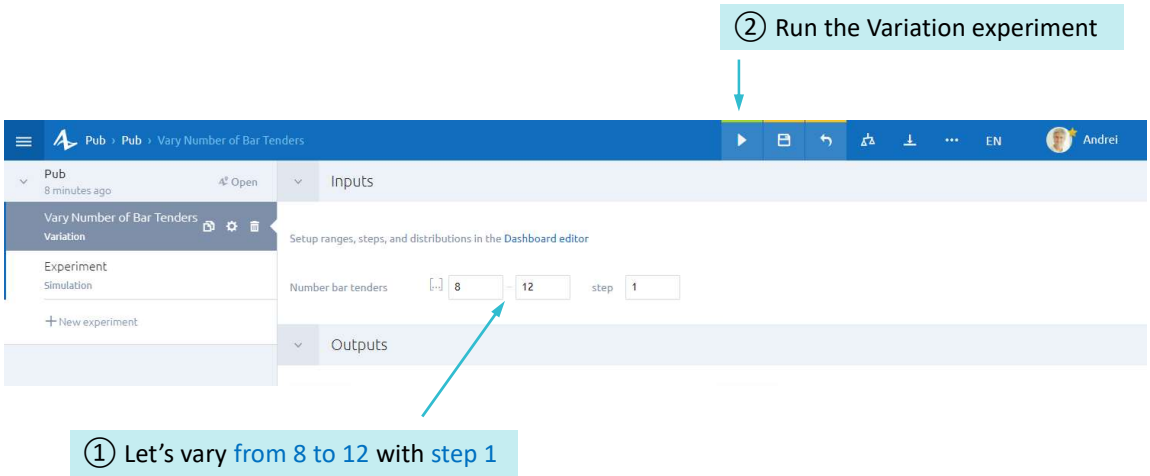
② For the Number bar tenders, select Varied in range input type



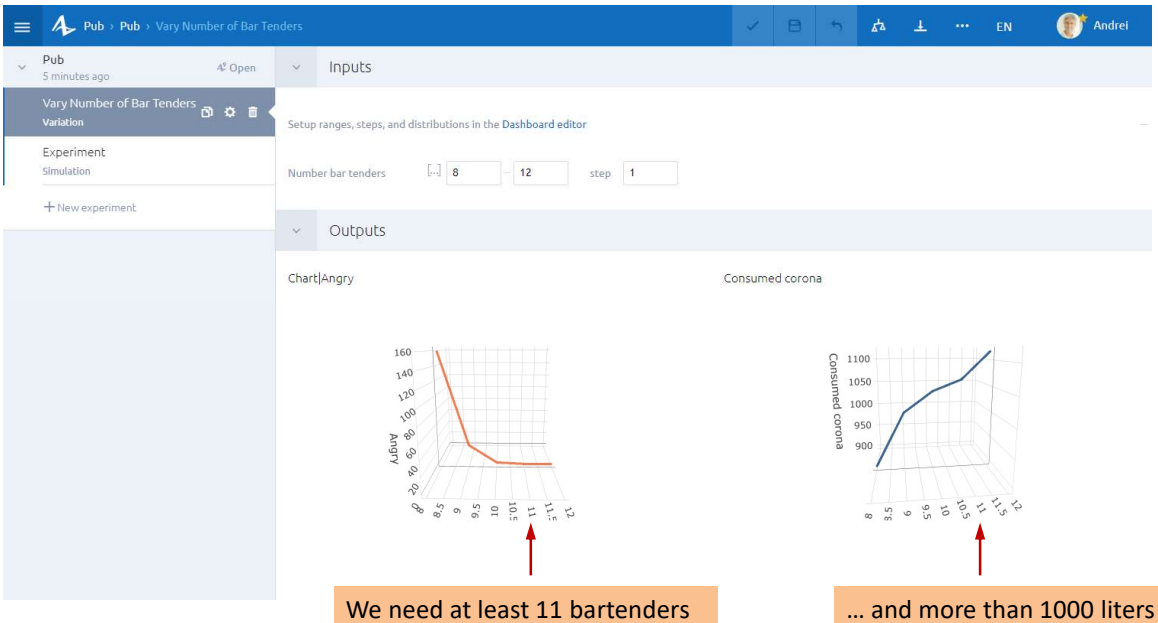
Setup Variation experiment outputs



Specify the variation range for the number of bartenders, and run



And here is the answer (for now, for one beer only):



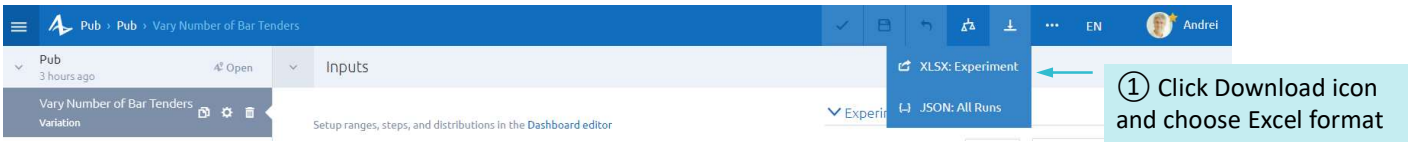
We need at least 11 bartenders to keep everyone happy

… and more than 1000 liters of Corona™ in stock!

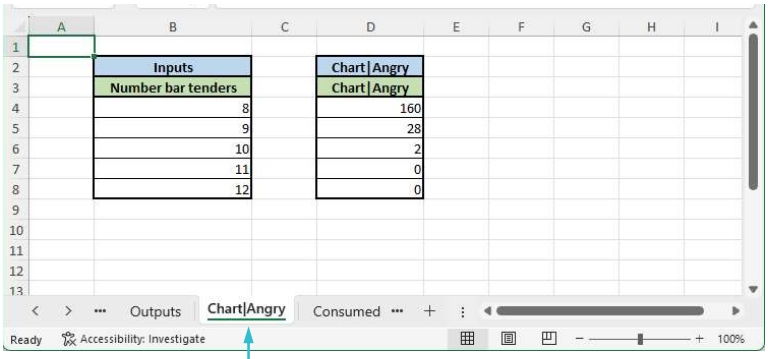
Phase 6

[optional]
Download experiment results.
Compare runs

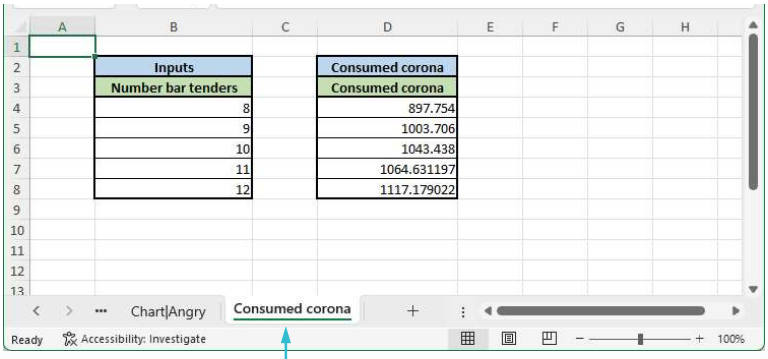
[optional] Download experiment results and look at the numbers



① Click Download icon and choose Excel format



Inputs	Chart|Angry
Number bar tenders	Chart|Angry
8	160
9	28
10	2
11	0
12	0



Inputs	Consumed corona
Number bar tenders	Consumed corona
8	897.754
9	1003.706
10	1043.438
11	1064.631197
12	1117.179022

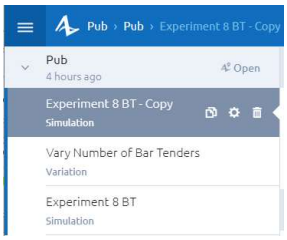
② Open the downloaded Excel file and see the numeric data of the two charts in the corresponding sheets

[optional] Create another simulation experiment with 11 bartenders

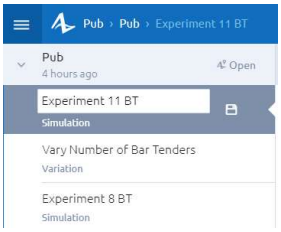
① Rename the first Simulation experiment to Experiment 8 BT

② Create a copy of that experiment by clicking here

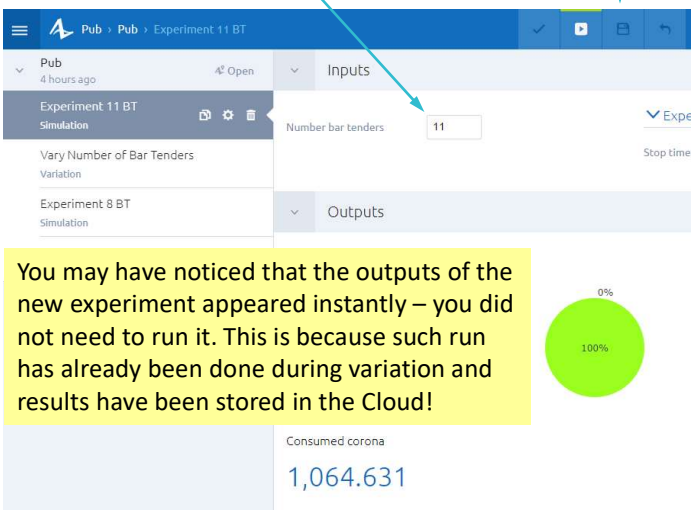
③ The copy is created and shown here at the top



④ Rename the copy into Experiment 11 BT



⑤ Change the Number bar tenders in the new experiment to 11 and see the results change; don't forget to save the input value



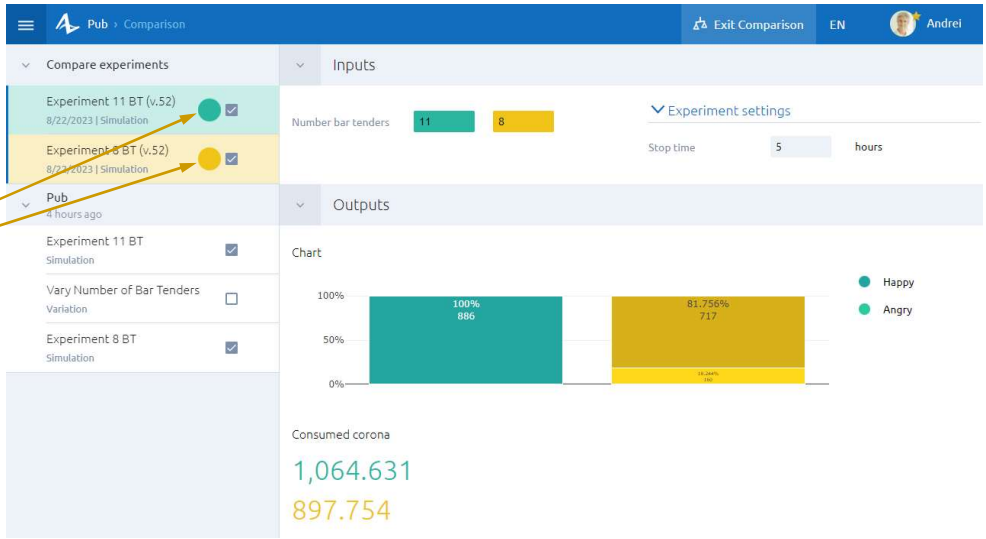
You may have noticed that the outputs of the new experiment appeared instantly – you did not need to run it. This is because such run has already been done during variation and results have been stored in the Cloud!

[optional] Compare the two simulation experiments

① Enter the Comparison mode

② Select the two simulation experiments to see the difference

You can change the colors of experiment outputs by clicking at the samples

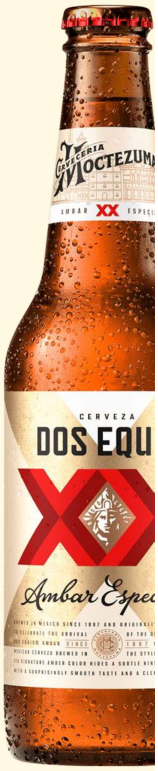


Phase 6

Add Dos Equis™ - the second beer

This will be your homework.

Your AnyLogic Cloud subscription will remain active until Oct 05



Thank you!