

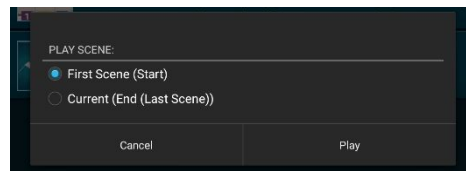
Game Template Guide: Physical simulation

The Physical simulation template contains 3 scenes:

- Experiment 1 - simulation
- Experiment 2 - hands on
- Experiment 3 - extra task



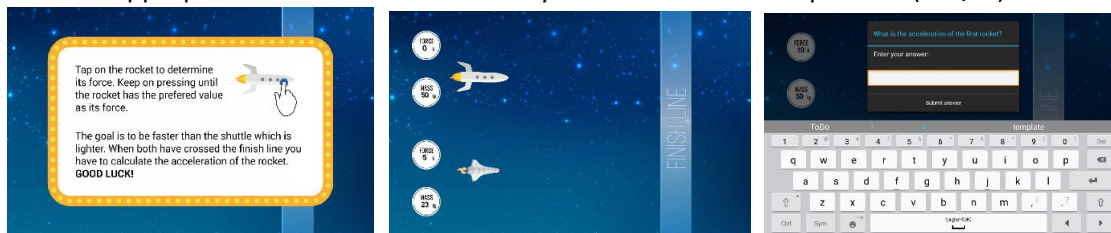
Each of these scenes works like an individual program. For example, objects and variables can only be used for one scene. You can start a scene by tapping on the play button.



Gameplay:

Physical experiments with mass, acceleration. Apply Newton's 2nd law of motion ($F=m \cdot a$). Play around with the properties.

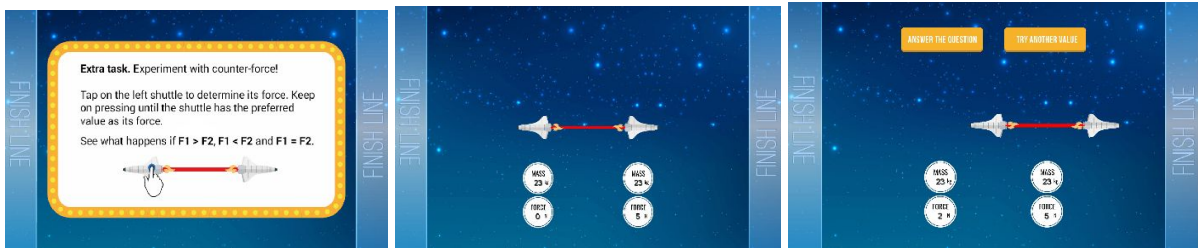
First level: See what happens if you change the force of the first rocket by pressing it. The first rocket (larger one) should reach the finish line first. You should figure out how the exact number to achieve this. The appropriate force $F = 11$. At the end you have to answer a question ($a=F/m$).



Second level: Create an own rocket with mass and force. Calculate the acceleration and set the velocity of the rocket. Answer the question at the end of the game.



Third level: See what happens if $F_1 < F_2$, $F_1 > F_2$ and $F_1 = F_2$. Answer the question which of Newton's laws is applied. Change the force (by pressing the rocket). The answer is 3.

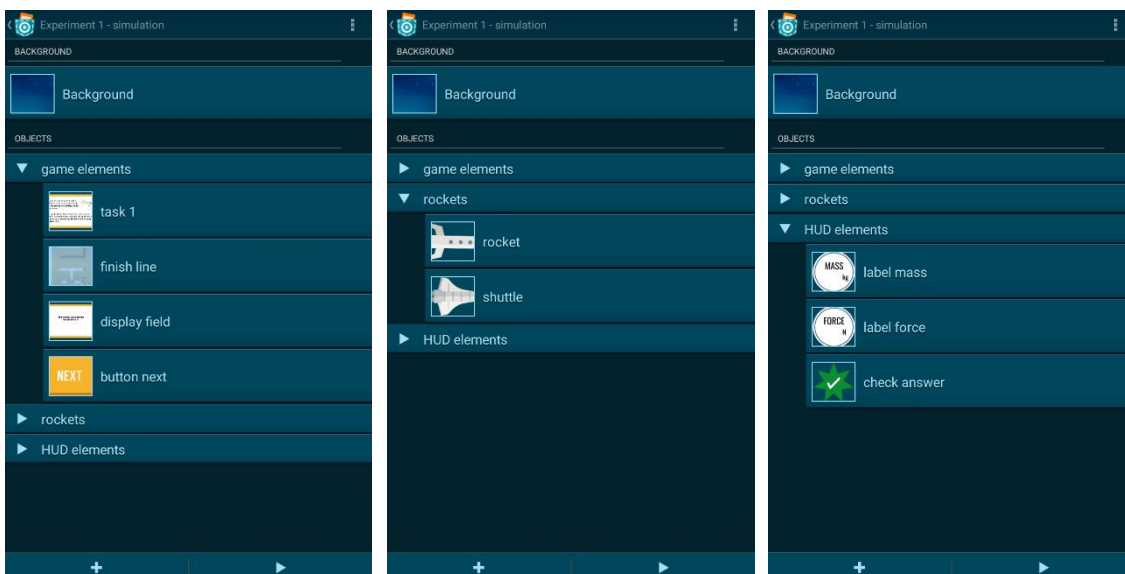


Scene Experiment 1 - simulation

In this scene you should play with the values of Newton's second law of motion $F = m \cdot a$ or $a = F/m$. You only play the game and don't change the code.

This scene contains the following objects:

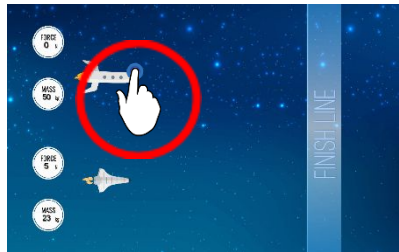
- Group: game elements
 - task 1
instruction of the scene
 - finish line
if the rockets touch the finish line, the game ends
 - display field
displays the answer, displays the acceleration of the rocket
 - button next
switches to the next level
- Group: rockets
 - rocket
 - shuttle
- HUD elements
 - label mass
 - label force
 - check answer
show a different look depending on the answer



ToDo - 2:

Play the simulation

1. Change rocket's force by pressing it. The value of the label "force" will change



2. The goal is that the rocket crosses the finish line first. The minimal force value applied to accomplish this is 11
3. After both rockets crossed the line you have to answer a question and calculate the acceleration of the rocket $a = F/m$
4. Type in the answer to finish the level (Attention: Use a point not a comma!)

Learning goal:

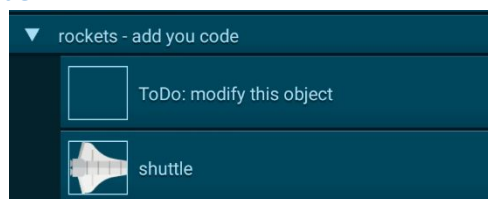
- define the appropriate value for the first rocket's force
- answer the question correctly

Note: Additionally you can have a closer look at the scripts. Note bricks explain important parts. The most important objects of this scene are the objects *rocket* and *shuttle*.

Scene Experiment 2 – hands on

Now you also have to add some bricks to the program.

This scene contains the same objects as scene *Experiment 1*. The object *rocket* is replaced by the object *ToDo: add your own code*.

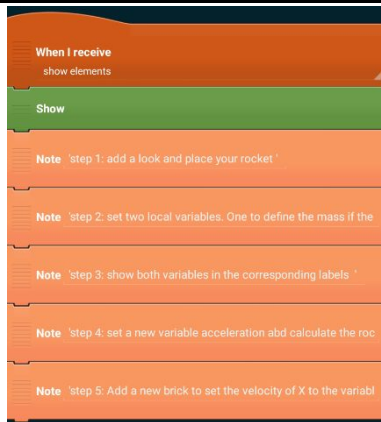


Edit the scene *Experiment 2 – hands on*

ToDo - 3:

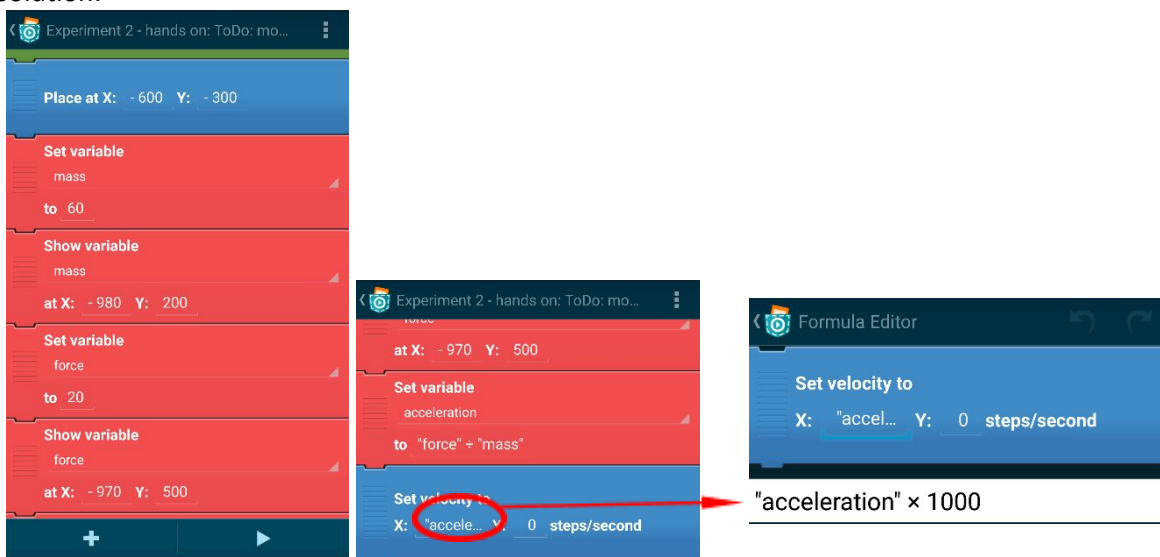
Add an image of your rocket and add bricks

1. Open the looks of your object *ToDo: modify this object* and add an image of your rocket
2. Open the scripts of the object and follow the instructions on the note bricks

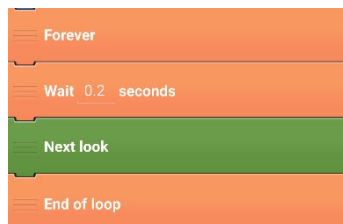


Hint: A nice idea is that the students can build or draw their rockets on their own and make a picture of it with the camera to add it to the app. It may be necessary to adopt the size of the picture with the brick *Set size*.

Solution:

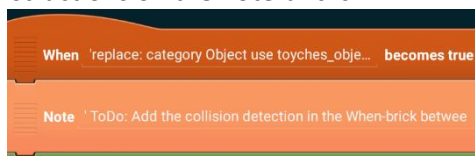


Extra Task: You can add bricks and a second look to the rocket to animate the fire

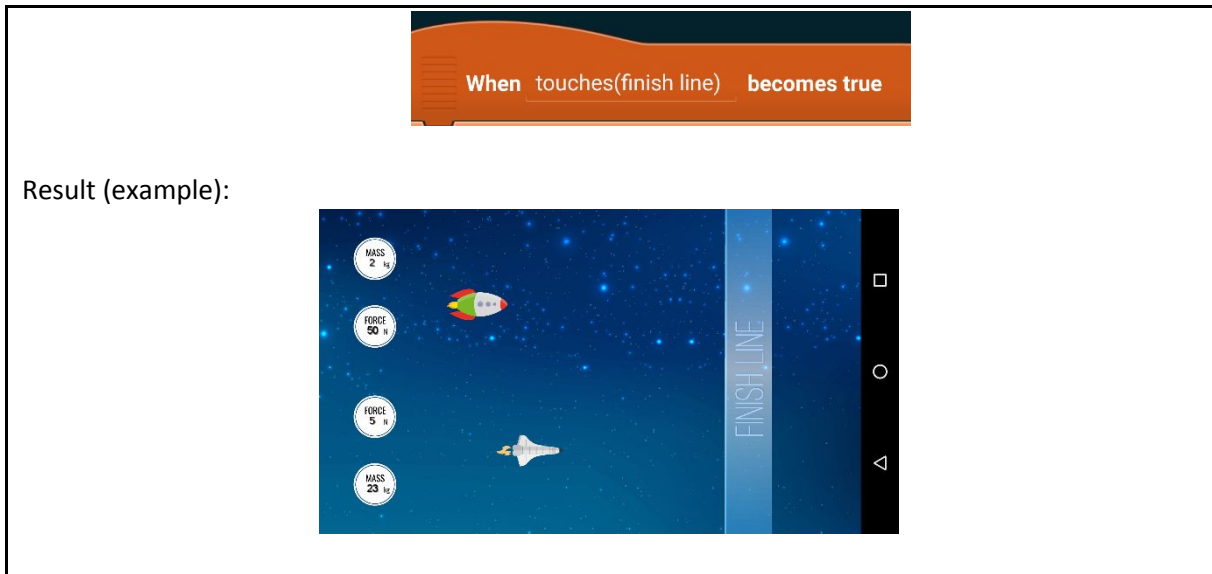


Add a collision detection between the rocket and the finish line

3. When brick: Follow the instructions on the note bricks



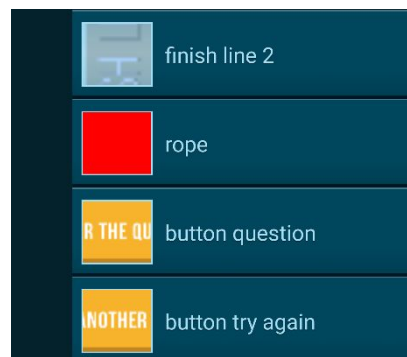
Solution:



Scene Experiment 3 – extra task

In this scene you should play with the values of Newton's laws of motion and see what happens if $F_1 < F_2$, $F_1 > F_2$ or $F_1 = F_2$. In this scene you only play the game and don't change the code. The scene has nearly the same objects than the previous scenes except for these:

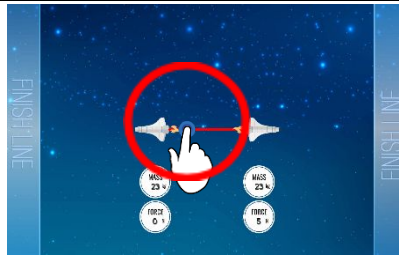
- Group: game elements
 - finish line 2
creates a finish line for the other direction
 - rope
simulates a rope
 - button question
for answering the question
 - button try again
for choosing another value for the force



ToDo - 4:

Play the simulation

1. Give the rocket a force by pressing it. The value of the label "force" will change



2. See what happens if $F_1 < F_2$, $F_1 > F_2$ or $F_1 = F_2$. You can play the level again with the button “Try another value”
3. Type in the correct answer to finish the level

Learning goal:

- test different force values for the left rocket
- answer the question correctly