## Unit 1: Events and Sequences

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### Magical Sensors

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To Be an Animation Designer

Learning objectives

1. Understand the concept of Sequence.
2. Master the basics of Sequence and learn how to create animations using Sequence.

Key Concept

To make Codey Rocky move forward for 1 second, turn right for 1 second and then stop moving, we need to make sure our coding blocks are arranged in the order as shown above. In brief, Sequence refers to a series of steps which are carried out in order to complete a task.
Situated Learning

1. If the panda wants to put the watermelon in the refrigerator, it should follow the steps as below:

   Step 1: Open the refrigerator.

2. Put the watermelon into the fridge.

   Step 2: Put the watermelon into the fridge.

3. Close the fridge door.

   Step 3: Close the fridge door.

4. The panda has to follow the sequence of steps, otherwise...

   Otherwise, the panda will fail to put the watermelon into the fridge.

5. A set of ordered steps for accomplishing a task.

   To put the watermelon into the fridge, we need to follow the steps above. The steps are called Sequences.

6. In computer programming, we should follow the sequence of steps as shown above when putting the watermelon in the fridge.

   We can write programs to simulate this process.
Learn Through Play

Join the teacher to play a game I’m a Robot. You will be able to get a better understanding of the concept of Sequence.
1. The teacher acts as a robot, walks from somewhere in the classroom to the blackboard and draws a smiley face on it.
2. Students give instructions to the robot and write the instructions down on paper.
3. The robot should carry out actions as instructed.

Coding Practice

Winking Eyes

How to make Codey Rocky Wink Eyes? Observe when the teacher is demonstrating how to do. Then practice yourself.

The Program Sequence
1. Add the Events block —— When button A is pressed;
2. Use the block show image () for () secs to make Codey open its eyes;
3. Duplicate the block show image () for () secs to make Codey wink its eyes;
4. Add the block show image () for () secs to make Codey open its eyes;
5. Upload the program to Codey. When button A is pressed, Codey will wink at you.

Traditionally, animation designers would make animations by following these steps: Put a sheet of static drawing on the table first and unfold another piece of drawing paper on top of the first paper. Designers would outline the frame and then change the drawing bit by bit at a time. Then another piece of paper, outline the frame and change the drawing slightly again. Designers repeat the steps over and over again until they complete a series of pictures that are slightly different from each other. Then, they flip the drawings quickly to animate the pictures. Based on the same principle, we use the block show image () for () secs in our program to create animations.
You are supposed to complete the project **Winking Eyes** as the teacher did.

Task 1: Work in pairs. Add the block `show image ( ) for ( ) secs` to the code. Duplicate the block but modify the image to make it look different each time. Then arrange the coding blocks in a top-to-bottom order as the teacher just did. Ok, now the animation is ready. Of course, you can add some facial expressions to Codey if you want.

Create A New Animation

Task 2: Work in pairs to complete Task 2. You need to create an image by filling the following grid. Then use the block `show image ( ) for ( ) secs` to create the same image; duplicate the block but change the image slightly; repeat the steps until you have a series of coding blocks. These coding blocks show different images and should be arranged in sequence.

Upload the program to Codey. Then invite classmates to watch your animation.
In this lesson, we created a project ____________________________

During the process, we came into an issue ____________________________

In the end, we solved the problem by ____________________________

---

**Self-review**

1. In this lesson, I learned that ____________________________
2. The part I like most about this lesson is ____________________________
3. I want to design my own animation. It will be like ________
   (Or you can draw it out in the space below.)
Learning Objectives

1. Learn about IR sensors and their applications.
2. Understand what IR sensors are used for and complete tasks.

Prior Knowledge

IR sensors work based on the reflection of infrared light and detect obstacles based on the intensity of the reflection. If it receives reflection, it means that there is an object ahead; if it does not receive any reflection, it means there is no object ahead. It is widely known that black colors are quite good at absorbing IR lights, so an IR sensor cannot detect black objects. What “scares” the light most is a black hole, because it can never escape a black hole.
**Challenge**

### Jumping Codey Rocky

Codey Rocky needs to avoid obstacles on its way. Use its IR sensor to make sprites avoid obstacles.

<table>
<thead>
<tr>
<th>Codey Rocky</th>
<th>Sprite-Codey</th>
<th>Sprite-Obstacle FIRE</th>
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</table>
| 1. Use the IR sensor to enable the sprite Codey to jump.  
2. When button A is pressed, the game starts.  
3. When the game is over, a sad face will be shown on the LED display. | 1. When the game starts, the sprite Codey appears in the middle of the stage.  
2. It avoids obstacles by jumping over them. Any contact with an obstacle means a game over. | 1. When the game starts, the sprite FIRE keeps moving from right to left. |

- Connect Codey Rocky to mBlock 5
  1. Connect via Bluetooth or a USB cable.

- Add/Delete Sprites
  1. Add the sprite C-codey-rocky1-a  
     Rename it as Codey.  
     Reset the size of the sprite to make it fit the stage.
  2. Add the sprite bonfire  
     Rename it as Fire.  
     Reset the size of the sprite to make it fit the stage.
  3. Delete the sprite Panda
• Write Programs

1. Device: When button A is pressed, a smiley face will be shown on the LED display and Codey Rocky will broadcast "Start".
2. Sprite-Codey: When receiving the message "Start", the sprite Codey will appear in slightly left off the middle of the stage. The following code will run repeatedly: if Codey touches the sprite Fire, it will broadcast "Game Over" and give a sad face. And all the scripts will stop.

```
| go to x: | -90 | y:  | -40 |
```

3. Sprite-Fire: When the message "Start" is received, the fire will move to the rightmost point of the stage. Then it starts moving from there to the leftmost point of the stage within the next 3.5 seconds and disappears there.
4. Device: When Codey Rocky starts up, it repeats the following instruction: if it detects obstacles, it will broadcast "Jump" and wait for 0.8 seconds.
5. Sprite-Codey: When the message "Jump" is received, Codey, mimicking a jumping locomotion, first moves upward within 0.4 seconds, then moves back to its original position within 0.8 seconds.

```
<table>
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<tr>
<th>glide</th>
<th>0.4 secs to x:</th>
<th>-90</th>
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<td>glide</td>
<td>0.8 secs to x:</td>
<td>-90</td>
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<td>-40</td>
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```

6. Device: When Codey receives the message "Game Over", a sad face will be shown on the LED display.

• Referential Stage Design
• Extension Task

Use variables blocks to keep track of the scores. You will gain 1 point each time you help Codey avoid an obstacle.

Share

Describe the tasks you completed during this lesson______________

Did you come across any problems?______________________________

And how did you solve them?____________________________________

Self-review

1. What did you learn from this lesson?________________________
2. What do you like most about this lesson?____________________
3. Describe where the IR sensor is located on Codey Rocky (or you can mark the position of the IR sensor by drawing).________________
The Greeter Codey

Learning Objectives

1. Learn about ultrasonic sensors and what they are used for in our everyday life.
2. Understand how ultrasonic sensors work and complete tasks.
3. Master the basics of ultrasonic sensors.

Applications

Ultrasound is sound waves with frequencies higher than the upper audible limit of human hearing. Ultrasonic sensors apply ultrasound waves to detect obstacles and measure distances. An ultrasonic sensor will send sound pulses at intervals. When these pulses hit objects, they will be bounced back. Then the ultrasonic sensor will measure the distance to the object based on the time that it takes the echo to return to the sensor. Ultrasonic sensors are commonly used in our everyday life, for instance, automatic door control systems, avoiding obstacles and measuring distances.
**Game**

Play a game **The Greeter Codey**.

Goal: When button A is pressed, the LED screen will show two hearts and the indicator will turn red. Put your hand close to the ultrasonic sensor to let the LED screen blink eyes and the indicator turn green. And Codey will say "hello" to you.

Note: You need to define the detection range of the ultrasonic sensor.

Rules:
1. Upload the program to Codey.
2. Press button A to start the game.

**Take on the challenge!**

Will Codey do a good job? Try it out! And think about what role the ultrasonic sensor plays in the game.

Think: If an object gets too close to the sensor, will Codey still be able to work as intended?

---

**Learn**

Codey has no ultrasonic sensor but it can work with the Neuron ultrasonic sensor. You can just attach the sensor to Codey in a snap. But remember, the measurement range of the ultrasonic sensor is 3cm – 300cm, which means that only when an object is within the range can it be detected by the sensor.

To program the ultrasonic sensor, you will need the purple block **ultrasonic sensor**( ) **distance(cm)** in your code.

Altogther, the code for The Greeter Codey is as shown below:
Set the detection range to "less than 10". The indicator turns green when an object is detected. Codey says hello and winks at the same time.

The indicator turns red and the LED screen shows hearts when no object is detected.

Coding Practice

In the game, using the ultrasonic sensor, we turned Codey into a greeter. Now, try using the ultrasonic sensor to make a car reversing aid system.

Challenge-Car Reversing Aid System

Combine Codey Rocky with the Neuron ultrasonic sensor and you can get a superb car reversing aid system.

- Connect the ultrasonic sensor to the rear of Codey Rocky, helping alert Codey Rocky of obstacles.

- Codey Rocky shows "start" when it starts up. The indicator turns red and after 1 second, the car starts driving in reverse.
- When detecting an object within 10cm at the back, the car stops and the LED screen displays a face looking surprised;

- Wait 2 seconds. If no object is detected, the car keeps driving in reverse until it detects an object;

- Wait 2 seconds. If an object is detected, the indicator turns black and the car stops.

Describe the tasks you completed during this lesson_____________________________________

Did you come across any problems?_____________________________________________________

And how did you solve them?_____________________________________________________________

Share

Describe the tasks you completed during this lesson_____________________________________

Did you come across any problems?_____________________________________________________

And how did you solve them?_____________________________________________________________

Self-review

1. What did you learn from this lesson?____________________

2. What do you like most about this lesson?____________________

3. Describe what you know about the Neuron ultrasonic sensor (or you can draw it out in the blank area).________