Ice-Skating Dash

Summary

Description

Dash is a little nervous, but also very determined to master the ice for the big Wonder Ice-Skating Show. It may even lead to a spot competing in the Wonder Olympics! Dash will start out slow, but by the end of this practice session, Dash will be skating like a pro!

Learning Procedure

Over the course of **9 challenges**, students will create a dramatic ice-skating program for Dash that includes driving the robot forward and backward in a straight line, turning forward in left and right arcs and circles by adjusting the wheel speed differential located in the **Set Wheel Speed** block, as well as stopping drive movement by using the **Stop Wheels** block. Students will also practice customizing and programming **Eye Pattern Lights** to create various expressions for Dash, as well as programming **All Lights** in various colors for a stunning ice-skating performance everyone will long remember!

Concepts Covered

- **Differential Drive**
    - students will learn that when one wheel rotates faster than the other, the robot turns in an arc towards the slower wheel. *From Reflection Questions & Activity Extensions
    - When the left and right wheels rotate in **opposite directions** at the **same rate**, the robot spins in a 360° circle.
    - When the left and right wheels rotate in **opposite directions**, at **different rates,** the robot turns in place.
- **Set Wheel Speed**
    - students will learn that when left and right wheels rotate at the same speed in a two-wheeled drive system in the same direction, the robot drives straight forward or back.
    - students will learn how to edit left and right wheel speeds independently in the **Accelerometer**: from very slow to very fast.
- **All Lights** - students will practice programming **All Lights** in colors, red, yellow, orange and green, to light up Dash's ears and chest.
- **Eye Patterns** - students will customize eye lights to create different expressions, e.g., smile, determined, happy and innovate new expressions.
- **Stop Wheels** - students will program the robot to stop movement using the **Stop Wheels** block.

- **Sound** - students will **record** their own **happy sound** for Dash in the **My sounds** block.

In App

Vocabulary
Differential Drive: a two-wheeled drive system with independent movement controls for each wheel
Set Wheel Speed - a block that allows you to adjust the speed in which the wheels turn
Stop Wheels - a block that immediately stops the movement of the wheels

Reflection Questions
1. Explain how you programmed the robot to move forward in a straight line?

2. When programming the robot, why was it necessary to program the left and right wheel to turn at different speeds? What happened when you did this?

3. How did you program the speed for each wheel to make the robot spin right? left? *When the left wheel rotated faster than the right one, the robot turned right while traveling forward. When the right wheel rotated faster than the left one, the robot turned left while traveling forward.*

4. How do you think different sized wheels would affect the robot's ability to turn? Do you think it matters? (Experiment with cardboard wheels and straw for axel.)

5. Does it matter what type of surface the robot spins on? Explain. Test your hypothesis.

6. What do you think would happen if you programmed the left and rights wheels to move in opposite directions at the same rate? At opposite rates? Program Dash and test it out. Were you correct in your predictions?

Activity Extensions

1. Olympic Skater
Read to Students: Now you have an ice-skating robot! Adjust the left and right wheel speeds in the **Set Wheel Speed block** and see what happens as Dash glides across the ice! You can also make Dash skate backwards! Dash is now ready to skate in the Robot Olympics. Program an exciting routine for Dash in "Create New" section of the Blockly App.

Test out what happens when the wheels move in opposite directions at the **same speed**. How is this movement different than when the wheels are moving in opposite directions at **different speeds**? Incorporate all types of tricky spins and turns in Dash's performance. Dash must end the routine right in front of the judge's table, using the **Stop Wheel** block. Your teacher will be the Olympic judge. Don't forget to create a dramatic ice-skating costume for Dash, too.

2. Speed Skating

In this exercise, students will extend the logic of wheel speed differential to the length of the inner and outer lanes of an ice-rink. Read to Students: Dash has been practicing skating and is now fast enough to race against the other robots in the Speed Skating event. The judge flips a coin and Dash gets to choose a starting point on the 400-meter rink first. Should Dash choose a position on the most outer ring of the rink or the most inner ring of the rink? Is there a difference? If so, how can you make the race between ice-skating robot fair?

3. Explaining Wheel Differential

Students will watch an old-fashioned, but informationally accurate video on wheel differential. After students understand the underlying mechanics of wheel differential, their knowledge will be assessed, as experts, explaining and teaching it to their peers. Download the app, *Explain Everything*, and have students create a movie screencast that includes text, voice overs, music, images, drawings and any student-produced videos that demonstrate the principles of wheel speed and turns. The objective is to create a multimedia presentation that will be more relevant to the current times in terms of the presentation and technology used to present it.
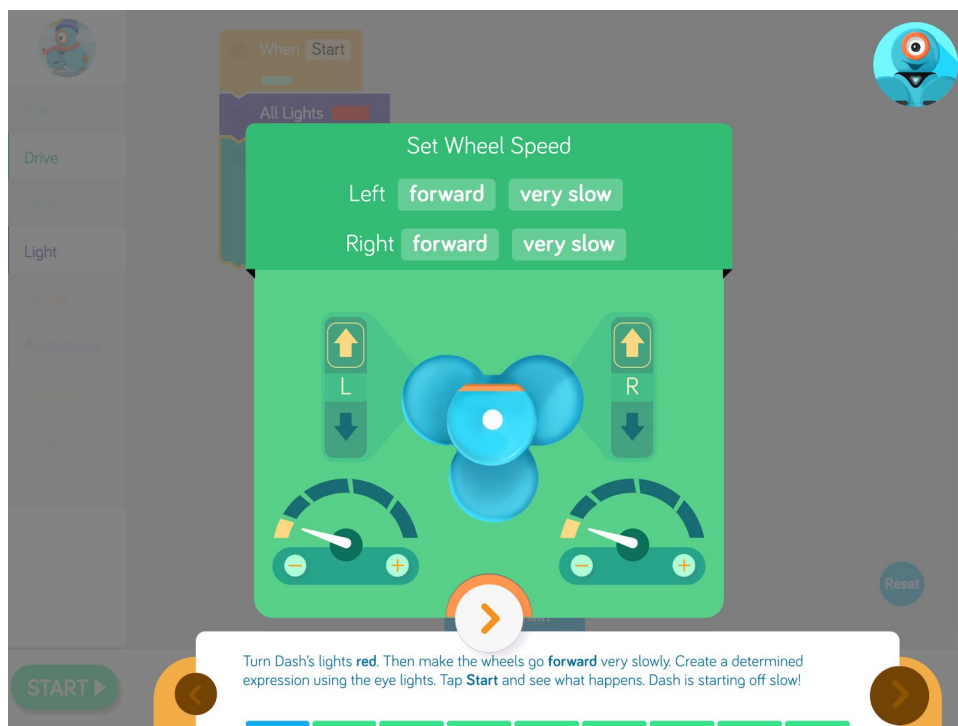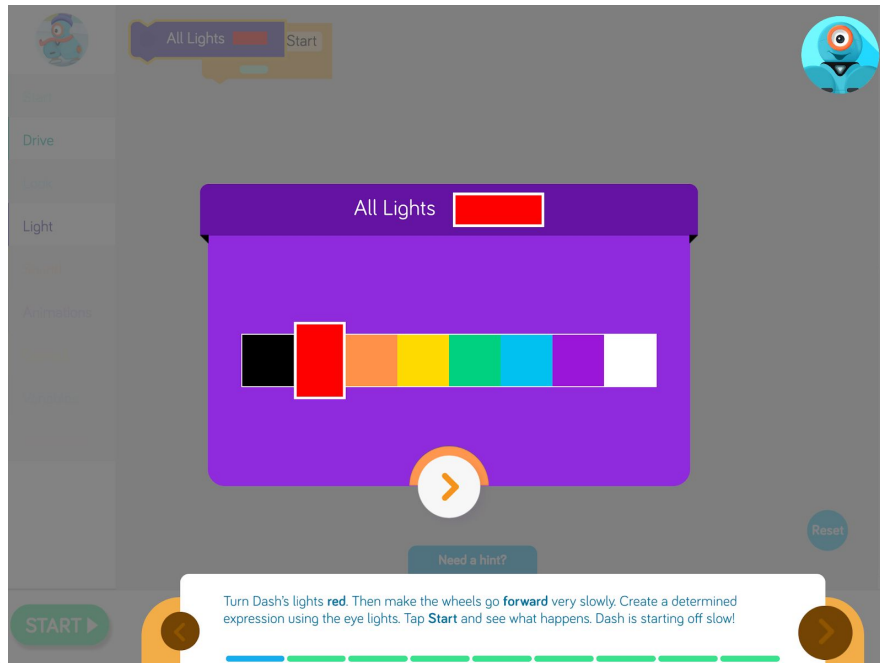http://www.geek.com/geek-cetera/a-brilliant-explanation-of-how-a-cars-differential-works-1450429/
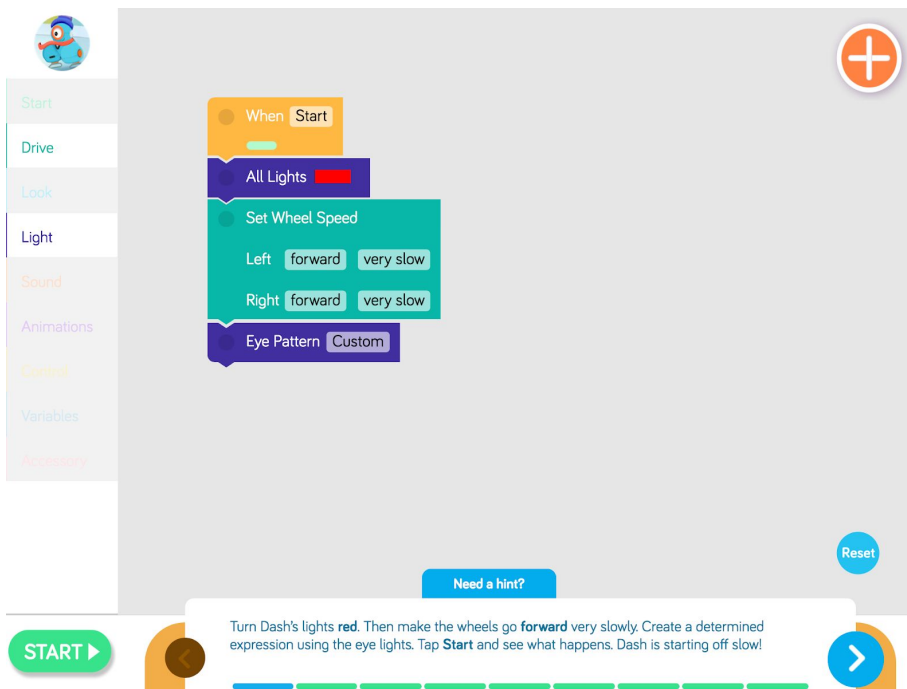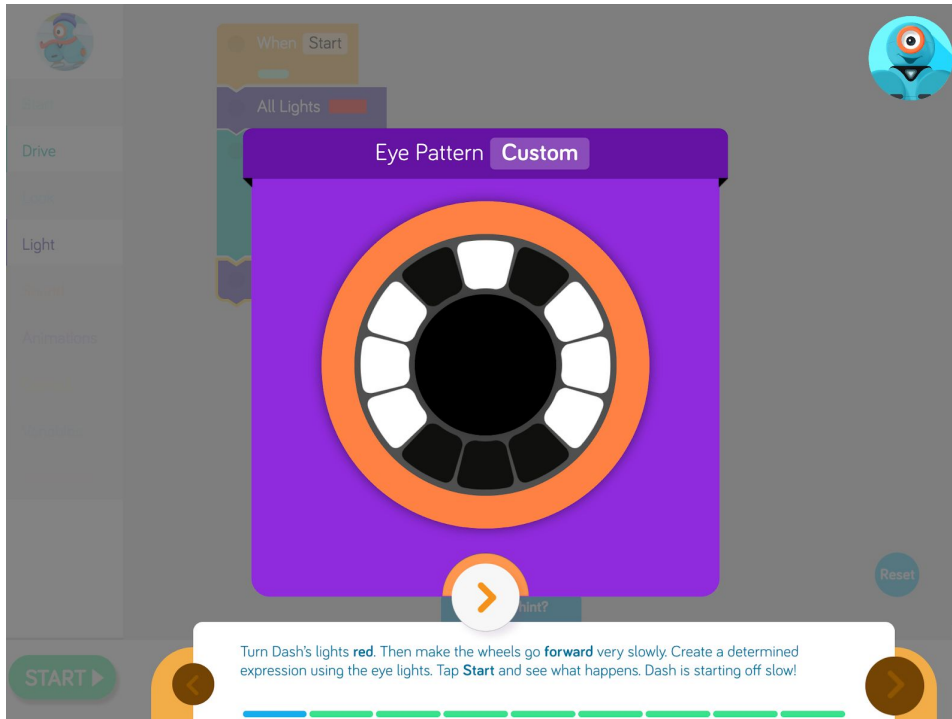
4. Obstacle Course Race

In this activity, your students will practice programming Dash, to make left or right turns, using wheel speed differentials. Have students design an obstacle course using books, building blocks or any other large units that can partition a large space into alleyways like a maze. Now students are ready for the newest event in the Wonder Winter Olympics. Divide students into groups of 4 to collaborate on programming a robot to maneuver through the maze from start to finish. Students will design this program in the "Create New" section of the *Blockly App*. Each team must incorporate, at least, 2 left turns and 2 right turns using wheel speed differentials. Dash must end the program coming to a complete stop at the exit of the maze. The team whose robot makes it through the maze in the shortest amount of time is the winner.

Solutions

Challenge 1

Turn Dash's lights **red.** Then make the wheels go **forward** very slowly. Create a determined expression using eye lights. Tap **Start** and see what happens. Dash is starting off slow.
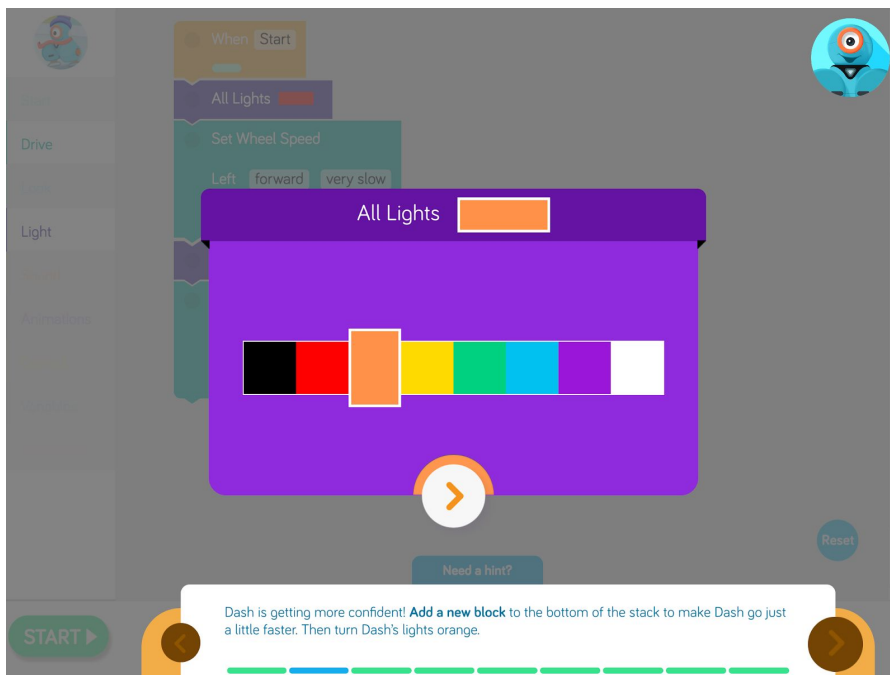
Eye Pattern **Custom**

Turn Dash's lights **red**. Then make the wheels go **forward** very slowly. Create a determined expression using the eye lights. Tap **Start** and see what happens. Dash is starting off slow!

Start
Drive
Look
Light
Sound
Animations
Variables

When Start

All Lights 🟥

Set Wheel Speed

Left forward very slow

Right forward very slow

Eye Pattern Custom

Need a hint?

START ▶

Turn Dash's lights **red**. Then make the wheels go **forward** very slowly. Create a determined expression using the eye lights. Tap **Start** and see what happens. Dash is starting off slow!
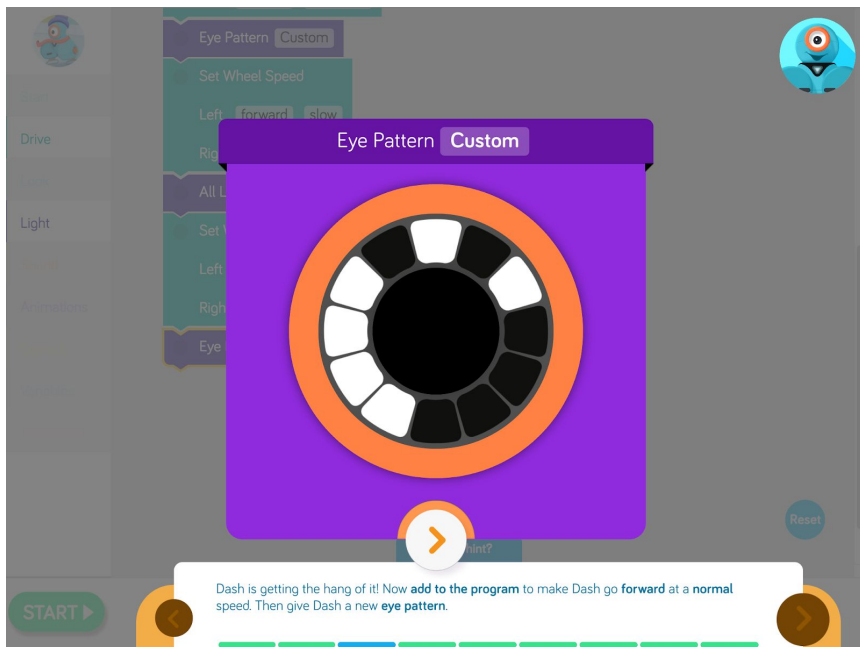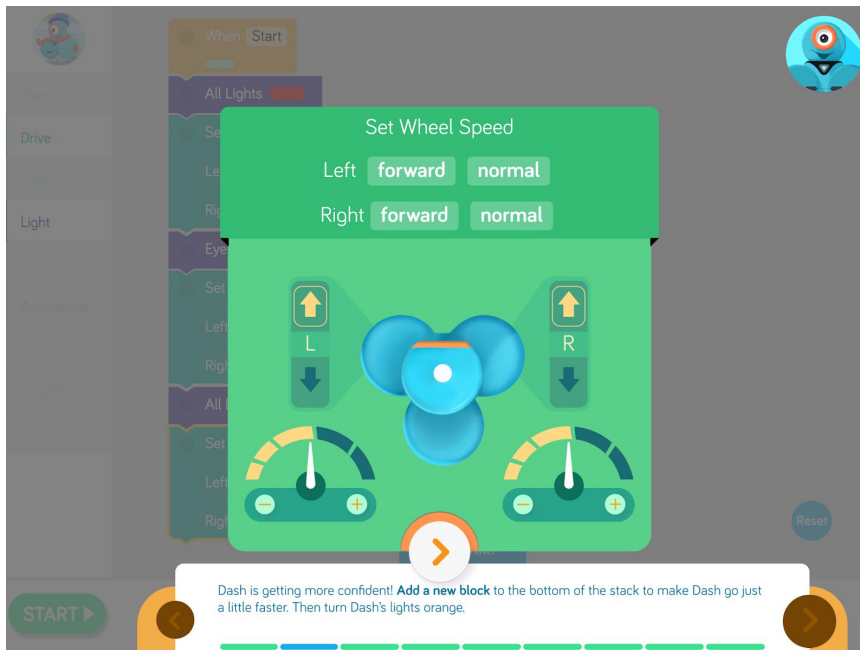
Challenge 2

Dash is getting more confident! **Add a new block** to the bottom of the stack to make Dash go just a little faster. Then turn Dash's lights orange.

When Start

All Lights ▬

Set Wheel Speed

Left forward very slow

Right forward very slow

Eye Pattern Custom

Set Wheel Speed

Left forward slow

Right forward slow

All Lights ▬

Start

Drive

Look

Light

Sound

Animations

Control

Variables

Accessory

Reset

Need a hint?

Dash is getting more confident! **Add a new block** to the bottom of the stack to make Dash go just a little faster. Then turn Dash's lights orange.
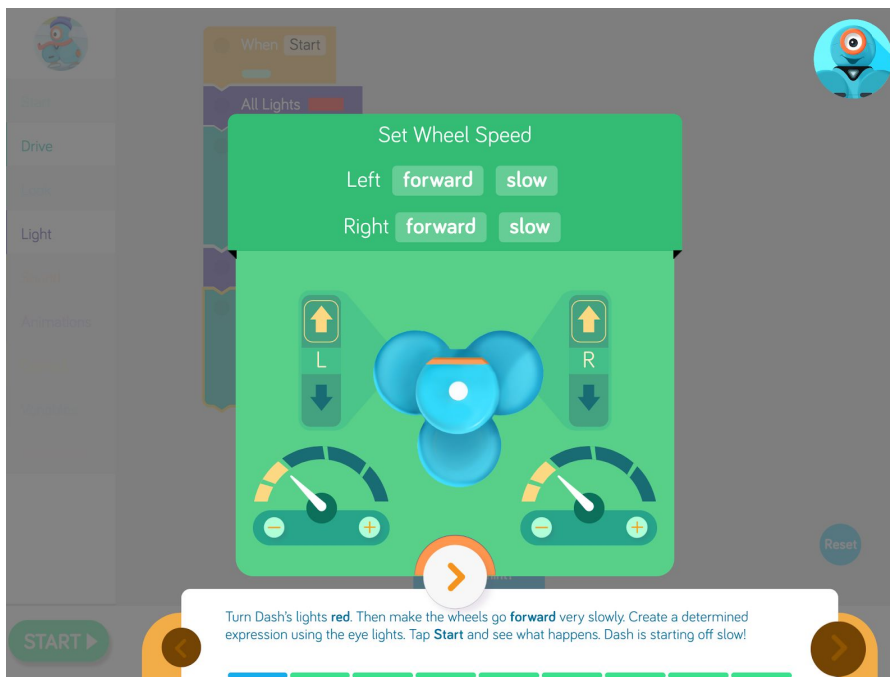
Challenge 3

Dash is getting the hang of it. Now **add to the program** to make Dash go **forward** at a **normal** speed. Then give Dash a new **eye pattern**.

When **Start**

All Lights ▬

Set Wheel Speed
Left **forward** **very slow**
Right **forward** **very slow**

Eye Pattern **Custom**

Set Wheel Speed
Left **forward** **slow**
Right **forward** **slow**

All Lights ▬

Set Wheel Speed
Left **forward** **normal**
Right **forward** **normal**

Eye Pattern **Custom**

Need a hint?

Reset

Start
Drive
Look
Light
Sound
Animations
Controls
Variables
Accessory

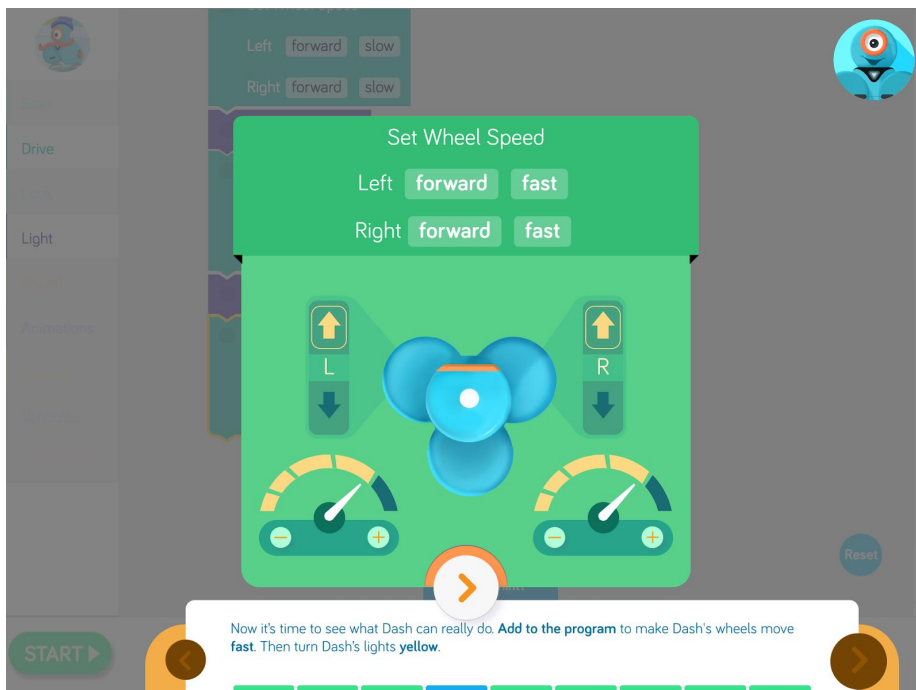Dash is getting the hang of it! Now **add to the program** to make Dash go **forward** at a **normal** speed. Then give Dash a new **eye pattern**.

Challenge 4

Now it's time to see what Dash can really do. **Add to the program** to make Dash's wheels move **fast.** Then turn Dash's lights **yellow**.

Right forward very slow

Eye Pattern Custom

Set Wheel Speed
Left forward slow
Right forward slow

All Lights ▬

Set Wheel Speed
Left forward normal
Right forward normal

Eye Pattern Custom

Set Wheel Speed
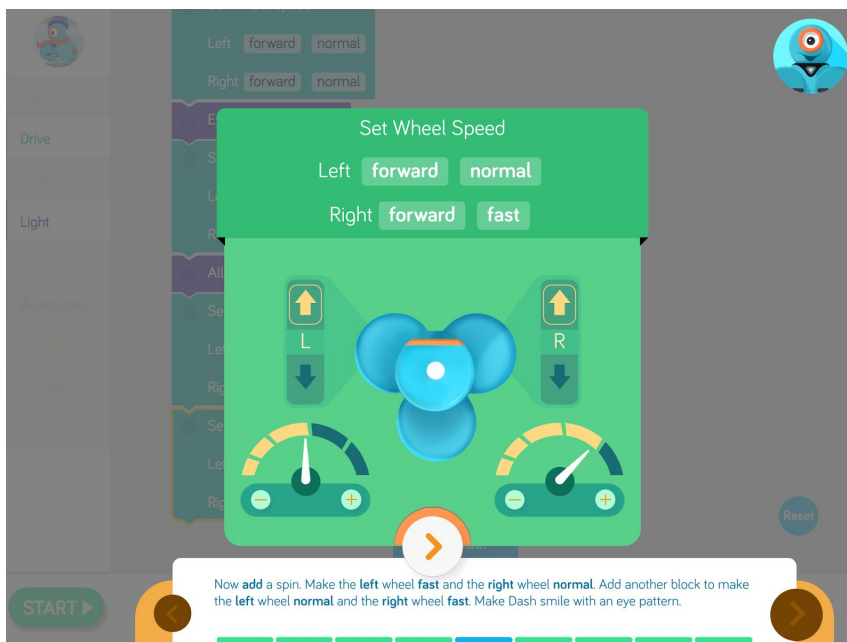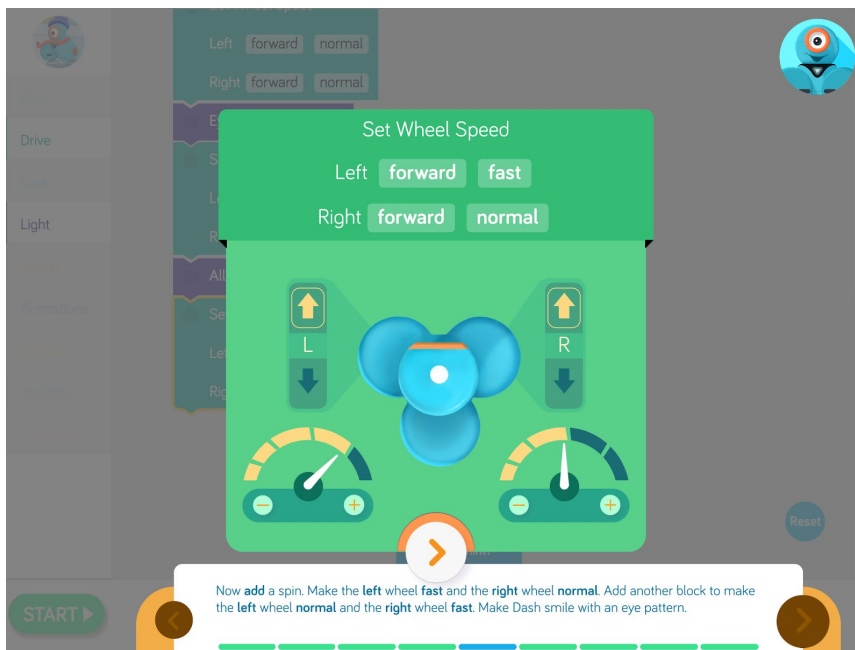Left forward fast
Right forward fast

All Lights ▬

Start
Drive
Look
Light
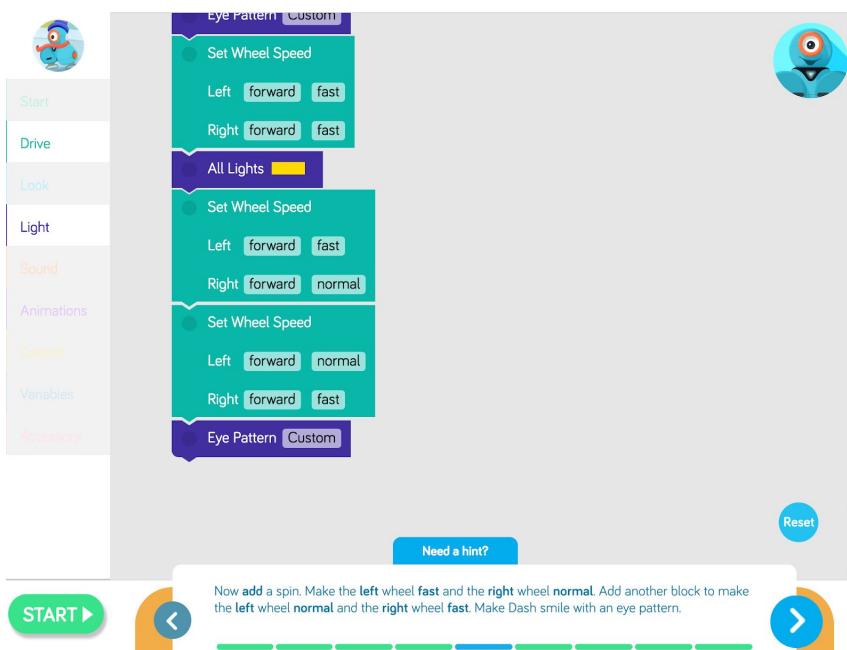Sound
Animations
Control
Variables
Accessory

Need a hint?

Reset

Now it's time to see what Dash can really do. **Add to the program** to make Dash's wheels move **fast**. Then turn Dash's lights **yellow**.

START ▶

Challenge 5

Now **add** a spin. Make the **left** wheel **fast** and the **right** wheel **normal**. Add another block to make the **left** wheel **normal** and the **right** wheel **fast.** Make Dash smile an eye pattern.

Set Wheel Speed

Left forward fast

Right forward fast

All Lights

Set Wheel Speed

Left forward fast

Right forward normal

Set Wheel Speed

Left forward normal

Right forward fast

Eye Pattern **Custom**

Now **add** a spin. Make the **left** wheel **fast** and the **right** wheel **normal**. Add another block to make the **left** wheel **normal** and the **right** wheel **fast**. Make Dash smile with an eye pattern.

Start

Drive

Look

Light

Sound

Animations

Control

Variables

Accessories

START ▶

Need a hint?

Reset

Now **add** a spin. Make the **left** wheel **fast** and the **right** wheel **normal**. Add another block to make the **left** wheel **normal** and the **right** wheel **fast**. Make Dash smile with an eye pattern.
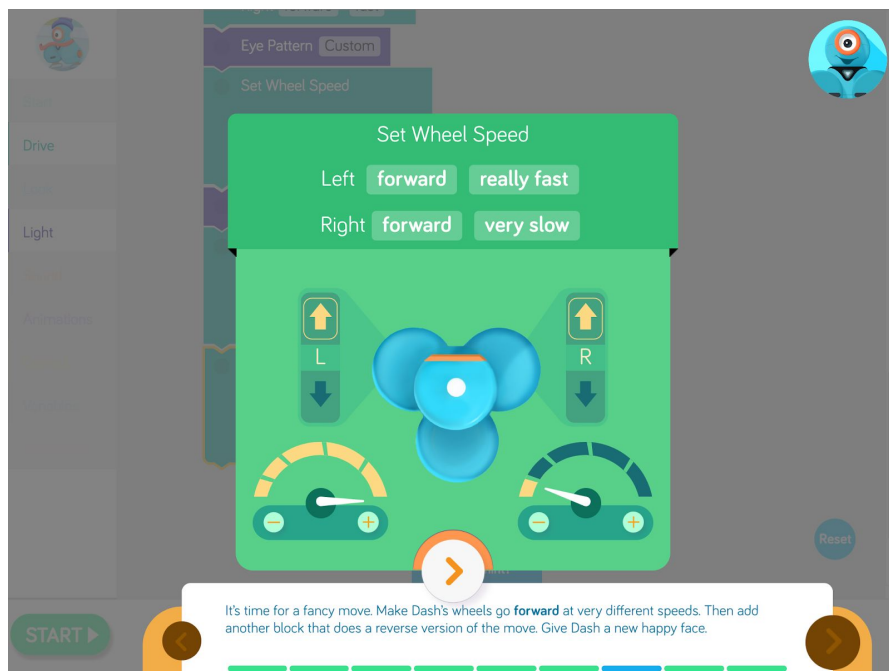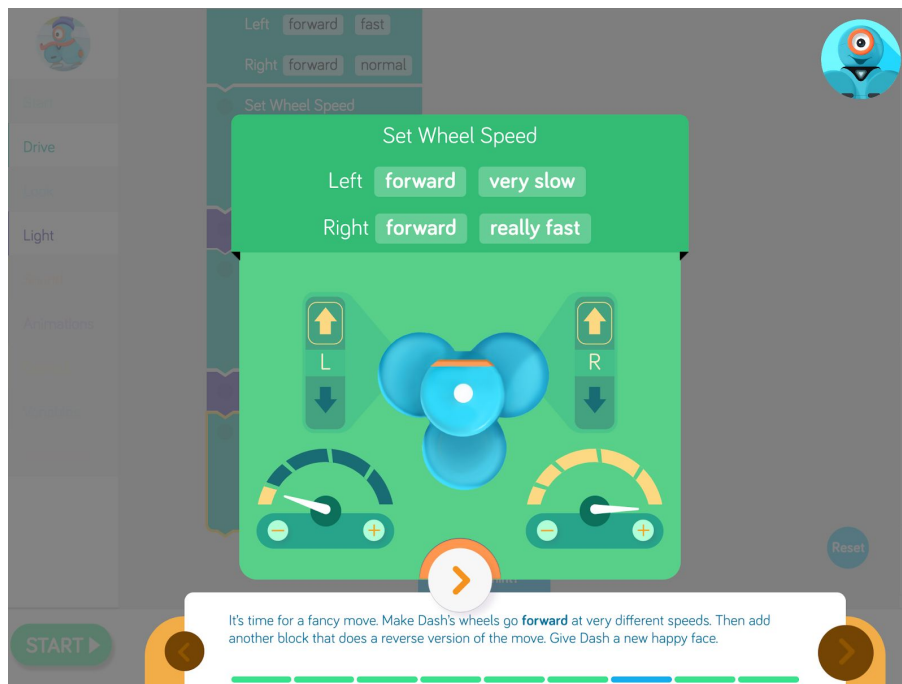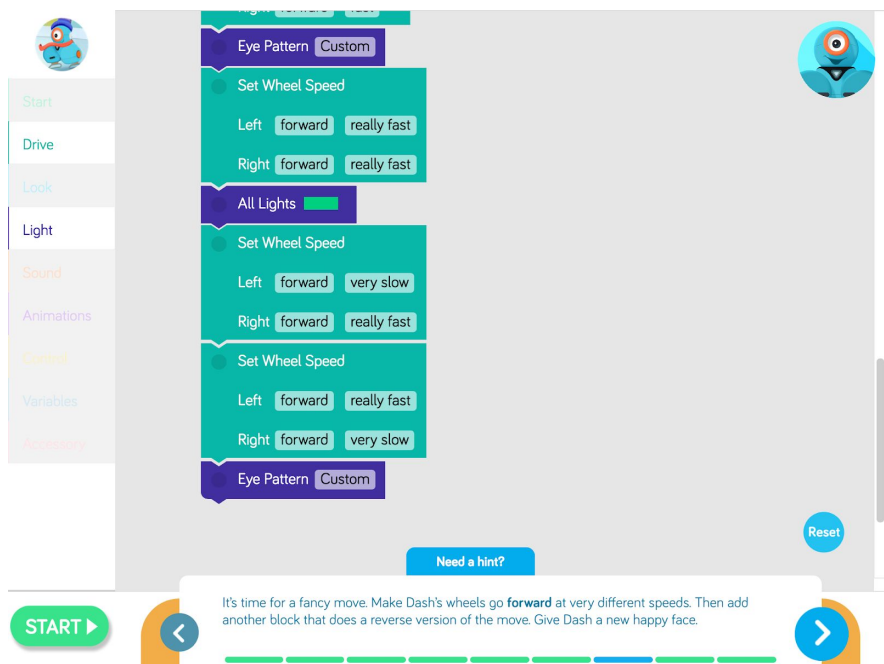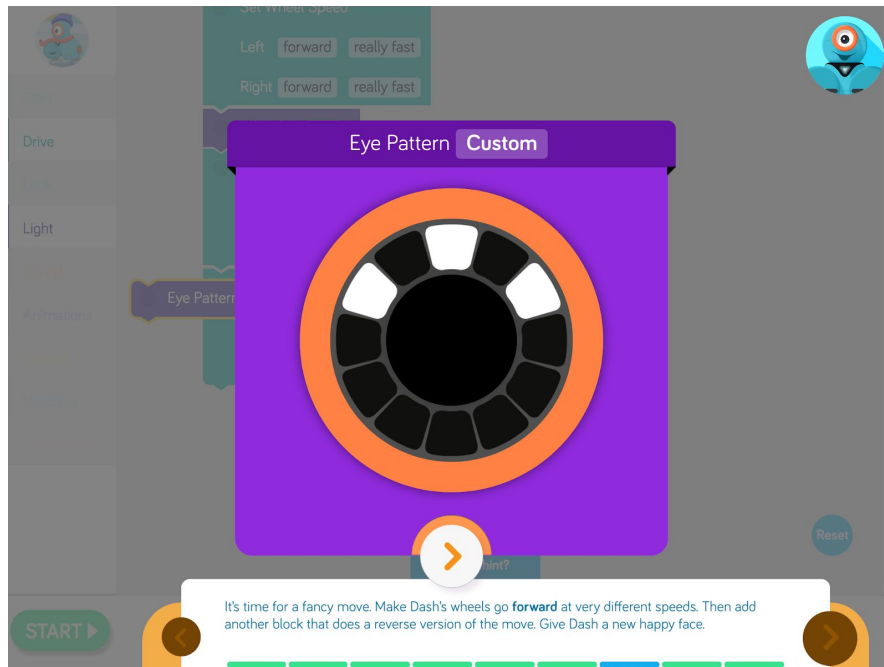
START ▶

Challenge 6

Dash is full of confidence and wants to try skating at top speed! **Add a block** to make Dash go forward **really fast.** Then make Dash's lights turn **green.**
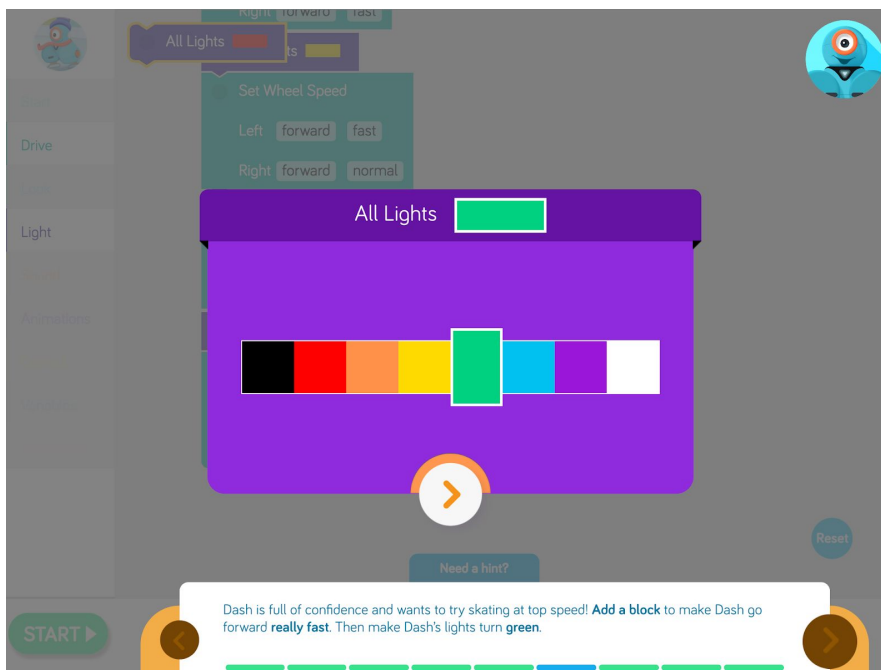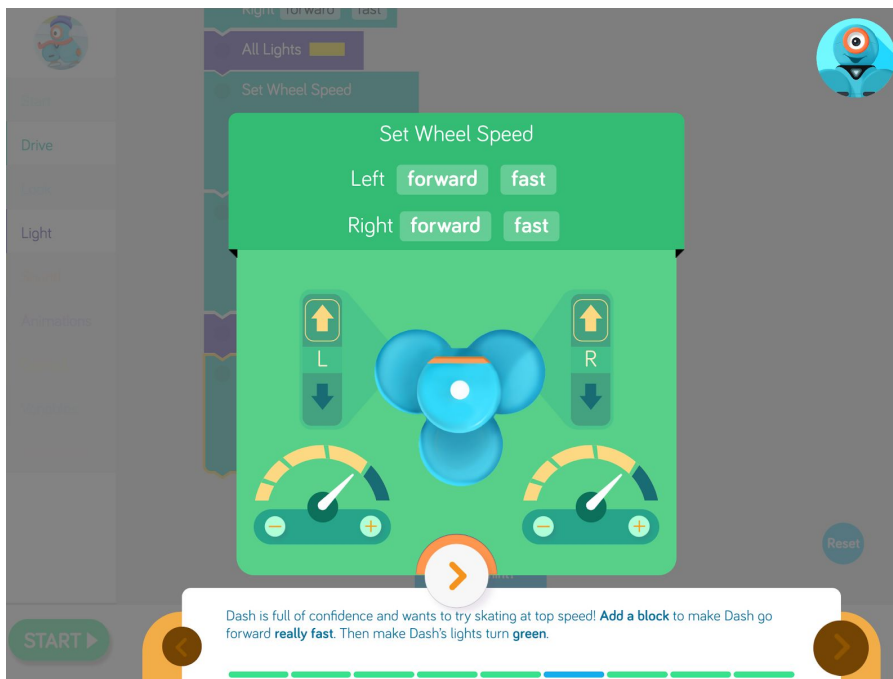
Challenge 7

It's time for a fancy move. Make Dash's wheels go **forward** at very different speeds. Then add another block that does a reverse version of the move. Give Dash a new happy face.

Screen 1 (top)

Set Wheel Speed
Left forward really fast
Right forward really fast

Eye Pattern Custom
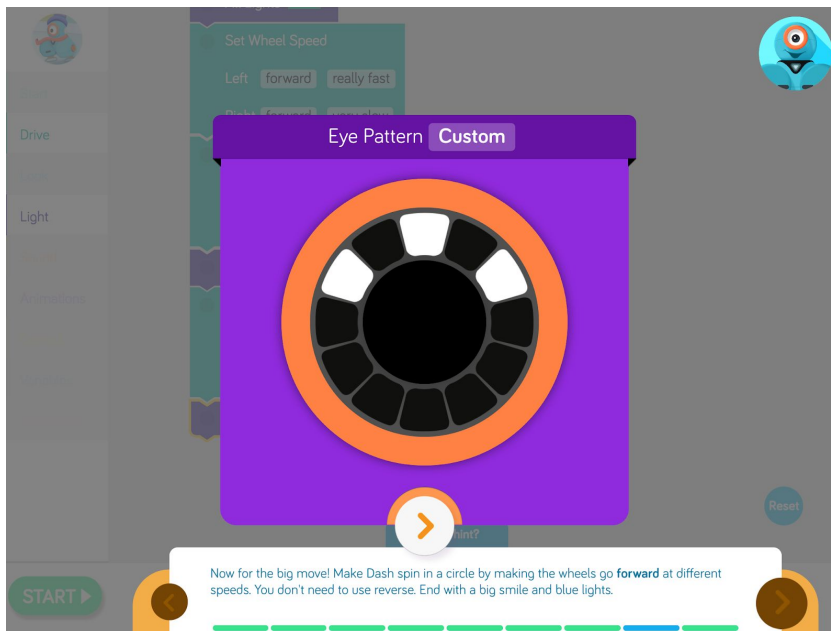

Eye Pattern

Drive
Light
Animations

Reset

It's time for a fancy move. Make Dash's wheels go **forward** at very different speeds. Then add another block that does a reverse version of the move. Give Dash a new happy face.

START ▶

Screen 2 (bottom)

Start
Drive
Look
Light
Sound
Animations
Control
Variables
Accessory

Eye Pattern Custom

Set Wheel Speed
Left forward really fast
Right forward really fast

All Lights

Set Wheel Speed
Left forward very slow
Right forward really fast

Set Wheel Speed
Left forward really fast
Right forward very slow

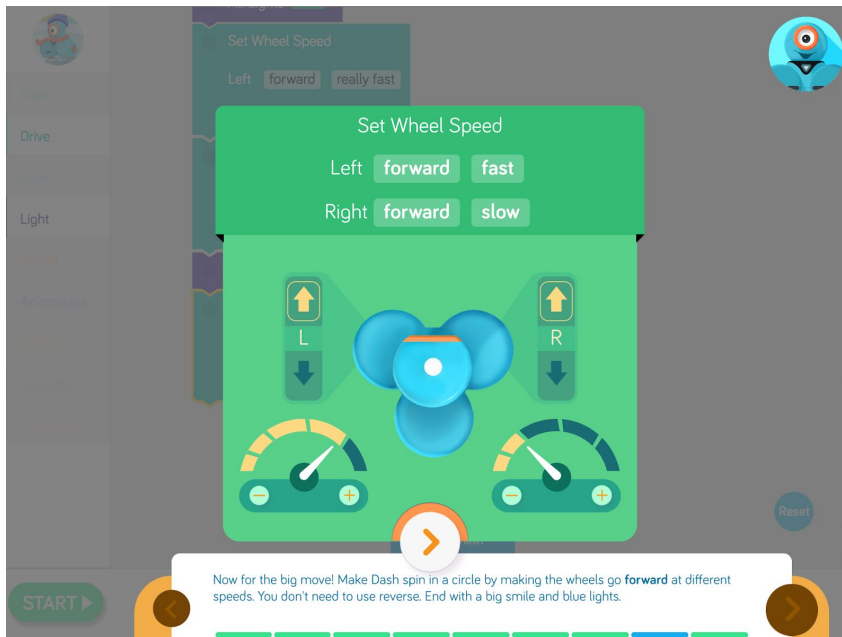Eye Pattern Custom

Need a hint?

Reset

It's time for a fancy move. Make Dash's wheels go **forward** at very different speeds. Then add another block that does a reverse version of the move. Give Dash a new happy face.

START ▶

Challenge 8

Now for the big move~ Make Dash spin in a circle by making the wheels go **forward** at different speeds. You don't need to use reverse. End with a big smile and blue lights.

Screen 1

All Lights

Set Wheel Speed
Left forward really fast
Right forward very slow

All Lights (color picker dialog)

All Lights [cyan]

Drive

Light

All Lights

START ▶

Reset

Need a hint?

Now for the big move! Make Dash spin in a circle by making the wheels go **forward** at different speeds. You don't need to use reverse. End with a big smile and blue lights.

Screen 2

Start
Drive
Look
Light
Sound
Animations
Variables
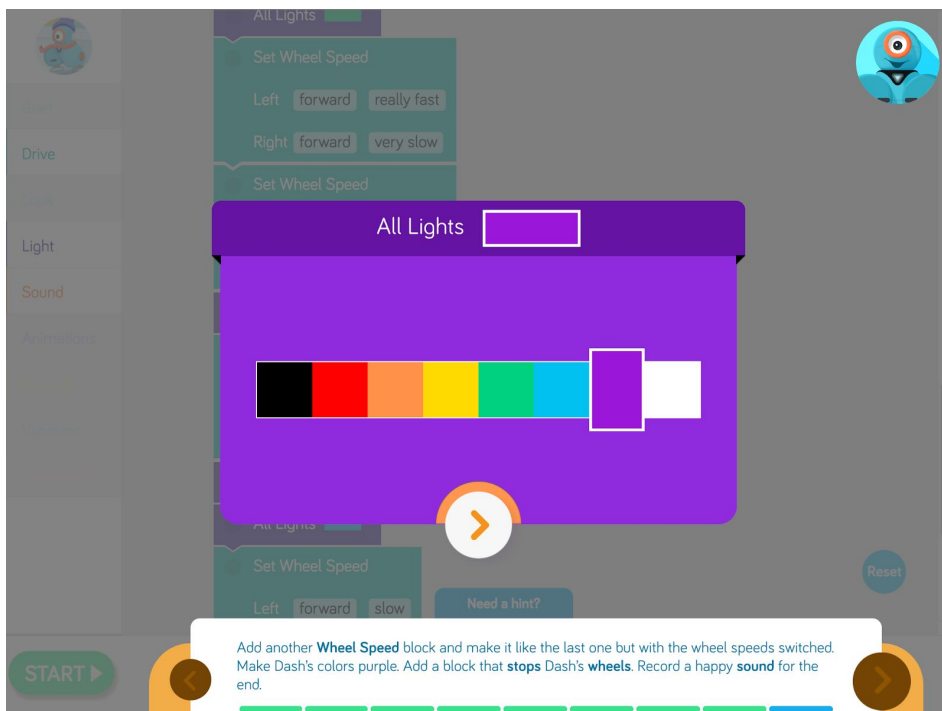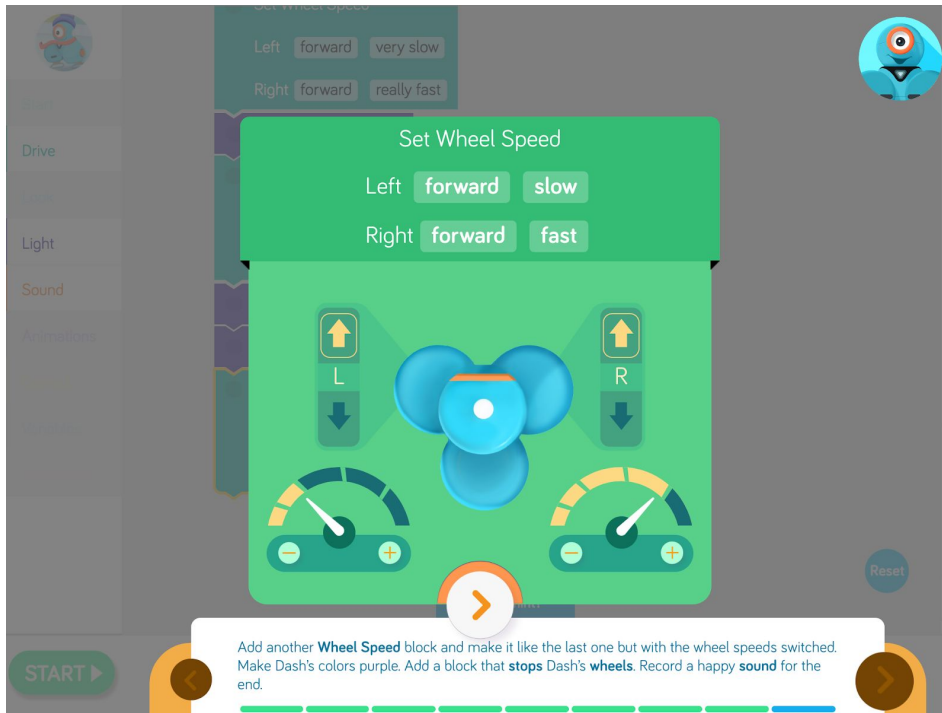
All Lights

Set Wheel Speed
Left forward really fast
Right forward very slow

Set Wheel Speed
Left forward very slow
Right forward really fast

Eye Pattern Custom

Set Wheel Speed
Left forward slow
Right forward fast

Eye Pattern Custom

All Lights

Reset

Need a hint?

START ▶

Now for the big move! Make Dash spin in a circle by making the wheels go **forward** at different speeds. You don't need to use reverse. End with a big smile and blue lights.

Challenge 9

Add another **Wheel Speed** block and make it like the last one but with the wheel speeds switched. Make Dash's colors purple. Add a block that **stops** Dash's **wheels**. Record a happy **sound** for the end.

Start

Drive

Look

Light

Sound

Animations

Control

Variables

Accessory

Left forward very slow

Right forward really fast

Eye Pattern Custom

Set Wheel Speed

Left forward really fast

Right forward very slow

Eye Pattern Custom

All Lights

Set Wheel Speed

Left forward slow

Right forward fast

All Lights

Stop Wheels

My sounds #1

Reset

Need a hint?

Add another **Wheel Speed** block and make it like the last one but with the wheel speeds switched. Make Dash's colors purple. Add a block that **stops** Dash's **wheels**. Record a happy **sound** for the end.

Educational Standards

CC Mathematical Practices:
1, 2, 4, 5, 6, 7, 8

CC Language Arts Standards
RI.2.5; R1.2.10; RI.3.4; RI.3.10; RI.4.4; RI.4.10; RI.5.4; R1.5.10

CSTA K-12 Computer Science Standards

- 1A-DA-05 Store, copy, search, retrieve, modify, and delete information using a computing device and define the information stored as data.
- 1A-AP-08 Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks.
- 1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.
- 1A-AP-11 Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.
- 1B-AP-08 Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
- 1B-AP-10 Create programs that include sequences, events, loops, and conditionals.
- 1B-AP-11 Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
- 1B-AP-12 Modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.

Next Generation Science Standards NGSS

- K-PS2-1 Motion and Stability: Forces and Interactions Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.
- K-PS2-2 Motion and Stability: Forces and Interactions Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.*
- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. *Applicable to Winter-Wheeling Downhill Activity Extension
- 4-PS3-1 Use evidence to construct an explanation relating the speed of an object to the energy of that object.*Applicable to Winter-Wheeling Downhill Activity Extension.