Bunny Times

It's carrot season on the farm, and Coach Hopper needs new recruits for the bunny team!

Bunny Times presents a visual and interactive approach for children to learn, with understanding, the multiplication facts 2 × 2 through 12 × 12. The early levels of the game introduce children to an array model of multiplication. A statement like 3 × 4 is represented as a field with four rows of three carrots each. Children control the hops of a bunny, telling it how many carrots are available to eat. Correct answers are rewarded with the bunny hopping through the field, collecting each carrot, and performing a celebratory somersault.

At these early levels, the numbers are small enough that children can, if necessary, count carrots one by one. Complicating matters is a fog patch that obscures the view of many carrots. Since counting carrots is now harder, children begin to focus on the number of rows and columns in each field and connect these numbers to an associated multiplication statement.

As the fields of carrots grow larger, children graduate from a single bunny to controlling entire teams of bunnies that hop in unison. The bunny teams foster a skip counting strategy to multiplication, allowing children to solve a problem like 5 × 7 by counting 5, 10, 15, 20, 25, 30, 35.

Soon, children discover that the team of bunnies can be divided into smaller teams of brown and gray bunnies. In doing so, children take a problem like 11 × 12 and break it into two simpler problems like 10 × 12 and 1 × 12. Computing the two products, 120 and 12, and adding them together gives the result, 132. Through this intuitive approach, motivated by arrangement of the bunny teams and the field, children are introduced to the distributive property of multiplicaiton over addition.

Bunny Times rewards repeated play with opportunities for children to improve their scores and develop, at their own pace, new insights and strategies into multiplication. By progressing successfully through all 11 levels of the game, children will approach multiplication with confidence, accuracy, and understanding.

Game Design: Scott Steketee and Daniel Scher

Game Implementation: Scott Steketee

Artist: Oliver Wade

Game Mechanics

Press *Learn to Play* on the title page of the game for a brief video geared towards children that explains the basic functionality of the game. Below are a few remaining gameplay tidbits not covered in the video.

- If children mistakenly press an incorrect number on the number pad, they can press the left arrow to delete digits one by one or press ‘C’ to clear the number entirely.
- Children can press *Next Problem* rather than *Eat Carrots* after entering the total number of carrots in a field. Doing so presents a speedy animation of the bunnies hopping.
- When children finish a level and go back to the Levels page, they will see the Bunny Family Coat of Arms appear on the medal for that level.
- If children play a level more than once, they can see their previous high score for that level in the left corner beneath the level number.
- Children can return to any level that they do not finish and resume play.
- To reset all scores and high scores to 0 and start fresh, press *Reset All Levels* on the Levels page. The button, once confirmed, will initialize all the level pages and will remove any Coats of Arms on the medals.

Game Levels

Level 1

A single bunny eats carrots in fields whose size progresses in an ordered fashion from 2×2 to 6×5. The problems begin with the $\times 2$ facts (2×2, 3×2, 4×2, 5×2, 6×2), proceed to the $\times 3$ facts, and eventually conclude with the $\times 5$ facts. Children can simply count the carrots one by one or skip count to determine the total number of carrots in the field. They might also use the ordering of the problems to their advantage, recognizing that since 3×5 is 15, then 4×5 is 5 more, or 20.

Level 2

A single bunny eats carrots in fields whose dimensions again range from 2×2 to 6×5, but now the problems are presented in a random order. Children can still count individual carrots or skip count, but now there are no patterns moving from one problem to the next.

Level 3

A single bunny eats carrots in a field whose dimensions again range from 2×2 to 6×5, but now a patch of fog obscures many of the carrots. Since counting carrots is no longer feasible, children must use a different strategy such as skip counting, and come to recognize that the dimensions of the field provide enough information to determine the total number of carrots.

Level 4

Teams that alternate between 2 and 3 bunnies help students make connections between the × 2 facts and the × 3 facts. Here is an example: A team of two brown bunnies jumps in unison to eat a field of carrots with 7 rows of carrots (7 × 2). As the two bunnies hop down the field, students can skip count 2, 4, 6, 8, 10, 12, 14.

The team of two brown bunnies is then joined by a gray bunny to eat a similar field, but with three carrots in each row (7 × 3). Displaying 7 × 3 as (7 × 2) + (7 × 1) helps children recognize that if they know 7 × 2 is 14, they can find 7 × 3 by adding 7 more to obtain 21.

Level 5

Teams of 10 or 5 bunnies help students make the connection between the × 10 facts and the × 5 facts. Knowing, for example, that 4 × 10 is 40, children can reason that 4 × 5 is half of 40, or 20.

A moveable slider separates the brown bunny team from the gray bunnies. The slider's initial placement helps emphasizes the connection between the × 10 facts and the × 5 facts, but children can drag the slider to redistribute the bunnies between the teams in other ways that they may find helpful.

Level 6

Teams that alternate between 4 bunnies and either 3 or 5 bunnies, help students make the connection between the × 4 facts and the × 3 and × 5 facts. For the × 4 facts, the slider initially separates the bunnies into teams of two brown bunnies and two gray bunnies, encouraging children to connect the × 4 facts with the × 2 facts. For the × 3 facts, the slider initially shows teams of two bunnies and one bunny to encourage students to connect the × 3 facts with the × 2 facts. For the × 5 facts, the slider initially shows all bunnies on the same team, and children can skip count by fives, or they can move the slider to connect the × 5 fact with the × 4 fact.

Level 7

Six bunnies are split into teams of 5 bunnies and 1 remaining bunny so that children can use their knowledge of × 5 facts to learn the × 6 facts. For example, since 8 × 5 = 40, then 8 × 6 is 8 more, or 48. Similarly, 7 bunnies are split into teams of 5 bunnies and 2 bunnies so that children can use their knowledge of × 5 facts to learn the × 7 facts. The × 6 facts alternate with the × 7 facts, allowing for one additional layer of connection: Since 9 × 6 = 54, for example, then 9 × 7 is 9 more, or 63.

As with earlier levels, children can move the slider to redistribute the bunnies between the teams in other ways that they may find helpful.

Level 8

Eleven bunnies are split into teams of 10 bunnies and 1 remaining bunny so that children can use their knowledge of × 10 facts to learn the × 11 facts. For example, since 10 × 6 =

60, then 11 × 6 is 6 more, or 66. Similarly, 12 bunnies are split into teams of 10 bunnies and 2 bunnies so that children can use their knowledge of × 10 facts to learn the × 12 facts. The × 11 facts alternate with the × 12 facts, allowing for one additional layer of connection: Since 7 × 11 = 77, for example, then 7 × 12 is 7 more, or 84.

As with earlier levels, children can move the slider to redistribute the bunnies between the teams in other ways that they may find helpful.

Level 9

This level alternates between bunny teams of size 8 and 9. Unlike earlier levels, the slider is always placed entirely to the side, allowing children to decide for themselves how, or if, they will divide the bunnies into teams.

Level 10

This Half Marathon level presents 50 random problems ranging from 2 × 2 to 10 × 12. In each one, the slider is initially positioned in way that may help students to break the multiplication problem down into two simpler problems.

Level 11

This Marathon level presents 100 random problems ranging from 2 × 2 to 10 × 12. In each one, the slider is initially positioned in way that may help students to break the multiplication problem down into two simpler problems. Unlike the earlier bunny team levels, a patch of fog obscures many of the carrots, prompting students to think about each problem more abstractly.

License (CC-BY-NC-SA 3.0)

Portions of this material are based upon work supported by the National Science Foundation under award number DRL-0918733. Any opinions, findings, and conclusions or recommendations expressed in this work are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.