SCIENCE NORTH SCIENCE NORD

EDUCATION GUIDE

Game Changers is a traveling exhibition developed and produced by the Canada Science and Technology Museum and managed by Science North in partnership with the Social Sciences and Humanities Research Council and Electronic Arts.

ABOUT THE EXHIBITION

Science North is pleased to present the highly interactive traveling exhibition *Game Changers*, developed by the Canadian Science and Technology Museum—tour managed by Science North.

This exhibition is 3,000 square feet.

ABOUT GAME CHANGERS

This highly-interactive exhibition is a sensory experience that engages visitors in multiple ways. Through carefully chosen video games and systems, and unique interactive platforms, visitors get to "live" the video game evolution.

With technological advancements, such as motion sensing and audio developments, our video gaming experience has evolved significantly from the first PONG to the photo-realistic, immersive games of today. Game Changers looks at what shapes the player's experience and explores how innovations have transformed the way we interact with computer technology.

This exhibition highlights over 140 iconic games, 16 of which are playable, that have had a significant impact on game design in popular culture and help demonstrate how every evolution has helped transform the overall experience – from the soundtrack to the storyline.

AUDIENCES

- Families
- Teens and young adults
- Adults
- School visitors

EDUCATIONAL THEMES

- Science
- Popular Culture
- History
- Technology and Innovation

GAME CHANGERS

PROGRAMMING

RESOURCES

Programming resources are available **here**.

EVENTS

Let's Talk Gaming

Video games play an important role in our society. Spark interesting conversations about where this technology is going with a speaker series by inviting guest speakers — academic or from industry — todiscuss such topics as: video games in education or medicine, sexualization in video games, or how virtual reality technology is changing the world of video games.

Game Jam

In a game jam, video game developers come together to develop a game based on a provided theme in a short period of time. Host a game jam of your own with help from the developers in your community. The International Game Developers Association (IGDA) hosts an annual Global Game Jam — see if there is a chapter in your community that can help you to set one up. www.igda.org

8-Bit Music

The audio in early gaming systems was generated by sound chips. Chiptune DJs, or 8-bit DJs, create a form of electronic music using these sounds chips, and this genre of music has influenced the electronic dance music that is popular today. Bring in a chiptune DJ to raise your event to a whole new level.

Meet the Makers

If there is a Game Development program at an academic institution in your region, invite the student programmers to run a simulation of a Meet the Makers event. Alternatively, chances are there is someone in your community who is making video games. Take advantage, and invite them to demonstrate their craft for visitors. Either option is an excellent opportunity for visitors to learn more about the video game industry and careers in video game development.

Video games on the big screen

eSports are wildly popular. Host an eSport tournament with a popular game such as Super Smash Bros. Melee, or a speedrun of games like Legend of Zelda. Alternatively, provide video games available to play on a large screen format — a sure way to draw attention.

Beep: A Documentary History of Game Sound (documentary film provided with exhibition)

Beep documents the history of game sound from the Victorian arcades through to today, with a special focus on video game sound, but also including mechanical games and pinball. Visitors will discover the creative techniques composers used to create the iconic music of early video games. Engage visitors with a screening of this film about the exciting technologies that have brought us to the video games of today. www.gamessound.com

Detailed descriptions are provided below for the following programming suggestions:

Furious Fowl

Visitors explore the physics of a catapult as they create their own catapult to launch a "furious fowl."

8-Bit and 16-Bit Sprites

Why do the graphics in retro video games look the way they do? Visitors can recreate their favourite childhood video game characters or create their own using Perler beads.

Physical Tetris

By interacting with a giant 3-D Tetris game, visitors experience Tetris in a whole new way while learning about geometry, surface area, and volume.

Robot Relay

Visitors learn about computer programming by creating an algorithm to instruct a "robot" to navigate an obstacle course.

Other programming suggestions:

Virtual Reality demos

If you have access to a virtual reality headset such as the Samsung Gear VR, this is a great opportunity for visitors to get a taste of the future of video games.

Console Dissection

Let visitors take apart old consoles and controllers to learn more about how they work.

3-D animation

Use modelling clay to create 3-D video game characters.

Coding Workshops

Teach visitors about coding and how to make video games using the free programming language and online community Scratch (scratch.mit.edu), or partner with a local organization to provide coding workshops for kids.

Furious Fowl: ages 6+

Materials
- large pompoms
- googly eyes
- yellow felt cut into small triangles
- glue gun
- pig target printout*
- Popsicle sticks or wide craft sticks
- elastic bands
- plastic spoons of varying lengths

*Printout can be found in the accompanying PDF.

Preparation
1. Make several furious fowls by using hot glue to attach googly eyes and a felt beak onto pompoms.
2. Prepare the pig targets by printing the template double sided onto card stock. Cut out the pigs along the black lines, including the slot lines. Slide A and B pieces together along the slot lines.
3. Make a few sample catapults for visitors to see and use:

Catapult construction
1. Stack two Popsicle sticks and secure them with an elastic band at one end.
2. Stack 4 to 6 Popsicle sticks and secure them with an elastic band at both ends.
3. Slide this thicker stack crosswise into the open end of the first stack (see photos). Secure with an elastic band.
4. Secure a spoon to the top Popsicle stick with another elastic (see photos). Your catapult is ready!

Delivery
Set up a table with instructions, a sample catapult, and building materials for visitors to create their own catapults. Create a separate area, including fowls and targets, for catapult launching, safe from hitting other visitors, artifacts, etc.

Provide a series of distances and target heights to increase the challenge. Invite visitors to try to improve their design: what happens if the centre bundle is thicker, or the lever arm is made longer?

Scientific Explanation for Visitors
When you push down the lever arm of the catapult you are storing potential energy. When the catapult arm is released, this potential energy is converted into kinetic energy

Option
Scale up the experience with larger catapults, fowls, and targets.

8-Bit and 16-Bit Sprites: ages 8+

Background
In computer terms, a bit is a basic unit of information used in computing, referring to the most basic amount of information that can exist in two states — known as a binary system — of 1 or 0.

The graphics of games available for early home gaming systems were restricted by the capabilities of the gaming device's processor. The early home gaming systems had an 8-bit processor, meaning that only 8 bits of information could be processed at a time. In order to maintain adequate speed, the graphics were limited in resolution and colour depth. At the time, every pixel that made up an image was manually coded, meaning it was incredibly time consuming to create high resolution graphics. This is why the graphics in 8-bit video games are very simple and low resolution.

The 16-bit processor in later generations of gaming systems allowed for greater image resolution and more colours, although the graphics were still two-dimensional and limited in resolution. 3-D graphics started with 32-bit processors and today gaming consoles use 64-bit processors.

The term sprite refers to a small two-dimensional image set within a larger scene found in many video games created in the 1980s and 1990s. For example, in Super Mario Bros., Mario, Koopa, and coins would all have been created as sprites that the video game developers would insert into their source code. The 8-bit and 16-bit characters in this activity would be considered sprites.

Materials
- printouts* of example patterns
- coloured pencils
- Perler beads in various colours
- square Perler pegboards
- tweezers (optional)
- wax paper or parchment paper
- iron with a linen setting

*Printouts can be found in the accompanying PDF.

Delivery
Set out the materials for creating the Perler bead sprites on a table.
Visitors may choose to design their own sprite using the blank template, or to create a sprite based on one of the provided templates.

It is recommended that a staff member be present to iron the finished product, and to present more information about 8-bit and 16-bit video games.

Tip
When setting out the beads in a pattern, start from the bottom and work toward the top, to avoid knocking beads off the pegboard.

Physical Tetris: ages 6+

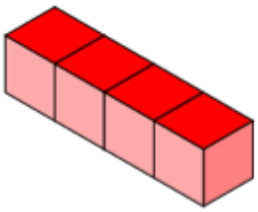
Background
Many people are familiar with dominoes, which are a type of polyomino created by attaching two squares together. A tetromino is a geometric shape created by attaching four squares together, and was popularized by the game Tetris.

Materials
144 12" x 12" coloured interlocking foam floor tiles
Note: 1 set of tetrominos including the five shapes below requires 92 12" 12" tiles; larger 48"x 48" tiles are not suitable because the blocks are too tall and unstable.

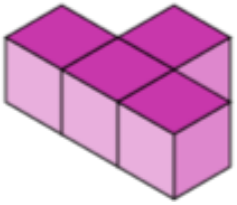
Preparation
In advance, make two of each tetromino shape:
1. Following the patterns below, assemble the interlocking floor tiles together at right angles.
2. Apply hot glue along the edges of the tiles to fix in place.

Z- Block
18 Tiles

L- Block
18 Tiles



I-Block
18 Tiles



T- Block
18 Tiles

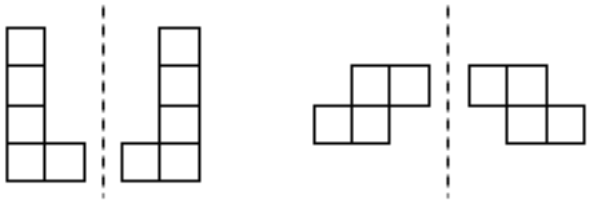
O-Block
20 Tiles

Note: this shape will be flimsy if built without interior walls. To make a solid shape, assemble two rectangular blocks (2x1x1) of 10 tiles each, and glue them together to create one square block (4x1x1).

Delivery
Set out the tetromino blocks in an open area away from through traffic. Although this activity is self-guided, a staff member or volunteer supervising is recommended. Young children should be assisted by an adult.

Options
1. Ask visitors to use all of the blocks to create a rectangle, without gaps.
Hints:
- This is impossible with just one set, but with two sets either a 5 x 8 or a 4 x 10 rectangle may be achieved.
- Either 8 or 10 squares are required along the bottom row.

2. To focus this activity on mathematical concepts, ask visitors the following questions:
• Which tetromino has the largest volume? Answer: they all have the same volume because they all consist of four cubes.
• Which tetromino has the largest surface area? Answer: the Z, L, I, and T blocks all have the same surface area because they all consist of 18 tiles; the O block is smaller with a surface area of 16 tiles.
• Which tetrominoes retain their shape even when they are rotated? Answer: only the O-block.
• Which tetrominoes change their shape when they are flipped? Answer: the I, T, and O blocks retain their shape when flipped; the Z and L blocks form mirror images (isomers) of themselves when they are flipped.



3. A two-dimensional version of this activity can be conducted on a smaller scale using magnetic or Velcro Tetris pieces on a board.

Robot Relay: ages 6+

Materials
- printout of legend cards
- printouts* of game pieces (bonuses, enemies, and starting and ending positions)
- printouts of grid and rules
- 2 rolls of double-sided floor tape
- whiteboard markers

*All printouts can be found in the accompanying PDF.

Preparation
Print and laminate the legend cards and game pieces.
Print the grid and the rules back to back, then laminate.
On the floor, use floor tape to lay out a grid that is 8 squares long and 8 squares wide, matching one of the grid printouts.

Delivery
Introduce the activity by asking participants how robots know what they are supposed to do.
Explain that robots operate using specific instructions, or code, called an algorithm. This algorithm tells the robot what to do. One of the biggest challenges for a computer programmer is writing an efficient algorithm. The more efficient it is the faster the algorithm will work. If there are "bugs" in an algorithm, it will slow down.
Invite visitors to pretend to be robots: in groups of two, one person takes the role of robot and the other takes the role of controller. The controller's goal is to instruct the robot through the grid as efficiently as possible while collecting bonuses along the way. Only the following five simple commands can be used to direct the robot: forward, clockwise (turn right), counter clockwise (turn left), jump, and star. There is room for four groups of participants on the grid.

Optional
Have someone take the role of computer: this person reads the code (the series of simple commands) that the controller has written to instruct the robot.

Goal
Write an algorithm that will get your robot from the start to the finish as efficiently as possible while collecting the most bonuses.

Rules
1. The robot must start in a starting block, facing the same direction as the arrow in the starting block.
2. The robot can only do exactly what the controller commands.
3. Entering a square with an enemy means there is a "bug" in your code. Debug the code if this happens.
4. Use the jump command to jump over squares with enemies.
5. The robot cannot collect a bonus unless commanded to do so — simply landing on a bonus does not mean that you have collected it.
6. Two robots may occupy the same square.
7. The efficiency score is based on the total number of commands, less 2 for every bonus that is collected — the goal is to achieve as low a score as possible.

Procedure
1. Split into groups of 2 or 3 players each.
2. Decide who will be the robot, the computer, and the controller (players can take turns).
3. The controller may choose to write the entire algorithm at once, or one command at a time and test as they go. They can use the whiteboard markers to write the code down on a laminated grid.
4. The computer must read the controller's code to the robot.
5. The controller can direct the computer to stop if they notice a bug in the code.
6. If the robot is directed out of the grid, or onto an enemy, the controller must debug the code.

Game Progression
- Start with an easy layout, with only 1 or 2 bonuses per player.
- Introduce enemies. Enemies can be avoided by going around them or jumping over them.
- Increase the level of difficulty further by changing starting and ending positions.

If you have any questions about *Game Changers* or any of Science North's traveling exhibitions, permanent experiences or services, please contact us at:

sales@sciencenorth.ca or **249.885.2142**

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