GAME CHANGERS

MAÎTRES DU JEU

MARKETING GUIDE

Game Changers is a travelling 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.

MESSAGING

MARKETING THEMES

There are several options for theming the marketing of the exhibition with artwork developed to help you with your promotional needs. Layered artwork for Game Changers is available on the Ad Templates and Samples page. You also have the option of developing your own tag lines and artwork, however you must request approval from Science North and the Canada Science and Technology Museum in advance — see who to contact for ad approval on the Contact page.

EXHIBITION DESCRIPTIONS

25 words (30 words)

Discover how innovation has shaped the video game industry. Opening [date] at [venue], Game Changers takes you on a fascinating journey, exploring the past and uncovering the future of gaming.

50 words (49 words)

Get your game on! Discover how innovation has shaped the video game industry. Opening [date] at [venue], Game Changers takes you on a fascinating journey, exploring the past and uncovering the future of gaming. Live the video game evolution, from memorable Pong to the photorealistic, immersive games of today.

100 words (96 words)

Get your game on! Discover how innovation has shaped the video game industry. Opening [date] at [venue], Game Changers takes you on a fascinating journey, exploring the past and uncovering the future of gaming.

Live the video game evolution, from memorable Pong to the photorealistic, immersive games of today. Step inside a game, and become a character yourself! Try your hand at operating a supersized Nintendo controller, and test your knowledge of retro video game music.

Experiment with augmented reality, and examine upcoming video game trends while imagining what gaming will look like in the future.

200 words (198 words)

Get your game on! Discover how innovation has shaped the video game industry. Opening [date] at [venue], Game Changers takes you on a fascinating journey, exploring the past and uncovering the future of gaming. Game Changers examines how the intersection of audio, storytelling, graphics, and gameplay creates the immersive environment of current video gaming systems.

Live the video game evolution, from memorable Pong to the photorealistic, immersive games of today. Step inside a game, and become a character yourself! Try your hand at operating a supersized Nintendo controller, play Tetris on a giant Game
Boy, and test your knowledge of retro video game music.

Discover original concept art, storyboards, level designs, and scripts of some of the most influential games ever developed, and listen to experts from the industry explain how they develop the games you love. Explore over 120 of the most influential games that have transformed the gaming scene, and test your skills with 16 games that have significantly changed the gaming experience, including Pac-Man, Super Mario Bros., Tetris, Angry Birds, Space Invaders, Flower, and Adventure.

Experiment with augmented reality, and examine upcoming video game trends while imagining what gaming will look like in the future.

SPEAKERS

Guest speakers, such as game developers, artists and researchers, are a great complement to Game Changers.

Please see below for bios from a Game Changers speaker series hosted in Ottawa.

Kelsey Catherine Schmitz, University of Ottawa
Kelsey Catherine Schmitz is a PhD candidate in the Department of Education at the University of Ottawa, focusing on Youth Studies and Digital Culture. She researches anti-oppressive spaces in digital technologies, with a focus on digital culture, gender and race. She is also the Project Manager of Indigenous Learning and Digital Content at Learning Bird, a Canadian educational app diversifying digital education. An educator with a passion for flipping her classroom, Kelsey has spent several years consulting with local schools and universities on digital citizenship and educational technologies in the classroom. She can be found on Twitter @KelseyCMS

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Dr. Shawn Graham, Carleton University
Dr. Shawn Graham is an associate professor in the Department of History at Carleton University in Ottawa. Trained as an archaeologist, he has published books and articles on ancient social networks in Rome and has built agent based simulations of Roman trade, and also, of Roman civil violence. Agent simulations led to an interest in games and how to represent the past algorithmically; video games — especially Minecraft — now are a prominent feature in his pedagogy and outreach. In his research he excavates digital data and develops new methods for interrogating and representing Big Humanities Data.. He is a co-author with Ian Milligan and Scott Weingart of Exploring Big Historical Data: The Historian's Macroscope (London: ICP, 2015), themacroscope.org. Dr Graham is a contributing editor to playthepast.org and blogs his own research at www.electricarchaeology.ca

Dr. Robert Warren, Lead Game Designer, Magmic
Robert Warren is a lead game designer at Magmic in Ottawa, Ontario. With a solid foundation in computer science, he holds a BSc from Memorial University, an MSc from the University of Victoria, and a PhD from the University of Ottawa. During his doctoral research in bioinformatics he developed a new algorithm to compare polyploid genomes. After completing graduate school, Robert fulfilled his childhood dream and became a game programmer, and in 2013 he made the move from programming to design. He has since focused on bringing world-renowned board games to life on mobile devices, including Skip-Bo, Apples to Apples, and most recently Scattergories.

WEB TEXT

Game Changers is a highly interactive and immersive travelling exhibition exploring how innovation has shaped gameplay in video gaming systems and transformed the way we interact with technology.

This 280 m^2 exhibition examines how the intersection of audio, storytelling, graphics, and gameplay creates the immersive environment of current video gaming systems. Visitors get to "live" the video game evolution, from memorable Pong to the photorealistic, immersive games of today.

Some 120 of the most influential games that have transformed the gaming scene are presented. Visitors get to play 17 that have significantly changed the gaming experience, including Pac-Man, Super Mario Bros., Tetris, Angry Birds, Space Invaders, Flower, and Adventure.

Visitors also learn about the concepts behind key game developments, play with the technologies behind the games, and explore the future of gaming.

Learn:
• See original concept art, storyboards, level designs, and scripts of some of the most influential games ever developed.
• Listen to experts from the video game industry explain how they develop video games.
• Explore iconic video game music and sound to learn how it has changed the gaming experience.
Play:
• Become a video game character — using Kinect technology, try out different costumes and accessories from your favourite characters.
• Create your own 8-bit character on a large-scale pixel wall.
• Play a game developed for people with vision loss, and discover how the gaming experience changes when the graphics are removed.
• Working with a partner, operate a supersized NES controller to play a game of Super Mario Bros.
• Play Tetris on a giant Game Boy.
• Play a sound-matching game and test your knowledge of retro video game music.
Explore:
• Explore the technologies that game creators use to develop increasingly sophisticated storylines, graphics, gameplay, and audio.
• Experiment with augmented reality and virtual reality and see how these technologies may alter the gaming experience.
• Examine future video game trends and imagine what gaming could be!

Game Changers is a travelling 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.

The exhibition debuts October 2016 at Science North in Sudbury, Ontario, before embarking on a Canadian tour until 2020, with a stop at the Canada Science and Technology Museum in fall 2017.

Audience
Multi-generational groups

Contact
Science North
100 Ramsey Lake Road
Sudbury, Ontario P3E 5S9
705-522-3701

CSTM logo
cstmuseum.techno-science.ca
Canada wordmark

SOCIAL MEDIA

Sample social media content (#GameChangersExhibit)

Twitter

“Live” the video game evolution by visiting #GameChangersExhibit @YOURMUSEUM DATE http://link2yoursite

Explore influential games that have transformed the gaming scene. #GameChangersExhibit at the @YOURMUSEUM DATE http://link2yoursite

Play games that have changed the gaming experience - #PacMan #AngryBird & more! #GameChangersExhibit @YOURMUSEUM http://link2yoursite

Facebook

Explores how innovation has shaped gameplay in video gaming systems and transformed the way we interact with technology.
See “Game Changers”, an exhibition developed and produced by the Canada Science and Technology Museum at (MUSEUM NAME). http://link2yoursite

“Live” the video game evolution, from memorable Pong to the photorealistic, immersive games of today! Visit “Game Changers”, an exhibition developed and produced by the Canada Science and Technology Museum at (MUSEUM NAME). http://link2yoursite

In the Game Changers exhibit, explore some 120 of the most influential games that have transformed the gaming scene and play over a dozen games that have significantly changed the gaming experience, including Pac-Man, Super Mario Bros., Tetris, Angry Birds, Space Invaders, Flower, and Adventure. Exhibition developed and produced by the Canada Science and Technology Museum at (MUSEUM NAME). http://link2yoursite

Click Here for Design Templates

CURRICULUM LINKS

Alberta

Grade	Curriculum	Strand
Grades 3-6	Art	- Appreciation - Expression
Grades 3-8	Languate Arts	- Understanding Forms, Elements and Techniques
Grades 3-12	Information and Communication Technology	- Foundational Operations, Knowledge and Concepts
Grades 5-9	Career and Technology Foundations	- Business - Communication
Grades 7-9	Art	- Encounters
Grades 10-12	Art 10-20-30	- Encounters
Grades 10-12	Art 11-21-31	- Creation of Art
Grades 10-12	Computer Science Programming	- Make personal connections to the cluster content and processes to inform possible pathway choices
Grades 10-12	Visual Composition Media Graphics Animation Audio/Video Creative Writing	- Make personal connections to the cluster content and processes to inform possible pathway choices
Grade 11	Canadian History	- The modern nation
Grade 12	Western World History	- Science, Technology, and Progress

British Columbia and Yukon

Grade	Curriculum	Strand
Grades 3-6	Visual Arts	- Context - Exhibition and Response
Grades 3 and 6	Social Studies	- Economy and Technology
Grades 3-8	Language Arts	- Purposes (Reading and Viewing)
Grade 7	Visual Arts	- Context
Grades 8-10	Visual Arts	- Image Development and Design Strategies - Context - Materials, Technologies, and Processes
Grades 8-10	Technology Education	- Self and Society - Communication
Grades 11-12	Media Arts	- Image-Development and Design Strategies - Context - Materials, Technologies, and Processes
Grades 11-12	Art Foundations	- Image-Development and Design Strategies - Context - Materials, Technologies, and Processes
Grades 11-12	Digital Media Development	- 3D Design and Animation
Grade 11	Computer Programming	- Introduction to programming
Grades 11-12	Electronics	- Careers and Society

Manitoba

Grade	Curriculum	Strand
Grades 3-8	Visual Arts	- Understanding Art in Context
Grades 3-8	Language Arts	- Comprehend and respons personally and critically to oral, literary, and media texts
Grades 9-12	Visual Arts	- Connecting - Responding
Grades 9-12	Interactive Digital Media	- Demonstrate understanding of the interactive digital media industry - Demonstrate an awareness of the evolution, technological progression, and emerging trends in interactive digital media
Grades 9-12	Graphic Design	- Demonstrate understanding of the graphic design industry
Grade 9	Social Studies	- Canada in the Global Context
Grade 10	Social Studies	- Industry and Trade
Grades 10-12	Computer Science	- Society and the Environment - Careers
Grade 11	2D Animation	- Define the purpose and audience for an animation - Discuss various types of animation - Analyze various ICT skills and competencies required in personal career choices
Grade 11	3D Modelling	- Describe the uses of 3D modelling - Analyze various ICT skills and competencies required in personal career choices
Grade 11	Interactive Media	- Define the purpose and audience for a project - Analyze various ICT skills and competencies required in personal career choices

New Brunswick

Grade	Curriculum	Strand
Grades 3 and 6	Visual Arts	- Understanding and connecting contexts of time, place and community
Grades 3-8	Visual Arts	- Responding to Art
Grades 3-8	Language Arts	- Reading and Viewing
Grades 6-12	Technology Education	- History and Evolution of Technology - Technology and Careers
Grade 9	Social Studies	- Decades of Change
Grades 9-11	Visual Arts	- Perceiving, reflecting, and responding
Grade 11	Graphic Arts and Design	- Perceiving, reflecting, and responding
Grade 11	Career Exploration	- Self-Assessment and Career Exploration

Newfoundland and Labrador

Grade	Curriculum	Strand
Grades 3-8	Language Arts	- Reading and Viewing
Grades 3-9	Visual Arts	- Understanding and Connecting Contexts of Time, Place, and Community - Perceiving, Reflecting, and Responding
Grade 7	Communications Technology	- History and Evolution of Technology - Technology and Careers
Grade 8	Production Technology	- History and Evolution of Technology - Technology and Careers
Grade 9	Social Studies	- Historical Influences on Identity II: Part of the Global Community (1945-present)
Grade 10	Art Technologies	- Perception, Culture, and Technology
Grades 11-12	Art and Design	- Graphic Arts - Media Arts
Grades 11-12	Communications Technology	- History and Evolution of Technology - Technology and Careers

Nova Scotia

Grade	Curriculum	Strand
Grades 3-6	Information and Communication Technology	-Technology, Operations, and Concepts
Grades 3-6	Music	- How music can convey feelings, ideas and understandings
Grades 3-6	Visual Arts	- Looking - Reflecting
Grades 7-9	Technology Education	- Fundamentals of Technology Education
Grades 10-12	Information and Communication Technology	- Basic Operations and Concepts
Grades 10-12	Music	- Perceiving and Responding
Grades 7-12	Visual arts	- Perceiving and Responding
Grades 10-12	Career Development	- Career Awareness
Grades 10-12	Drama 11,12	- Perceiving and Responding

Northwest Territories

Grade	Curriculum	Strand
Grades 3-6	Language Arts	- Understanding Forms and Techniques - Plan and Focus
Grades 7-9	Language Arts	- Respond to a variety of print and non-print texts - Understand and aappreciate textual forms, elements, and techniques - Focus on purpose and presentation form
Grades 10-12	Language Arts	- Respond to a variety of print and non-print texts - Understand and aappreciate textual forms, elements, and techniques - Focus on purpose and presentation form
Grades 5-9	Career and Technology Foundations	- Business - Communication
Grades 10-12	Art 10-20-30	- Encounters
Grades 10-12	Art 11-21-31	- Creation of Art

Nunavut

Grade	Curriculum	Strand
Grades 3-6	Language Arts	- Understanding Forms and Techniques - Plan and Focus
Grades 7-9	Language Arts	- Respond to a variety of print and non-print texts - Understand and aappreciate textual forms, elements, and techniques - Focus on purpose and presentation form
Grades 10-12	Art 10-20-30	- Encounters

Ontario

Grade	Curriculum	Strand
Grades 3-8	Language Arts	- Media Literacy
Grades 6-8	Arts	- Visual Arts
Grades 9-12	Visual Arts	- Reflecting, Responding, and Analyzing - Foundations
Grade 9	Exploring Technology	- Technology, the Enfironment, and Society - Professional Practice and Career Opportunities
Grade 10	Computer Technology	- Technology, the Enfironment, and Society - Professional Practice and Career Opportunities
Grade 10	Introduction to Computer Studies	- Computers and Society
Grade 10	History	- Canada, 1982 to the present
Grades 10-12	Media Arts	- Reflecting, Responding, and Analyzing - Foundations
Grades 11 or 12	Exploring and Creating in the Arts	- Reflecting, Responding, and Analyzing
Grade 11	Computer Engineering Technology	- Computer Technology Fundamentals - Technology, the Environment, and Society - Professional Practice and Career Opportunities
Grade 11	Introduction to Computer Science	- Topics in Computer Science
Grade 11	Introduction to Computer Programming	- Computers and Society
Grade 12	Computer Engineering Technology Computer Technology	- Computer Technology Fundamentals - Technology, the Environment, and Society - Professional Practice and Career Opportunities
Grade 12	Computer Science	- Topics in Computer Science

Prince Edward Island

Grade	Curriculum	Strand
Grades 3-12	Communication and Information Technology Literacy	- Technology Systems - History and Evolution of Technology - Technology and Careers
Grade 3	Language Arts	- The Role of Media Literacy - The Role of Critical Literacy - The Role of Visual Literacy
Grades 4-6	Language Arts	- The Role of Media Literacy - The Role of Critical Literacy
Grades 3-4	Visual Arts	- Fundamental Concepts - Reflecting, Responding, and Analyzing
Grades 5-7	Visual Arts	- Fundamental Concepts - Reflecting, Responding, and Analyzing
Grades 8-10	Visual Arts	- Understanding and Connecting Concepts of Time, Place, and Community - Perceiving, Reflecting, and Analyzing
Grades 9-11	Language Arts	- Writing and Other Ways of Representing
Grades 10-12	Visual Arts 401A	- Perceiving and Responding - Careers
Grades 10-12	Creative Multimedia 801A	- Aesthetic Expression - Technological Competency
Grades 10-12	Introductory Computer Science 521A	- Computer Literacy
Grades 10-12	Information Technology Communications 401A	- Computer Literacy

Quebec

Grade	Curriculum	Strand
Grades 3-11	Drama	- Appreciate dramatic works
Grades 3-11	Visual Arts	- Appreciate works of art and images
Grades 3-6	Language Arts	- Exercise critical judgement with regard to texts - Appreciate literary works
Grades 3-11	Media Literacy	- Understanding the way media portray reality
Grades 3-6	Information and Communication Technologies	- Effective use of computer tools
Grades 7-11	Language Arts	- Reads and listens to written, spoken, and media texts
Grades 7-11	Personal and Career Planning	- Familiarity with occupations and trades

Saskatchewan

Grade	Curriculum	Strand
Grade 3	Language Arts	- Environment
Grade 5	Language Arts Social Studies	- Pop Culture
Grade 6	Career Education	- Identity
Grade 7	Career Education	- Place
Grade 8	Social Studies	- Social Issues
Grade 9	Career Education	- Inquiry into developing a personal career plan
Grades 10-12	Art 10, 20, 30	- The Arts and Popular Culture - Expanding Horizons: The Arts in Canada
Grades 10-12	Computer Science 20	- Careers Related to Computer Science
Grades 10-12	Computer Science 30	- Impact of Information Technology
Grades 10-12	Communications Studies 20	- Foundational Objectives - Technological Literacy
Grades 10-12	Media Studies 20	- Foundational Objectives
Grades 10-12	Visual Art 10, 20, 30	- Foundational Objectives - Technological Literacy
Grades 10-12	Drama 10, 20, 30	- Foundational Objectives - Technological Literacy - Critical and Creative Thinking

PROGRAMMING

The following are suggestions for events and programs that host institutions could hold to complement the visiting exhibition Game Changers.

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 — to discuss 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

Click Here for Programming Resources

Detailed descriptions are provided 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+

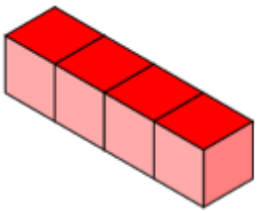
Background
Many people are familiar with dominoes, which are a type of polyomino created by attaching two squares together. A tetromino is a geometric shape created by attaching four squares together, and was popularized by the game Tetris.

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.

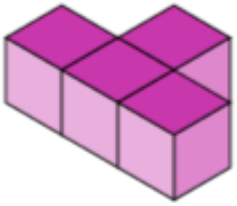
Preparation
In advance, make two of each tetromino shape:
1. Following the patterns below, assemble the interlocking floor tiles together at right angles.
2. Apply hot glue along the edges of the tiles to fix in place.

Z- Block
18 Tiles

L- Block
18 Tiles



I-Block
18 Tiles



T- Block
18 Tiles

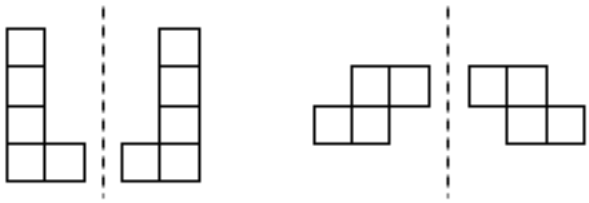
O-Block
20 Tiles

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.

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