

PINBALL: DESIGNING A GAME

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DESIGN IT! ENGINEERING IN AFTER SCHOOL PROGRAMS

Education Development Center, Inc.

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Activity 1: Setting Up a Pinball Game

What Materials Do I Have?

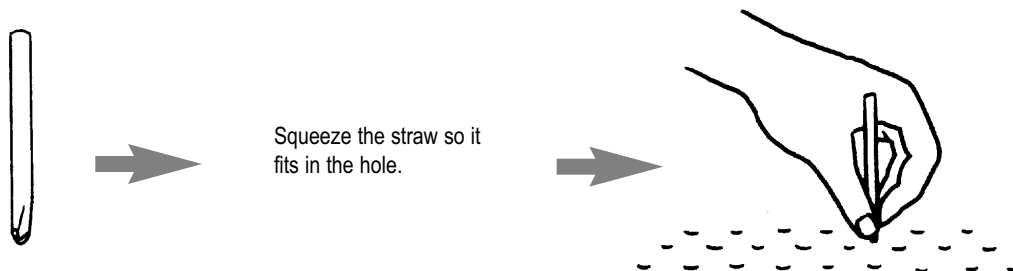
- 1 pegboard
- 2 yardsticks
- 5 marbles (1 inch in diameter)
- 3 16-ounce cups
- 1 empty half-gallon milk carton
- 30 flexible drinking straws
- masking tape
- scissors
- 1 pegboard template

THE CHALLENGE

Design a pinball game using a pegboard and drinking straws.
What arrangements will be the most fun for others to play?

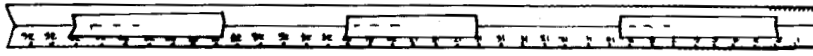
What Do I Do?

1. Lay the pegboard on a table and prop up one end with the large cups.
2. Using the flexible drinking straws, make a guardrail around the edges of the pegboard. This arrangement will keep the ball from rolling off the board.
3. Talk to your teammates about where to place the traps. Cut short lengths of straw and place them into the holes where you want the traps to be. Don't forget to squeeze the end of the straw pieces to make it easier to get them into the holes.



Challenge Sheet

4. Assemble a ramp by taping two yardsticks together into a “V” along their long edges. Place the tape on the top (inside the V) of the yardsticks so the ramp is easy to fold in half. Make sure you can still read the numbers on the yardstick.



Yardstick ramp with tape

5. Test your design by launching the ball using the ramp.

SAFETY

Do not throw marbles at anyone or launch the marbles on the ramp with a great deal of force.

What to Think About

- Can you get the ball to travel the same path if you launch it in the same way each time?
- Can you get the ball to roll into all of your traps by changing how the ball is launched before each roll?
- Can you get the ball to go into the same trap several times in a row?

Activity 1: Setting Up a Pinball Game

PREPARING AHEAD

1. Make copies of the pictures of the pinball games (pages 53–54) to show the children.
2. Make enough copies of the Challenge Sheet and the pegboard template (page 57) for each team.
3. Plan how you will divide the children into teams.
4. Construct a game yourself as suggested in Introducing the Activity to get a feel for the game and to anticipate some of the difficulties the children might encounter. You can then show your constructed game to the children when you are explaining the project to them.
5. Find a place to store the children's games between sessions. The games can be set against the wall at an angle, but only if in an area where others won't disturb them. If you must store them in a place accessible to others, prepare to cover them with cloth or some large pieces of cardboard for protection.

INTRODUCING THE ACTIVITY

Ask the children if they have seen or played pinball games. Nowadays, pinball games for individual home use are not as popular as they once were, and pinball arcades no longer exist in every shopping mall. There are, however, some smaller versions sold by toy companies that children may have played. Also, some pinball games exist in the form of video games, so perhaps the children have been introduced to them through that medium.

Ask those children who have seen or played pinball games to describe to the whole group as best they can what the game is about. To the right is a picture of an earlier version of a pinball game. There is a larger version of this picture at the back of the booklet (page 54) that children can pass around to get some sense of what the game looks like.

Show the children the materials and explain how they can use them to create their own pinball games.

Materials

FOR EACH TEAM

- 1 pegboard
- 2 yardsticks
- 5 marbles (1 inch in diameter)
- 3 16-ounce cups
- 1 empty half-gallon milk carton
- 30 flexible drinking straws
- 1 pegboard template

FOR THE WHOLE GROUP

- masking tape
- scissors

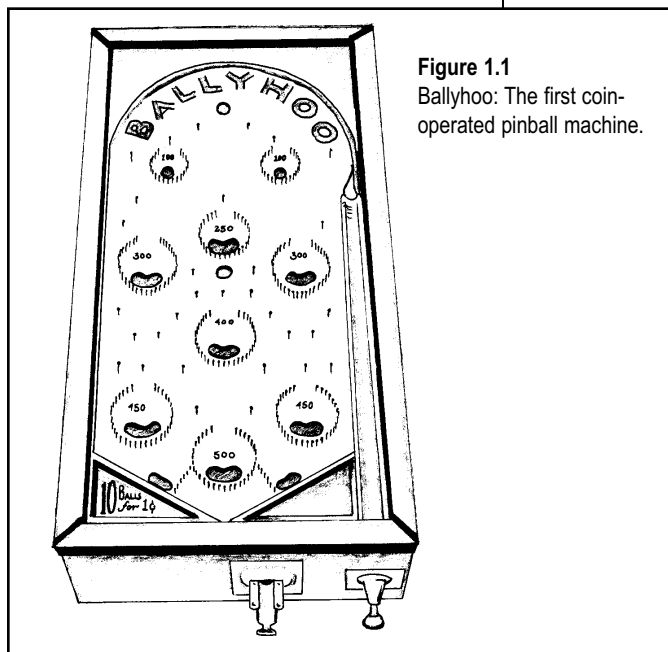


Figure 1.1
Ballyhoo: The first coin-operated pinball machine.

1. Lay the pegboard on a table, propping up one end with 2 16-ounce cups, as shown in Figure 1.2.

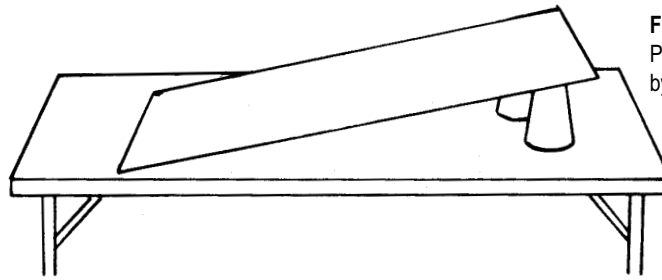


Figure 1.2
Pegboard propped up by cups.

2. Assemble a ramp by taping two yardsticks along their long edges together so that they form a “V.” Place the tape on the top (inside of the V) of the yardsticks so the ramp can easily be folded in half.

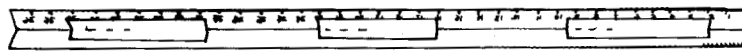


Figure 1.3
Yardstick ramp.

3. Place the ramp on top of a half-gallon milk carton next to the bottom of the pegboard. Bend the top of the milk carton so that the ramp sits snugly on top of it (Figure 1.4). (Stacks of books or pieces of wood can also be used as supports.) You can add some rocks or other kind of small, heavy objects to the milk carton to keep it steady.

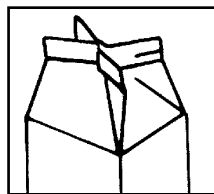
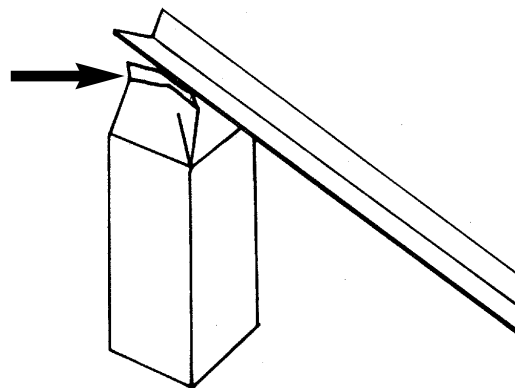


Figure 1.4
Open the top of the carton and rest the ramp in the opening.



4. Show the children how a marble can be rolled down the ramp so that it travels up the tilted pegboard and then rolls off (Figure 1.5). Point out that they will need to keep the marble from falling off the board.

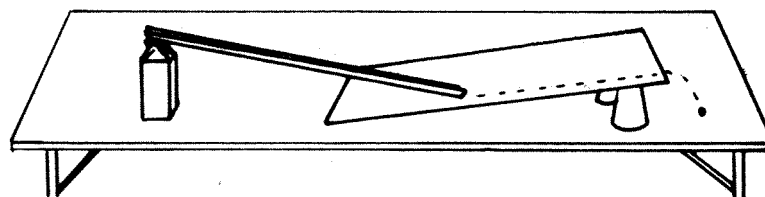
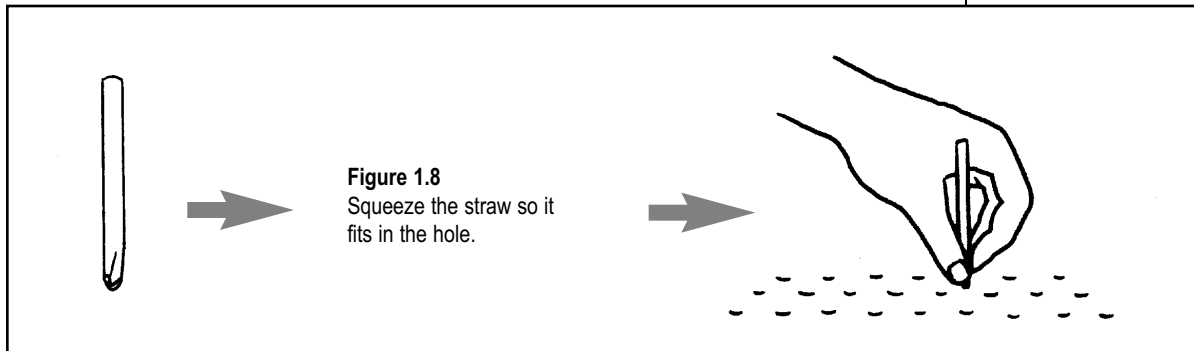
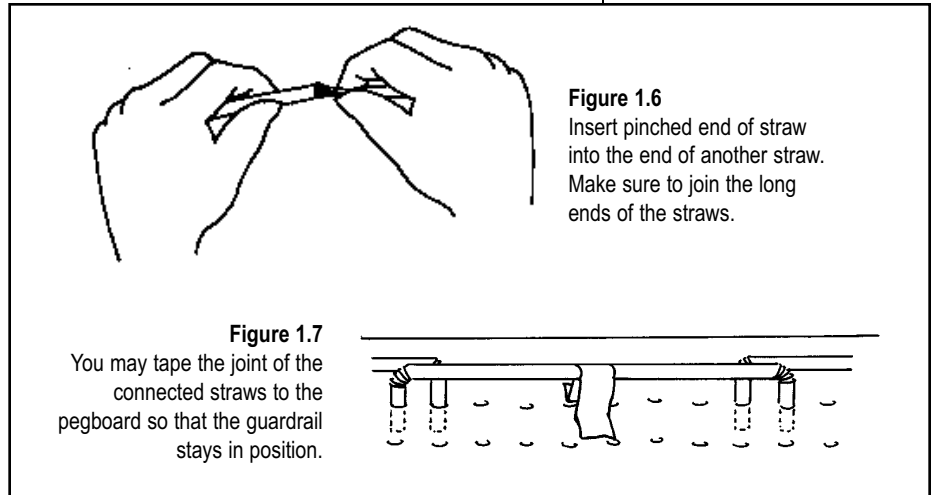


Figure 1.5
Roll a marble down the ramp; it falls off the board.

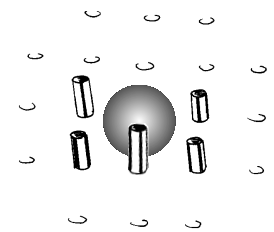
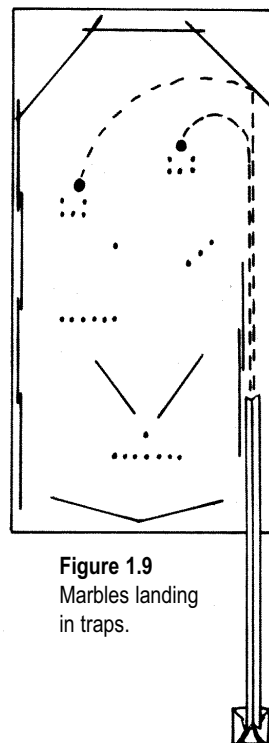
Guiding the Activity

5. Demonstrate how the flexible straws can be used to make guardrails (Figures 1.6 and 1.7).
6. Cut off short segments of straw. Place several segments in the holes on the pegboard to make traps (Figure 1.8). Point out that the ends of the straws will have to be squeezed first to fit them into the holes.



7. Roll the marble down the ramp again and show how it can land in a trap (Figures 1.9 and 1.10).

Tell the children that in this first session, they will begin to set up their games. At this point, they should only make two or three traps. Later, they will be given more materials to add more traps and develop other ways of trapping or guiding the movement of the ball. Help them understand the second provision of the challenge. They are making their games not only for themselves, but also for others to play. Therefore, they need to consider how others will use their designs. Ultimately, children should aim to create games that are challenging for the players to get the balls to land in the traps, gaining points for each trap. This should be in the back of their minds while designing this first phase of the game.



THE CHALLENGE

Design a pinball game using a pegboard and drinking straws. What arrangements will be the most fun for others to play?

LEADING THE ACTIVITY

In this first session, children will probably need help in the use of the straws. Check in with each team to see how they are connecting the straws and how they are placing them into the holes of the pegboard. If the children crush the straws as they join them together or put them in the hole, the straws will not function very well as guardrails.

Children will likely need more than one session to construct and test their designs and to share their results.

Terminology

It is helpful when having discussions to come up with some agreed upon terminology to describe the different arrangements that children assemble. You do not have to use the terms in the margin and in Figure 1.11 if the children prefer to invent their own terms. It is suggested, however, that the parts be named to help describe the set-up and to promote easier discussion about the pinball game designs.

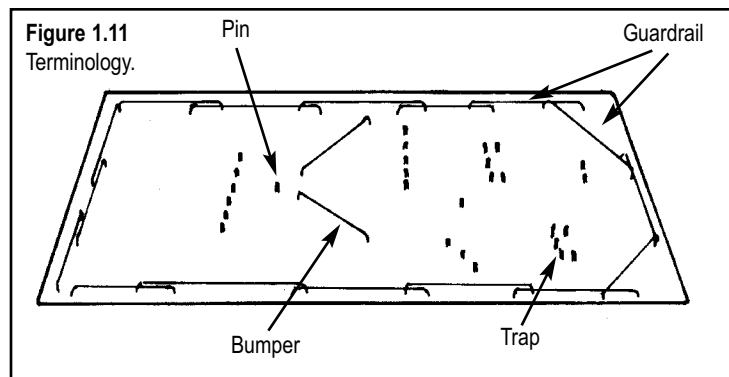
USEFUL TERMS

Pin: Individual pieces of straw stuck here and there to divert the pathway of a moving ball.

Trap: Several straws placed together where a ball can come to rest.

Guardrail: Length of drinking straws on the edge of the pegboard that keeps the ball from falling off the board.

Bumper: Length of straw parallel to the pegboard used to guide a ball into a trap or toward a section of the board with several traps.



When the children are making their traps, try to get them to decide with their team members where the best place would be to put them. Ask:

- Do you want to make it easy or hard to get the balls into the traps?
- Do you want a combination of easy and hard traps?
- Will you allow the player to put the ramp anywhere on the board or will it be anchored in one spot?
- Can the player raise or lower the ramp to change the movement of the ball?
- Can the player change the ramp so the ball can be aimed at different parts of the board?



These questions are to get children to think explicitly about the different design features of the game. Some may have definite opinions about these considerations while others may only decide what to do as they start to play their game. Each team should spend some time playing their game to get a sense of where the ball can roll and how often it goes into the different traps.

Troubleshooting

Perhaps the most prominent problem children may have in this activity is caused by their carelessness when anchoring the guardrails on the pegboard. To be effective, the guardrails need to keep the balls from slipping under or over the straws. Suggest that they test their guardrails by rolling a marble against different parts to see whether it will keep the marble on the board.

Some teams may decide to use the straws to build a structure to support the ramp. Any support will have to be sturdy so the ramp does not collapse. Also, the support for the ramp cannot be taped to the pegboards since the games may have to be disassembled after each session for storage.

Recording the designs

When teams have decided on a design for their games that works, have each team's recorder use a copy of the pegboard template (page 57) to record the team's design. This should be done at this point during each of the following activities. Teams can then compare their new designs with their old, see what has worked in the past, and watch their progress.

Storing the games

Care should be taken in storing the games. They need to be placed in such a way that the straws are not crushed.

LEADING THE DISCUSSION

After all the teams have had a chance to test their designs, have the children gather in one group. Tell them that they will now have the opportunity to test each others' games. Each team will demonstrate their game, and then a few children will try it out. Explain that there are several reasons for doing this:

- To show each other what they have accomplished.
- To get new ideas for their own games.
- To offer suggestions of how to improve other teams' games.

After some children have tested a particular game, ask them if they think the game is too easy or too hard to play. To be considered "easy," a child should be able to get the ball into one or all of the traps with little effort. To be considered "hard," the traps should be situated in a way that makes it almost impossible for a child to get the ball into one or all of the traps. Ask the group to make suggestions of how the game might be improved. Carry out this process with each of the teams.

Activity 1: Setting Up a Pinball Game

RATIONALE

In this activity, children become acquainted with the available materials and begin to get a sense of how the ball moves on the pegboard. Some children may have difficulty squeezing the straws into the holes of the pegboard, but practice and experience should bring success.

After setting up a few traps, they should also get a sense of how the ball rolls down the ramp and along the board. Because the board has holes, the path of the ball isn't totally predictable. Given these conditions, it will be difficult for children to have a full scheme in mind of how they will design their games. There will be plenty of time for them to make more elaborate designs in later activities.

It is important to limit the materials available to the children. Given unlimited access to materials, some children will have a tendency to keep adding traps and other kinds of barriers without thinking about how it affects the overall game.

LEADING THE ACTIVITY

In the excitement of assembling their game, each child in the team will probably put straws in holes without consulting with their teammates. Although it is difficult for some children to collaborate in this kind of situation, you should moderate the interaction among members of a team. Try to get them to talk to each other before placing their traps. Encourage them to discuss where they all think the best place is for the traps. The traps do not have to be permanently placed. After a few trials, they can be removed and placed elsewhere. Point this out to the children so they realize that they can try out different arrangements. Also, tasks can be divided up so that everyone is doing something and no one person is dominating the action. For instance, the materials manager can get pieces of tape for wherever it is needed and cut the straws; the designer can place them in the holes; and the launcher can test the game by launching balls down the ramp.

LEADING THE DISCUSSION

Children enjoy showing off their work. Although sharing their games may take significant time during each session, it is very useful because it provides a more explicit and formal way of sharing discoveries and experiences compared with just allowing the children to wander around during the activity observing what other teams are doing. It also relates directly to the design challenge. How do others react to the games they have designed so

far? There is a tendency with children this age to be self-centered in the sense that if the game is fun for them, it must be fun for others. One of the central issues in the design process is assembling products that are useable and interesting for a wide audience. As each team presents their game, remind them that they are also designing for others.

At a more specific level, you should also try to get the children to pay attention to the correlation between the height of where the ball is released and how far it rolls up the inclined pegboard. This determines where it might land and is one reason for using the yardsticks. Children can use the numbers along the yardsticks to measure the starting point and highest point for their balls.

Demonstration

To emphasize this point, do a demonstration. Choose a point on the ramp from which to launch the ball. Ask the children to observe the path of the ball while you launch it four or five times from the same spot. Then release the ball halfway down the ramp four or five times. Ask them to describe the difference. Also, have them observe whether the ball moves in exactly the same path for the same kind of release. It should be apparent that because of the holes in the pegboard, the marble will sometimes be diverted from a smooth trajectory (path of movement).

ASSESSMENT

You can assess what children are gaining from this activity by having them share with the whole group. Sharing with others encourages them to be more explicit in what they were attempting to do. It also provides an occasion for discussing what they understand about the design process.

Use the drawings of the pinball game designs (on the pegboard template) as a reference point at the end of each of the next activities so that the children can see the evolution of their games throughout the project. This kind of comparison will give you some sense of how they are progressing.

The extent to which they make adjustments to their traps is one indicator of how closely they are thinking about their designs. Do they move the traps around trying to make the game easier or harder? Are they working cooperatively?