

# PLANS AND STRUCTURES

GEOMETRY

- Spatial visualization
- Congruence

## Getting Ready

### What You'll Need

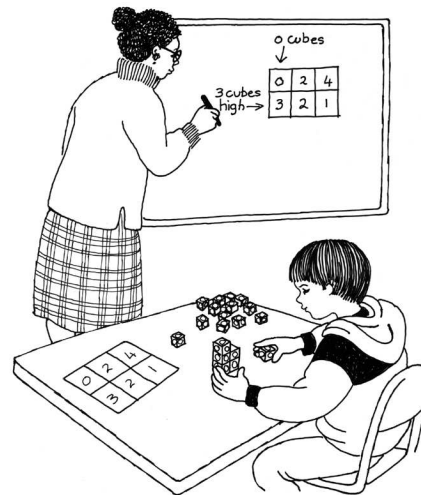
Snap Cubes, about 15 per child  
Trays or large box top lids from copy paper boxes  
Snap Cube grid paper, page 90

## Overview

Using Snap Cubes, children make structures and then create coded plans for their structures. Children exchange their structures and coded plans with other groups of children and match each structure with its coded plan.


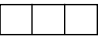
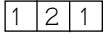
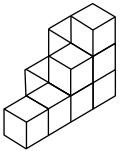
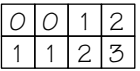
In this activity, children have the opportunity to:

- ◆ represent a three-dimensional figure in two dimensions
- ◆ use a two-dimensional drawing to build a three-dimensional structure
- ◆ recognize the value and limitations of a coded plan



## The Activity

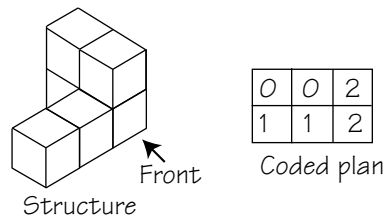
### Introducing

- ◆ Show children the structure to the right and have them build it. 
- ◆ Ask children to stand up and look down at the structure. Have volunteers describe the “bird’s eye view” of the structure.
- ◆ Draw a rectangle as shown and have children confirm that it is a bird’s eye view of the structure. 
- ◆ Put a number in each box of your rectangle. 
- ◆ Establish that each number tells how many cubes have been used in that column of the structure.
- ◆ Tell the class that the rectangle you’ve drawn is called a *coded plan*.
- ◆ Display this structure and its coded plan.  
- ◆ Discuss how this coded plan represents the structure.

## On Their Own

### *Can you match a coded plan to its Snap Cube structure?*

- Work in a group. Each of you use 8 to 15 Snap Cubes to build a structure.
- Draw a coded plan of your structure and put your name on it.
- Here is an example of a 6-cube structure and its coded plan. The numbers in the coded plan tell how many cubes are in each column of the structure.



- Have your group check that your coded plan matches your structure.
- When all the structures and coded plans have been checked, put all the structures on a tray. Put all of the coded plans in a pile and place that on the tray, too.
- Switch trays with another group.
- Try to match the structures and the coded plans. If you don't agree, talk to the creator of the coded plan.
- Then switch trays with other groups. Each time, try to match their structures and their coded plans.

## The Bigger Picture

### *Thinking and Sharing*

Once children have had the chance to match the structures and coded plans of at least two other groups, call them together to talk about what happened.

Use prompts such as these to promote class discussion:

- ◆ What strategies did your group devise to help you make the matches?
- ◆ What information on the coded plan helped you decide which structure matched that plan?
- ◆ Could you match more than one structure to the same coded plan? Explain.
- ◆ What information is missing from a coded plan?
- ◆ If a structure was turned on its side, would the coded plan change? Why?

## Writing

Ask children to describe what the structure built from this coded plan could look like.

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## Teacher Talk

### Where's the Mathematics?

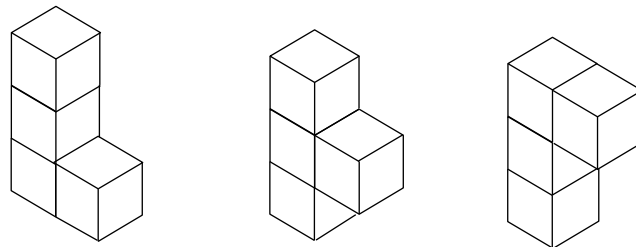
Creating structures with Snap Cubes helps children develop their spatial skills. This activity gives children the opportunity to use mathematics as a means to organize and convey information in an efficient manner. It also gives children a tool for bridging the three-dimensional world around them with the two-dimensional world of paper.

Children use a variety of strategies to match the coded plans to the structures. Some add up the numbers in the coded plans to find the total number of Snap Cubes used in the structure and then search for structures with that number of Snap Cubes. Others look at the dimensions of the coded plan rectangle and then look for structures with similar dimensions. Some groups look over all of the coded plans and structures before they begin to make any matches. Other groups immediately assign each member a structure or coded plan to look for.

During their investigations, children may discover that more than one structure can be created using the same coded plan. The coded plans used in this lesson tell how many cubes are in each column, but the plans do not specify the placement of the cubes within the column. For example, the coded plan 

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 could be used to build any of these three structures:



*Discussing the limitations of coded plans will set the stage for the lesson One of a Kind (page 46) where children are asked to create a better way of describing three-dimensional figures.*

## Extending the Activity

1. Have children create a coded plan and build as many different structures as they can that match the coded plan.
2. Ask children to write a description of their structure that does not use a coded plan. Make a classroom list of all the words and phrases they use to indicate location, such as *on top of*, *behind*, *to the right*.

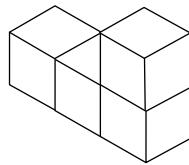
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This discovery enables children to see the need for giving additional information in order to produce a specific structure from a coded plan.

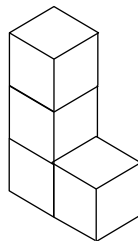
This activity can help children strengthen their spatial reasoning skills. For example, many children will not immediately recognize that the coded plan

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 could be matched with a structure that looks like this:



Only when the structure is turned, as shown below, does it become apparent that there is a match.



As children make the matches between coded plans and structures, they will have to re-orient the structures and communicate to their peers why the match between plan and structure now works.

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# SNAP CUBE GRID PAPER

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