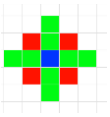
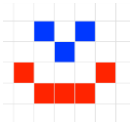
INTRODUCTORY ACTIVITIES

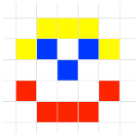
These are step-by-step activities to introduce how the eXpresser works. We have 3 activities:



STARS (creating a model)



MR HAPPY (animating a model)



MR HAPPY's HAT (linking patterns)

Activity 1 - Stars

Title	Stars
eXpresser Objectives	Gain familiarity with eXpresser
Mathematical Objectives	• Encourage the exploration of the structure of patterns • Create a pattern • Identify elements of structure • Create patterns for different repetitions
Teacher Notes	This activity is done on the Free Play area of the eXpresser, and is a simple guided exercise through the process of building a pattern. It can be done step by step, with a teacher modelling each step and each member of the class then creating the building block. Doing the exercise as a class activity to introduce eXpresser worked well when a student was selected to perform the steps as the rest of the class read out the instructions. The teacher can then pause to highlight features and draw attention to feedback that the system gives (coloured animation, smiles etc.), allowing time for students to write their answers to the questions.

Task / Activity

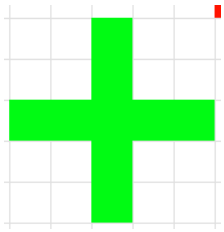
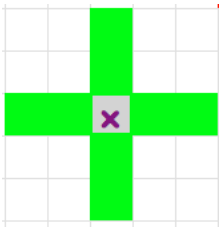
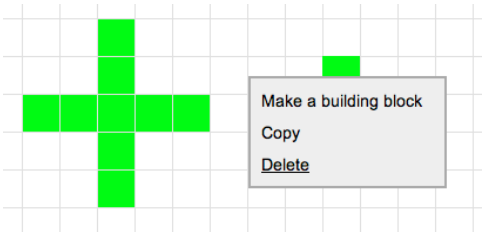
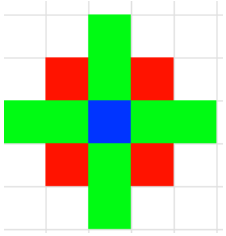
The aim of this activity is to become familiar with the features and the language of the eXpresser. This activity will involve creating a pattern, identifying elements of its structure, and working on how to find a rule to recreate the pattern for different numbers of repetitions. Later activities will focus on generalising the rules.

By the end of the activity we will have a pattern that is coloured for a specific number of repetitions.

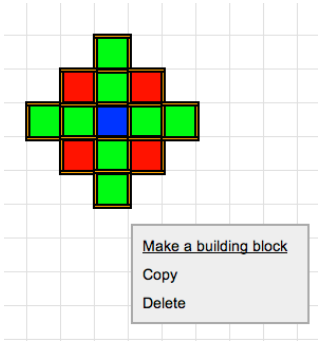
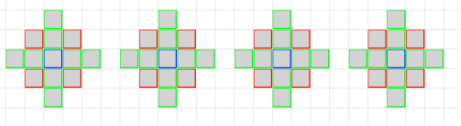
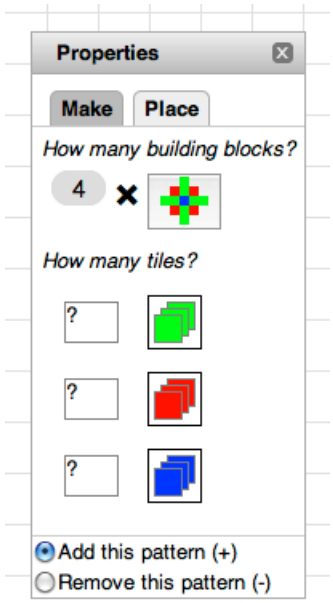
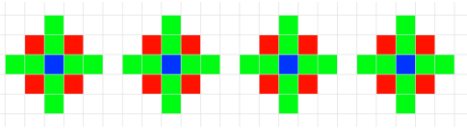
In this activity, we will:

- move tiles around the canvas by clicking and dragging;
- delete tiles from a pattern;
- create a building block;
- create a pattern and identify its properties;
- try varying the number of terms in the pattern to look at what happens; and
- make Smiley happy.

Making a pattern

1. Create a green cross that is 5 tiles across and 5 down by clicking on the green tile icon and dragging green tiles to the white grid (this is the canvas). How many tiles have you used to make your cross?	
2. Click and drag another tile to the centre of the cross. Write down two things that happen? *(a) the centre tile loses its colour, (b) the centre tile is replaced with a cross, and (c) Smiley is unhappy*	 
3. To remove the extra tile click and drag it to a blank part of the canvas. Now delete it: left click and choose "Delete". **Notice that all actions with the eXpresser are done by *left* clicking**.	
4. Replace the green tile at the centre of the cross with a blue tile. **(You can delete the green tile directly from the centre, but it is often easier to drag things to the blank canvas and work on things there.**) Don't forget to delete the green tile. (Left click and choose "Delete".)	
5. Now click and drag 4 red tiles to your cross to make a star. Your star should look like this.	

Creating a building block and a pattern

6. Select the star by left clicking and dragging over the whole shape. Select “Make a Building Block”	
7. Click on the star, and select “Make a pattern”. By default, the eXpresser chooses to repeat the Building Block 4 times in the horizontal direction. Click OK.	
8. We want the pattern to be coloured. To colour the pattern, put the number of tiles of each colour in the right box. Click on the star in the dialogue box to reopen the Properties window. This will show you what you need for each *building block*. How many of each coloured tile do you need for the *pattern* of 4 building blocks? Green: _____ Red: _____ Blue: _____ Put the number for the red tiles into the number generator box at the top of the screen and drag the number to the box with the question mark. You can release that number when the frame of the box with the question mark gets highlighted with a red line. Now do this for each other colour.	
11. What happens when you do this? *The pattern is coloured.*	

12. Change the number of building blocks in the pattern to 3: put 3 into the number generator box and drag it over the 4 in the pattern dialogue box, then select 3 from the drop down box. (This may take a bit of practice, so just remember to right click to delete anything you don't need). The pattern is not coloured. Put the correct values for the number of tiles needed so that the pattern is coloured again. Write the number of coloured tiles in the spaces below: Green: _____ Red: _____ Blue: _____ This will help you get used to how to change inputs and select what you want from the menu. Can you see a connection between the number of green tiles in one building block and the number of green tiles in the pattern? What is the rule for how many green tiles you need? How many tiles would you need if there were 5 building blocks in the pattern? Green: _____ Red: _____ Blue: _____ Now check you are right by seeing if the pattern is coloured when you put your answers to the properties box.	
14. Can you work out the rule that connects the **total** number of tiles to the number of stars? To finish this activity, let's make Smiley happy. He wants to know the total number of tiles needed to make the pattern. One by one, click and drag the number of tiles of each colour to the "Model Rules" box at the bottom of the screen. This should give you 12 + 24 + 3. In the next activity we will look at how to give the eXpresser those rules so that the pattern is coloured for any number of building blocks.	 

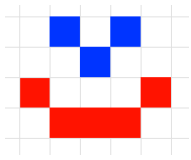
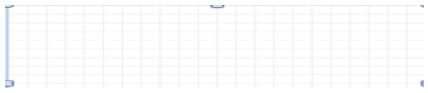
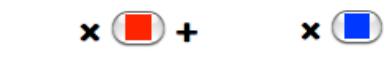
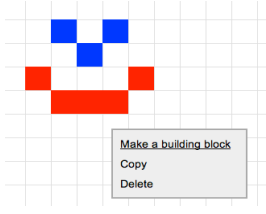
Activity 2 – Mr Happy

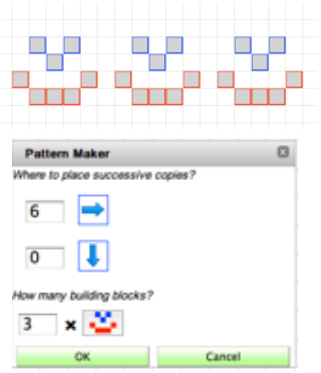
Title	Mr Happy
eXpresser Objectives	Creating building blocks, creating and animating patterns, producing a model rule
Mathematical Objective	• Making a variable
Teacher Notes	This is a guided "how to" activity where students create and animate a model with one building block. You may want to have students watch a demonstration where a simple model is created and animated and a model rule is given prior to starting the activity, if possible, or some teachers have found making the Mr Happy model together as a class, helps students by allowing them to see how the eXpresser works generally, and provide an initial guide to its layout. In trials, teachers found a detailed guide to the activity valuable at this early stage, as students can then move at their own pace through the steps of model making. It is also a useful reference for later lessons when students have forgotten the steps to animating the model. Having a paper record of the students' work was also considered helpful for consolidation and reflection away from the computer.

Task/Activity

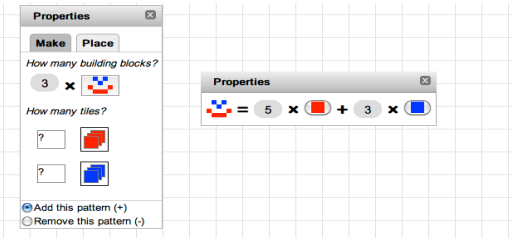
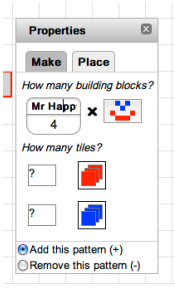
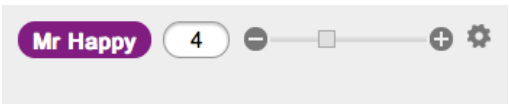
The aim of this activity is to create a model that the eXpresser can animate. We will make a pattern that remains coloured for any number of repetitions and that animates in the eXpresser.

Creating a pattern

1. Launch the activity. Create a face by clicking and dragging red and blue tiles to the working area.	
2. Draw your building block.	 How many **red** tiles? _____ How many **blue** tiles? _____
3. Complete the rule for one building block.	
4. Make a building block by selecting the whole picture, left click and select "create a building block" from the menu.	

5. Create a pattern by selecting the whole picture, left click and select “create a pattern” from the menu. Click OK.	

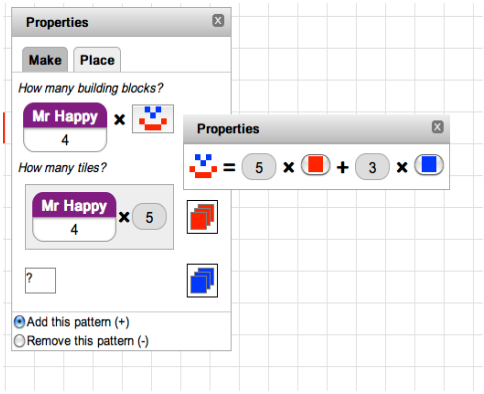
Unlocking numbers

1. Click on the picture of the face in the Properties box to get the rule for the number of tiles	
For four copies of the building block: Complete the rule for **4** building blocks:	How many **red** tiles? _____ How many **blue** tiles? _____ _____ + _____
2. “Unlock” the number of faces: Click on this number and select “Unlock”. Give your unlocked number a name.	
What is the name of your unlocked number?	
3. The slider appears at the top of the screen. This allows you to change the number of faces in the pattern.	

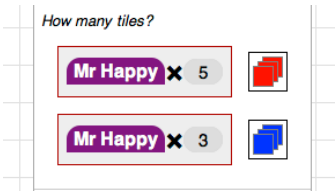
Creating expressions

<table>
<tr>
<td>1. To colour the pattern you need to write a rule for the number of tiles of each colour.

On the working area, create an expression for the number of red tiles by clicking and dragging the 5 (from the number of building blocks), and clicking and dragging the unlocked number to hover over the 5, drop it and then connect them with a multiplication sign.

2. Repeat for the number of blue tiles.</td>
<td> 
</td>
</tr>
<tr>
<td>Use the slider to change the number of faces in your pattern.

Write the rule for 6 faces.</td>
<td>Red Tiles
___ × 5 ×
Blue Tiles
___ × 3 ×

Total Tiles
___ × 5 × + ___ × 3 ×</td>
</tr>
<tr>
<td>3. Click and drag the expressions to the box asking for the number of tiles.</td>
<td> 
</td>
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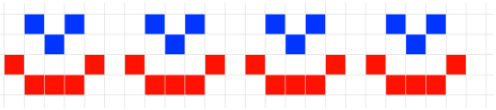
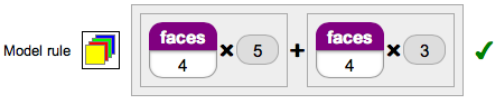
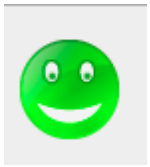
<tr>
<td>4. Check using the slider that the pattern remains coloured for any value of the unlocked number.</td>
<td>  </td>
</tr>
</table>

Giving the model rule

1. To get a smiley, you need to give the computer the rule for the total number of tiles in the model.	
2. Click and drag your blue tile expression to the box with the question mark at the bottom of the working area. When the box is red, drop the expression. Do the same with the expression for the blue tiles. Have you got a tick and a smiley?	 

Animating the General Model

1. To check if you have completed the task successfully, you need to animate the General Model to see if it stays coloured. Click on the General Model icon at the top of the screen. Move the grey vertical bar that separates the 2 'windows' in eXpresser to the right for more space. Now click on the arrow to animate the model.	

Using the Model Rule

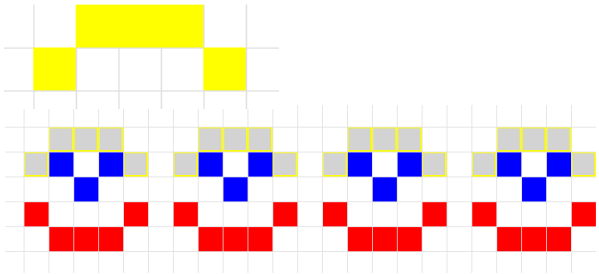
Use the slider to answer these questions. (Remember you can click on expressions or model rules and select "calculate value" to find the number of tiles.) Show your working (write down the expression or rule that you use to get your answer).	How many **red** tiles are there in Model Number 10 (10 faces)? How many **blue** tiles are there in Model Number 15 (15 faces)? _____ What is the total number of tiles in Model Number 8 (8 faces)? _____

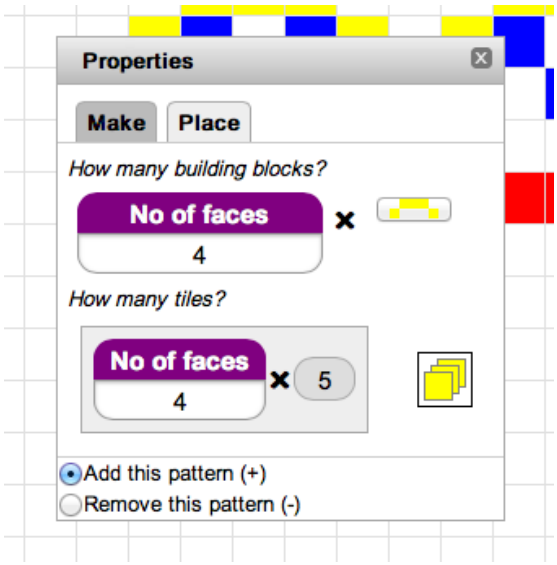
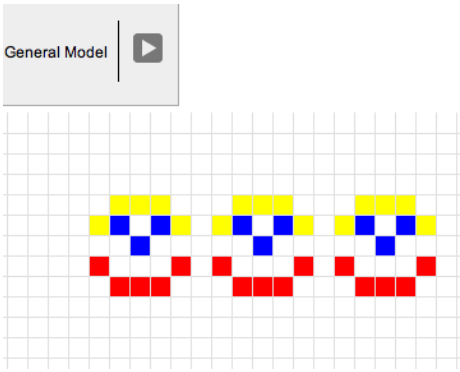
Activity 3 – Mr Happy's Hat

Title	Mr Happy's Hat
eXpresser Objectives	Linking patterns, practice with creating building blocks, creating and animating patterns and producing a model rule
Mathematical Objectives	• Making and linking variables
Teacher Notes	This is a guided "how to" activity aimed at linking patterns, a step which is needed for models made out of more than one building block. The activity starts with the Happy Faces pattern already made. The aim for students is to recognise the need to use the unlocked number from the Mr Happy pattern for the Mr Happy's Hat pattern; if a second unlocked number is used, the number of hats will not be linked to the number of faces that is the number of hats is dependent upon the number of faces. Try to help students answer this for themselves. To practise linking models, get students to create a further pattern and add it to the model such as putting a green pompom on top of the hat, or giving Mr happy a beard.

Task/Activity

The aim of this activity is to link one pattern to another to create a model. We are going to add a hat to the model of Mr Happy.

1. Launch the activity on the website. Create the hat pattern by clicking and dragging yellow tiles. (You can create a pattern anywhere on the working area and then drag it where you want to.)	

2. To colour the hair you need to create an expression for the number of yellow tiles. Since you need to put hair on each face in the model, the number of hats must equal the number of faces. To do this, you have to **link** the number of faces to the hat pattern, by using the **same** unlocked number for each pattern. Click on the Properties box of the Mr Happy pattern and drag the unlocked number to the expression you are creating for the hat pattern.	
3. Animate the pattern in the General Model to make sure it remains coloured.	
4. Remember to give the model rule, and get your Smiley!	 
5. Challenge: Can you put a pompom on the hat? Make sure you update the model rule to get Smiley happy again.	