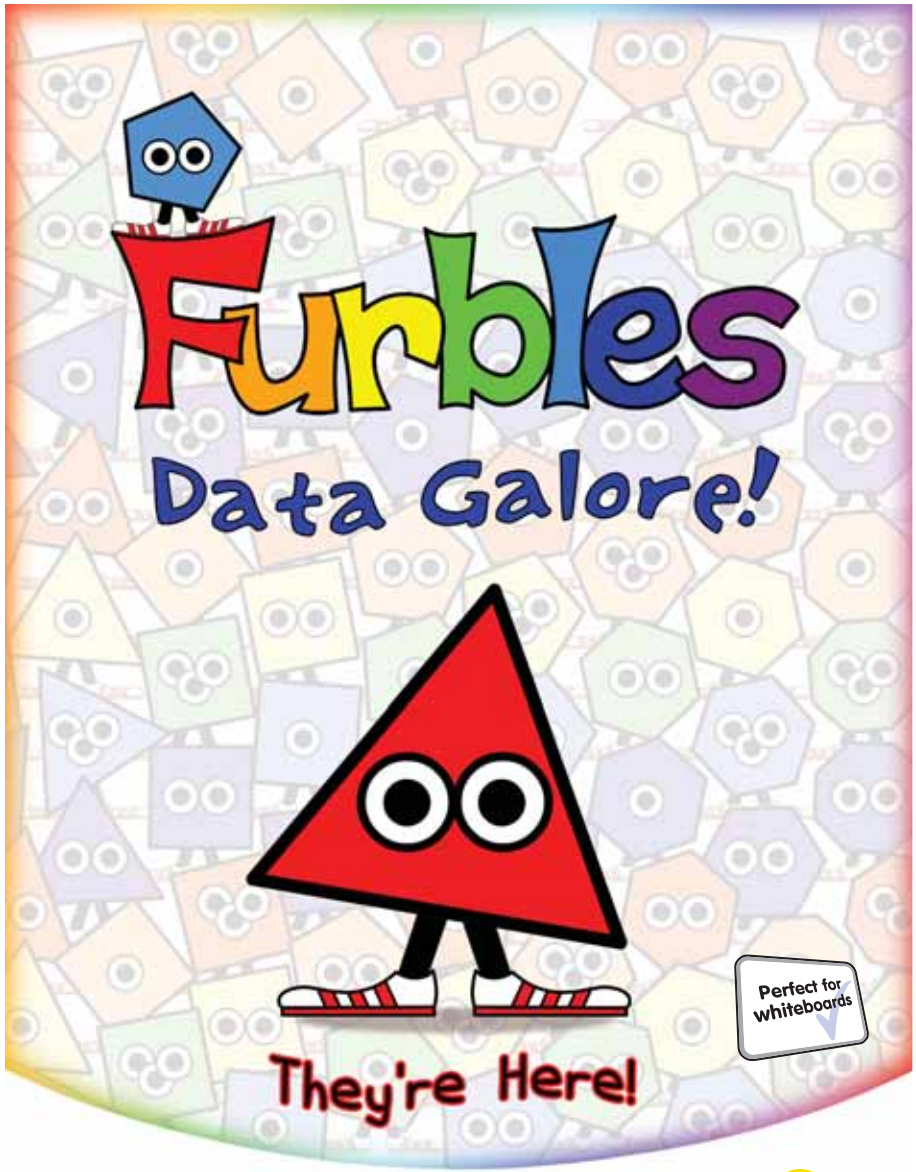
Sales HelpDesk
sales@sherston.co.uk
01666 843 200

Technical HelpDesk
support@sherston.co.uk
01666 843 224

Education AdviceDesk
education@sherston.co.uk
01666 843 280

Sherston Website
www.sherston.com

Sherston Publishing Group
Angel House, Sherston, Malmesbury, Wiltshire SN16 0LH



User Guide and Educational Notes

User Guide
and
Educational Notes

Furbles: Data Galore! Credits and Copyright

Design: Alec McEachran
Project Consultant: Paul Hollin
Project Manager: Georgina Calderbank
Developers: Alec McEachran
Animation and Graphics: Alec McEachran
Sound Effects: Paul Hutchinson
Lead Tester: Kate James
Testing: Duncan Henderson, Josh Pattie and Maggie McKenna
User Guide and Educational Notes: Alec McEachran
Print: Leah Poppy Holmes
Print Design and Production: S. Baskar

First Published in 2007 by Sherston

Sherston Publishing Group,
Angel House, Sherston,
Malmesbury, Wiltshire
SN16 0LH, England
Telephone: 01666 843 200
Technical HelpDesk: 01666 843 224
Fax: 01666 843 216
Email addresses:
Sales HelpDesk: sales@sherston.co.uk
Education Advice Desk: education@sherston.co.uk
Technical HelpDesk: support@sherston.co.uk
Website: www.sherston.com

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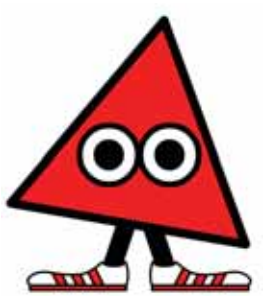
Introduction

Furbles are enchanting creatures that offer children a unique and imaginative insight into the links between data and graphs.



Clans of Furbles are used as data to produce an assortment of diagrams and problems. They have three properties: their colour, their shape and their number of eyes. There are 7 different colours, 5 different shapes, and 8 different numbers of eyes to choose from – 280 different possible Furbles!

Handling Data is one of five strands of the English National Curriculum for Mathematics, which from KS1 to KS3 focuses on constructing and interpreting graphs. Often a table of numbers sits between the graph and the data that it represents. This can cause problems for younger pupils who are concrete learners. With *Furbles: Data Galore!* if you want to create a pie chart, the data itself will create the chart.

Furbles: Data Galore! includes five different diagrams: Bar Charts, Pie Charts, Tally Charts, Carroll Diagrams and Venn Diagrams. The Carroll and Venn Diagrams can divide clans of Furbles into either two or four sets.

Educational Overview

Furbles has been designed to cover key concepts in Data Handling. It seeks to strengthen the conceptual bonds between graphs and diagrams and the data that they represent.

Furbles helps to cover the following learning objectives:

- interpreting a variety of charts
- identifying data required to solve a problem
- develop an understanding of probability
- develop problem solving skills
- interpret graphs and diagrams using ICT

For specific educational references to the Data Handling curricula throughout the United Kingdom, please visit *www.furbles.co.uk/references/*

Activities

There are four different sorts of activity in *Furbles: Data Galore!* In each, pupils must work with a clan of Furbles which represents the data, and one or more graphs or diagrams.

Each diagram has two or three different types of activity and there are 13 activities in total. Each activity is carefully designed to help pupils to reinforce their understanding of a particular diagram.

Explore Mode

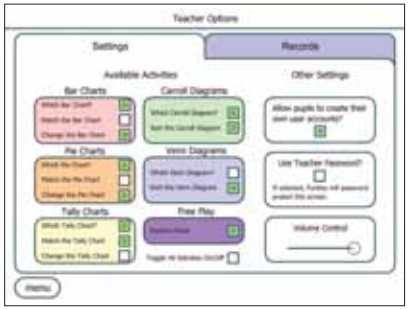
Explore Mode includes a host of features which can be used in many different ways. It has been carefully designed for use with interactive whiteboards in whole-class settings.

It can also be used to set individual or small groups of pupils specific challenges or problems. Please refer to the Teaching Ideas section of this guide for some ideas.

Teacher Options

The Teacher Options screen can be reached by clicking on the **Teacher Options** button on the **Main Menu**, in the **Activity Menu** or in the **Teacher Mode Menu**.

Options

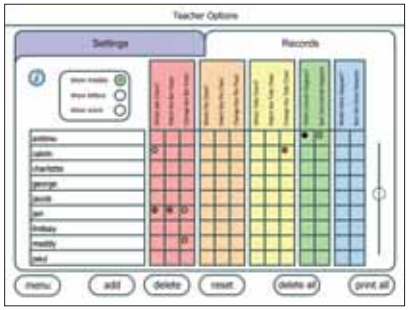


The Options screen enables you to select which activities pupils can access from the Activity Menu.

You can also choose whether to only allow users to log-in as existing users, whether to hear the sound effects or not, and whether to password-protect the Teacher Options and Teacher Mode.

The password is '**control**'.

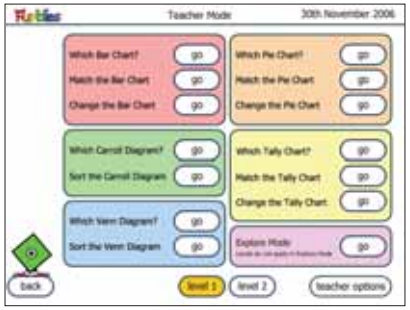
Records and Users



This screen allows teachers to view and print the records of users. Users can also be added and deleted.

Reset clears a particular user's activity record. **Delete all** removes all users.

Teacher Mode



All the activities are available in a modified form in the Teacher Mode Menu. In this mode, navigation buttons allow teachers to change which question they are on without answering them in sequence.

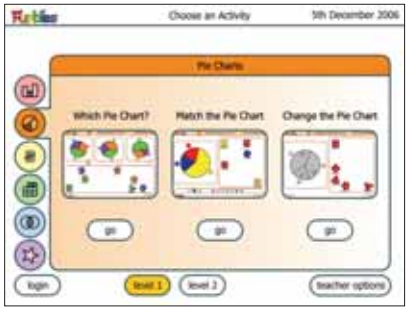
Accessing Explore Mode from this menu also allows teachers to save and load clans of Furbles and print the Explore Mode. These features are not available when accessed via the Activity Menu.

Activities in Teacher Mode

This mode is designed to make it easy for teachers to demonstrate how an activity works, or to discuss a particular question. The four navigation buttons at the bottom of the screen allow teachers to move back and forward quickly through the questions.

Activities

Activity Menu



There are four different kinds of activity (not all activities are available for each type of graph).

The different activities are grouped by the graphs that they practise. First choose the type of graph, then choose from the available activities and click the **Go** button.

Activities you don't want pupils to access can be disabled from within the **Teacher Options**. Activities that are disabled will not have a **Go** button.

If a pupil earns a medal for an activity when they are logged in, the Activity Menu displays the medal for them. This allows children to keep track of which activities they have completed successfully.

The **Level 1** and **Level 2** buttons allow pupils to switch between easier and more difficult problems.

The activities are designed to reinforce pupils' understanding of graphs and data handling.

Each activity comprises of 10 questions. Questions are generated randomly but are designed to get harder during an activity. This means that if a pupil returns to an activity they will not get the same questions as they had on a previous occasion, preventing them from simply completing the activity from memory.

Pupils earn a point for a question if they get it right first time. They cannot continue to the next question until they get it right.

Within each activity, pupils should be encouraged to interact by moving Furbles around to help them answer the questions. Individual Furbles can be picked up and moved around using the mouse by **clicking and dragging**. Groups of Furbles can also be selected then dragged using the selection box, by clicking on an empty space and dragging a box around the Furbles.

Pressing **S** on the keyboard at any time will make the Furbles stare momentarily, making it easier to count how many eyes they have.

Activity Levels

There are two levels for each activity. Level 2 activities are similar in nature to Level 1, but present more complicated problems.

Earning Medals

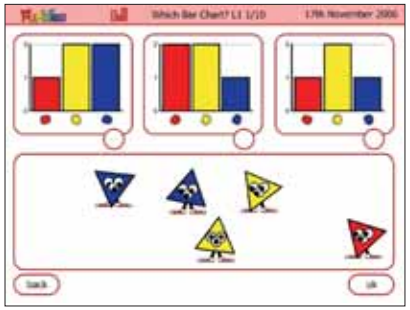
Medals are a quick way for both teachers and pupils to check which activities have been completed by a child. A point is scored for getting an answer correct first time. Medals are awarded for the following scores in each activity:

Medal	**Answers correct first time**
GOLD	10
SILVER	7 – 9
BRONZE	4 – 6

At the end of an activity the final screen shows pupils how well they have performed. They then have the option to try the activity at the other **level**, to **play again** at the same level, or to **print** a certificate of their performance in that activity.

Which Chart?

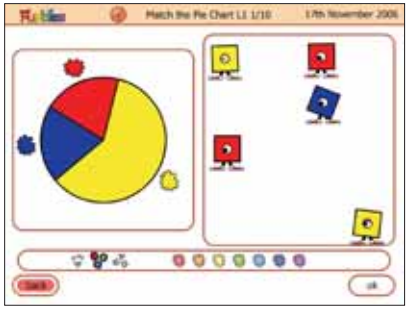
Activity Focus: These activities focus on distinguishing between correct and incorrect graphs and diagrams.



Three charts or diagrams are displayed. The pupil must choose which of the three is an accurate graph for the clan by clicking on the circular checkbox underneath the graph or clicking on the graph itself. The choice is not finalised until the pupil clicks OK.

Match the Chart

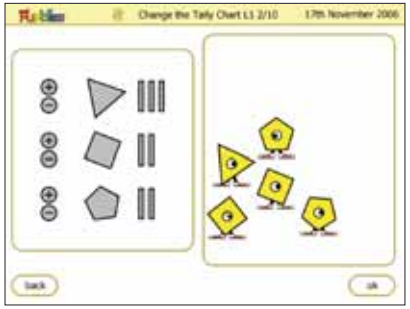
Activity Focus: These activities focus on pupils' interpretation of graphs by letting the children recreate data from the graphs.



A chart is displayed and pupils have to make the clan of Furbles match this chart by changing the properties of members of the clan. They do this by first selecting a Furble, then using the palette of properties at the bottom of the screen to choose which new property it should have. When they are happy with their choice, they must click OK to check whether they're correct.

Change the Chart

Activity Focus: These activities focus on pupils' understanding of how to construct graphs from given data.



A clan of Furbles is displayed next to a graph with circular buttons on it. These buttons allow the graph to be altered. Pupils must change the graph until it accurately represents the clan of Furbles.

The way in which the circular buttons works differs depending upon the type of graph.

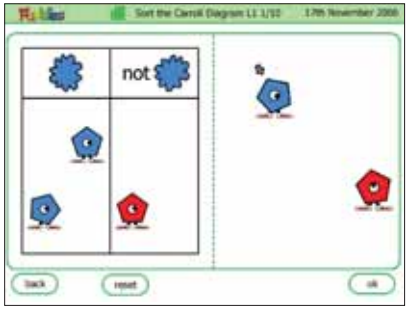
For Bar Charts, click and drag the buttons up and down to change the height of the bar.

For Pie Charts, click and drag the buttons around the centre to change the size of each pie sector.

For tally charts, click on the + and - buttons to increase and decrease the number of tallies for each category.

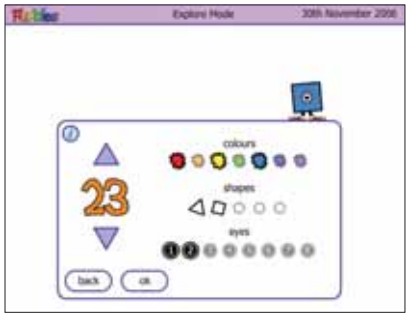
Sort the Diagram


Activity Focus: These activities focus on pupils' understanding of how to construct set-based diagrams.



An empty chart is displayed on the left of the screen, and on the right is a clan of Furbles. Children have to drag the Furbles into the appropriate portion of the diagram. They can determine which portion by looking carefully at the labels that define the diagram. All the Furbles must be dragged into a portion of the diagram before the question is completed and the answer checked using the OK button.

Explore Mode



When you start up Explore Mode you are initially taken to the **Creator**, which allows you to tailor the properties you want your clan of Furbles to have.

Click on the **up and down arrows** to change the total number of Furbles. If you click and hold down the total changes more rapidly. You can have between 1 and 100 Furbles.

Please note: With more than 40 Furbles in Explore Mode, the Furbles' eyes do not follow the cursor, to help the program run smoothly. However, running Explore Mode may still result in some loss of performance.

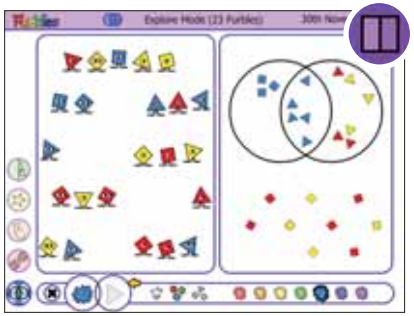
Change which properties your Furbles will have by toggling properties ON or OFF. There must always be at least one property in each of the categories.

If you want to change your clan of Furbles or exit Explore Mode click on the **blue cross** (available when no graph is being displayed) to return to the Creator. You can exit Explore Mode from the Creator.

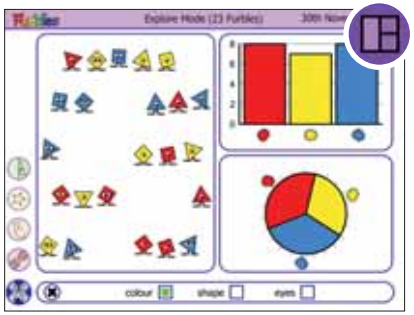
Changing Views

Different modes change the way that your graphs and clans of Furbles are displayed.

In Normal Mode Furbles create the graphs that are displayed. When you select a graph the Furbles animate into position. The animation can be controlled using the **Timeline Control**.



In **Half Mode** the clan of Furbles and the graph can be viewed alongside each other.



Two Graph Mode is similar to Half Mode, except that you are able to view two different graphs simultaneously.

Displaying Graphs

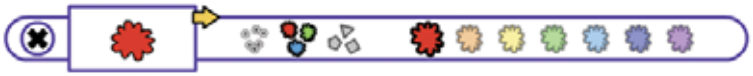
Bar Charts, **Pie Charts** and **Tally Charts** can be displayed by clicking these buttons. This will open the **Chart Chooser**:

From here you can choose whether to categorise your data by colour, shape, or number of eyes. You can also choose these categories in combination, though this is disabled for Tally Charts when this would result in an unreadable graph.

In the Chart Chooser shown above there is a cross to close the control. This happens in **Half Mode** and **Two Graph Mode**. *Clicking this does not stop displaying the graph*. This allows you to use the **Editor** or other controls while the graph is being displayed.

In **Normal Mode** the cross will be displayed as a tick. Clicking this closes the Chooser and opens the **Timeline**.

Carroll Diagrams are displayed by clicking this button. This will open the **Carroll Chooser**:



On the left of the Chooser, an icon representing the set or sets that your Carroll Diagram will display is shown. They can be altered by choosing different properties using the right portion of the Chooser. Clicking the **yellow arrow** toggles between a one-set diagram and a two-set diagram. When you have two-sets, to choose which set you want to modify, click on the respective left-hand icons.

As with Bar Charts, Pie Charts and Tally Charts, when in **Normal Mode** there will be a tick rather than a cross, which will open the **Timeline**.

Venn Diagrams are displayed by clicking this button. This will open the Venn Chooser.

The **Venn Chooser** works in the same way as the **Carroll Chooser**. In **Normal Mode** the cross to close the Chooser is replaced by a tick, which will open the **Timeline**.

While a graph is being displayed, its button will show a cross on it. Clicking on that button will cause the graph to close.

In **Two Graph Mode** you can choose from these four combinations of graphs to display on the right side of the screen. When you click on the buttons a relevant Chooser will be displayed that controls both graphs. Clicking the cross will close the Chooser, but the graphs will continue to display.

Clicking any of these icons when available will stop the two graphs being displayed.

Timeline

The Timeline is used to control the animation of Furbles and graphs in Normal Mode. When you have chosen the graph you wish to create with the appropriate Chooser, the Timeline opens and begins to play automatically.

The **rewind**, **play**, **pause** and **fast-forward** buttons control the speed and direction of the animation. The position knob can also be clicked and dragged to move the animation to a particular point.

The Timeline will stop in the middle when the graph is fully displayed. You can close the Timeline with the cross at the left of the control. Closing the Timeline will close the graph also.

Please note: If you click play again when in the middle position the chart transforms into Furbles who move back into their original positions.

If you close the Timeline, the Furbles will move back to their starting positions.

Selecting and Moving Furbles

Furbles can be selected by clicking on them. Clicking on them again will deselect them. To select more than one Furble at a time, you can hold down the **Shift** key on the keyboard and select them individually.

You can also select groups of Furbles by clicking anywhere inside the clan boundary where there isn't a Furble and dragging a Selection Box. This will select all the Furbles that are touching the Box.

When Furbles are selected, a **grey arrow** will point at them.

Explore Mode Buttons

Editing Furbles

Clicking the **Edit** button opens the Editor, which allows you to change the properties of any of the Furbles. Any graphs that are visible will automatically update if a relevant property is changed.

To use the Editor, select a Furble or a group of Furbles. Then use the buttons on the Editor to choose what their new properties should be. When you have finished, click the cross to close the Editor.

Random Stars

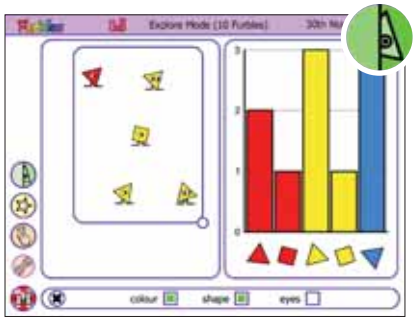
The **Star** button selects a Furble at random from the clan. It can be used to introduce ideas of probability. When a Furble is selected, stars circle around it, and its body spins.

A star also appears at the top of the screen. This is to show that a Furble has been selected in case that Furble is currently hidden using the **Window**.

Walkabout

The **Walkabout** button instructs the Furbles to find a new position on the screen. It is useful when Furbles have been dragged into an arrangement and you want to randomise their positions again.

Window



The Window is a feature which can be used to show just a section of the Furbles' area. Questions could then be posed to a class what data is hidden, particularly when using Half Mode or Two Graph Mode when a graph is displayed. At the top of the screen, Explore Mode usually displays how many Furbles there are on screen, but when the Window is active this number is hidden.

The Window can be moved around by clicking and dragging it. It can also be resized using the knob at the bottom-right of the window. The Window is closed by clicking the button a second time.

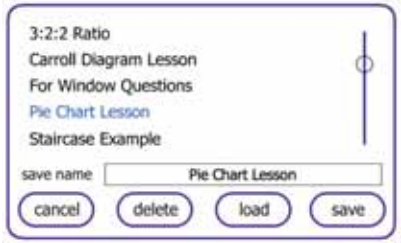
The Window cannot be used while animating a graph in Normal Mode.

Recycling and Restoring Furbles

Furbles can be removed from the clan by selecting them and clicking on the **Recycle** button. These Furbles can be returned to the clan by hitting the **Restore** button.

Saving and Loading

By clicking on the **Save** button you open a control through which you can save and load specific clans of Furbles.



From this screen any previously saved clans are displayed for loading, or by typing in a new name and clicking save you can save a new clan. The delete button also allows you to manage your saved clans.

When you save a clan, information about the properties of Furbles, their position on screen, and any that have been deleted is stored. However, it does not save information about any graphs or how the screen is currently arranged.

This button is only available when Explore Mode is opened through the Teacher Menu.

Print

The **Print** button allows teachers to create paper copies of clans of Furbles. This button is only available when Explore Mode is opened through the Teacher Menu.

Templates

At the right of the screen in **Normal Mode** are some small buttons that allow you to add templates to your screen. This can be useful if you are discussing how to create charts and want your class to drag Furbles in a way that mimics the Normal Mode graph animations. There are six templates available.

The circle displays a circle under the clan of Furbles, intended to assist the discussion of Pie Charts.

The grid displays a grid under the clan of Furbles, intended to assist the discussion of Bar Charts.

The two Carroll Diagram templates display a template on the right of the screen and push the Furbles to the left of the screen. They have no labels so that the structure of the diagram can be decided by the class.

Furbles can be freely dragged over the template. Removing the template will revert Furbles to their original positions.

Venn Diagram templates work in the same way as Carroll Diagram templates. To activate them push the Furbles to the left of the screen; deactivating them will revert Furbles to their original positions.

Activating a graph will cancel any templates currently active, as will changing the Mode.

Teaching Ideas

This section includes 19 different ideas and activities to help use Furbles to teach different aspects of Mathematics. These ideas are appropriate for different ages and levels of children. The activities should always be tailored to the level of your class.

Naming Shapes

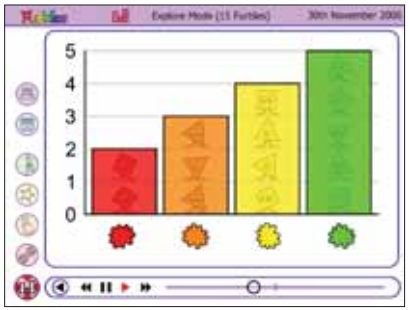
Using Furbles with KS1 children can provide useful practise in the naming of shapes, as well as tackling the common misconception that when shapes are rotated they are called other things, like 'diamonds' for rotated squares.

Furbles correctly treats shapes the same irrespective of their rotation.

Three Different Bars Problem

Challenge the class or a group to create a clan of 12 Furbles so that when you create a Bar Chart all 3 bars are each a different height. This activity could be setup with a clan of 12 identical Furbles by setting only one colour, one shape and one number of eyes in the Creator. *Thanks to the University of Southampton PGCE website for this idea*.

Create a Bar Chart Staircase



Challenge the pupils to create a bar chart that has 4 bars resembling a set of stairs. *Thanks to the University of Southampton PGCE website for this idea*.

Four Sets of Three

Create a clan of 12 Furbles so that when you create a Carroll or Venn Diagram there are 3 Furbles in each of the four parts of the Diagram.

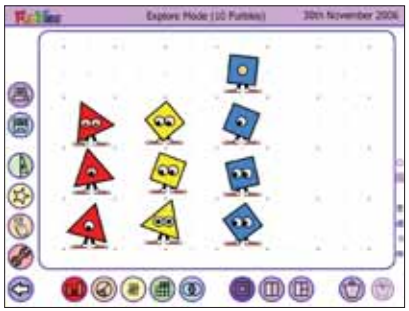
Printed Graphs

Create some graphs in Half Mode, and print the screen using the Print button (only available if you enter Explore Mode from the Teacher Menu). Cut the page in half and give the graph to a group of pupils with the challenge to recreate the graph.

When they have succeeded they can then compare their clan with the original one. How are they the same and how are they different?

Alternatively, pupils could try to work out which graph goes with which clan as a paper exercise.

Learning to Construct Bar Charts



Create a small clan of Furbles with three or four different colours. Click on the **Grid Template** on the right-hand edge of the screen and ask pupils to use the grid to line up Furbles as they'd line up for making a Bar Chart. (Remind them that the colours of the rainbow always appear in order from left to right!)

When the class is happy that the chart resembles a Bar Chart, click on the **Bar Chart** icon, ensure that only Colour is chosen in the **Chart Chooser** and then click the arrow to start the animation. If your pupils were correct the Furbles shouldn't change places but should move smoothly into position for the chart.

If they do change places, use the timeline control to observe how the graph differs from what the pupils created. If you want to go back to how the Furbles were lined up before the graph is drawn, you must ensure that the timeline position is at the very start or the very end of the animation, not in the middle, before closing the timeline.

Learning to Construct Pie Charts

This **Learning to Construct Bar Charts** activity can be duplicated for Pie Charts.

For Pie Charts, use the **Circle Template** (do not confuse this with the simple Venn Diagram template) and line up the Furbles either just inside the circle or on the line. It is harder to do because as far as possible you want the Furbles to be evenly spaced.

In Pie Charts, colours are always ordered clockwise.

Interpreting Bar Charts (and Tally Charts)

Create a clan of about 30 Furbles with three colours. In **Half Mode** choose a **Bar Chart** to display colours. Then, click the **Window** button and make some or all of the Furbles invisible.

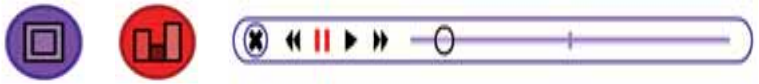
Ask pupils to write down how many of each colour there are according to the graph. It is likely that some pupils will disagree with each other about how many of each category there are. With larger numbers of Furbles, the scale changes from going up in units to going up in steps. This makes it harder to read from the graph.

To help the discussion, pupils should be reminded that at the top of the screen it tells them how many Furbles there are in total; their different totals should add up to that number. This can lead to discussion about the problem that Bar Charts don't always give you clear data about the numbers of each category.

To help check the actual results, close the Bar Chart and open a Tally Chart, or close the window. It should be much easier for the class to agree upon the actual values.

If you want to take this discussion further use the Two Graph Mode to look at the differences between Bar Charts and Tally Charts.

Does *Furbles* draw Pictograms?



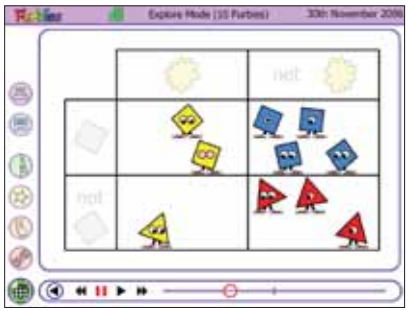
The answer is yes, but can the pupils spot it? Create any clan of Furbles and in **Normal Mode** choose a **Bar Chart** and trigger the animation.

Just before the animation starts to fade in the axis, labels and bars, there is a split-second when all Furbles are lined up as a Pictogram, which then becomes a Bar Chart. Pausing and using the timeline controls can allow you to capture that moment.

This can be demonstrated to the class and could lead to a discussion about how Pictograms and Bar Charts are related, and which is better for what, and why.

If pupils feel that pictograms are always better than bar charts, go back and choose a big population with the same properties. Then repeat the animation, pausing it as they are lined up. They should be very small and hard to distinguish, while the Bar Chart will remain colourful and easy to interpret!

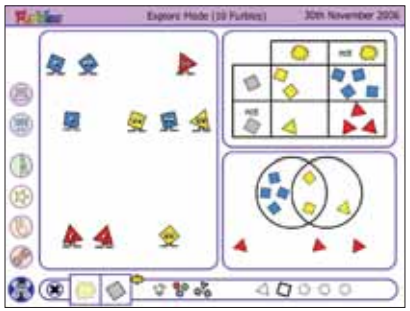
Introducing Carroll Diagrams



Demonstrating how a Carroll Diagram works is easy with Furbles. Create a clan of Furbles in **Normal Mode** and click the **Carroll Diagram** button. At the bottom of the screen you can select the Carroll Diagram that you want to display using the **Diagram Chooser**. The Furbles will move into place. The animation can be controlled using the Timeline to allow you to discuss with a class the different things that are happening.

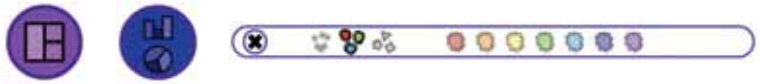
When the class have an idea of how things work, use the **Carroll Diagram Templates** to create an empty Carroll Diagram outline, and ask the children to create a diagram using the template, using sets of your choice.

Introducing Venn Diagrams via Carroll Diagrams



The Carroll Diagram is a very neat way to introduce the idea of sets, and is in some ways easier to get to grips with than Venn Diagrams. Furbles provides a way to introduce Venn Diagrams through Carroll Diagrams.

The difference between Bar Charts and Pie Charts



In **Two Graph Mode** create a clan of Furbles and display both a **Bar Chart** and a **Pie Chart** using the **Bar and Pie Button**. Close the Graph Chooser but keep the graphs visible. Then use the **Editor** to change the properties. Ask the class to describe how each graph changes when you change the properties. The biggest change comes if you completely eliminate one of the categories.

People Bar Charts and Pie Charts

Why stick to the whiteboard? A fun kinaesthetic extension to Furbles is to get pupils into a hall or outside and let them become the Furbles themselves. Pupils will need to choose their favourite Furbles or be given Furble cards or stickers with different properties. A cone or similar will be needed to act as a central point for Pie Charts and the side of the room or a playground edge will be required for at least the horizontal Bar Chart axis.

Pupils can then be asked to mill around until an instruction is given, such as "Colour Bar Chart" or "Shape Pie Chart", whereupon they have to waddle into position.

For Pie Charts, in order to create the most circular possible shape, ask children to hold hands with the two people next to them and then to carefully move backwards until their arms are outstretched.

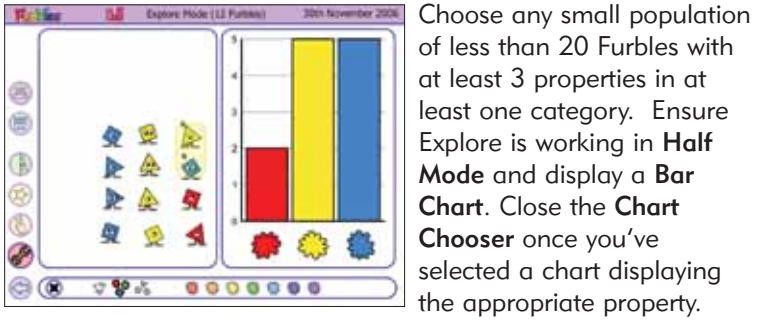
Introducing Probability

Create a clan of Furbles where Red is twice as common as any of the other colours and where every Furble has two eyes. Click on the **Star** button a few times. Discuss which colour is most likely to be chosen and why.

Ask the class to keep track of which colours of Furble are being chosen. Click at least once for every Furble, though preferably more. If appropriate, ask the pupils to create a bar chart of how often each colour was chosen. Then, create a bar chart of the colours. Discus how the graphs are similar and how they are different.

Discuss with the class how often they expect a 2-eyed Furble to be selected. What about a 3-eyed Furble?

Making Equal Categories



Choose any small population of less than 20 Furbles with at least 3 properties in at least one category. Ensure Explore is working in **Half Mode** and display a **Bar Chart**. Close the **Chart Chooser** once you've selected a chart displaying the appropriate property.

Ask pupils how they would change the Furbles to make sure that the graph's bars are an equal height (without changing the number of properties). This may or may not be possible depending upon the number of properties. If we had 2,3,4,5… properties could we make a chart with bars that are an equal height?

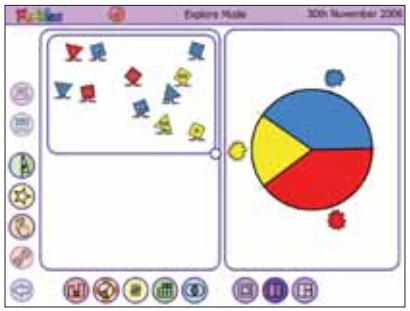
This problem can be explored for different sizes clans. Only when the number of properties is a factor of the size of the clan will the problem be possible.

This activity can be altered by choosing Tally Charts or Pie Charts rather than Bar Charts.

Why Pie Charts are Difficult

Set up a clan of Furbles on the board in **Half Mode**, and display a Pie Chart on the right-hand portion of the screen. Close the **Chart Chooser** but leave the Pie Chart displayed.

Move the Furbles so that they are split into two groups. Then, use the **Window Mode** to hide one group of Furbles.



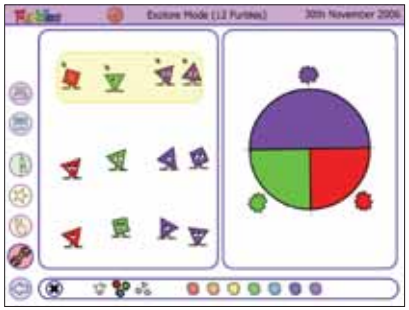
The problem is now how to work out what properties you know about the hidden group of Furbles; how many there are and so forth.

This could lead to discussion about how Pie Charts are not very good for showing how many of a property there is.

Sneaky children may realise that at the top of Explore Mode you are told how many Furbles there are. To be doubly sneaky remove a few with the Recycle Bin; the total at the top doesn't change. You can choose whether to warn pupils about this or not.

Pie Chart Ratios

Create (and then edit if required) a clan of Furbles so that the properties are in a ratio which simplifies; with 12 Furbles, 3 red, 3 green, with 6 purple it has a ratio of 3:3:6 which simplifies to 1:1:2.



Ensure that you're working in **Half Mode** and display a **Pie Chart** on the right-hand side of the screen. The aim is to remove some Furbles without changing the Pie Chart. Ask a pupil to separate a group of Furbles from the main clan. If the class agree with the choice, then select them by dragging a selection box around them, and press **Recycle**. If the choice is correct the shape of the Chart shouldn't change.

Please note: This activity is mimicking the mathematical act of simplifying ratio. If the pupil chose 1 red, 1 green and 2 purple in the example above then the numbers change from 3:3:6 to 2:2:4 but the ratio doesn't change.

Relative Frequency

Create any clan of Furbles, then activate the Window and move and resize it until it takes up a quarter of the screen.

Explain to the class, if they are not already aware, that whenever a Furble is selected a star spins at the top of the screen. With the Window, if you select a Furble but it's invisible, the stars may not be visible either. Click on the stars a few times. Ideally it should be at least as many times as there are Furbles in the clan. How often was a visible Furble selected? How often was an invisible Furble selected? Based on this evidence, how many Furbles are there on the whole screen?

Relative Frequency and the Mean

Create a clan of furbles, then activate the Window and move and resize it until it takes up a quarter of the screen.

Count how many Furbles are visible. How many Furbles do you think there are in total in the clan?

Use the walkabout icon. Each time Walkabout finishes the class can consider again how many Furbles are visible and how many Furbles they think are in the clan.

This activity could lead to discussing what was the mean (average) number of Furbles that were visible in the quarter-screen each time. It also develops the idea ofrelative frequency, whether explicitly stated or not.

Mathematical Notes

Categorical and Set Data

The graphs in Furbles are split into two fundamentally different kinds of diagram. Bar Charts, Pie Charts and Tally Charts all display Categorical Data, while Carroll Diagrams and Venn Diagrams display Set Data. It is for this reason that not every activity is appropriate for each kind of graph.

Categorical Data is where one or more properties is chosen and the population is then split into as many different sets as required so that within each set every Furble is identical for those properties.

Set Data is different; a particular property or combination of properties is selected and either Furbles have those properties or they do not, creating two sets of Furbles. Two sets can be chosen separately, creating four possible composite sets; Furbles may be members of both sets, of neither set or of just one of the sets.

Axis Labels and Keys

None of the charts drawn by Furbles have axis labels, keys or a title. With these axes removed, the graphs can be drawn larger than they might otherwise. Furthermore, with a graph already drawn, pupils can be asked to identify the information it displays without having the answer in the form of the title.

Tally Charts

In Furbles, Tally Charts do not have a numerical frequency next to them. This is to force children to count the tallies that they see, and to develop the counting in multiples of five, which is the particular facility of Tally Charts.

Pie Charts

Pie Charts are interesting but awkward graphs since they do not display frequency data but only proportional data. In light of this, the (English) National Curriculum only introduces Pie Charts in Year 6, and develops them in Years 7 and 8. They are included in Furbles because they are covered in KS2, and because Furbles can help to motivate discussion in how they differ with Bar Charts or Tally Charts.

In order to help children develop their understanding of Pie Charts I have included light tick marks around the outside of the circle. These divide the Chart up into equal sectors. Please be aware that they do not necessarily divide them up into unit-sectors; if there are 3 red, 6 orange, and 3 green Furbles there will only be tick marks every three Furbles; their frequency is taken as the Highest Common Factor of all the category frequencies. If more than 36 tick-marks are needed, then because they become too closely spaced together, they are removed. It is important, therefore, when introducing pie charts in Explore Mode to be careful not to use more than 36 Furbles.

There is a pernicious use of 3D pie-charts in modern society brought about by the use of Excel. Please avoid them! They are mathematically incorrect because they are misleading; data represented at the 'front' of the chart is represented by a greater area than data represented at the 'back' of the chart.

Venn Diagrams

The Sort the Venn Diagram activity includes labels for the circles which represent the sets, while in other areas of Furbles they do not. In all other contexts, the rule which defines the set can be determined by the Furbles or labels displayed within them, whereas for that activity they are required. This was done to avoid the confusion that the label might represent another Furble.

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Notes