



Using the Vernier Scale

Interactive Screen Experiment

Introduction

The Vernier scale is a mechanical means by which an analogue scale (usually a linear or angular measurement) can be read to very high precision. The ability to reliably use such a scale is of great value in many fields of science and engineering, but does take some familiarisation and practice.

The purpose of this Interactive Screen Experiment (ISE) is to enable you to develop your skills in reading a Vernier scale to a point where you can reliably use such a scale in an experimental laboratory or other setting.

The ISE you will be using is a computer resource based on your interactions with a set of real images of a demonstration scale, rather than a computer generated simulation. The outcomes will therefore be a far closer representation of reality, enabling you to connect this exercise more closely to a real situation.

Getting started

The ISE is a stand-alone executable application on the computer, and requires no additional software (such as Internet Explorer etc.) to run. To activate the Vernier ISE, locate the resource named 'Vernier_OER.exe' in the archive, extract it to your desktop and double-click it. The ISE will now run, but please wait until the title screen appears – this may take a short while, due to the large number of images the application needs to load.

You will be presented with the title screen of the Vernier ISE, as shown in Figure 1.

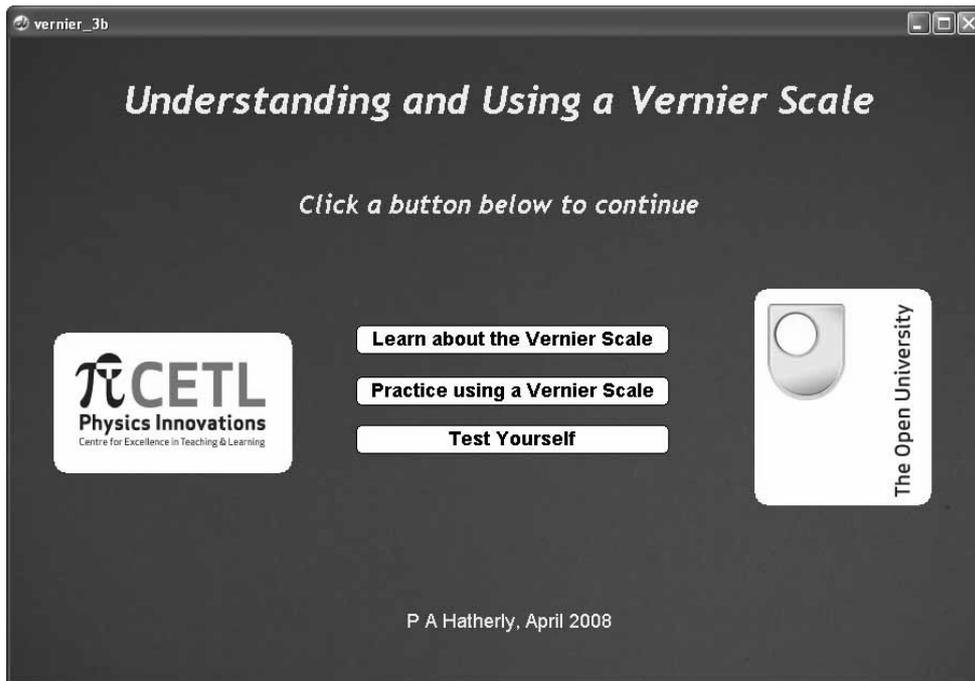


Figure 1. The Vernier scale ISE start-up screen

You will see three buttons, which take you to different sections of the ISE, dependent on your previous knowledge and experience. If you have not previously encountered a Vernier scale, it is recommended that you start from the 'Learn about the Vernier Scale' section. The rest of these notes assume this is the route you have taken.

About the Vernier scale

On clicking the 'Learn about the Vernier Scale' button, you will see the screen shown in Figure 2.

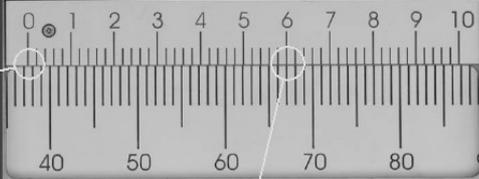
vernier_3b

About the Vernier Scale

A Vernier scale (named after the French mathematician Pierre Vernier (1580–1637)) helps one read a finely divided scale to high precision.

Here is an illustration of a Vernier scale.

The measurement you want is where the zero of the upper scale lines up with the lower - in this example, between 37 and 38 units



The decimal place is found by looking for where the upper and lower scales align - in this case, at 6 on the upper scale.

The full reading of the scale is therefore 37.60 units (Notice that the scale can be read to 0.02 units using the sub-divisions of the upper scale)

[Practice using a Vernier Scale](#) [Return to Start](#)

Figure 2. An explanatory screen shown on clicking 'Learn about the Vernier Scale'

Study this screen carefully, as it contains information on how to read a Vernier scale which you will use in the remaining parts of the ISE.

Once you have studied the material on this screen to your satisfaction, clicking the 'Practice using a Vernier Scale' button takes you to the next screen, where you have the opportunity to set and read a Vernier scale for yourself. Alternatively, you may return to the opening screen by clicking 'Return to start'.

Practice using a Vernier scale

The 'Practice using a Vernier Scale' screen is shown below in Figure 3.

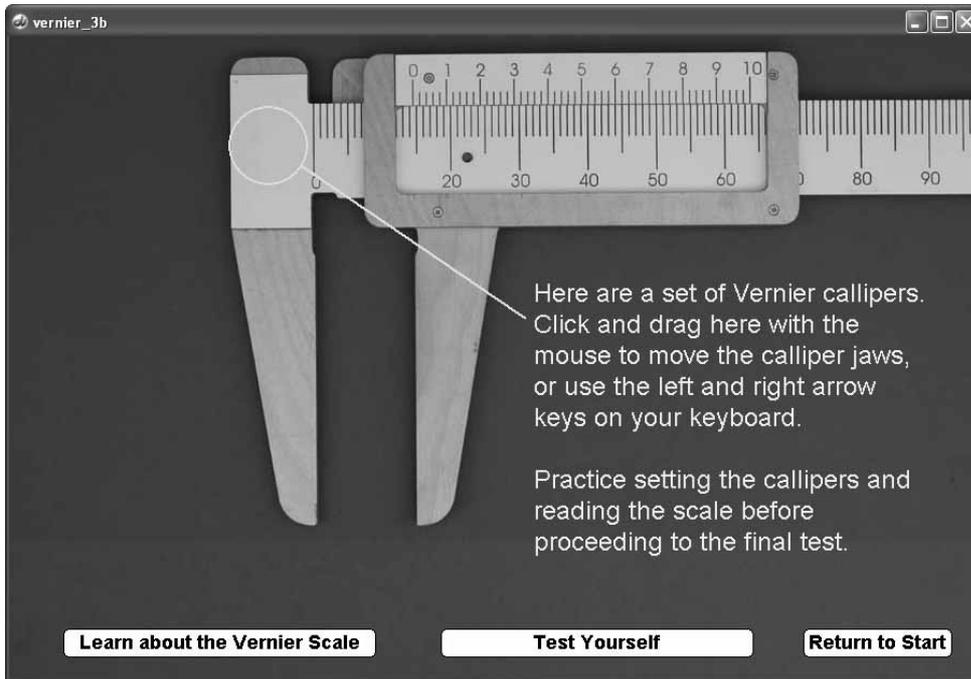


Figure 3. The ISE screen enabling you to practise setting and reading a Vernier scale

Moving the mouse pointer into the region indicated by the circle causes it to change to a 'clenched hand', indicating that you interact with an item on the screen. Move the mouse pointer into the circle, and drag the mouse left and right whilst holding the left mouse button down. You will see the calliper jaws open and close as you move the mouse. Alternatively, you may use the left and right arrow keys to move the calliper. Try setting the callipers to a few positions and read the measurements.

When you are satisfied that you can read the Vernier scale, proceed to the final screen by clicking the 'Test Yourself' button. Alternatively, you may return to any of the previous pages by clicking the appropriate button.

Test yourself

The final screen, shown in Figure 4, enables you to put into practice your learning from the previous screen.

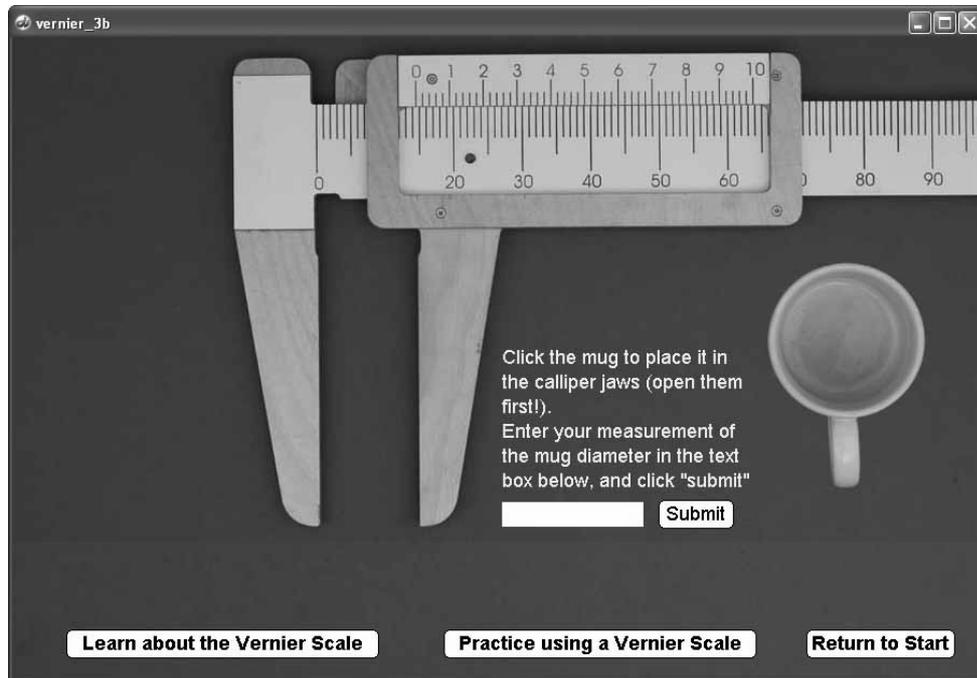


Figure 4. The ISE screen enabling you to test yourself on reading a Vernier scale

In this final part, you will measure the diameter of a given object (a mug). The mug is placed into the calliper jaws simply by clicking on it. Notice that the jaws have to be sufficiently opened before the mug can be inserted. Once the mug is inserted, close the jaws either by dragging or using the left and right arrow keys to close them on the mug. Enter your measurement in the text box, and click 'Submit' to check your result. Notice that, given computer monitor resolution, it can be difficult to read a well-defined value. Don't worry about this – a suitable range of values are accepted as correct. This is consistent with the idea of 'experimental error', where every measurement has some level of uncertainty associated with it.

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