



Exploring wave motion

Apertures and diffraction

The next thing I want to look at is what happens to a water wave when it passes through an aperture. Well, I've fitted an aperture in here but it's rather too wide for what I need at the moment. So if I fit these sliding doors I can make an aperture that's about, well, about 3 centimetres across. And if you now look at the screen, you can see that as the waves pass through the aperture, they spread out. This spreading out of a wave as it passes through an aperture is known as diffraction and it's a property of all types of waves. So, what do you think controls how much the wave spreads out? Well, one possibility is the width of the aperture. And what do you think would happen if I made the aperture smaller? Well, you might be surprised to learn that a narrower aperture leads to more spreading out of the wave, more diffraction. If instead, I make the aperture wider, then after it's settled down you can see that the wave becomes less spread out, the diffraction is less pronounced. And if I were to make the aperture very wide indeed, then there'd be hardly any diffraction. Well, I'm now going to return the aperture to its original width and take a look at the effect of changing the wavelength of the wave. Now, remember I can change the wavelength by altering the frequency of the paddle, using this control here. If I make the wavelength longer, you can see that the waves become more spread out beyond the aperture, more diffraction. And if I make the wavelength smaller again, here's where we started, then even shorter wavelength, there's less diffraction. So here are the two separate factors that affect the diffraction of a wave passing through an aperture. The wave spreads out more if the aperture is made narrower or if the wavelength of the wave is increased. And conversely, it spreads out less with a wider aperture or a shorter wavelength. In fact, all kinds of wave, not just water waves, exhibit diffraction at an aperture, as long as the aperture's not too big.