The analogy with the bicycle can be extended here. Supposing the rear wheel diameter of the bicycle was variable. On first pushing the bike the rear wheel is very large and the rear valve position lags a long way behind the front valve position. As more distance is covered the rear wheel diameter is gradually reduced until when equal to the front wheel the diameter is held. The valves are now in step (but not necessarily pointing in the same direction) for some distance and then suddenly the rear wheel shrinks in diameter, the rear value goes round quicker with respect to the front valve and therefore starts to increase its lead in position..

The horizontal portion of the phase response will not coincide with 0° in practice, but has been drawn at 0° for clarity. Similarly when the rear valve of the bike is in phase with the front valve although they are rotating at the same speed the valves do not necessarily point in the same direction at any instant in each wheel revolution.

There is a mathematical relationship between amplitude response and phase response for electrical networks. This can be used to test the quality of a drive unit since the amplitude response can be simultated by an electrical filter. If the test is successful the drive unit is termed "minimum phase" The test comprises examing the amplitude response for small deviations i.e. maxima, minima and points of inflection (maximum rate of change of amplitude) and comparing these deviations with the phase response. Every amplitude maxima or minima should correspond to a point of inflexion in the phase response and vice versa.

Most well designed drive units exhibit minimum phase characteristics over their respective pass bands. An important property of a minimum phase drive unit is that if an electrical filter is placed in the signal path to equalise the amplitude response (measured anechoically) then corresponding equalisation and improvement to the phase response will ensue. Equalisation of course refers to any electrical network including graphic equalisers and parametric equalisers. Therefore aberrations in amplitude for minimum phase systems can be corrected by graphic equalisers provided the system response is separated from the room response.

So far we have examined drive units individually for phase and found them to be classical if well designed. But to make a loudspeaker system we need to combine the acoustic output from two or more drive units to cover the whole audio band. In addition we must ensure that to an observer or listener the acoustic radiation appears to come from one source without wildly characteristic identifications giving any clues that a multiple source is present.

In the analogy with the bicycle we find that we don't really like riding it too much as the saddle position seems to go up and down a lot - although there is a good bit on the journey where the wheel diameter stays constant. Notice that even in this increasingly tenuous analogy the amplitude of the rear wheel diameter and the phase of the rear tyre valve with respect to the front valve are inextricably linked. Amplitude and phase go together.

In order to combine drive units successfully the exact nature of sound radiation from a drive unit should be examined. For example : Where does the sound appear to be generated? What are the consequences of the speed of sound in air with respect to the phase of the components making up the overall sound image? Why do some two way speakers sound better when lying on the floor?