UNSW THE UNIVERSITY OF NEW SOUTH WALES EDUCATIONAL ASSESSMENT AUSTRALIA

# THREE-D CUBES

## A GUIDE TO THREE DIMENSIONAL DIAGRAMS

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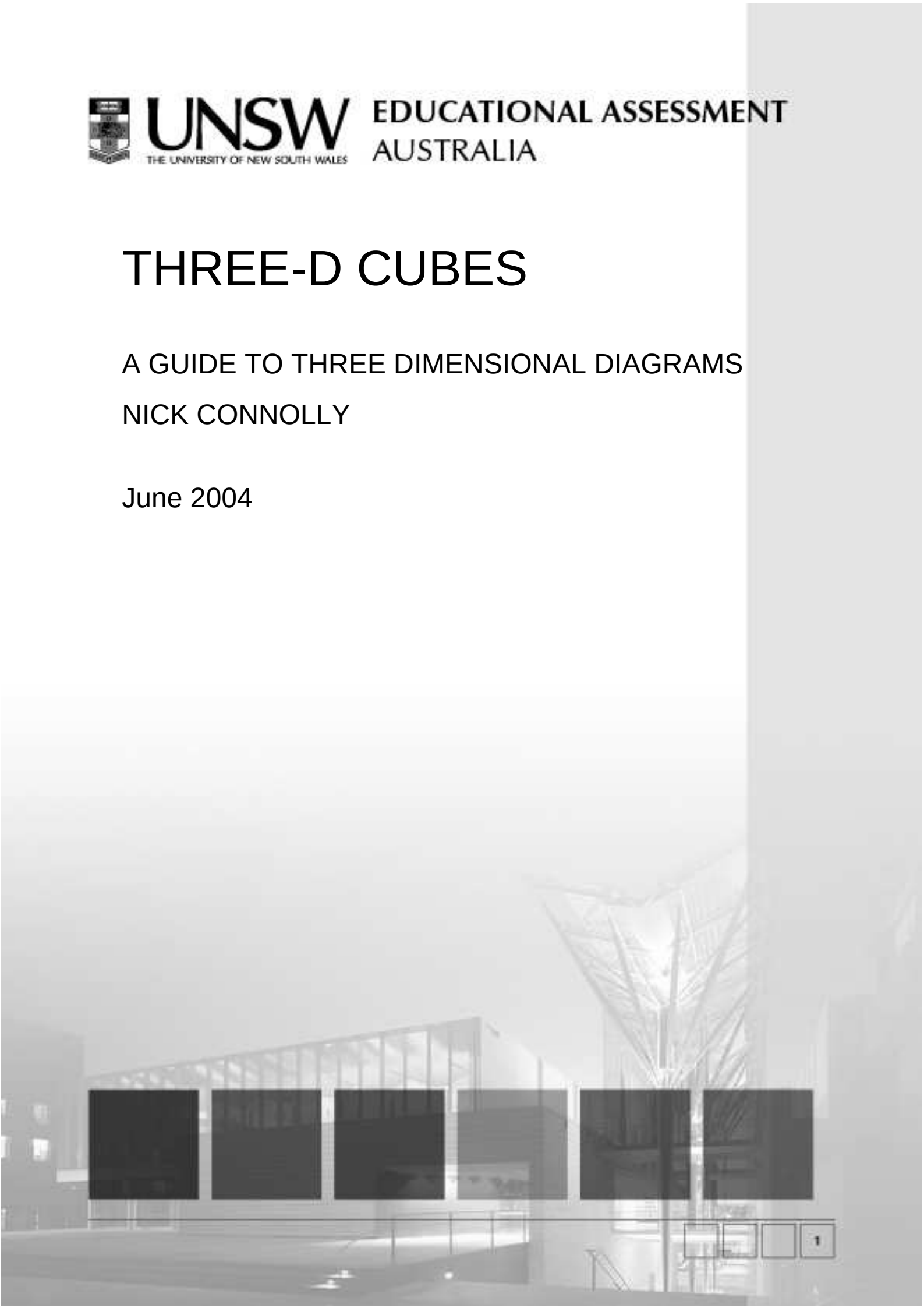
June 2004



# Content

# 3-Dimensional Diagrams

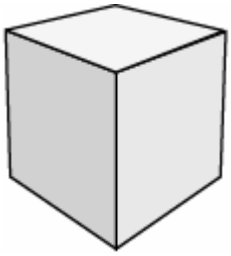
Nick Connolly June 2004

In the course of our tests we frequently produce diagrams of three dimensional objects. There seems to be a degree of confusion as to how we represent three dimensional objects as well as a great deal of inconsistency. This is further exacerbated by confusion not only amongst us but amongst the DTP staff as well.
There may well be a good argument for retaining a variety of different styles of representation in our papers. In some cases syllabus documents dictate the use of particular styles. Isometric drawings (particularly on isometric dots) are often included in curriculum documents (notable in ACT).
I have tried to compile a basic guide. This is far from authoritative and I have tried to cut down the number of terms used (e.g. dimetric, anoxometric, planometric etc are not mentioned.)

## *Basic Diagram Types*

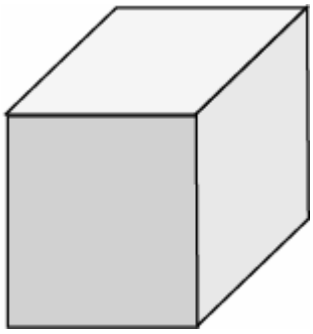
Our tests include three basic types of diagrams of three-dimensional objects.

### Perspective



Perspective drawings are based on how we perceive three dimensional objects. A photographic representation of an object will be perspective. Most significantly the distance from the observer effects lengths.
Perspective drawings are the most realistic but distort angles and lengths.

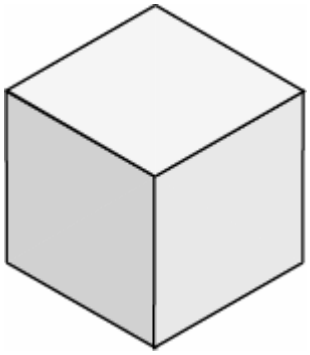
### Oblique



Oblique drawings are one of the most common forms of diagrams and the simplest to draw.
In an oblique drawing one face is drawn as if two-dimensional, so the front face of a cube would be drawn as a square. Lines are then drawn from the vertices to create an illusion of depth. Typically these ‘oblique’ lines are drawn at either 45 or 30 degrees.
Oblique drawings are the least realistic but preserve angles and lengths on face.

### Isometric

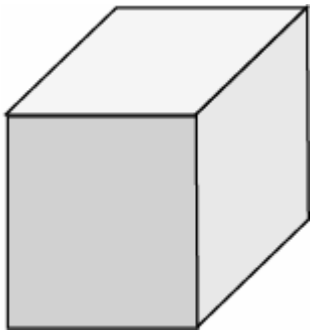


Isometric drawings create an illusion of depth by using lines set at multiples of 60 degrees. Right angles become 60 or 120 degrees. Squares become rhombuses.
The lines that are parallel in the real three-dimensional object remain parallel in the isometric drawing.

## *Oblique Diagram Types*

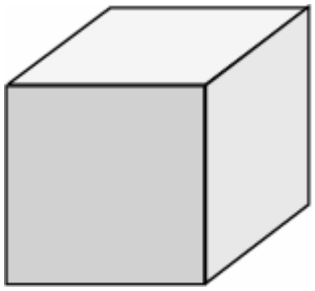
Typically come in two types with a gradual variation between them. The difference depends on the angle the oblique lines are set.

### Oblique lines at 45 degrees



Any higher than 45 and the shape will look oddly distorted rather than three-dimensional.

### Oblique at 30 degree

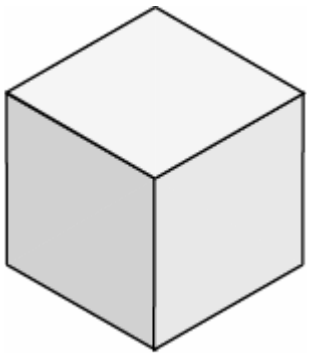


Smaller angles than 30 may make the shape seem less three-dimensional.

## *Isometric Diagram Types*

Technically only one kind of drawing is an isometric drawing.
Isometric drawings are based on grids of equilateral triangles. In schools these grids are commonly presented as triangular dotty paper.

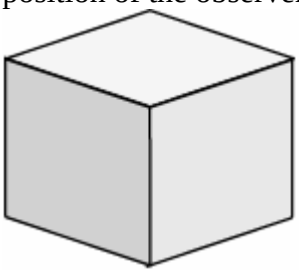
### Standard 60 degree diagram



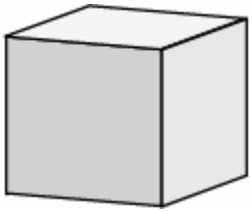
This form is easy to reproduce on an appropriate grid. It is also used in some computer games. Unfortunately the isometric view is prone to optical illusion effects. They can be perceived in two contradictory ways and can seem to flip in and out. This effect can be disturbing or distracting.

### Variations

The isometric view is a specific instance of a whole range of view points. By changing the notional position of the observer different drawings can be produced.



The picture above has ‘lower’ view point as if the observer has brought their eye-level closer to the top of the box.



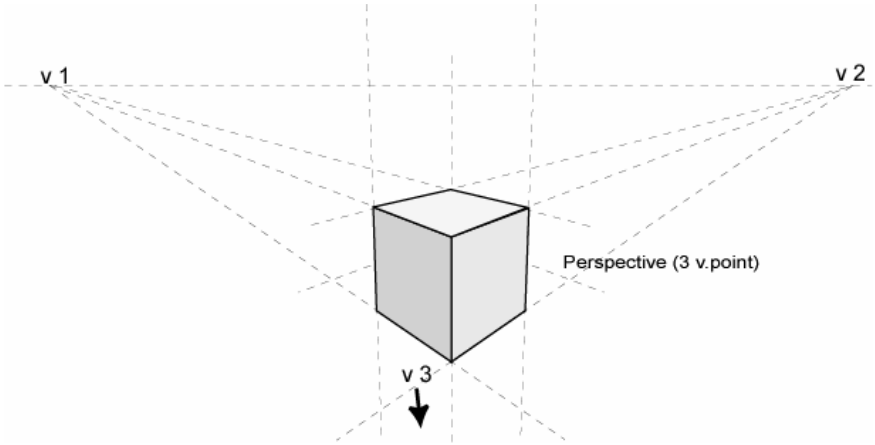
The picture above has both a ‘lower’ viewpoint but the observer is looking more directly at a particular face. This viewpoint is a good compromise with an oblique view.

## *Perspective Diagram Types*

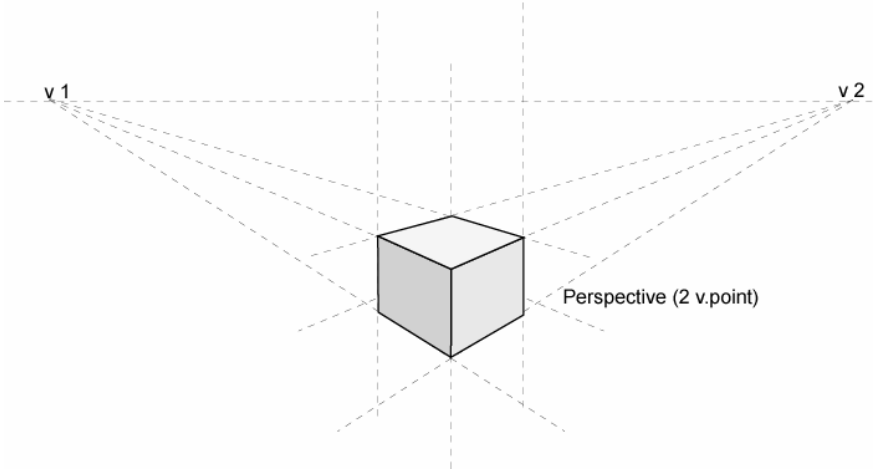
Perspective drawings use vanishing points to create an illusion of depth. They come in three different degrees of realism.

### 3-vanishing points

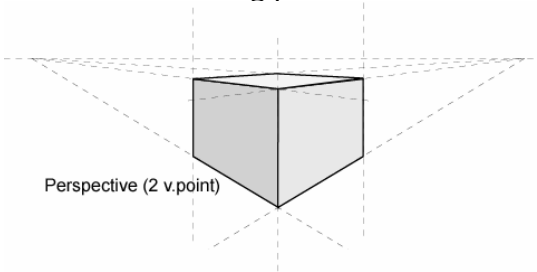



All parallel lines on the object are represented by lines that converge on three vanishing points. Each vanishing point corresponds to the 'infinity' at the end of one of the *x*, *y*, or *z* axis in three-dimensional coordinate system.
The 'further' away the vanishing point the more the lines represent parallel lines. In other words the perspective of a small object, close up, is less pronounced than in a large object the continues off into the distance.

### 2-vanishing points

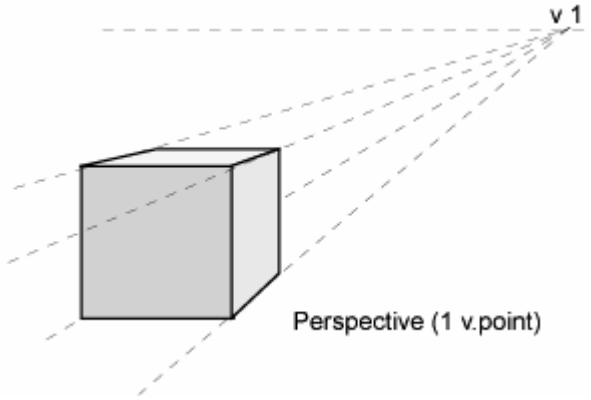



This is the most common type of perspective drawing. Vertical lines remain parallel but other lines move to vanishing points. The three-dimensional effect is quite pronounced but the construction is simpler than with three vanishing points.




The 'height' of the notional observer can be adjusted to produce different perspective views.

## 1-vanishing point




This is a compromise between the oblique view and the perspective view. The ‘front’ face is still drawn as a two-dimensional object but then the edges of the ‘side’ faces are drawn in perspective.