Glossary of Terms

'Do not go gentle into that good night,
Old age should burn and rave at close of day;
Rage, rage against the dying of the light.'

(Dylan Thomas, *Do Not Go Gentle*)

2AFC : see *2 Alternative Forced Choice*.

2 Alternative Forced Choice : an experimental procedure in which the user is presented with a stimulus in one of two intervals and must identify the correct one, guessing if necessary. This overcomes the problems of subject bias found in simple Yes/No type experiments (p. 138).

blind spot : the area of the retina where all of the axons of the retinal ganglion cells meet to form the optic nerve (p. 182).

cones : a class of *photoreceptor cells* responsible for the detection of chromatic light; specialised for daylight conditions (p. 14).

contrast : the difference in light intensity between an object and its immediate surroundings.

contrast grating : a pattern of alternating light and dark bars generated by varying *contrast* sinusoidally across the display. Used to measure a subject's *contrast sensitivity* (p. 53).

contrast sensitivity : a measure of an observer's sensitivity to spatial detail in terms of its *contrast*. Defined as the reciprocal of *threshold contrast* (p. 55).

contrast sensitivity function : a curve that records an observer's ability to resolve detail in terms of *contrast* and *spatial frequency* (p. 54).

cortical magnification factor : an equation describing the disproportionate weighting of the *visual cortex* to represent the foveal region of the retina (p. 91).

CSF : see *contrast sensitivity function*.

eccentricity : see *retinal eccentricity*.

field of view : the solid angular subtense which is viewable by the eye.

focus point : the 2D coordinate on the viewport which is used to calculate the *eccentricity* of an object. For example, the point where the user is gazing (p. 120).

forced-choice method : see *2 Alternative Forced Choice*.

Fourier analysis : a method for decomposing any waveform into the series of harmonic frequencies that sum to produce that waveform.

FOV : see *field of view*.

fovea : the point of the retina which is most sensitive to detail (p. 21).

fundamental frequency : the lowest frequency component that exists in a waveform (p. 58).

geons : a theory of object recognition proferred by Biederman (1987) suggesting that recognition is based upon identifying a small number of primitive shapes in an object (p. 45).

Gestalt psychology : a school of visual perception, prevalent earlier this century, believing that overall structure is more important than individual components for form perception (p. 51).

Gestalt principles of organisation : certain stimulus properties that are believed to control the perceptual grouping of objects, e.g. proximity, similarity, closure, and good continuation (p. 51).

global topology : the geometric structure of an entire polygonal model.

grating : see *contrast grating*.

head-mounted display : a display device which is mounted on the user's head and normally incorporates some form of tracking technology so that the user's head orientation and/or position can be ascertained.

highest displayable spatial frequency : the term that we use in this thesis to denote the highest *spatial frequency* that can be produced by a display device; referred to as the symbol ξ (p. 124).

highest visible spatial frequency : the term that we use in this thesis to denote the highest *spatial frequency* that we expect the user to be able to perceive; referred to as the symbol α_{vis} (p. 123).

HMD : see *head-mounted display*.

hyperacuity : term used to descibe the phenomenon that certain stimuli can be perceived which are smaller than the size of a single retinal *photoreceptor cell* (p. 183).

hysteresis : a lag in the transition between different *levels of detail*. Often performed to stop models continuously switching at threshold (p. 29).

image segmentation : a digital image processing technique which attempts to segment an image into a number of individual regions for independent analysis.

inferior retina : the lower half-meridian of the retina.

JND : see *just noticeable difference*.

just noticeable difference : the smallest unit perceptual difference between two colours. The degree to which any two colours are perceived distinct can be expressed as a number of JNDs.

level of detail : a computer graphics technique for optimising performance whereby a number of different models are provided for a single object—each varying in complexity—and the system can select the most appropriate model to use at any juncture.

local topology : the geometric structure surrounding a particular vertex or face of a polygonal model.

LOD : see *level of detail*.

Marching Cubes : an algorithm that creates a polygon model from a *voxel* (volumetric) dataset. Developed by Lorensen and Cline (1987) (p. 42).

modulation transfer function : a measure of a display device's ability to maintain the *contrast* of a signal as a function of its *spatial frequency* (p. 126).

MTF : see *modulation transfer function*.

multichannel model : contemporary model of early vision processing stating that information in a scene is analysed simultaneously at a number of different scales (p. 52).

nasal retina : the half-meridian of the retina located nearest to the nose.

perceptually uniform colour space : a mathematical representation for colour in which the numerical difference between two colours is directly related to their perceptual distance.

photopic : referring to daytime lighting conditions.

photoreceptor cell : the cells in the retina that are responsible for converting incident light energy into neural signals. There are two classes: *rods* and *cones* (p. 14).

polygon simplification : a process that takes an original polygon model and produces another such description, retaining the general shape and appearance of the original, but containing fewer polygons (p. 40).

popping effect : the noticeable flicker that can occur when the graphics system switches between different levels of detail (pp. 12, 50).

predictive scheduler : a system which adjusts the detail of objects, in order to achieve a desired frame rate, based upon the complexity of the scene about to be rendered (p. 33).

psychophysics : the branch of psychology which is concerned with establishing quantitative relations between physical stimulation and perceptual events.

reactive scheduler : a system which adjusts the detail of objects, in order to achieve a desired frame rate, based upon whether the previous frame was rendered before or after the deadline (p. 33).

receptive field : the region immediately surrounding a cell that stimulates that cell if excited (p. 17).

retinal eccentricity : angular deviation from the centre of the retina, often taken as the *fovea* (p. 21).

retinal ganglion cells : the cells in the retina that extract gradients of light from the *photoreceptor cells*. Their outputs form the optic nerve (p. 14).

rods : a class of *photoreceptor cells* responsible for the detection of achromatic light; specialised for dim light conditions (p. 14).

saccade : a rapid movement of the eye which is made in order to fixate a target onto the *fovea* (p. 181).

smallest bounding sphere : the smallest sphere that completely encloses an object and whose centre is coincident with the centre of that object (p. 112).

Snellen fraction : a measure of *visual acuity* that uses a fraction in the form $20/n$ to relate an observer's acuity to that of a normal adult (p. 63).

spatial frequency : a measure of the rate of change of intensity across the retina; often measured in units of cycles per degree, c/deg (p. 53).

spatiotemporal threshold surface : the surface which describes the sensitivity of an observer to stimuli of varying spatial and temporal characteristics (pp. 89, 165).

spherical tessellation : the process of approximating a sphere with a mesh of polygons, usually triangles (p. 113).

staircase method : an adaptive psychophysical procedure which attempts to converge on a signal threshold by selecting new stimuli based upon the observer's previous responses (p. 139).

standard observer : a notional 'average' human for whom we can develop general models of perception that are applicable to most of the population (p. 64).

superior retina : the upper half-meridian of the retina.

temporal retina : the half-meridian of the retina which is located nearest to the temple on the same side of the face.

threshold contrast : the minimum *contrast* required to see a target (p. 55).

topology : see *local topology* and *global topology*.

transition spatial frequency : the term that we use in this thesis to denote the *spatial frequency* threshold when two successive *levels of detail* for an object can be switched between; referred to as the symbol α_{trans} (p. 116).

triangulation : the act of decomposing an arbitrary polygon into triangles.

troland : (td) a measure of light intensity defined as the product of source luminance (cd/m^2) and pupillary diameter squared (mm^2).

unique spatial frequency : the term that we use in this thesis to denote a *spatial frequency* (magnitude and position) that exists in the image of only one of two successive *levels of detail* of an object, i.e. a spatial frequency that differs between successive LODs (p. 108).

VE : see *virtual environment*.

vestibular system : the sensory mechanism in the inner ear that detects head movements and aids balance (p. 5).

view sphere : the bounding sphere around an object whose surface represents all possible viewpoints to that object for a certain distance from the centre of the object (p. 113).

virtual environment : a 3D computer-generated world that is simulated by a *virtual reality* system.

virtual reality : a technology that allows the user to particpate in, and interact with, a 3D computer-generated world.

visual acuity : a measure of the smallest detail which an observer can resolve under ideal illumination conditions (p. 56).

visual cortex : the region of the brain responsible for visual perception (p. 13).

voxel : volume element—the 3D equivalent of a pixel for volumetric datasets. Normally arranged in a fixed regular grid. (p. 43).

VR : see *virtual reality*.

window of visibility : the range of *spatial frequencies* that an observer can see, given sufficient contrast (p. 54).