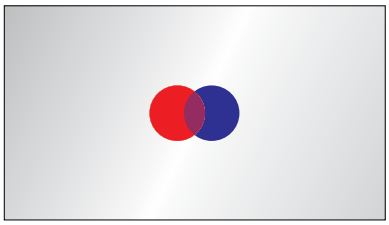
Basic Principles

Placing objects in a 3D space

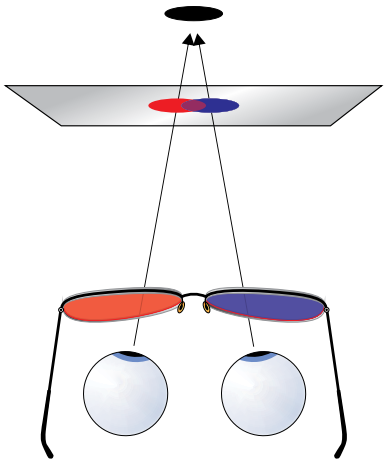
In 3D two images are projected onto the display. By wearing a special pair of glasses the two images are split so that each eye only sees one of the two images. When comparing the left and right eye images, every object in the scene is horizontally displaced by a small amount. The brain assumes these two displaced objects are actually one object, and tries to fuse them together. The only way it can do this is to assume the object is either in front or behind the screen plane. The direction and amount of displacement defines where each object is in the 3D space.

Positive parallax

The object is displaced slightly to the left for the left eye and slightly to the right for the right eye. The brain assumes this is only one object behind the screen.

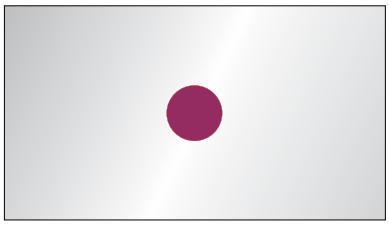


Projected image

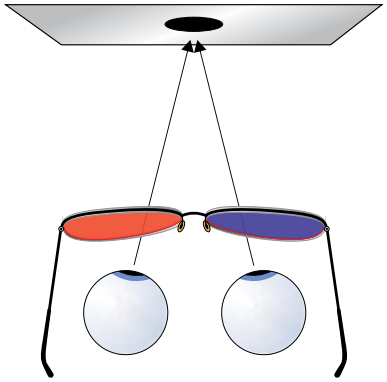


Zero parallax

The object for the left eye and right eye are in the same position on the display. The brain sees this as one object on the screen plane with no 3D diplacement.

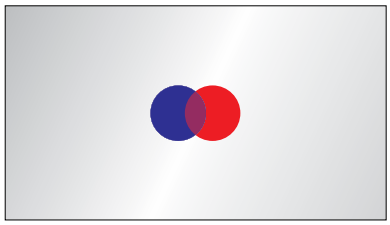


Projected image

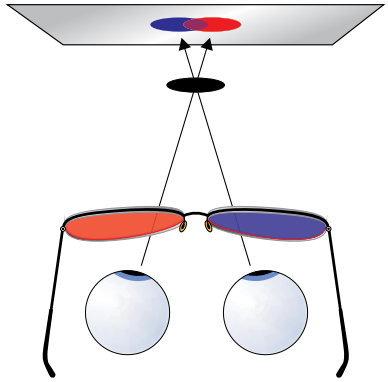


Negative parallax

The object is displaced slightly to the right for the left eye and slightly to the left for the right eye. The brain assumes this is one object in front of the screen.

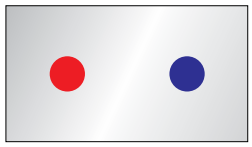


Projected image



Pushing the limits

Film producers, programme makers and games designers will use these basic principles to provide a 3D rich experience to viewers. However it is the stereographers job to moderate the excesses of 3D so that everyone can enjoy 3D movies, games and programmes that both look good and do not push the limits of our ability to see 3D. (See **The Stereographer**.)



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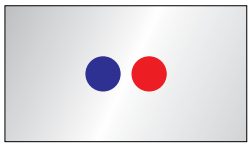
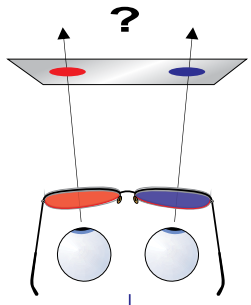
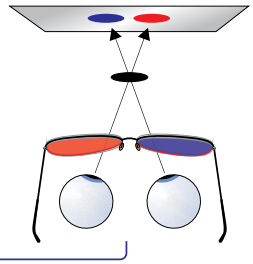


Projected image





Divergence, no matter how small the amount, is unnatural to humans. This will either break the 3D illusion or cause eye strain.

Excessive convergence on the display causes the eyes to converge beyond their normal limit, which either breaks the 3D illusion or causes eye strain.

3D Blindness

It is estimated that about 5% of people cannot see 3D. There are many reason for this, some of them connected with the eyes, and others connected with the brain.

Ophthalmic problems

Problems with the eye include blindness, amblyopia (lazy eye), optic nerve hypoplasia (underdeveloped eye), strabismus (squint eye). Anyone with total blindness in one eye cannot see 3D. However such people are able to estimate depth by using any combination of the first six depth cues, which do not require two eyes. Those with lazy, underdeveloped or squint eye will subconsciously compensate by using these depth cues. (See **Depth Cues**.)

Cerebral problems

Tests have shown that our ability to calculate and distinguish 3D information in what we see around us is constructed in our brains in the first few months of our lives. Some people with ophthalmic problems in early infancy may never be able to see 3D, even if the ophthalmic problem itself is cured in later life. In some milder cases, careful practice will allow such people to see 3D movies and video. In severe cases those people may never be able to understand 3D moves and video.