DOWNLOAD PDF STEREOSCOPE IN OPHTHALMOLOGY

Chapter 1 : Stereoscopy - Wikipedia

The familiar Brewster stereoscope consists of a rigid tubular type of viewing head that covers the eyes and much of the face. This viewing head contains a pair of lenses that are usually decentered outward so as to permit inspection of a pair of large stereoscope pictures, each 3 by 3 inches (by cm.), which are pasted on a single card.

FOIA Stereo imaging in ophthalmology is an important diagnostic modality. Origins of retinal stereo imaging date back to over years ago. Stereo retinal photography and angiography facilitate the diagnostic process by clearly defining retinal structure and elevation. Stereo imagery has been around for a long time. Long before the resurgence in modern 3D cinema attractions and 3D enabled televisions. The first attempt at reproducing a stereo image was undertaken by Sir Charles Wheatstone in Wheatstone designed the mirror stereoscope and presented his work on binocular vision to the Royal Society1. Viewing stereo photographs became a popular parlour pastime in Victorian England after Brewster introduced his lenticular stereoscope at the Great Exhibition of From this date on, photographers from all over the World produced thousands upon thousands of stereo photographs, mainly of cityscapes and of urban life. By the turn of the 20th Century, rapid progress in retinal photography had been made. Commercially available retinal cameras were being produced and so it was only a matter of time before retinal stereo photography was performed. The first published retinal stereo photographs were taken in by W Thorner2. The process for all stereoscopic photography involves exposing two photographs from slightly different viewpoints of the same subject and then presenting these right and left images to the right and left eyes of the observer by means of a stereo viewer. The observer fuses the images together to recreate a sense of depth in one single image. In simultaneous stereo photography, 2 lenses are used to capture the right and left images during the same exposure. And today camera manufacturers have developed compact digital stereo cameras. In sequential stereo photography, one single lens is used to capture the left image and the camera is moved laterally to the right to take the right image. The distance between the 2 lenses used in simultaneous photography is typically 64mm. The distance required to move the camera laterally in sequential stereo photography is typically 64mm. This distance is known as the stereo base. This distance of 64mm is typically the distance between both pupils. Fundus photography is a unique exception to the rule of using the 64mm distance for the stereo base because it incorporates the optical properties of the subject eye into the stereo and parallax equation. At a working distance of about 60mm from the front element of the retinal camera to the subject eye, a lateral movement of only mm is required to create a stereo effect. During the lateral shift of mm the image-forming rays fall on opposite slopes of the cornea, increasing parallax and creating a hyper-stereoscopic effect. Cornea-induced parallax, as described by Lee Allen in , negates the use of the 64mm stereo base distance. Most retinal cameras are capable of producing sequential stereo images. The camera begins in the same position used for single fundus photography. It is shifted, first to the left and then the mm to the right. Most software applications that run ophthalmic digital imaging systems will have the ability to tag and format photographs taken in stereo. We routinely take stereo images on all our patients, particularly during fluorescein and ICG angiography. Once the images are saved the software will allow you to view the stereo pair. The right and left images are presented on the viewing monitor. A pair of viewing glasses should be used to merge the two images together see image above. Some software will allow you to convert the side by side pair into a single anaglyph image. The anaglyph is a variation in the presentation and viewing of stereo images that uses two monochromatic images in complementary colours. The unaided eye perceives two overlapping images. With an appropriate set of viewing filters, the right and left images are separated. Also, when presenting stereo images in a presentation to a large audience, the use of anaglyph images facilitates this imaging modality. Contributions to the Physiology of Vision â€" Part the First. Die stereoskopische photographie des augenhintesgrundes. KIM Monatsbl Augenheilkd ; Am J Ophthalmol ;

Chapter 2 : Earthquake Captured in 3-D Stereographs - American Academy of Ophthalmology

The Stereoscope in Ophthalmology, With Especial Reference to the Treatment of Heterophoria and Heterotropia Designed to Accompany the Phoro-Optometer Stereoscope and the Wells Selection of Stereoscopic Charts by David Washburn Wells.

Distinctions[edit] Coarse and fine stereopsis[edit] There are two distinct aspects to stereopsis: Coarse stereopsis also called gross stereopsis appears to be used to judge stereoscopic motion in the periphery. Fine stereopsis is mainly based on static differences. It is typically measured in random-dot tests; persons having coarse but no fine stereopsis are often unable to perform on random-dot tests, also due to visual crowding [5] which is based on interaction effects from adjacent visual contours. Fine stereopsis is important for fine-motor tasks such as threading a needle. The stereopsis which an individual can achieve is limited by the level of visual acuity of the poorer eye. In particular, patients who have comparatively lower visual acuity tend to need relatively larger spatial frequencies to be present in the input images, else they cannot achieve stereopsis. There are indications that in the course of the development of the visual system in infants , coarse stereopsis may develop before fine stereopsis and that coarse stereopsis guides the vergence movements which are needed in order for fine stereopsis to develop in a subsequent stage. One study shows that Professional activity may involve operating stereoscopic instruments such as a binocular microscope. While some of these tasks may profit from compensation of the visual system by means of other depth cues, there are some roles for which stereopsis is imperative. Occupations requiring the precise judgment of distance sometimes include a requirement to demonstrate some level of stereopsis; in particular, there is such a requirement for airplane pilots even if the first pilot to fly around the world alone, Wiley Post , accomplished his feat with monocular vision only. Many persons lacking stereopsis have or have had visible strabismus , which is known to have a potential socioeconomic impact on children and adults. In particular, both large-angle and small-angle strabismus can negatively affect self-esteem , as it interferes with normal eye contact , often causing embarrassment, anger, and feelings of awkwardness. It has been noted that with the growing introduction of 3D display technology in entertainment and in medical and scientific imaging, high quality binocular vision including stereopsis may become a key capability for success in modern society. History of investigations into stereopsis[edit] Objects at different distances from the eyes project images in the two eyes that differ in their horizontal positions, giving the depth cue of horizontal disparity, also known as retinal disparity and as binocular disparity. Wheatstone showed that this was an effective depth cue by creating the illusion of depth from flat pictures that differed only in horizontal disparity. To display his pictures separately to the two eyes, Wheatstone invented the stereoscope. Leonardo da Vinci had also realized that objects at different distances from the eyes project images in the two eyes that differ in their horizontal positions, but had concluded only that this made it impossible for a painter to portray a realistic depiction of the depth in a scene from a single canvas. Had he chosen any other near object, he might have discovered horizontal disparity of its features. Stereoscopy became popular during Victorian times with the invention of the prism stereoscope by David Brewster. This, combined with photography , meant that tens of thousands of stereograms were produced. Until about the s, research into stereopsis was dedicated to exploring its limits and its relationship to singleness of vision. In the s, Bela Julesz invented random-dot stereograms. No recognizable objects could be seen in either half image. The two half images of a random-dot stereogram were essentially identical, except that one had a square area of dots shifted horizontally by one or two dot diameters, giving horizontal disparity. The gap left by the shifting was filled in with new random dots, hiding the shifted square. Nevertheless, when the two half images were viewed one to each eye, the square area was almost immediately visible by being closer or farther than the background. Julesz whimsically called the square a Cyclopean image after the mythical Cyclops who had only one eye. This was because it was as though we have a cyclopean eye inside our brains that can see cyclopean stimuli hidden to each of our actual eyes. Random-dot stereograms highlighted a problem for stereopsis, the correspondence problem. This is that any dot in one half image can realistically be paired with many same-coloured dots in the other half image. Our visual systems clearly solve the correspondence problem, in that we see the intended depth instead of a fog of false matches. Research began to understand how. Also in the s, Horace Barlow , Colin Blakemore , and Jack Pettigrew found neurons in the cat visual cortex that had their receptive fields in different horizontal positions in the two eyes. Their findings were disputed by David Hubel and Torsten Wiesel , although they eventually conceded when they found similar neurons in the monkey visual cortex. In Antonio Medina Puerta demonstrated with photographs that retinal images with no parallax disparity but with different shadows are fused stereoscopically, imparting depth perception to the imaged scene. He named the phenomenon "shadow stereopsis". Shadows are therefore an important, stereoscopic cue for depth perception. He showed how effective the phenomenon is by taking two photographs of the Moon at different times, and therefore with different shadows, making the Moon to appear in 3D stereoscopically, despite the absence of any other stereoscopic cue. This has led to various crazes for stereopsis, usually prompted by new sorts of stereoscopes. In Victorian times it was the prism stereoscope allowing stereo photographs to be viewed , while in the s it was red-green glasses allowing stereo movies to be viewed. In the concept of the prism stereoscope was reworked into the technologically more complex View-Master , which remains in production today. In the s polarizing glasses allowed stereopsis of coloured movies. In the s Magic Eye pictures autostereograms - which did not require a stereoscope, but relied on viewers using a form of free fusion so that each eye views different images - were introduced. Geometrical basis[edit] Stereopsis appears to be processed in the visual cortex of mammals in binocular cells having receptive fields in different horizontal positions in the two eyes. Such a cell is active only when its preferred stimulus is in the correct position in the left eye and in the correct position in the right eye, making it a disparity detector. When a person stares at an object, the two eyes converge so that the object appears at the center of the retina in both eyes. Other objects around the main object appear shifted in relation to the main object. The two eyes converge on the object of attention. The brain gives each point in the Cyclopean image a depth value, represented here by a grayscale depth map. Because each eye is in a different horizontal position, each has a slightly different perspective on a scene yielding different retinal images. Normally two images are not observed, but rather a single view of the scene, a phenomenon known as singleness of vision. Nevertheless, stereopsis is possible with double vision. This form of stereopsis was called qualitative stereopsis by Kenneth Ogle. There is a hysteresis effect associated with stereopsis. In the vertical direction, there is a similar but smaller effect. Computer stereo vision Computer stereo vision is a part of the field of computer vision. It is sometimes used in mobile robotics to detect obstacles. Example applications include the ExoMars Rover and surgical robotics. A computer compares the images while shifting the two images together over top of each other to find the parts that match. The shifted amount is called the disparity. The disparity at which objects in the image best match is used by the computer to calculate their distance. For a human, the eyes change their angle according to the distance to the observed object. To a computer this represents significant extra complexity in the geometrical calculations epipolar geometry. In fact the simplest geometrical case is when the camera image planes are on the same plane. The images may alternatively be converted by reprojection through a linear transformation to be on the same image plane. This is called image rectification. Computer stereo vision with many cameras under fixed lighting is called structure from motion. Techniques using a fixed camera and known lighting are called photometric stereo techniques, or " shape from shading ". Computer stereo display[edit] Many attempts have been made to reproduce human stereo vision on rapidly changing computer displays, and toward this end numerous patents relating to 3D television and cinema have been filed in the USPTO. At least in the US, commercial activity involving those patents has been confined exclusively to the grantees and licensees of the patent holders, whose interests tend to last for twenty years from the time of filing. Discounting 3D television and cinema which generally require more than one digital projector whose moving images are mechanically coupled, in the case of IMAX 3D cinema , several stereoscopic LCDs are going to be offered by Sharp , which has already started shipping a notebook with a built in stereoscopic LCD. Although older technology required the user to don goggles or visors for viewing computer-generated images, or CGI, newer technology tends to employ Fresnel lenses or plates over the liquid crystal displays, freeing the user from the need to put on special glasses or goggles. Stereopsis tests[edit] In stereopsis tests short: This can be achieved by means of vectographs visible with polarized glasses , anaglyphs visible with red-green glasses , lenticular lenses visible with the naked eye , or head-mounted display technology. The type of changes from one eye to the other may differ depending on which level of stereoacuity is to be detected. A series of stereotests for selected levels thus constitutes a test of stereoacuity. There are two types of common clinical tests for stereopsis and stereoacuity: Random-dot stereopsis tests use pictures of stereo figures that are embedded in a background of random dots. Contour stereotests use pictures in which the targets presented to each eye are separated horizontally. Without stereopsis, the image looks only like a field of random dots, but the shapes become discernible with increasing stereopsis, and generally consists of a cat indicating that there is ability of stereopsis of seconds of arc of retinal disparity , a star seconds of arc and a car seconds of arc. The patient uses a 3-D glasses to look at the picture and determine whether a 3-D figure can be seen. The amount of disparity in images vary, such as sec of arc, and sec arc. Stereoblindness and Stereopsis recovery Deficiency in stereopsis can be complete then called stereoblindness or more or less impaired. Causes include blindness in one eye, amblyopia and strabismus. Vision therapy is one of the treatments for people lacking in stereopsis. Vision therapy will allow individuals to enhance their vision through several exercises such as by strengthening and improving eye movement. It occurs in many mammals, birds, reptiles, amphibia, fish, crustaceans, spiders, and insects.

Chapter 3 : Advancements in Surgical Microscopes

Note: Citations are based on reference standards. However, formatting rules can vary widely between applications and fields of interest or study. The specific requirements or preferences of your reviewing publisher, classroom teacher, institution or organization should be applied.

Advancements in Surgical Microscopes After decades of not much change, microscopes are beginning to change the way surgeons operate. Ophthalmic surgical microscopes continue to evolve, and the latest advances help them seamlessly integrate with other equipment. He notes that there were few advancements for about 30 years, but then surgery changed and demanded more of the microscopes than they were capable of. Microscopes went from large, heavy, ceiling-mounted scopes and those of us who used them still have the scalp bruises to prove it to smaller and lighter scopes mounted on a moveable base. However, ergonomics is still an area that needs improvement. Eric Donnenfeld, MD, of Ophthalmic Consultants of Long Island, says one of the major upgrades that is already available in some microscopes is integrating the microscope into the surgical procedure. Here are some of the latest advances. TrueVision enables the surgeon to operate in a heads-up manner by viewing a large screen instead of traditional microscope oculars. Images courtesy Eric Donnenfeld, MD. It also provides premium visualization and detail recognition and contrast, along with penetrating depth of focus. OPMI Lumera This ophthalmic surgical microscope from Zeiss features Stereo Coaxial Illumination technology, which makes even fine anatomical details clearly visible. The red reflex is high in contrast and stable. For retinal surgeons, the OPMI Lumera and Resight fundus viewing system allow recognition of every detail of the retina. The microscope can be configured with Invertertube E, which facilitates an upright, ergonomic posture as well as rapid changeover from cataract to case surgery. A fully integrated HD video recording system includes a p HD video recorder, which can be operated by the foot control panel or handgrip of the microscope head. This microscope works seamlessly with the Callisto eye-assistance system. The Callisto Eye and Integrated Data Injection System allows surgeons to view visual assistance functions, such as incision and rhexis assistant and the toric intraocular lenses alignment feature Z Align, which are displayed directly into the eyepiece of the microscope. It also includes an integrated assistant microscope that works with no light loss for the main surgeon. It features a zoom function that can work with the main surgical microscope or independently. Eye tracking on the Zeiss Callisto enables the templates to follow the movement of the eye. Richard Hoffman, MD, also uses the Lumera. For instance, the Callisto system can be added onto your operating microscope. Because the microscope has that information in it, your limbal relaxing incisions can be placed exactly where you want them, and the toric IOLs can be aligned exactly where you want them. In the future, I think these microscopes are going to have wavefront aberrometry built into them as well. He is also in private practice at Drs. The Hi-R NEO is designed for use in ophthalmology, and it delivers advanced red reflex and offers stereoscopic co-observation. The patented capture method acquires data samples that include position data. This can allow accurate reassessment of the same specular data sample areas to trend cellular statistics over time. M and M Microscopes Leica Microsystems has several ophthalmic surgical microscopes to choose from. They feature a low-light concept, with direct halogen illumination and high-intensity transmission optics, which provide the necessary contrast ratio for retina procedures. The coaxial double-beam stereo illumination and OttoFlex II provide a stable red reflex, even in patients who have anatomical conditions that make this difficult, such as small pupils. These microscopes are modular and expandable. The M is especially helpful for posterior and high-end anterior segment surgery. When this microscope is combined with the APO OptiChrome optics and direct halogen illumination, it offers optimal clarity, contrast and sharp, true anatomical color images at safer low-light levels. The M is a surgical microscope with enhanced red reflex, which enables precise and efficient cataract surgery. It achieves this with a unique illumination system that combines LED and halogen. It has an ergonomic design for intuitive control of the system. It also offers high-definition video, open architecture for easy integration of vitreoretinal accessories, and interchangeable floor stands. TrueVision This is a stereoscopic high-definition visualization system for refractive cataract, glaucoma, and retinal procedures that displays the surgical field of view in real time on a 3D flat-panel display in the OR. It enables the surgeon to operate in a heads-up manner by viewing a large screen instead of traditional microscope oculars. One of the nice things about these new 3-D microscopes is that they provide an incredible increase in depth of field so that you can judge depth in the eye more accurately and the distance between your phaco needle and the posterior capsule. Not only does it allow visualization during surgery, but it allows everyone in the operating room to have the same view as the surgeon for the first time. It provides a wonderful teaching tool in the OR as well as at meetings. Miller, the resolution and the visual quality of this system have come along in the last few years. Miller believes that all microscopes will be digital in the future, because they provide capabilities that cannot be duplicated by optical microscopes. The BIOM 5 is aligned coaxially with the operating microscope while observing the vitreous and the fundus. During the extraocular parts of the surgery, it can be moved out of the way of the observation beam while the inverting action of the SDI is neutralized. The BIOM 5c has electronic focus, and, when used with the SDI 4c, it offers the convenience of electronic foot pedal focusing and intelligent and automatic image inversion. This microscope streamlines all surgical workflow and maximizes surgical efficiency. Key features include the following: The Future According to Uday Devgan, MD, the next step is integrating biometry equipment into the actual microscope, such as aberrometers, keratometers, and more. The eye in its aphakic state would be measured, and then the appropriate IOL power would be determined on the spot. He notes that one challenge to improving the technology is the cost. If they want a specific refractive outcome, that falls under refractive surgery and services. When patients are willing to pay out of pocket to have a precise refractive outcome, we can use these new technologies to provide the very best vision. Kershner has no financial interest in any of the products mentioned in this article. Donnenfeld is a consultant to Alcon, TrueVision and Zeiss. Miller is a consultant to Alcon. Hoffman is a consultant to Zeiss.

Chapter 4 : Ophthalmologist - Medipark

Excerpt from The Stereoscope in Ophthalmology, With Especial Reference to the Treatment of Heterophoria and Heterotropia: Designed to Accompany the Phoro-Optometer Stereoscope and the Wells Selection of Stereoscopic Charts The ortho'ptic treatment of heterotropia is not always successful.

Pulfrich effect The Pulfrich effect is based on the phenomenon of the human eye processing images more slowly when there is less light, as when looking through a dark lens. Because the Pulfrich effect depends on motion in a particular direction to instigate the illusion of depth, it is not useful as a general stereoscopic technique. For example, it cannot be used to show a stationary object apparently extending into or out of the screen; similarly, objects moving vertically will not be seen as moving in depth. Incidental movement of objects will create spurious artifacts, and these incidental effects will be seen as artificial depth not related to actual depth in the scene. The most common one with mirrors is the View Magic. Another with prismatic glasses is the KMQ viewer. Autostereoscopic display technologies use optical components in the display, rather than worn by the user, to enable each eye to see a different image. Because headgear is not required, it is also called "glasses-free 3D". Automultiscopic displays provide multiple views of the same scene, rather than just two. Each view is visible from a different range of positions in front of the display. This allows the viewer to move left-right in front of the display and see the correct view from any position. The technology includes two broad classes of displays: Examples of autostereoscopic displays technology include lenticular lens , parallax barrier , volumetric display , holography and light field displays. Holography and Computer-generated holography Laser holography, in its original "pure" form of the photographic transmission hologram, is the only technology yet created which can reproduce an object or scene with such complete realism that the reproduction is visually indistinguishable from the original, given the original lighting conditions. The eye differentially focuses objects at different distances and subject detail is preserved down to the microscopic level. The effect is exactly like looking through a window. Unfortunately, this "pure" form requires the subject to be laser-lit and completely motionlessâ€”to within a minor fraction of the wavelength of lightâ€"during the photographic exposure, and laser light must be used to properly view the results. Most people have never seen a laser-lit transmission hologram. The types of holograms commonly encountered have seriously compromised image quality so that ordinary white light can be used for viewing, and non-holographic intermediate imaging processes are almost always resorted to, as an alternative to using powerful and hazardous pulsed lasers, when living subjects are photographed. Although the original photographic processes have proven impractical for general use, the combination of computer-generated holograms CGH and optoelectronic holographic displays, both under development for many years, has the potential to transform the half-century-old pipe dream of holographic 3D television into a reality; so far, however, the large amount of calculation required to generate just one detailed hologram, and the huge bandwidth required to transmit a stream of them, have confined this technology to the research laboratory. In , a Silicon Valley company, LEIA Inc , started manufacturing holographic displays well suited for mobile devices watches, smartphones or tablets using a multi-directional backlight and allowing a wide full- parallax angle view to see 3D content without the need of glasses. Volumetric display and Bubblegram Volumetric displays use some physical mechanism to display points of light within a volume. Such displays use voxels instead of pixels. Volumetric displays include multiplanar displays, which have multiple display planes stacked up, and rotating panel displays, where a rotating panel sweeps out a volume. Other technologies have been developed to project light dots in the air above a device. An infrared laser is focused on the destination in space, generating a small bubble of plasma which emits visible light. Integral imaging Integral imaging is a technique for producing 3D displays which are both autostereoscopic and multiscopic , meaning that the 3D image is viewed without the use of special glasses and different aspects are seen when it is viewed from positions that differ either horizontally or vertically. Wiggle stereoscopy and Kinetic depth effect Wiggle stereoscopy is an image display technique achieved by quickly alternating display of left and right sides of a stereogram. Found in animated GIF format on the web. Online examples are visible in the New-York Public

Library stereogram collection. The technique is also known as "Piku-Piku". Stereo photography techniques For general purpose stereo photography, where the goal is to duplicate natural human vision and give a visual impression as close as possible to actually being there, the correct baseline distance between where the right and left images are taken would be the same as the distance between the eyes. This could be described as "ortho stereo. The factors to consider include the viewing method to be used and the goal in taking the picture. The concept of baseline also applies to other branches of stereography, such as stereo drawings and computer generated stereo images, but it involves the point of view chosen rather than actual physical separation of cameras or lenses. Stereo window[edit] The concept of the stereo window is always important, since the window is the stereoscopic image of the external boundaries of left and right views constituting the stereoscopic image. If any object, which is cut off by lateral sides of the window, is placed in front of it, an effect results that is unnatural and is undesirable, this is called a "window violation". This can best be understood by returning to the analogy of an actual physical window. Therefore, there is a contradiction between two different depth cues: So that the stereo window must always be adjusted to avoid window violations. But these objects can not be seen as too close, since there is always a limit of the parallax range for comfortable viewing. If a scene is viewed through a window the entire scene would normally be behind the window, if the scene is distant, it would be some distance behind the window, if it is nearby, it would appear to be just beyond the window. An object smaller than the window itself could even go through the window and appear partially or completely in front of it. The same applies to a part of a larger object that is smaller than the window. The goal of setting the stereo window is to duplicate this effect. Therefore, the location of the window versus the whole of the image must be adjusted so that most of the image is seen beyond the window. In the case of viewing on a 3D TV set, it is easier to place the window in front of the image, and to let the window in the plane of the screen. On the contrary, in the case of projection on a much larger screen, it is much better to set the window in front of the screen it is called "floating window" , for instance so that it is viewed about two meters away by the viewers sit in the first row. Therefore, these people will normally see tha background of the image at the infinite. Of course the viewers seated beyond will see the window more remote, but if the image is made in normal conditions, so that the first row viewers see this background at the infinite, the other viewers, seated behind, will also see this background at the infinite, since the parallax of this background is equal to the average human interocular. The entire scene, including the window, can be moved backwards or forwards in depth, by horizontally sliding the left and right eye views relative to each other. Moving either or both images away from the center will bring the whole scene away from the viewer, whereas moving either or both images toward the center will move the whole scene toward the viewer. This is possible, for instance, if two projectors are used for this projection. The edges of the stereo frame can be straight or curved and, when viewed in 3D, can flow toward or away from the viewer and through the scene. These designed stereo frames can help emphasize certain elements in the stereo image or can be an artistic component of the stereo image. Uses[edit] While stereoscopic images have typically been used for amusement, including stereographic cards , 3D films , stereoscopic video games , printings using anaglyph and pictures, posters and books of autostereograms , there are also other uses of this technology. This image, captured on June 8, , is an example of a composite anaglyph image generated from the stereo Pancam on Spirit , one of the Mars Exploration Rovers. A single 2D version is also available. Space exploration[edit] The Mars Exploration Rovers , launched by NASA in to explore the surface of Mars , are equipped with unique cameras that allow researchers to view stereoscopic images of the surface of Mars. This allows the image pairs to be made into scientifically useful stereoscopic images, which can be viewed as stereograms, anaglyphs, or processed into 3D computer images. In environments without hazy atmospheres or familiar landmarks, humans rely on stereoscopic clues to judge distance. Single camera viewpoints are therefore more difficult to interpret. Multiple camera stereoscopic systems like the Pancam address this problem with unmanned space exploration. Stereogram cards and vectographs are used by optometrists , ophthalmologists , orthoptists and vision therapists in the diagnosis and treatment of binocular vision and accommodative disorders. One issue related to stereo images is the amount of disk space needed to save such files. Indeed, a stereo image usually requires twice as much space as a normal image. Recently, computer vision scientists tried to find techniques to attack the visual redundancy of stereopairs with the aim to define compressed version of stereopair files.

Chapter 5 : Stereoscopic Ophthalmic Microendoscope System | JAMA Ophthalmology | JAMA Network

THE STEREOSCOPE IN OPHTHALMOLOGY THE LLOYD COMBINATION CHART, Lloyd's slate, described in the Ophthalmic Record, August, 19l7, is a combination of the Haitz and.

Chapter 6 : Ophthalmic Operating Microscopes | calendrierdelascience.com

Stereoscopic vision and depth perception testing is important in identifying diseases such as Amblyopia, Strabismus, Suppression and Stereopsis. Stereovision is how each eye may see an object from different angles, but combines these angles to give us a 3D image. There are many stereoscopic/depth.

Chapter 7 : What Is Stereopsis? - American Academy of Ophthalmology

The stereoscope in ophthalmology: with especial reference to the treatment of heterophoria and heterotropia Item Preview remove-circle Share or Embed This Item.

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Stereo imaging in ophthalmology is an important diagnostic modality and a task not often undertaken in many ophthalmic photography departments. Origins of retinal stereo imaging date back to over years ago.

Chapter 9 : Stereo Imaging in Ophthalmology - RPS

Stereo imaging in ophthalmology is an important diagnostic modality. Origins of retinal stereo imaging date back to over years ago. Stereo retinal photography and angiography facilitate the diagnostic process by clearly defining retinal structure and elevation.