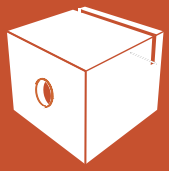

EARLY VISUAL MEDIA LAB

CICANT

Nicholas J. Wade is an Emeritus Professor of psychology at the School of Humanities, Social Sciences and Law of the University of Dundee in Scotland. His research covers the representation of space and motion in human vision, the history of research in visual science, and the relationship between visual science and visual art. https://orcid.org/0000-0003-1702-8256

Corresponding Author

Nicholas J. Wade

Department of Psychology, University of Dundee, Dundee DD1 4HN, UK

n.j.wade@dundee.ac.uk

NON-STEREOSCOPIC STEREOSCOPY

NICHOLAS J. WADE

Emeritus Professor,

Department of Psychology, School of Humanities, Social Sciences and Law, University of Dundee, Scotland

INTERNATIONAL JOURNAL ON STEREO & IMMERSIVE MEDIA, Vol. 8 No. 1
pp. 4-19
DOI: 10.60543/ijsim.v8i1.9441
ijsim.ulusofona.pt

Abstract

The principal application of the stereoscope is to induce apparent depth from two slightly different stimuli – usually photographs. In his classical article describing the stereoscope, Wheatstone referred to this as stereoscopic depth perception. Wheatstone also presented radically different patterns in the stereoscope thereby inducing binocular rivalry. Whereas stereoscopic depth perception reflects cooperation between the two eyes, binocular rivalry is evidence of their competition. Rivalry is an example of non-stereoscopic stereoscopy: the stereoscope is used to display a phenomenon that does not yield the perception of solidity. Anaglyphic examples are shown which indicate the scope of binocular rivalry art.

Keywords: *Anaglyphs, Stereoscope, Depth perception, Binocular rivalry*

Introduction

Studies of binocular vision are among the oldest topics of visual inquiry. Interest has been directed principally to single and double vision rather than stereoscopic depth perception, which entered the experimental scene with the announcement of the stereoscope by Charles Wheatstone (1838). Long before the invention of the stereoscope, rivalry between dissimilar images in each eye was described as were some of its characteristics (see Wade and Ngo, 2013). Wheatstone realized that binocular rivalry could be investigated more conveniently with the aid of a stereoscope. Among the different types of stereoscope were those that presented differently coloured stimuli viewed through similarly coloured filters; they became called anaglyphs (see Wade, 2023) and the patterns presented in this article are of this type. The anaglyphs are designed to be viewed with red/cyan filters. Stereoscopic art has been mainly confined to photography although abstract works have increased since the introduction of random dot stereograms (Julesz, 1971). Examples of art based on binocular rivalry have been sparse in comparison

Binocular rivalry refers to the oscillating appearances when markedly different patterns are presented to the eyes. It can be experienced with Fig. 1 when viewed with two eyes so that one looks through the red filter and the other through the cyan. Closing one eye and then the other results in visibility of each monocular component in turn. With both eyes open the pattern appears unstable, changing from parts of one intermingled with different parts of the other and occasionally the whole of one pattern visible for a short time. Stereoscopic photography requires that the filters are: left eye/red and right eye/cyan. Reversing the filters destroys the stereoscopic depth. No such restrictions apply to binocular rivalry although reversing the filters can produce changes in the rivalry experienced. Two factors are at play: differences between the filters and also between the eyes. It is frequently the case that one eye is dominant and this can result in the pattern or parts of it viewed by that eye remaining visible for longer than the corresponding parts in the other pattern.

Rivalry has a much longer descriptive history than stereoscopic depth perception, partly because the competing patterns are easier to present to the eyes without any special device (see Wade, 1998). Following the invention of stereoscopes there has been a growing interest in producing binocular art, either from paired photographs or less commonly from paired drawings or paintings. Surprisingly, much less attention has been directed to art involving binocular rivalry considering that the visual dynamics of rivalry are more striking than the subtleties of stereoscopic depth perception. The visual transformations that occur during binocular rivalry are easy to experience but difficult to describe. This applies particularly the changes that take place when complex patterns compete with one another. Scientists have tried to overcome this by using very simple patterns like gratings but few artists have exploited the dynamic variety that is a consequence of competitive processes occurring in the brain.

Rivalry art

The options for rivalry art are broader than those for stereoscopic art and they can be expressed through photography as well as graphics. Indeed, binocular rivalry with anaglyphs

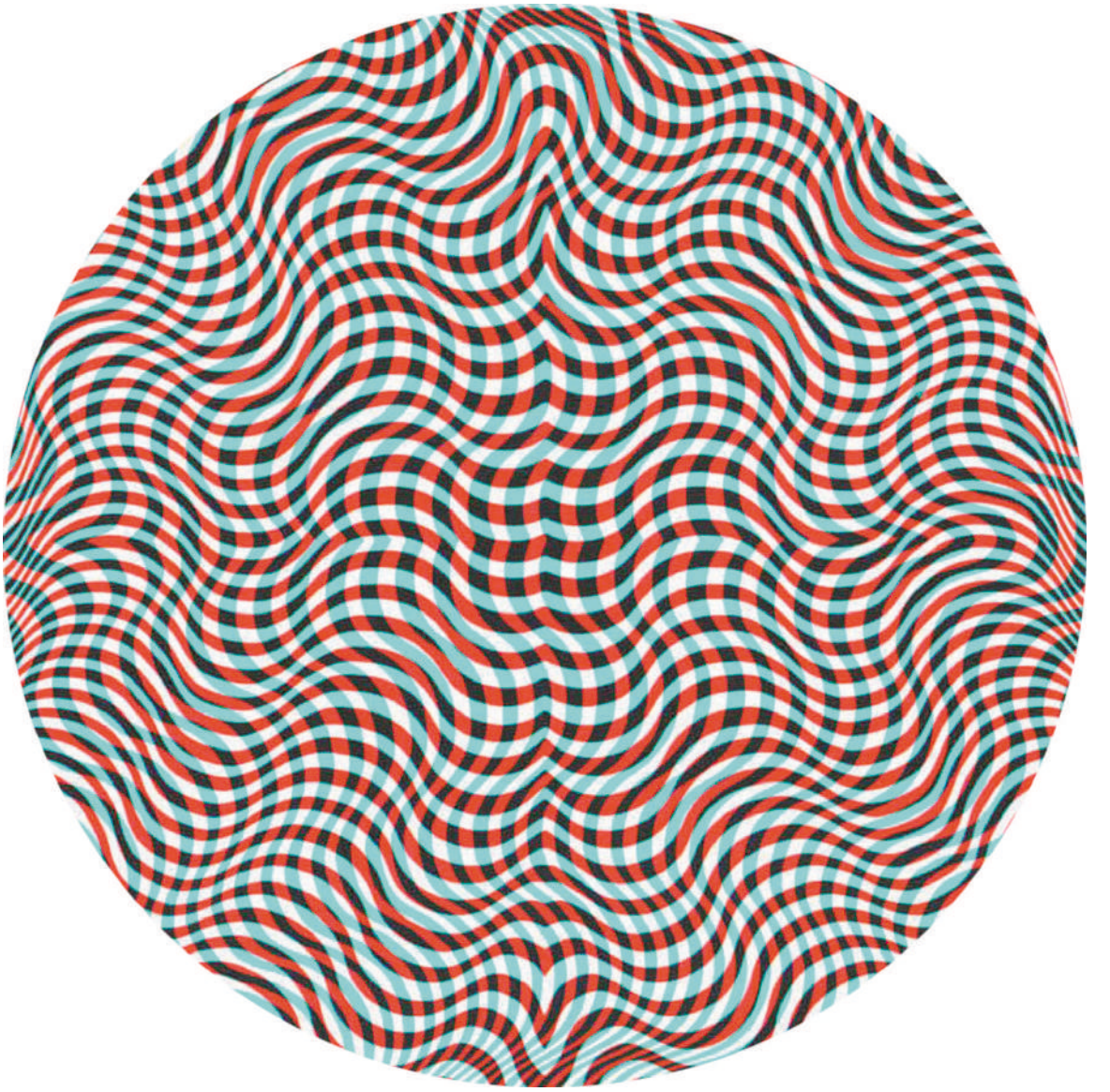

Fig. 1 *Curves in competition* by Nicholas J. Wade

presents an additional advantage because the component patterns can interact with one another in vision without the viewers so that many visual possibilities arise; they can also be projected onto a screen so that the rivalry can be experienced by many viewers. In all the illustrations that follow the component patterns can be seen by viewing through one coloured filter at a time.

Three broad categories of pattern combinations will be presented: paired photographs, paired graphics and paired photo-graphics (combinations constructed from a photograph and a graphic design).

Photographs in rivalry

Wheatstone described the mirror stereoscope to the Royal Society on 21 June, 1838, now celebrated as International Stereoscopy Day. Six months later, in January, 1839, two different methods for making photographic images were announced to the public (see Schaaf, 1992). First, Jacques Louis Mandé Daguerre (1787–1851) described his positive method, followed quickly by the report of a paper-based negative process by William Henry Fox Talbot (1800–1877). Daguerre treated silvered-copper metal plates to make them sensitive to light which after exposure produced single positives called daguerreotypes, whereas Talbot coated paper with silver chloride so that a negative image was formed following exposure to light; positives could be formed by contact printing the negatives. Daguerre and Talbot are shown together (and in anaglyphic rivalry) in Fig. 2.

Fig. 2 *Daguerre and Talbot* by Nicholas J. Wade. The photograph of Daguerre was taken by Biot and that of Talbot by Moffat.

Wheatstone was aware of Talbot's photographic experiments before they were made public and he saw the advantages of paired photographs for stereoscopy. Wheatstone asked Talbot to take stereoscopic photographs for him, but Talbot made the separations between the two views too large to be combined stereoscopically, resulting in rivalry. Thus, the first photographs that displayed rivalry were produced in error (see Wade, 2021)!

Fig. 3 *Autumn at Villa Serbelloni* by Nicholas J. Wade. A photograph of Villa Serbelloni in Bellagio, Northern Italy is combined with one of the autumnal ivy on a wall in its grounds.

Unlike stereoscopic photographs, where the two components need to retain close correspondence in space and time, rivalling photographs are not so constrained. Moreover, there is no 'correct' arrangement of the filters and eyes: stereoscopic photographs do not reverse in depth with reversal of the filters but rivalry can be quite different with such reversals, depending on eye dominance. Rivalling photographs need to be sufficiently different for competition rather than cooperation to take

Fig. 4 *Summer and winter* by Nicholas J. Wade. A metal tree casting its summer shadow is contrasted to its snow-covered state in winter.

place. Another strategy is to combine two similar photographs with a few features in rivalry; the stability of the overall scene is disturbed by the localized rivalry within it. It is also possible to select the components so that they reflect different aspects of the same subject, like portraits of the same person at different ages. Examples of some of these are shown in Figs. 3-5.

Fig. 5 *Ecclectic collector (Werner Nekes)* by Nicholas J. Wade.

Stereoscopes are very collectable items because of the variety and ingenuity of the many models that have been made. Werner Nekes (1944-2017) assembled a remarkable collection of pre-cinematic optical devices (see Dewitz and Nekes, 2002; Mannoni, Nekes and Warner, 2004; Nekes and Kieninger, 2015; Wade, 2004). In Fig. 5, he is shown, in a typically playful pose, to one eye combined with a photograph of part of his collection in the other.

Portraits that rival with one another can be of the same person either in contrasting postures, at different ages or carried by appropriate graphical or textual motifs. The two components need not be of the same person as is the case for Fig. 2, so that a wide variety of possibilities can be entertained (see Wade, 2021, 2023).

Graphics in Rivalry

Experimental research on binocular rivalry has tended to use lines as stimuli. Either achromatic or complementary-coloured parallel lines are presented to one eye with the same pattern at right angles in the other. More complex drawings and paintings are employed to induce rivalry in Figs. 6-8.

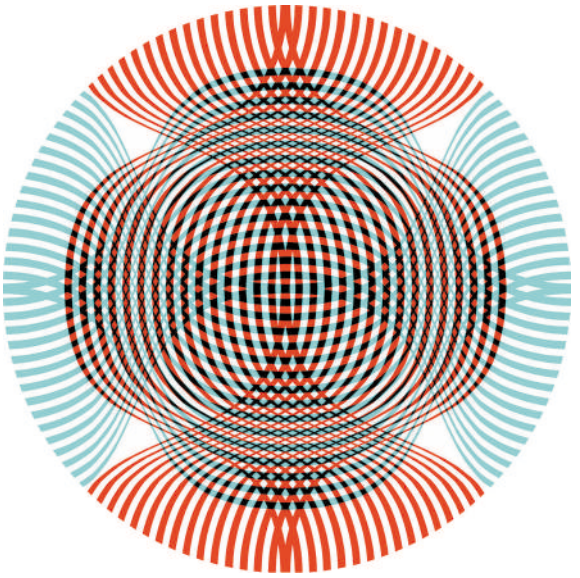

Fig. 6 *Gaussian curves* by Nicholas J. Wade. The contours follow the lines of normal distribution functions as defined by Gauss over 300 years ago. The curves are graphically repeated and superimposed; one series is inclined at right angles to the other.

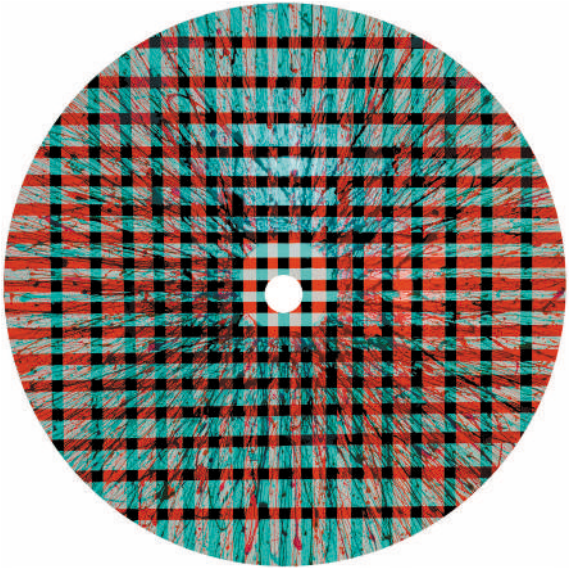

Fig. 7 *White hole* by Nicholas J. Wade. A splash painting on a set of parallel lines is present in each eye but one is at right angles to the other. The white centre from which the paint radiates is common to both eyes.

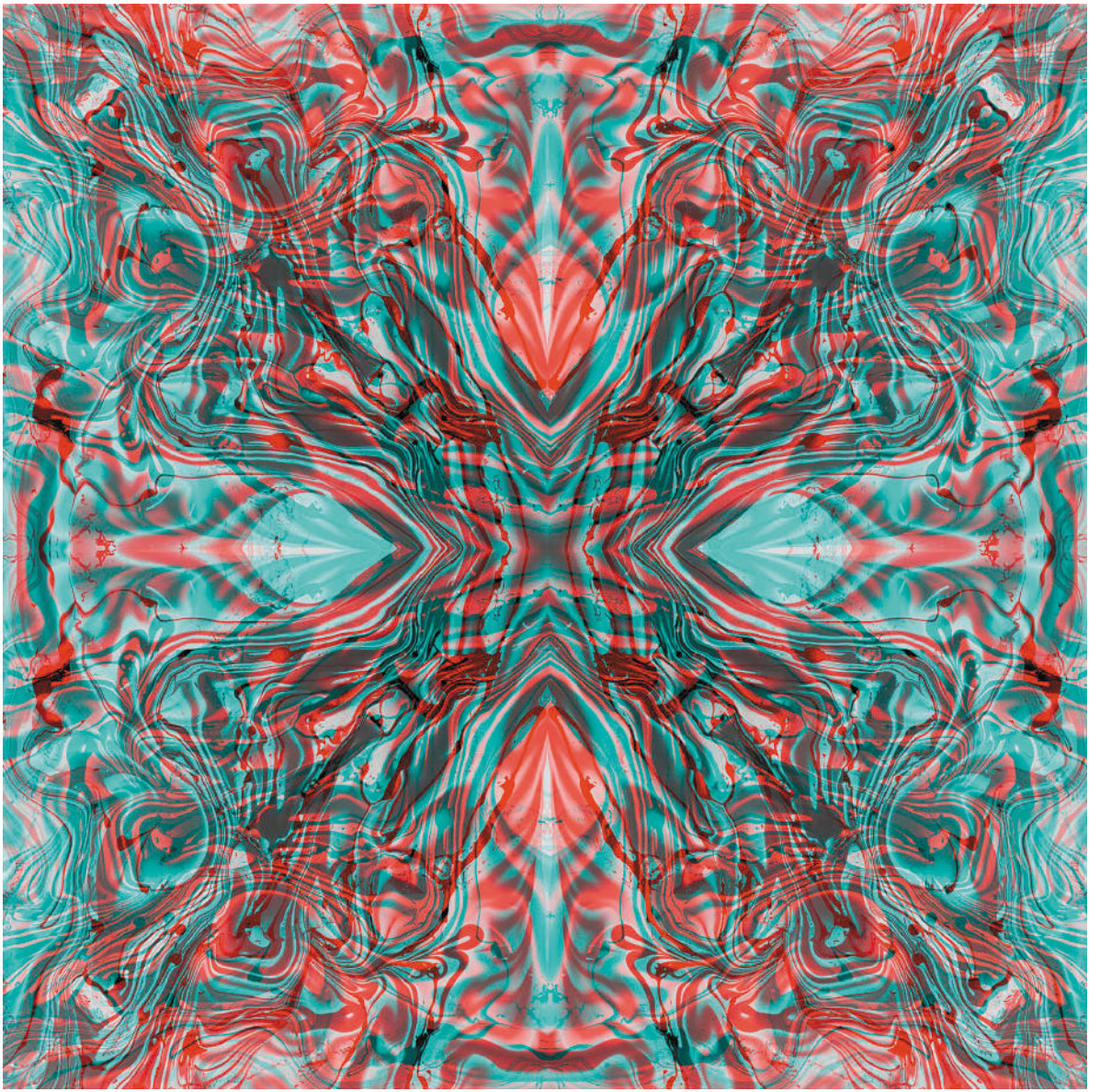

Fig. 8 *Eye wash* by Nicholas J. Wade. The component patterns are based on a flow painting in which paint was gently poured onto water lying on a horizontal board; the pattern on the surface of the water is transferred to the board after which the water evaporates. The same pattern is presented vertically and horizontally.

Photo-graphics – combinations of graphics and photographs

Rivalling contours can be derived from a variety of sources and the following anaglyphs combine photographs with graphics that have some relationship to them. That is, the starting points for each anaglyph are a photograph and a graphic design (either a drawing or a painting). For example, Fig. 9 presents a combination of a photograph of the ruins of the cathedral at St. Andrews with a painting that is based on St. Andrew's Cross.

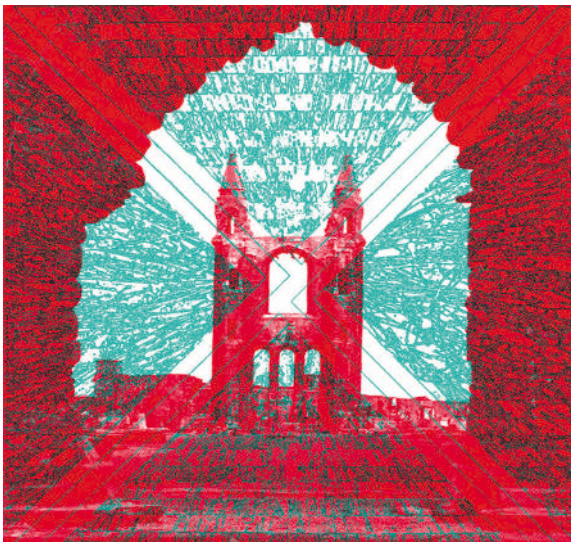

Fig. 9 *St. Andrew crossed* by Nicholas J. Wade.

The graphical elements themselves can be manipulated prior to combination with a photograph, which itself can be modified. The photographic element in Fig. 10 was taken in a large mirror kaleidoscope and the drawn design was modified using computer graphics.

Text can be employed as the graphical element for combination. The text can be conventional typescript or it can be specially drawn, depending upon the photographic subject matter. In the case of Fig. 11, the text is itself potentially ambiguous being in reversed as well as normal orientation; the photograph (of a distillery on the isle of Islay, Scotland) has been rendered in outline.

The final anaglyph (Fig. 12) has many allusory associations in addition to the binocular rivalry it induces. First, the

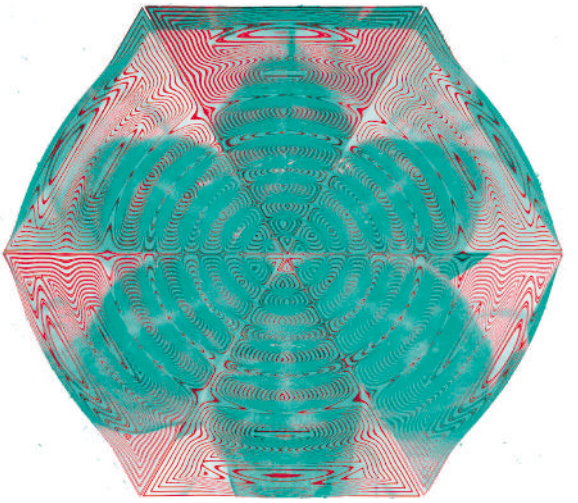

Fig. 10 *Kaleidoscopic portrait* by Nicholas J. Wade.

allusion is to Magritte's painting of a pipe (*The treachery of images*, 1928) beneath which he painted 'this is not a pipe'. Magritte is drawing a distinction between objects and pictures representing them as well as between individual and collective categories of linguistic labels (see Foucault, 1982; Wade, 1990). A variant of the painting can be seen by one eye. The other eye is presented with my graphical answer to Magritte displayed on a computer monitor; the text reads 'this is a pipe' because it is written to reflect the shape of Magritte's painted pipe. There is also the playful device of seeming to paint on the computer monitor. The second allusion is to Magritte's painting (*Clairvoyance*, 1936) of an egg

Fig. 11 *Distilled wisdom II* by Nicholas J. Wade.

Fig. 12 *Pipe dreams (Homage to Magritte, twice)* by Nicholas J. Wade.

lying on a table to the side of his canvas (in the manner of the pipe in Fig. 12); his representation of the egg is what it will be in the future – a bird in flight – not what is before him. In like manner, looking at the pipe on the desk in Fig. 12 results in a transformed image so that the representation of the object is a word.

Conclusion

Non-stereoscopic stereoscopy refers to the use of the stereoscope to present markedly different images to each eye. They then engage in binocular rivalry, which is the unstable appearance of parts of each component image and occasionally of all one monocular image. Rivalry reflects competition

between the eyes rather than the cooperation that yields the appearance of depth in conventional stereoscopy. The images are presented as anaglyphs. While anaglyphs do not separate the images to each eye as completely as reflecting and refracting stereoscopes do, they have the advantage of providing a combined image to two eyes. The principal purpose of non-stereoscopic stereoscopy is to induce binocular rivalry. This article has described and displayed various ways in which this can be achieved. However, like conventional stereoscopy, it can be employed to carry allusory messages that are a characteristic of pictorial imagery.

References

Dewitz, B. von, & Nekes, W. (2002). *Ich sehe was, was Du nicht siehst! Sehmaschinen und Bildwelten. Die Sammlung Werner Nekes*. Göttingen: Steidl.

Foucault, M. (1982). *This is not a Pipe*. University of California Press: Berkeley, CA.

Julesz, B. (1971). *Foundations of Cyclopean Perception*. Chicago: University of Chicago Press.

Mannoni, L., Nekes, W., & Warner, M. (2004). *Eyes, Lies and Illusions*. Hayward Gallery: London.

Nekes, W. (2003). *Die Wunderkammer des Sehens*. Graz: Landesmuseum Joanneum.

Nekes, W., & Kieninger, E. (2015). *Kinomagie*. Filmarchiv, Vienna.

Schaaf, L. (1992). *Out of the Shadows. Herschel, Talbot and the Invention of Photography*. London: Yale University Press.

Wade, N. J. (1990). *Visual Allusions*. Erlbaum: London.

Wade, N. J. (1998). *A Natural History of Vision.* MIT Press: Cambridge, MA.

Wade, N. J. (2004). Toying with science. *Perception, 33,* 1025-1032.

Wade, N. J. (2021). On the art of binocular rivalry. *i-Perception,12(6),* 1-23.

Wade, N. J. (2023). *Vision and Art with Two Eyes*. Springer: Cham, Switzerland.

Wade, N. J. & Ngo, T. (2013). Early views on binocular rivalry. In S. Miller (Ed.) *Constitution of Visual Consciousness: Lessons from Binocular Rivalry*. Amsterdam: John Benjamins. pp. 77-108.

Wheatstone, C. (1838). Contributions to the physiology of vision - Part the first. On some remarkable, and hitherto unobserved, phenomena of binocular vision. *Philosophical Transactions of the Royal Society, 128*, 371–394.

EARLY VISUAL MEDIA LAB

CICANT