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RESEARCH ARTICLE

The Spherical Sound of Spectral Colours

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Abstract

Being able to react to different frequencies of fast electromagnetic waves has turned out to be a survival advantage. Colour vision is complex and depends on physical, chemical, physiological, neurological and psychological processes. In addition to perception via the cones, colour recognition is also linked to the quality of light, to surface properties of objects, and to cerebral processing and modification including verbalization, interpretation and feeling associations. Colours attract attention. They create sentiment and cohesion at the expense of contrast. The refracted rays of the solar spectrum differ from reflected rays and those created by interference. The brain's ability to adapt and complement visual perception is enormous. Whether colours can be heard depends on the synaesthetic abilities of the observer. Ultimately, colour perception is an illusion, manipulated and censored by a dominant brain.

Keywords: Awareness, Colour Perception, Colour Vision, Optical Phenomena, Sound, Synaesthesia.

1. Introduction

In the imagination of some pre-Socratic philosophers, the space between the celestial bodies is filled with spherical music. Pythagoras of Samos (Greek philosopher, 570-510 BC) even assigned a specific tone to each planet, depending on its rotational speed and its distance from other planets. This harmony of the spheres in Greek mythology was seen as an acoustic phenomenon and a sonic expression of the cosmic order (Diels & Kranz, 1951). Referring to this historical metaphor, the Austrian composer Gustav Mahler wrote to a friend after completion of his 8th symphony: "Imagine that the universe begins to resound. It is no longer human voices, but planets that orbit" (www.haenchen.net/fileadmin/media/pdf/mahler_band10.pdf).

From today's perspective, the metaphor of an interplanetary acoustic phenomenon would not be physically possible, as sound cannot be transmitted in the almost complete vacuum of the universe. While electromagnetic waves can spread evenly in the interplanetary space at the speed of light with virtually no retardation, sound waves are transmitted by compression and rarefaction and are bound to solid, liquid or gaseous medium (Kuhn & Noschese, 2020). In addition to the several billion years old rays from countless stars the electromagnetic radiation in our solar system consists mostly of the about 8 minutes old rays from the sun. The wavelengths of the solar spectrum range primarily from 200 nm to 2,000 nm with the majority being predominately within the range of 380 nm to 780 nm that is visible to humans. When beams of light radiation created from reflection, absorption and refraction hit the eye, rods and cones in the retina are stimulated. The physical stimuli in the photoreceptors are converted through chemical reactions into electrical impulses, further processed as signals, modulated and transmitted to the brain (Silbernagl & Despopoulos, 2018). Then the signals are filtered, evaluated, interpreted, categorized, supplemented, verbalized and associated, and ultimately combined into a fused visual impression. Vision and colour differentiation and depth perception of many million shades requires the coordinated interaction of different brain regions.

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Ultimately, the brain adapts primary visual perception to different lighting conditions, attributes colours and changes colour assignments.

From a metaphysical perspective, it is quite conceivable that a convolute of deflected, reflected, refracted, amplified and dampened electromagnetic waves forms an excessively huge cloud in the interplanetary space. In this hypothetical consideration, the sun's action fields would extend from a physical space with thermal radiation, and an optical space with light and colours, to an acoustic space, permeated by spherical harmony. For a gifted artist with synaesthetic sensitivity the harmonies of colours and sound could merge. Then bright and rich colours seem like loud and penetrating music while blurring in the visual perception turns to acoustic vibrations. How else can a colour be loud or a sound be garish?

2. Methodology

According to Wittgenstein, the phenomenology of colours lies somewhere between science and logic. He distinguished three pairs of primary colours, namely red and yellow, green and blue, and white and black that form the corners of a crystal inside an eight-sided double pyramid (Wittgenstein, 1930). In this theory, secondary colours result from the mixing of two primary colours. Tertiary colours result from the mixing of a primary colour with a secondary colour. Intermediate colours are mixed colours that lie between adjacent colours of a colour wheel. A colour is regarded rich if it contains neither white nor black and appears neither whitish nor blackish. A primary colour may also be defined a pure colour that has a specific brightness (Wittgenstein, 1950).

Optical phenomena do not occur independently of physical principles. They include reflection (mirroring of light waves off a surface), refraction (deflection of light waves when passing from one medium to another), and diffraction (deflection of light waves around obstacles or through narrow gaps). This may induce further effects described as interference patterns. The superposition of light waves can cause amplification (positive interference) or extinction (negative interference) of waves. Other phenomena arise from absorption of light by matter and undirected reflection at the surface (scattering), that for instance give the impression of the constantly changing blue colours of the sky caused by small particles in the atmosphere. Depending on the light intensity, the differences between brightness and darkness is put into perspective. Amazingly, signals from stimuli that decrease in brightness are evident in the brain more rapidly than signals from stimuli that increase in brightness (Rekauzke, 2016).

This essay focuses the phenomenological investigations of pure colours and of mixed colours that arise from neighbouring spectral colours using Wittgenstein's colour mathematics. In a simple investigation I observed the standardised colours 11, 54, 59a, 59b, 109, 120, 128, and 130a from Pelikan K12 paint box (https://www.pelikan.com/de) under different natural lighting conditions from a distance of 70 cm. In particular, I compared and rated the sensory impressions of colours under natural conditions in bright (sunlight) surroundings at noon, and in semi-dark (full moon) and in dark (starlight) surroundings at midnight.

3. The Spectral Sound of the Rainbow

When sunlight is refracted and reflected in the atmosphere upon entering a raindrop it is split into seven different colours. This phenomenon can only be seen when the angle between the incident sunlight and the reflected light to the observer is precisely 42 degrees (National geographics, 2025). Two different observers of a rainbow have two different impressions of the same phenomenon that may range from an arc to a circle. Observed from the ground, the rainbow appears as a semicircle, because the horizon cuts off the lower half of the circle. Observed from an aircraft, the rainbow presents as a complete circle. From outside to inside the sequence of the spectral colours goes via red, orange, yellow, green, blue, and indigo to violet. Thus, as the angle of refraction increases, the colours become darker from the outside to the inside. The inner edge is formed by the most strongly refracted colour violet (National geographics, 2025). This effect also reinforces the impression that the rainbow separates an outer dark area of the sky from an inner bright area. When light is reflected twice inside the raindrops a double rainbow may occur. The sequence of spectral colours of a secondary rainbow above the primary rainbow is mirrored (National geographics, 2025). In the colour complex of the rainbow, the individual colours follow one another in a gradual manner without smooth transitions. Although refraction and reflection on the curved surface of a raindrop provide a continuous transition between the different wavelengths, in the sensory perception of this optical phenomenon the transitions between the colours occur in steps. Neighbouring colours influence each other in the borderline range of the rainbow's colour jumps. Overlapping colours produce a sheen of white light at their edges (National geographics, 2025).

If we compare a harmony of colours to the classical harmony of music, then we have to correlate the frequencies of the rich spectral colours with the frequencies of an equally tempered harmony. In the classical harmony of music, the frequency spectrum of a single tone consists of a fundamental tone as the base in combination with several associated overtones. The overtones give the tone its characteristic sound. A tone is perceived as pure when the frequencies of the overtones are an integer multiple of the frequency of the fundamental tone (Grabner, 2005). The integer multiples of the tonal frequencies of consecutive tones within an octave are expressed in steps of tempered whole tones. In the twelve-semitone scale, the frequencies of directly adjacent tones differ by a factor of $\sqrt[12]{2}$, the twelfth root of 2 (Cooper 1973). If one considers the spectral colours as fundamental tones and further intermediate colours as intermediate tones, then colours can also be imagined as sounds. This would necessitate to classify colours into groups, allow only certain mixtures, and create rules without justifying them, as is the case with the theory of sound harmony (Wittgenstein, 1950). A theory of sound harmony must be based on different approaches than the theory of colour harmony, as subtractive and additive colour mixing are used to create intermediate colours.

The integer multiples of the audio frequencies of consecutive tones correspond to the frequencies of consecutive rich spectral colours of the rainbow in the ratio of 1:1 trillion (Tab. 1). In the aliquot middle frequency range for each spectral colour there are five tempered whole tones and two tempered semitones. The seven tones of a scale in the key of A minor form a sound staircase, a perfect solar tune.

Table 1. *Wavelengths (nm) and frequencies (THz) of rich spectral colours of the rainbow and the corresponding wavelengths (m) and audio frequencies (Hz) in the ratio of 1:10^{12}*

	Light spectrum		Sound spectrum		
	Wavelength	**Light Frequency**	**Wavelength**	**Tone**	**Frequency**
Red	620 - 780 nm	385 - 480 THz	0.78 m	A’	440 Hz
Orange	590 - 620 nm	480 - 522 THz	0.69 m	H’	494 Hz
Yellow	570 - 590 nm	522 - 545 THz	0.65 m	C”	523 Hz
Green	490 - 570 nm	545 - 606 THz	0.58 m	D”	587 Hz
Blue	450 - 490 nm	606 - 667 THz	0.52 m	E”	659 Hz
Indigo	450 - 425 nm	667 - 710 THz	0.49 m	F”	698 Hz
Violet	380 - 425 nm	710 - 790 THz	0.44 m	G”	784 Hz

How could one imagine the sound of a rainbow? Human sensory organs are only affected by selected stimuli. For the eye, these are electromagnetic waves in a frequency range from approximately 380 THz to 780 THz and for the young ear, these are soundwaves in a frequency range from approximately 20 Hz to 20,000 Hz (Silbernagl & Despopoulos, 2018). The frequencies of light waves and sound waves differ by a factor of 10 to the power 12 (Kuhn & Noschese, 2020). However, light waves can be transformed into electrical signals and further processed to audible waves. Technically, conversion of light waves into radio waves depends on complex interactions with matter. Experimentally, electromagnetic waves of the spectral colours can be transformed into sound waves by mixing low-frequency waves to obtain frequencies in the audible range using a mixer-detector. Computer simulation could offer a simpler conversion of waves ignoring the 1:1 trillion difference between the frequencies. Pythagoras of Samos proposed the symphony of harmonious sounds based on speed and distances between celestial bodies as a perfect tonal harmony. The inaudibility of the spherical sounds he explained that humans had been exposed to the music of the spheres since birth and to the silence it opposed (Diels & Kranz, 1951).

4. Newton’s Trichromatic Theory

In his famous prism experiment Isaac Newton used polychromatic sunlight for his investigations. He observed that refraction at the surfaces of a glass prism can split white light into seven spectral colours of the rainbow in the sequence red, orange, yellow, green, blue, indigo, and violet. These spectral colours did not further split when they were passed through a second glass prism. Newton doubted that spectral colours were created by the prism. He rather concluded that white light was composed of spectral colours. He proved his thesis by combining all spectral colours with the help of a converging lens to generate white light again (Isaac Newton, 1672). Newton also observed that surfaces absorb and reflect different wavelengths of visible light that determines the colour assigned but the composition of the underlying colour stimulus cannot always be determined from the perceived colours alone. He concluded that an identical colour impression can arise from a single monochromatic frequency as well as from a composition of two or more different monochromatic frequencies that complement each other. Eventually, Newton determined the trichromatic theory, in which he distinguished the primary colours red, green and blue from the secondary colours yellow, cyan, and magenta. The exclusively physical understanding of the trichromatic theory explains the basic colour formation and corresponds to the mechanisms of colour recognition at the level of the photoreceptors in the retina. Colour is reduced to a quality of light.

From a physical perspective, intermediate colours can arise through subtractive mixing or through additive mixing. The wavelength of a mixed colour is not always between the wavelengths of the original colours. Mixing of the two primary colours red and blue makes violet. The wavelength of violet (380 - 450 nm) is shorter than the wavelength of red (620 – 780 nm) and blue (450 – 490 nm). For light propagating at a constant speed (v), wavelength (λ) and frequency (f) are inversely proportional to each other (Kuhn & Noschese, 2020) (1).

$$\lambda = v / f \qquad (1)$$

Furthermore, light is a form of energy. In the postulated equivalence of matter and energy, matter can arise from energy, and energy from matter. A wave particle duality is assigned to light to explain the properties that sometimes correspond to a wave and sometimes to a particle. Hypothetically, the wave motion of light arises from a regular, periodic movement around a mean value following a specific pattern with the restoring force being proportional to the deflection. The physical oscillating circuit is repeating within a specific time, comparable to the oscillations of electrons in atoms. The typical wave motion of propagating light occurs when the oscillations in the vertical plane are moved by a momentum along the horizontal plane. Electromagnetic waves transfer energy and momentum but the oscillating particles of the medium do not propagate with the waves. Presumably, the particle properties of light also stem from the contact with matter, either in the generation of light waves or through reflection and refraction. Pure waves without particle properties that propagate through kinetic energy would correspond to Aristotle's classical view of light (Diels & Kranz, 1951).

4.1 White and Black

Pure white and pure black are rarely observed (Wittgenstein, 1950). Whether or not white and black are considered colours is handled very differently. Although, white can be created by mixing spectral colours, white is neither generally classified colour nor mixed colour. Some consider black a colour because it can be created by mixing different colour pigments. The dispute has existed for a long time. Empedocles of Agrigento (Greek philosopher, 495-435 BC) already considered white and black to be colours while Democritus (Greek philosopher, 460-370 BC) taught that there are no colours only colour impressions (Diels & Kranz, 1951). In any case, white and black evoke emotions, just as we know colours do.

In the visible colour spectrum of a rainbow, one can see bright colours such as red and orange and dark colours such as indigo and violet, but there is no black. Physically speaking, black is the absence of light. In its purest form, this corresponds to the black centre of a black hole. In painting, pure black is a colour created by the reflected light from pigments or dyes. In contrary to the physical definition of black, a black colour from pigment and dye cannot exist without any light. In painting technique, white and black are considered achromatic colours, which can be used to create shades and tints of bright colours. In digital design, additive colours combine to create white (Adobe Illustrator, 2025). In the additive (light-based) colour model, black is represented by unlit pixels. In the subtractive (ink-based) colour model, subtractive colours combine to create black. In design, white and black are essential for representing light and shadow and can convey spatial depth and mood just as effectively as other colours. White and black mix with all colours (Adobe Illustrator, 2025). Grey lies between the extremes of pure white and pure black and can take on a shade of any colour. In a continuous transition, infinite shadows of grey between white and black are distinguishable in finite steps. When the colours grey and black are no longer distinguishable, grey in various shades emerges.

4.2 Colours

Newton already had recognized that different spectral compositions of the colour stimulus can lead to the same colour perception (phenomenon of metamerism). In addition, microstructures on the surface can also create colour impressions. In this context, colour is also a property of the object and not only a quality of light. Correspondingly, Wittgenstein argues that the classification "golden" essentially describes the quality of the surface, which shines (Wittgenstein, 1950).

Colour experience is significantly influenced by light intensity. As brightness decreases, colour discrimination by the cones fluctuates, while the light-dark discrimination by the rods prevails. Colour perception comes at the expense of contrast. In a small investigation, I treated the concepts of colour similarly to the concepts of sensory perceptions (Tab. 2).

Table 2. *Rich spectral colours and the colours white and black observed in bright (sunlight), in semi-dark (full moon) and in dark (starlight) surroundings.*

Sunlight	Full moon	Starlight
Red	Dark red	Blackish
Orange	Dark orange	Dark red
Yellow	Yellow	Dark yellow
Green	Dark green	Blackish
Blue	Blackish	Black
Indigo	Black	Black
Violet	Blackish	Black
White	Greyish	Light grey
Black	Black	Black

I observed that colours present differently when being observed under different brightness. In semi-dark surroundings (full moon), the demarcation of a colour becomes blurred. In addition, red and green appear darker, blue even becomes blackish, violet turns to blackish and indigo turns to black. In dark (starlight) surroundings, the contrast between light and dark colours becomes even more pronounced. Light colours (orange, yellow, white) appear relatively brighter than expected and dark colours (blue, indigo, violet) appear relatively darker. Amazingly, yellow remains colour-constant in semi-dark surroundings and still relatively bright even in dark (starlight) surroundings. This phenomenon of colour constancy refers to the ability to perceive the intrinsic colour of objects with more or less the same intensity, regardless of changing natural lighting throughout the day and seasons (Nassau, 2006). Similarly, white transitions into a greyish and light grey. Not surprisingly black remains the same, but blackish and black do not describe the same intensity. This also applies to greyish and light grey. Wittgenstein would not have agreed to that, as he clearly postulated that grey is not a poorly lit white. However, depicting a poorly lit white in a painting, needs a grey dye.

Regarding colour discrimination, two colours are considered identical if no differences can be discerned between them. To be able to recognize differences between two colours, at least two receptors with different sensitivity are required. One to detect the colours themselves, and another to detect colour properties as differences between the two. It is conceivable, that four different types of cones can detect significantly more colour nuances than three types of cones. According to Wittgenstein, a discontinuity can only be recognized as long as one has not reached the limit of what is distinguishable. Furthermore, two colours cannot be perceived simultaneously in exactly the same place. He explains this phenomenon with the shape of the colours and the space (Wittgenstein, 1950). Logically, one can assume that two coloured objects cannot be identical, since in the simplest case, they differ in location or time. Since differences in location and time are usually not considered in colour discrimination, the abilities to abstract and to remember colours are also required. Differences between colours are further relativised and categorised, so that ultimately, what appears similar can only be graded to "largely similar". Colour similarity therefore is more dependent on the discriminatory properties of receptors than on the examined colour itself. In concrete terms, this means that identicalness between two objects exists when the differences lie outside the limits of discriminability.

5. Wittengenstein's Phenomenological Theory

In his *Philosophical remarks* Wittgenstein wrote: "What I need is a phenomenological theory of colour, not a physical one, nor a physiological one. And it must be a purely phenomenological theory of colour, which concerns only what is truly perceptible" (Wittgenstein, 1930). In his colour mathematics, mixed colours arise from the paired elementary colours red - green, blue- yellow, and white - black. From these six selected elementary colours, he constructed the central crystal of his double eight-sided colour pyramid (Fig. 1). The phenomenological theory contrasts with Newton's trichromatic theory. Wittgenstein's system with the three opposing colour pairs is rather in line with the opponent process theory of Ewald Hering (1874). This theory orients the mechanisms of colour recognition at the level of the downstream, colour-antagonistic ganglion cells of the retina (Baumann, 2002). Regarding his choice of green as an additional elementary colour, Wittgenstein stated: "Blue and yellow, as well as red and green, appear to me as opposites - but that may simply be because I'm accustomed to seeing them at opposite points on the colour wheel".

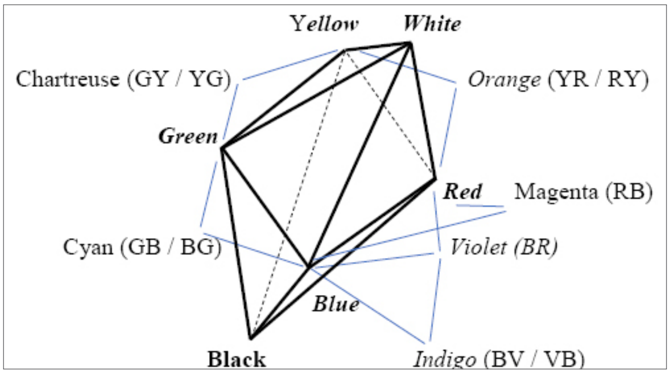

Figure 1. *The central crystal of Wittgenstein's colour pyramid is made of the six primary colours: red (R), yellow (Y), green (G), blue (B), white and black. The secondary colours: orange, chartreuse, cyan, and violet, complement a double eight-sided colour pyramid.*

White is at the top of the colour pyramid and black is at the bottom. The primary colours red, yellow, green, and blue are arranged at angels of 90° to each other. Combining primary and secondary colours, the angle between colours declines to 45 degrees. Intermediate colours are created by mixing adjacent colours. In this pyramid, mixing neighbouring primary colours produces the secondary colours orange, chartreuse, cyan, and violet. The primary colour blue and the secondary colour violet produce the tertiary colour indigo. However, mixing a primary colour and the opposite secondary colour (complementary colour) produces different shades of grey between white and black.

In his colour mathematics, Wittgenstein recognized that colours differ in their mixing properties. When mixing, for example, violet and orange the colours can partially extinct each other, but when mixing red and yellow this effect does not occur. Furthermore, the mixing of neighbouring colours does not necessarily result in an intermediate colour that corresponds to the two original colours. For instance, the colour orange can easily be imagined as an intermediate colour between the neighbouring colours red and yellow. But yellow is not a mixed colour of red and green even though it lies between the elementary colours red and green in the pyramid. In subtractive colour mixing, light absorption creates a mixed colour that lies within the range of the two primary colours. Subtractive colour mixing of red and blue results in a darker red or even black. In additive colour mixing, the wavelength of the mixed colour lies outside the range of the two primary colours and the sensory impression corresponds to a separate, new colour.

Unlike dyes, pigments are not soluble and do not appear transparent due to surface light scattering. When gradually adding orange pigment to violet pigment, the mixture will gradually turn more orange, but will not go beyond pure red. The quantitative mixing ratios do not correspond to the expected colour. Wittgenstein distinguished the statement that a mixed colour lies between the two original colours from the statement that a mixed colour must lie between the neighbouring colours in the pyramid. The statement that x is a mixture of y and z belongs to another category than the statement x is the common component of y and z (Wittgenstein, 1950). Correspondingly, Wittgenstein observed that blue and yellow (and also red and green) cannot coexist in any perceived colour as there were no bluish yellows or no reddish greens. This was also evident when mixing the primary pigments blue and green, which resulted in a blue-green, while mixing the secondary pigments blue-green and blue-red, no blue pigment was produced (Wittgenstein, 1930). In this concept, Wittgenstein doubted that the colour grey can be seen as a mixture of black and white in the same sense that orange can be seen as a mixture of red and yellow. He noted, that phenomenological investigations of sensory impressions are always underestimated and considered much simpler that they are (Wittgenstein, 1930). He concluded: "The boundlessness of visual space is most clearly evident when we see nothing, in complete darkness."

6. Kandinsky's Colour Awareness

Wassily Kandinsky (Russian painter, 1866 – 1944) rated his expressionistic painting as a visual equivalent to music, perceiving colours and shapes as sound and rhythms that intensify a particular feeling. Kandinsky saw abstract painting as an opportunity to create a "visual symphony" and stated: "The more abstract is form, the more clear and direct is its appeal." He was convinced that a form can stand alone as representing an object but a colour cannot stand alone (Kandinsky, 1912). The same form in the same circumstances will always have the same inner appeal. The painter distinguished between warm and cold colour tonality and its valuation of light and dark. He specified four pairs of antitheses, including yellow and blue, white and black, red and green, orange and violet (Kandinsky, 1912). Regarding his diverse sound and feeling associations Kandinsky restricted: "A parallel between the coloured and musical tones, can naturally be only relative, just as a violin gives very different tones which can be expressed by various instruments to reproduce the various shades (Tab. 3).

Table 3. *Kandinsky's sound and feeling associations with spectral colours focusing his four pairs of antitheses: red and green, yellow and blue, orange and violet, and white and black.*

	Sound association	Feeling association
Red	Trumpet, tuba, cello	Strength, energy, joy, triumph, ringing
Green	Placid violin middle tones	Calm, without nuances, most restful
Yellow	Trumpet	Eccentric, penetrating, loud, sharp
Blue	Flute deep tones	Introverted, heavenly
Indigo	Cello, double bass, organ	Grief
Orange	Angelus bell, alto violine	Warm, happy
Violet	English horn, bassoon	Frailty, expiring sadness
White	Musical pause	Cold, infinite, blank, harmony of silence
Black	Profound and final pause	Eternal, dead silence

Colour perception is interpreted differently between physics,physiology,neurology,psychology,linguistics, and philosophy of mind. While optical laws apply to the relative size and surface proportions of the visual impression, colour perception is modified by cerebral processing and alignment of colour characteristics and influenced by individual experience and expectations. Priming lowers the activation threshold for certain colour stimuli, which then unconsciously trigger certain emotions. Colours are often assigned specific associations and meanings and express a particular mood and character, depending on culture and the individual experiences and expectations (Elliot, 2015). Certain colours even have physiological effects on body and mind, promote well-being, appetite and health (e.g. red, orange, yellow), and may increase concentration (e.g. green). In psychology the colour theory determines how colours influence emotions, sentiments, and behaviour (e.g.: red activating, orange stimulating, yellow inspiring, green harmonizing, blue balancing, indigo calming, violet relaxing). Colours attract attention. Commonly, red vehicles appear faster than equally fast but differently coloured vehicles. Specific colours like yellow and red even have warning and signal effects and are used for deterrence and mimicry.

Verbalization plays a key role in conscious cognition. Thus, the linguistic precision within a community also determines the quality of what can be consciously perceived. The consciousness of an individual does not exist independently from the consciousness of his community (Lederer, 2024). Precise linguistic differentiation enables more detailed and intense recognition. What cannot be precisely specified linguistically is also likely to be underestimated in sensory perception. Ultimately, language enables perception and colour discrimination. Wittgenstein specified: "If even the word 'blond' can sound blond, how much more likely can hair appear blond in a black-and white photograph (Wittgenstein, 1950). Colour perception depends on interpretation. The mere distinction of colours without interpretation would have no meaning. Kandinsky's symphonic work "Composition VIII" conveys that there is an abstract visual language that expresses the spiritual nature of the world. All harmonies sound together, appear at the same time, all rhythms and melodies move simultaneously in circles and semicircles. The overall impression of the symphonic work reminds of Mahler's euphoric exclamation: "Imagine that the universe begins to resound. It is no longer human voices, but planets that orbit."

The ability to "hear" light waves is bound to synaesthesia that simulates imagination and expands the perception. Synaesthesia defines an enhanced sensory cross activation in which a particular stimulus elicits a secondary sensory-perceptual experience in the brain and is considered a combination of genetic factors and neurological overreaction (Dorsch, 2025). In fact, a very mild form of synaesthetic perception is likely widespread. In an attempt to describe a particular sensory impression as accurately as possible, sometimes expressions are used that derive from various visual, acoustic, olfactory, gustatory, and haptic sensations. At least most people can imagine something behind warm and cold colours and bright, fat and colourful sounds. Colour perception is a matter of language games.

7. Conclusion

The trichromatic theory explains the basic colour formation from the physical point of view and refers to the mechanisms of colour recognition at the level of the photoreceptors in the retina. The phenomenological perspective corresponds more to the opponent process theory that orients the mechanisms of colour recognition at the level of the ganglion cells of the retina. Most important on colour vision is the brain's ability to adapt and complement visual perception. In addition to physical, chemical, physiological, neurological and psychological processes, the synaesthetic perception of colours and shapes as sound and rhythms can intensify associated feelings. Experiencing spectral colours as fundamental tones and intermediate colours as intermediate tones can combine art and the universe into one.

8. References

1. Diels, H., Kranz, W. (1951). The fragments of the Pre-Socratics. [Die Fragmente der Vorsokratiker], Ed.: H. Diels, W. Kranz, 6th ed., Weidmann Zürich, 1903-10.
2. Kuhn, K. F., Noschese, F. (2020). Basic Physics: A Self-Teaching Guide. Ed.: Jossey-Bass, Wiley 978-11196229900.
3. Silbernagl, S., Despopoulos, A. (2018). Pocket Atlas of Physiology. [Taschenatlas Physiology], Georg Thieme Verlag, Stuttgart, Germany
4. Wittgenstein, L. (2022 [1930]). Philosophical remarks [Philosophische Bemerkungen], In: Sammelband 2, Ed.: C. H. Beck, 13th ed., Suhrkamp Verlag Berlin, Germany. 273-281].
5. Wittgenstein, L. (2023 [1950]). Remarks about the colours. [Bemerkungen über die Farben] In: Sammelband 8, Ed.: C. H. Beck, 13th ed., Suhrkamp Verlag Berlin, Germany. 7-112].
6. Rekauzke, S., Nortmann, N., Staadt, R., Hock, H. S., Schöner, G., Jancke, D. (2016). Temporal asymmetry in dark-bright processing initiates propagating activity across primary visual cortex, *Journal of Neuroscience*, DOI: 10.1523/JNEUROSCI.3235-15.2016
7. Rainbow. (2025). In: National geographics. https://education.nationalgeographic.org/resource/rainbow/
8. Grabner, H. (2005). Handbuch der funktionellen Harmonielehre [Handbook of Functional Harmony], G. Bosse, Kassel Germany, ISBN: 9783764921125.
9. Cooper, P. (1980). Perspectives in Music Theory: An Historical-Analytical Approach. Harpercollins College Div. ISBN 978-0060413736
10. Newton, I. (1672). A letter of Mr. Isaac Newton, Professor of the Mathematicks in the University of Cambridge; containing his new theory about light and colors: sent by the author to the publisher from Cambridge, Febr. 6. 1671/72; in order to be communicated to the R. Society. Phil. Trans. R. Soc. 6(80):3075-3087 https://doi.org/10.1098/rstl.1671.0072
11. Baumann, C. (2002). The Physiologist Ewald Hering (1834–1918). [Der Physiologe Ewald Hering (1834–1918)]. Hänsel-Hohenhausen, Frankfurt a. M. 2002, ISBN 3-8267-1216-1.
12. Adobe Illustrator (2025). What is colour? www.adobe.com/at/creativecloud/design/discover/is-black-a-color.html
13. Nassau, K. (2006). The perception of colour. In: Encyclopedia Britannica. www.britannica.com/science/color/the -psychology-of-colour
14. Kandinsky, W. (1946 [1912]). The language of form and colour. In: Concerning the spiritual in art. Ed.: H. Rebay, Solomon R Guggenheim Foundation, for the museum of non-objective painting, NY
15. Elliot, A. J. (2015). Color and psychological functioning: a review of theoretical and empirical work. Front Psychol. 6:368. doi: 10.3389/fpsyg.2015.00368.
16. Lederer, W. (2024) The Socio-hydrological Cycle Between Origin and Transience. Adv in Hydro & Meteorol. 1(5) https://irispublishers.com/ahm/pdf/AHM.MS.ID.000525.pdf
17. Synaesthesia. (2025). In: Dorsch - Lexicon of Psychology. Ed.: M. A. Wirtz. https://dorsch.hogrefe.com/stichwort/synaesthesie