

Original Contributions - Originalbeiträge

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The Myopia Discrepancy Phenomenon

1. Introduction

1.1 *The phenomenon*

The background to this work is a visual observation made by the author during his studies of image processing in the 1980s. It is a very simple procedure that can be reproduced by many people with virtually no additional aids. A light spot is observed in darkness in such a way that the size of the light spot is near the resolution limit of the healthy eye, which is about one arc minute, corresponding to a size of 1 mm at a distance of about 3 to 4 metres. Then the same spot is viewed under myopia, in my case -3 dpt, simply by removing the glasses. The perceived image of the spot looks quite structured and finely detailed and not at all smeared as expected. No description of this phenomenon could be found in the available literature so far. Discussions about this discrepancy with more experienced people than the author did not lead so far to a satisfactory explanation. Therefore, the author decided to publish the perceived discrepancy as a preliminary phenomenological study and thus as a basis for a broader discussion or investigation.

1.2 *Visual perception*

Visual perception has been an important topic of research since the beginning of time. Many different fields of research have been involved, but have often worked independently of each other: philosophy, epistemology, physics, psychology, physiology, medicine, biology and neuroscience. Greek philosophers proposed a theory of visual rays (as early as 500 BC), Alhazen carried out important optical experiments and emphasised that light enters the eye. Leonardo da Vinci studied the anatomy of the eye, Johannes Kepler described the lens system of the eye and the retinal image, which René Descartes extended to the brain. Isaac Newton experimented with prisms and discovered the nature of light and colour. The 19th century brought important advances with Hermann von Helmholtz's work on colour vision and physiological optics on the one hand (von Helmholtz, 1867), and with Ramon y Cajal and Camillo Golgi's discovery of the structure of the nervous system through staining and the establishment of the neuron theory on the other. Around 100 years ago, Gestalt psychology was the leading

discipline in perception research. Gestalt theory emphasised the holistic perception of visual stimuli, which led to the Gestalt principles. Wolfgang Köhler, one of the main proponents, proposed the concept of a psychophysical field potentially formed by electromagnetic streamlines and introduced the isomorphism postulate (Köhler, 1920).

The most recent and currently recognised scientific concept of visual perception was presented by David Hubel and Torsten Wiesel around 50 years ago. Using microelectrodes, they investigated the activation potential of individual neurons in anaesthetised animals while showing them visual patterns. In this way, they identified simple and complex cells in the visual cortex and showed how visual information could be processed. They propose a feature-based decomposition and analysis of visual information (Wiesel and Hubel, 1963, Hubel and Wiesel, 1968). This approach is somewhat similar to how image processing is performed on a computer. A comprehensive description of the neurobiological basis of visual perception can be found in (Georgiev, 2011). However, those concepts do not make any statements about how subjective visual perception could come about.

Current research focuses on imaging techniques such as functional magnetic resonance imaging (fMRI) to analyse brain activity during (visual) tasks and to deduce whether and where a neuronal correlation eventually takes place. The great advantage of this approach is that human brain activity can be observed on the spot. However, these techniques are far from being able to resolve individual neuronal activity or even the underlying physical processes (Logothetis, 2008, Yun et al., 2024).

In addition to such psychological and physiological findings, a much older insight came from Eastern philosophy and logic around 500 AD (Roloff, Carla, 2005, Deeg, Max, 2017): *All perceived things are creations of our mind*. This is a very early insight that there is no objectively accessible reality for beings. We only perceive an individual, subjectively created image of the external “reality”. In normal everyday life, nobody is really aware of this fact. Our visual system works so perfectly that we are not aware of this incredible illusion. Rainer Mausfeld explains this by the fact that our brain almost completely encapsulates the functioning of perception and only brings the final perception into consciousness. Normally, we have no privileged access to intermediate stages of perception (Mausfeld, 2006).

But despite all this research, which has been going on for a long time and across various disciplines, we have no recognised explanation of how our visual perceptions arise. There is simply no suitable technical equipment to look into our brains and to understand what is going on there in detail. With the phenomenon presented below, we might have an additional thought experiment to approach this unfortunate situation.

2. Phenomenology of the myopia discrepancy

The main aim of this article is to make my personally perceived phenomenon and the associated discrepancy understandable and comprehensible for other people. Firstly, I would like to emphasise that the term “introspection” best describes the way in which the phenomenon is to be observed. It is meant in its literal sense: observe the perceived inner image in all its facets, not at all the outer object. In the next section, I would like to define a nomenclature in order to be able to discuss the phenomenon more clearly in the following. Secondly, and most importantly, I want to express my first person percepts and validate them through the perceptions of two other persons. For the overall phenomenological approach, we adhere loosely to (Aspers, 2009). Thirdly, in order not to lose touch with physical reality, we present some geometric and radiometric considerations about our experiment.

2.1 *Experimental setup and introspection*

With reference to the title of the 23rd GTA conference, we place our introspection procedure in the context of reality, perception and mind. In our experiment to create the phenomenon, our (external) reality consists of only a single object O , namely a small light source with an area of about 1 mm^2 , located about 3 metres away from the observer's eye. This condition corresponds approximately to the spatial resolution limit of the human eye of about 0.5 to 1 arc minutes. We assume extensive darkness so that the pupil remains wide open. An appropriate light source is a simple small colour LED (Light Emitting Diode), e.g. the status LED of a charger or other electrical device. In this case, we have an almost monochromatic light source which reduces chromatic aberration effects. And we are in the realm of colour vision. The important thing is to observe the light spot under noteworthy ametropic, in my case myopic conditions, in order to get a defocused image on the retina. It is not so important to meet the exact conditions, the effect can be observed in a large variety of situations, also in everyday life. But of course, the better the conditions are adhered, the clearer the effect emerges.

The photons emitted by the light spot enter the eye and generate a spatio-temporal light field L on the retina. We consider L as input for the visual perception process. After L has been “processed” by the retina and the visual pathway by nervous activity, our mind perceives a figure F , which represents our (internal) image of O . In this context, the visual perception P can therefore be interpreted as a mapping from L to F (figure 1). Assuming normal vision, we should see a fairly sharp image of the light spot. Under myopic (or hyperopic) conditions, however, due to the defocussed imaging geometry, we expect to perceive a larger, correspondingly darker, but relatively homogeneous and possibly blurred image of the light spot. Introspection then consists of consciously and carefully analysing and examining the perceived figure F in all its details: shape, colour, structure.

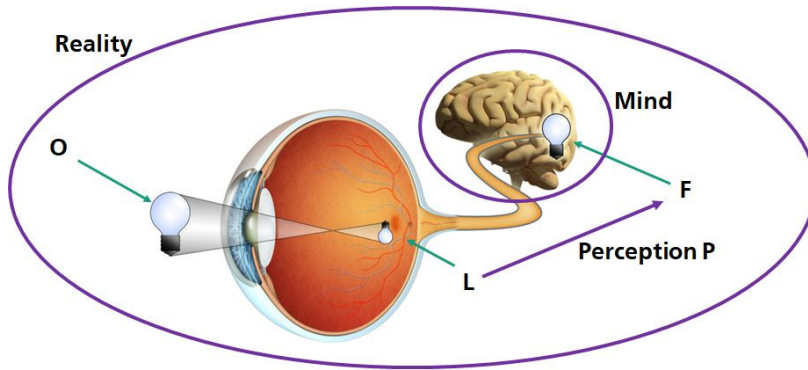


Fig. 1. Illustration of the relevant components of the experiment: object *O*, here a spot of light, light field *L* impinging on the retina and perceived figure *F*. We consider the mapping from *L* to *F* as visual perception *P*. (Annotations added to an illustration licensed from shutterstock).

2.2 First person percepts

2.2.1 Author

The author was aged 50 years, had a myopia of -2.75 dpt and was sober.

Verbal description. In the first phenomenological part I describe verbally how I see *F*: a) I see a mostly round figure. b) It is surprisingly large compared to my corrected vision with glasses. c) It is strongly structured, by no means homogeneous, as I had expected. The structure is fascinating for me due to that discrepancy. It never lets go of me and is the origin of that contribution. d) There is a series of thicker, knotty areas that seem to be connected by thinner lines. e) There are again thinner, often parallel lines that are much finer than the size of the light spot in normal vision. The finest lines are usually in the outer areas of *F*. f) Sometimes, there appear concentric circles. g) The figure is very sparse; between the luminous structures mentioned, there is: aa) Nothing, i.e. complete blackness, when the experiment is carried out in complete darkness. bb) When there is no complete darkness, then I see some kind of non-luminous background image which appears to be completely independent of and behind the luminous figure *F*. As if *F* and the background image were of completely different origin. h) When I close my eyes and open them again, I see a similar, but not exactly the same figure. i) After opening my eyes, there is a phase of about 0.5 s in which the figure converges to a stable shape. j) Movements of the head have no significant influence on *F*. k) Observing *F* with only one eye results in different figures, depending on the individual eye's ametropia, but *F* observed with both eyes is some kind of fused image and not a simple addition of the two individual figures. l) The contours of the individual lines and other structures appear absolutely clear and continuous,

not at all noisy or disrupted by some kind of sampling artifacts. m) In case of an LED source, the colour of the individual ‘fragments’ is absolutely constant. n) In case of polychromatic light sources, sometimes a differently coloured ring appears around the figure (depending on the type of the light source and its spectrum), which is finely separated from the interior part of the figure.

Drawings. A picture is worth a thousand words, which is why drawings of the figure F seen are a better basis for exchange and discussion. This is not as easy as you might think: If you want to draw, you have to take your eyes off the light spot and the figure in your head gets lost (verbal property h). Personally, I have a very poor visual imagination, it is very difficult for me to memorise the structure and the fine details of F exactly. But also tracing these fine details onto paper is not common and therefore it is very tedious to reproduce F . My first attempts to draw my F are shown in figure 2 (felt-tip pen on paper).

The sparseness of F is recognisable at first glance, as are the knotty, net-like areas connected by lines. It was not possible for me to reproduce the finest details of F correctly. The “virtual” size of F , if it existed in reality, would I estimate to about 30 mm. Please note that the drawings do not reflect the true colour of F . Although these drawings are only a very poor reflection of my true percept, I hope that the basic structure and in particular the discrepancy between the expected homogeneous spot and the figure seen now becomes more clear.

To rule out the possibility that my perception of F is a purely individual and subjective perception on my part, I asked two colleagues to apply the same procedure. Please consider, that all observations and drawings have been carried out independently and under different conditions.

2.2.2 Colleagues

The first colleague, TF, was aged 49 and had a myopia of -4.5 dpt. And to my relief, he perceived and drew very similar figures, as can be seen in figure 3 (left

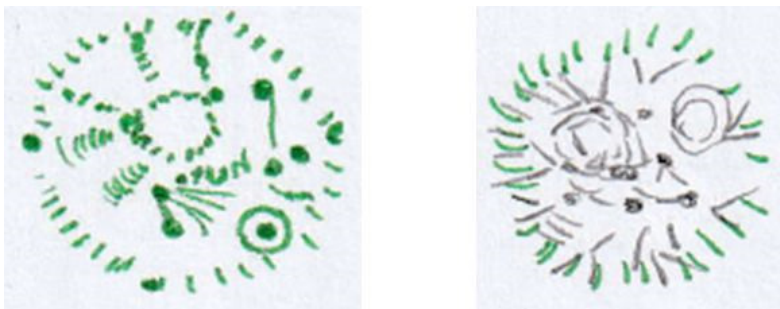


Fig. 2. First drawings of F by the author from 2015. The observed object O was a green status LED of an Alcatel DECT mobile phone.

and mid drawing): a) Common features were the coherent net-like basic structure with thicker (knotty) dots and the often parallel fine lines at different scales. b) Also the sparseness of *F*, with dark spaces in between, in which really nothing is depicted, has been reported similar to the author's experience.

The second colleague, MF, was aged 46 and had a hyperopia of 2.5 dpt. His drawing can be seen in figure 3 at the right side. Although he has an opposing visual defect, his figure is composed of similar structures and he too, reports about the same unexpected sharp lines surrounding completely dark areas. Also, the knotty regions are present.

2.3 Geo- and radiometric considerations

Before discussing the phenomenon and its discrepancy, let's take a closer look at the light field *L* to get a first estimate of its dimension and the involved light intensity. We assume some typical parameters for the eye: pupil diameter 6 mm, focal length 17 mm, eye length 22.8 mm, cone diameter 2 μm . With normal vision, the retinal image of the 1 mm LED according to Emsley's eye model is about 5.6 μm in size and thus covers about 8 cone cells. With short-sightedness of -3 dpt, however, the retinal image reaches a size of about 310 μm , which corresponds to a "virtual" size of about 40 mm. More importantly, the illuminated area on the retina is about 3000 times larger and therefore the light density per receptor cell decreases by the same factor. Figure 4 shows a size comparison of the idealised expected light fields.

To estimate the rough photon flux, we consider an LED with a brightness of 10 milli candela at a wavelength of 550 nm. In this way, around 1.3 billion photons/sec enter the eye through the pupil. Assuming a photon loss due to absorption or scattering of 90% within the eye (Gibbs, 1996), 130 million photons/sec reach the retina. And under the myopic conditions mentioned, each illuminated cone is hit by around 540 photons/sec. Assuming an image frequency of 25 Hz, this corresponds to a photon flux of only around 20 photons per cone and image.



Fig. 3. Left and middle: Drawings of colleague TF from 2018. In this case, the observed object *O* was an orange-coloured LED of a Nokia mobile phone charger. Right: Drawing of hyperopic colleague MF from 2025, *O* was a green status LED of a USB-C charger.

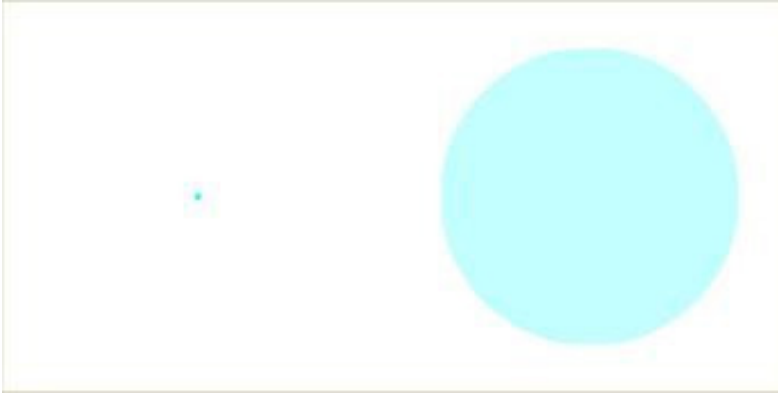


Fig. 4. Illustration of relative sizes of L for a 1 mm large O at 3 m distance: left normal vision, about $6\ \mu\text{m}$; right myopic vision of $-3\ \text{dpt}$, about $310\ \mu\text{m}$. Note that the brightness in the myopic case is not scaled accordingly, otherwise it would not be visible.

We therefore expect L to be a relatively large, mostly homogeneous light field with very low intensity and no conspicuous structure, and we expect to perceive a correspondingly shaped figure F . But we do not! F seen does look completely different!

2.4 Research question: What is the origin of the observed discrepancy?

The perceived size of F agrees well with our estimate. But as we have seen, there is a large discrepancy between the expectation of an almost homogeneous image of the defocussed spot and the very structured appearance of the perceived F . And so the question arises as to where these structures in F come from. Basically, two approaches are possible:

Focus-on- L : Either our expectation of an approximately homogeneous light field L is completely wrong, in which case L could have an intensity distribution whose appearance is similar or identical to the shape of F . In this case, the visual perception process ($P: L \rightarrow F$) would be a kind of structural “identity” mapping that “only” produces the experience of visual perception. And the research question collapses to: ‘*What could be the reason that L has such a shape?*’. Candidates for explanation would be all kinds of optical effects like scattering or diffraction. Proving the true form of L through direct measurement however will be difficult due to limited accessibility and the low photon flux. This type of explanation is of course an obvious and important approach, but it will not at all advance our understanding of the emergence of F . Moreover, this variant implies that P could faithfully reproduce arbitrarily small and/or weak stimuli, which is certainly not true.

Focus-on- F : Or L is really almost homogeneous. In this case, the appearance and structure of F would be an intrinsic property of P . And as such, it could provide valuable information about how visual perception essentially works, in particular how the individually experienced perception comes about. The research question here could be: ‘*Which physical processes or neurophysiological conditions could produce that appearance of F ?*’ This formulation sounds similar to Kurt Koffka’s question ‘*why do things look the way they do?*’, but in a more specific context.

3. Discussion

As already mentioned, no relevant publication could be found on the observation and individual perception of very small light spots defocussed by defective vision. Therefore, before we can assess and evaluate the situation, I would like to cite sources that I believe could be relevant to the topic at hand. Many of these belong to Gestalt theory because many experiments have been carried out in this tradition.

3.1 Phenomenology and Gestalt Theory

At the beginning of the 20th century, phenomenology (Marx, 2024) was an important approach to gaining new insights into perceptual processes. According to Edmund Husserl, the phenomena of things as we perceive them in our consciousness offer the strongest explanatory power when it comes to new insights. Early Gestalt psychology also relied heavily on phenomena (Stemberger, 2022), Wolfgang Köhler published his book on ‘*Die physischen Gestalten in Ruhe und im stationären Zustand --- Eine naturphilosophische Untersuchung*’ at the same time (Köhler, 1920). He described one of the few theories to explain F . He suggested that the perceived shapes might somehow consist of a superposition of electric field current lines. I found this theory very attractive because my personal perception of F included elements that looked like what I would imagine electric field lines could look like. This applies in particular when F contains patterns like concentric circles. To our knowledge, we don’t know whether Köhler had a specific comprehensible phenomenon in mind that led him to this assumption. Köhler attributed the morphogenesis (‘*Gestaltbildung*’) to a minimisation of the underlying (inorganic) physical processes (structural energy). On page 254 he posed the question of what shapes could look like that correspond to the smallest possible energy values¹. I don’t know if this question has ever been answered.

At the end of the 1920s, Wolfgang Metzger published his Ganzfeld experiment (Metzger, 1929). The test subjects were exposed to a completely homogeneous visual field, which sometimes led to visual hallucinations. In contrast to that, the

¹ ‘*Wie sehen Gestalten aus, die kleinsten möglichen Energiewerten entsprechen?*’

visual field in our experiment is also homogeneous in the extreme case, namely dark, with the exception of the tiny defocused spot of light. Thus, Ganzfeld experiments are not really comparable to our approach. In (Metzger, 1975) a large number of visual experiments are described to demonstrate the laws of vision and Gestalt Theory: optical illusions and figure/background scenes. In chapter 15, page 662/663, Metzger writes about prevailing assumptions at that time: ‘... visual perception (in our context: F) may actually only have such properties as the retinal image (L) already possesses...’². In this respect, visual perception (mapping P) is only granted some kind of information transfer. I think this is an inadmissible simplification of how our perception really works. And further he writes, in my opinion precisely in the original sense of Husserl: ‘*There is only one way to arrive at useful predictions and conjectures about the physical processes that have to do with vision: to immerse oneself in direct observation (introspection) without any sideways glance at physics, chemistry, anatomy and physiology, and not to cross out or even adjust a single dot from the results of such unbiased (one could also say “phenomenological”) observations, just because it does not fit into our current knowledge of the nervous system and of nature in general. If this condition is fulfilled, then we can also think about the nature of the areas in which the processes take place that are directly associated with the visual phenomena, and about the nature of the processes themselves*’³. I believe this is still true after 50 years.

Concerning the vision of tiny (microscopic) objects, which is related to our contribution, he reports on observations of ‘*Sehdingen*’ (F) when their size decreases sharply: first their shape becomes rounded and when ‘*their contour is no longer closed enough*’, they disintegrate into fragments. Here could be a relationship to our drawings presented, when the structures seen in F are interpreted as fragments of the disintegrated object O . In this context (as of 1975), Metzger mentions two sources that were 40 years old at that time: Erich Wohlfahrt discusses visual acuity issues related to professions that work with small objects, such as watchmakers (Wohlfahrt, 1928). Curt Berger discusses the suitability of letters for use in visual acuity tests such as Snellen (Berger, 1932). Overall, very few references can be found that discuss the perception of impulse-like stimuli at or below the resolution limit of the eye. In fact, the discussion of Gestalt laws and

² ‘...die Meinung, dass Sehdinge (F) eigentlich nur solche Eigenschaften haben dürfen, die nach dem gegenwärtigen Stand unseres Wissens über die Abbildung im Auge schon das Netzhautbild (L) besitzt...’

³ ‘Um zu brauchbaren Voraussagen und Vermutungen über die körperlichen Vorgänge zu gelangen, die mit dem Sehen zu tun haben, gibt es nur einen Weg: Ohne jeden Seitenblick auf Physik, Chemie, Anatomie und Physiologie sich in die unmittelbare Anschauung zu vertiefen (Introspektion), und von den Ergebnissen solcher unvoreingenommener (man kann auch sagen “phänomenologischer”) Beobachtungen kein i-Tüpfelchen abzustreichen oder auch nur zurechtzurücken, nur weil es nicht in unsere gegenwärtige Kenntnis des Nervensystems und der Natur überhaupt hineinpasst. Ist diese Bedingung erfüllt, so können wir uns auch Gedanken machen über die Natur der Gebiete, in denen sich die Vorgänge abspielen, die den Seh-Erscheinungen unmittelbar zugeordnet sind, und über die Natur der Vorgänge selbst.’

their respective phenomena and experiments take place exclusively in the “macroscopic” regime, in the sense that a large field of view is used and the emphasis is placed on properties of the macroscopic object such as parallelism, angles, sizes, etc. Even in (Bischof, 1966) the perception of tiny impulse-like stimuli is not dealt with. A discussion of ametropic visual perception of small objects could not be found anywhere.

Lothar Spillmann reported on the thinned-out psychophysical vision research in Germany as a result of the scientific loss due to the Nazi regime. The potential of quantitative phenomenological research towards psychophysical relationships between vision and brain activity was not recognised at that time. Moreover, advances in experimental neurophysiology have shifted the focus of research from the holistic subjective description of perception to the objective analysis of individual neuronal activity in animals. Often these technical methods of data collection are difficult to understand and the relationship to biological or psychological perception is not obvious or completely lacking (Spillmann, 1974). A more recent text on the connections between phenomenology and neurophysiology can be found in (Spillmann, 2009). On the occasion of 100 years of Gestalt psychology, Johan Wagemans describes its history and current developments, which now focus more on the two Gestalt principles (simplicity or minimal principle (*Prägnanz*) and likelihood principle) and related computational models (Wagemans et al., 2012a, Wagemans et al., 2012b).

3.2 Optical approaches

In most discussions related to the topic of myopia discrepancy, attention is immediately drawn to the optical effects in the eye, which is obvious at first glance. We will try here to give a brief overview of possible discussions. Herman von Helmholtz reported on experiments in which very small points of light were observed just beyond the maximum accommodation distance (von Helmholtz, 1867), p. 138. He described an irregular radial (*‘strahlige’*) figure and also made drawings of what he perceived (ibid. Fig. 65). He called these figures ‘circle of confusion’ (*‘Zerstreuungskreis’*) and attributed the irregularity to his astigmatism. This type of explanation for the phenomenon of “radiality” is obviously focussed on *L*, which is no wonder as this research was carried out around 1850, long before the discovery of the neuronal structure of the brain.

There is a wide range of entoptic phenomena in general (Charman, 1991) (Ch. 15, pp. 345-356), (Mausier, 2011, Artal, 2014). Spherical aberrations and intraocular scattering degrade the (retinal) image quality (Artal, p. 357), but in my opinion these effects should not lead to such sharply perceived details as in the present experiment. An extensive collection on scattered light at the retina can be

found in (Franssen and Coppens, 2007), similarities to our observed phenomenon could not be found. A very interesting paper is (Navarro and Losada, 1997), in which the point spread function (PSF) of the eye is measured approximately while a point-shaped stimulus of about 1.8 arc minutes diameter is presented. In addition, the subjects recorded their perceptions (ibid. Fig. 3, p.356). Compared to our drawings, these pictures are the most similar I have found in the literature so far, but they do not show such fine and sharp details as in our observations. (Wilson et al., 2002) present a study on the measurement of astigmatism with a Hartmann-Shack sensor. These measurements are used to simulate the PSF of the eye for different degrees of refractive error. Interesting approach, but again, no such fine details were reported and no comparison to subjective perceptions is shown. (Vanston et al., 2023) report a study on colour perception of very small green light spots when only a few cones are illuminated. They focus only on subjects with normal vision, and the morphology of perception is not taken into account at all, only the perceived colour. Similar studies can be found in (Domdei et al., 2021, Witten et al., 2024).

3.3 Interim conclusion

The phenomenological observation of the author could be confirmed in broad outline by two other persons. It can therefore be assumed that it is not about a pure personal phenomenon. We have introduced designations for O , L and F , through which we hope to simplify the discussion about the entanglement of optic and psychic processes involved. Within the treated literature, there is a clear tendency to explain said visual phenomena either by a corresponding shaping of L or by trying to correlate certain properties (such as colour or orientation) of the object O with neuronal action potentials somewhere in the brain. But there are only few theories about the perceived F and its origin. Köhler's psychophysical theory of isomorphic electrochemical fields was more or less the only theory focussing on the actual perception of the seen image. Subsequent theories are discussed in (Stadler, 1981, Pockett, 2012, Hunt et al., 2024). It is also clear that with today's technical means we can neither measure L nor F precisely, and in the case of the latter we do not even know what it consists of.

3.4 Personal interpretation

From this literature review it could be determined that the phenomenon presented here has not yet been described in this specific form: Light spot of a size at the spatial resolution limit with normal vision in the dark with a significant myopia. This is astonishing, as there are many short-sighted people who could easily make this observation without technical aids. I encourage interested readers to try the experiment for themselves to better understand what I mean and how

multi-faceted this myopia discrepancy study is. The verbal descriptions and drawings above are only poor copies of true perception.

I will try to summarise my thoughts in my own words: A point-shaped, practically structureless object O is imaged as a light field L on the retina. Of course, L is somehow shaped by the lens and vitreous body as well as by scattering and diffraction effects, so that L is not completely homogeneous. The nonuniform spatial distribution of the various cone receptors within the retina might also have a certain influence. But in my humble opinion, it is very unlikely that these inhomogeneities could ever lead to such fine and sharp details in L as perceived in F . The photon flux in L estimated above is likely to be in the range of the sensitivity threshold for colour vision, so that eventually true photopic vision can only occur locally (Kenneth R. Spring, Thomas J. Fellers and Michael W. Davidson, 2020).

My interpretation is that our visual system is running completely outside its normal operating conditions in this situation. The incident light density is too low to activate the bulk of retinal (colour) receptors in the illuminated area. Only a subset of the cones is activated. To put it in Gestalt language: no perceptual grouping can take place to produce a closed figure. The Gestalt laws (proximity, similarity, continuity, closedness, connectedness) cannot work in the 'normal' way due to the low stimulus intensity. Accordingly, the activation in the visual cortex is also only sparse and the perceived figure F is only a poor, but the best approximation to L that the visual cortex is able to produce under these conditions. Thus, it could be possible that the perceived structure of F , especially the net-like structures, reflect (neuronal?) activity that actually generate the visual perception. If this were the case, the proposed phenomenon could help to create a meaningful mapping between subjective perception and the neural causal process. Be that as it may, for 1500 years we have known that F is generated in our minds and nowhere else. Even if F looks nothing like the object under consideration O , it is still a real perception that contains a quantity of information that should not be underestimated. I think it is much more information than is emitted by O . We would like to explore this information and its nature. Operating the visual system outside its typical mode (low intensity stimulus due to myopia defocus vs. fully illuminated field of view in daylight) can also be interpreted as a pathological situation, which, as we know since Phineas Gage, sometimes is very instructive (Zahavi, 2006). Maybe, this 'pathologic viewing mode' allows to access some kind of basic or intermediate stage of perception, which can lead us further in understanding the whole thing.

I know this interpretation is quite speculative and currently unverifiable, but it is also very likely in some respects: would it really be surprising if we were to recognise net-like structures when looking into the cerebral cortex? The smallest of the fine details could correspond to the shapes that correspond to the lowest possible

energy values, which might be what Köhler wanted to know. It could be that we can thus directly observe the psychic part of the psychophysical level at which visual perception arises. If this interpretation were correct, we could finally learn from the possible morphologies of F how visual perception arises and what it consists of. Gestalt theory in its literal sense could act as link between F and neurophysiology, in the sense that we could infer the processes of percept formation from the gestalt of F . And as long as we do not have the appropriate technical instruments to measure F directly, we as intelligent humans could experience it through ‘micro-introspection’. ‘Micro’ here in the sense that the presentation of very small and weak stimuli activates the smallest perception-creating units in the visual cortex.

Our hope is that by examining these “gestalts” using the proposed “micro-introspection”, it may be possible to deduce the underlying “perception-creating” processes and thus come closer to a true understanding of how our brain and mind work.

4. Summary and perspectives

We have described a previously unpublished phenomenon, which might tentatively be called ‘*myopia discrepancy*’. Instead of a blurred image, we see a richly structured figure. Visual micro-introspection could be a name for the future approach to investigate this discrepancy: a) Defocussed presentation of a weakly structured (empty) stimulus. b) Introspective observation of the perceived structure and its finest details. Mental “discussion” about whether the perceived structure is more attributable to L or to F . c) Externalisation of the first-person perception through verbal description and drawing (phenomenology). d) Derivation of hypotheses about how neural tissue might be able to produce such figures.

Our attempt to explain the discrepancy is as follows: a) L as initial stimulus for visual perception is not subliminal, but so small that only a tiny, sparse sub-area of the visual cortex is activated. We therefore favour an explanation of the perceived structures that concentrates on F . b) The Gestalt laws of grouping are “out of order” due to the low intensity. c) The structure of the perceived F is caused by the underlying neuronal activity and morphology. In other words, the shape of F is induced by the morphology of the “perception-creating” units. d) This activation takes place within a cortical column.

If our considerations and interpretations are correct, we see the following potential: there would be a method for directly observing neuronal perception-forming processes in our own brain. In situ and in real time. It could be used on a scale where no other instruments are currently available and probably won’t be for a long time.

Future work could consist of a more comprehensive and systematic phenomenological recording of perceptions F , for different conditions with regard to

defective vision, age, colour, size and intensity of *O* or other parameters. The variation of experimental conditions such as ambient lighting or the ametropic observation of small light reflections in daylight are also very interesting. There is a plenty of different situations to study the phenomenon. In addition, tools of any kind that help to externalise such fine and detailed structures could be helpful. In order to confirm or reject our assumption, we would be grateful for any hint, any discussion, any new or old clue, or even descriptions or drawings of your own *F*. We would be happy to collect those under the following e-mail: *myopia.discrepancy@gmx.de*. We thank you.

Summary

The origin of subjective visual perceptions is still not fully understood. Existing instruments do not work at sufficient resolution to observe microscopic processes in the brain in situ. We present a preliminary empirical phenomenological study. A light spot at the resolution limit of the healthy eye is observed by visual introspection under ametropic, especially myopic conditions. We would like to discuss this as yet undescribed phenomenon of visual perception, particularly from the point of view of Gestalt theory. The phenomenon consists in the discrepancy that instead of a correspondingly blurred version of the spot, a surprisingly sharp and complex structure is perceived that completely contradicts our expectation. Since the shape perceived under these conditions does not contain any geometric information from objects in the physical external world, we postulate that the shape contains morphological information about its formation process. We present our phenomenon, including geometric and radiometric considerations, the first-person perceptions in our preliminary study, as well as our reasoning.

Keywords: Phenomenology, Visual Perception, Introspection, Myopia.

Zusammenfassung

Der Ursprung der subjektiven visuellen Wahrnehmung ist noch nicht vollständig geklärt. Die vorhandenen Instrumente arbeiten nicht mit ausreichender Auflösung, um mikroskopische Prozesse im Gehirn in situ zu beobachten. Wir stellen eine empirische phänomenologische Studie vor, in deren Rahmen wir ein bisher noch unbeschriebenes Phänomen der visuellen Wahrnehmung insbesondere aus der Sicht der Gestalttheorie diskutieren. Ein Lichtfleck an der Auflösungsgrenze des gesunden Auges wird durch visuelle Introspektion unter kurzsichtigen Bedingungen beobachtet. Das Phänomen besteht in der Diskrepanz, dass anstelle einer entsprechend unscharfen Version des Lichtfleckes eine überraschend komplexe und scharf abgegrenzte Struktur wahrgenommen wird, die unserer Erwartung völlig widerspricht. Da die unter diesen Bedingungen wahrgenommene Form keine strukturellen Informationen von Objekten in der physischen Außenwelt enthalten kann, postulieren wir, dass die subjektiv gesehene Figur morphologische Informationen über ihren eigentlichen Entstehungsprozess enthält. Wir stellen unser Phänomen, einschließlich geometrischer und radiometrischer Überlegungen, die subjektiven Wahrnehmungen aus der Ersten-Person-Perspektive in unserer Vorstudie vor, diskutieren diese und legen unsere Interpretation des Phänomens dar.

Schlagwörter: Phänomenologie, Visuelle Wahrnehmung, Introspektion, Kurzsichtigkeit.

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Acknowledgements

I would like to thank my colleagues Dr. Theobald O.J. Fuchs for his drawings and his valuable contribution to the initial geometric and radiometric considerations as well as Dr. Markus Firsching for his hyperopic contribution. I would like to thank the organizers of the 23rd GTA conference in Milan for the event and its inspiring title as well as the editors and reviewers of Gestalt Theory journal. I am moreover grateful to the following debaters: Michael Bach, Ivana Bianchi, Norbert Bischof, Wolfgang Fries, Tobias Grulich, Randolph Hanke, Susanne, Eva und Lisbeth Hassler, Ines Langemeyer, Jan Kremers, Reiner Korn, Günther Kostka, Michael Kubovy, Andreas Maier, Manfred Mastek, Markus Michen, Michael Pronath, Markus Rehak, Barbara Rosenzweig, Roger Rottler, Oliver Scholz, Marianne Soff, Lothar Spillmann, Wolfgang Stegherr, Gerhard Stemberger, Norman Uhlmann, Rainer Wolf, as well as to the organizers of the Riva preparation camp. And not to forget the ones I foolishly forgot... Parts of the literature research and manuscript editing were supported by Fraunhofer IIS.

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