

ADAPTATION and VIRTUAL REALITY (VR)

[DEC 1, 2023](#)

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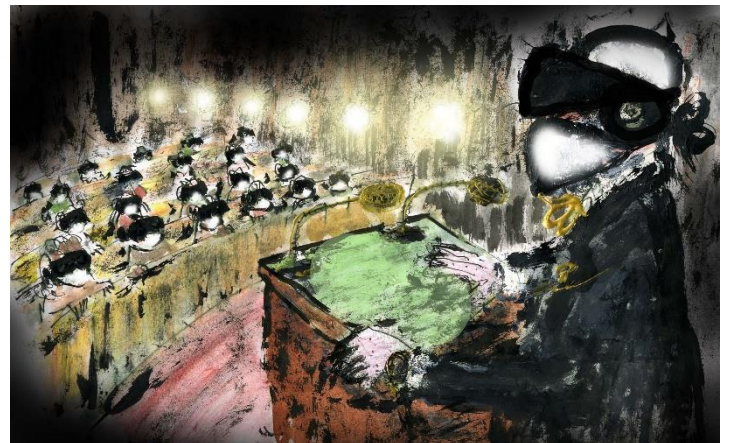
*Man is the measure of all things** - and not the other way around, as it seems at the moment. The eye and central nervous system cannot 'adapt' to the increasingly overdosed potentially phototoxic light intensities. Depending on



the intensity and duration of exposure, acute - or, in the case of repeated, seemingly reversible light exposure, permanent - retinal light damage manifests itself. Steadily increasing 'overloads' of working memory and especially visual short term memories (VSTM) in road traffic (e.g. due to daytime running lights) also cause cognitive deficits (distraction blindness, inattention blindness). No adaptation or similar could adjust the capacitive limits of the system to non-physiological stimulation.

"Retinal plasticity" can repair retinal damage (e.g. solar retinopathy), but only in ground squirrels during hibernation. During this resting phase, bipolar dendrites 'remember' previously intact neuronal connections and restore them with renewed, fully functioning elements (*'remodeling'*). And in spring, even before waking up, these almost unimaginable repair processes are finished.

The industry apparently assumes that such *miraculous* cures would also be possible in the species homo sapiens sapiens. Potentially phototoxic light is blasted into the eyes of future 'VR users' from an extremely short distance. Prototypes (VR-Head-Mounted Displays (VR-HMDs)) with luminances of allegedly ~ 6000 cd/m are waiting for them². With the square of the distance, the light intensity decreases - vice versa. The thoughtless use of extremely bright light sources, even at such a minimal distance from the eye, borders on bodily harm (§ 84 StGB). Biological defense mechanisms are intentionally switched off and high-energy, short-wavelength dominated light is focused (usually over long periods of time) as if with a magnifying glass at the retinal level.



TU Berlin: *"There are no restrictions regarding potential blue light hazards in the choice of displays (VR) that are on the market today."* (Leontopoulos et al). 'VR' would now stand more for 'V recognized Reality'. Statements such as: *"the risk of blue light damage does not matter"* (see below) characterize unacceptable "risk-taking". However, this risk is not borne by the producers, but by gullible but unsuspecting users, who are not warned of possible irreversible damage by any 'package insert'.

The physiological adaptability of the human eye to light intensities - the adaptation, extends over a remarkably wide range, from -10^{-6} cd/m² up to

10^5 cd/m². The pupil contributes relatively little (~ 4:1 to 16:1); the crucial processes take place predominately in the retina. *"The impedance level of the electrolytic photoreceptor neuron is orders of magnitude higher than any electronic circuitry made by man"* (Fulton).



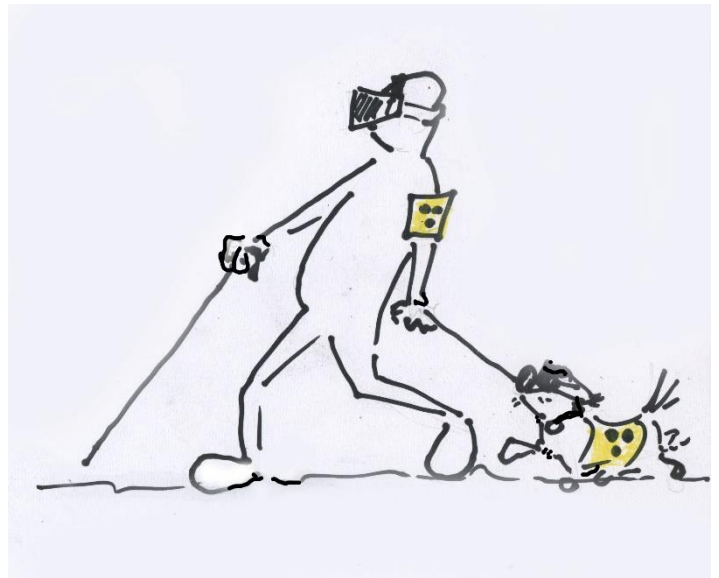
"Physiological" (?) Blinding, as it still wreaks havoc as 'misnomer' in semi-official and official guidelines, is a contradictio in adjecto. And if anything is unphysiological in sensory physiology, it's glare. The term "psychological" (?) Glare is meaningless. **Disability Glare and Discomfort Glare** impressively describe the effects of such undesirable light intensity overdoses. Disability glare: severe glare, can have fatally long effects depending on the duration of exposure and intensity - increased risk of accidents.

Discomfort Glare is distracting and can be described as 'Distraction Blindness' (overflow of visual short term memory (VSRT), working memory, etc.) Cause functional failures. In addition to overdosed light exposure durations and intensities, media opacity as well as retinal photodamage, macular degeneration, etc. can further exacerbate the problem.

Quantification attempts and mathematical modelling, such as converting them into complicated formulas (see below), do not contribute to a better understanding. Experts such as traffic psychologists, accident researchers, traffic lawyers and physicians are being 'done a disservice' with such strangely cryptic formulas (see below).

$$UGR = 8 \log 0.25 L_b \sum_n (L_n^2 \omega_n p_n^2), \quad \{\mathrm{UGR}\} = 8 \log \left\{ \frac{0.25 \{L_b\}}{\sum_n \left(L_n^2 \frac{\omega_n}{p_n^2} \right)} \right\}$$

Where \log is the common logarithm (base 10), L_n is the luminance of each light source numbered n , ω_n is the solid angle of the light source seen from the observer and p_n is the Guth position index, which depends on the distance from the line of sight of the viewer".



In addition to adaptive processes in cones and rods, such processes have also been observed in *mRGCs*- in connection with 'circadian entrainment, intraretinal processing', influencing adaptation states of other retinal elements, etc.: "*mRGC-driven visual pathways and behaviors may be more complex than previously thought*".



The underrated Müller's Glia (MG) also makes valuable contributions to the adaptation: "*.. activation of Dio2 in MGs during light adaptation is involved in the regulation of mitochondrial metabolism and gene transcription in cones via the TH (thyroid hormone signaling) pathway and intercellular communication. . Furthermore, light increased the transcription of the deiodinase Dio2 in MGs, which converted thyroxine (T4) to active triiodothyronine (T3). Subsequently, light increased T3 levels and regulated mitochondrial respiration in retinal cells in response to light conditions (Wei et al).*"

Electroretinography, which has been declared dead repeatedly, 'closed a circle': More than seventy years ago, the ERG documented retinal recovery processes (photoreceptors, bipolars) in the context of dark adaptation. After massive bleaching, the "rod photoreceptor circulating current, estimated from the rod-isolated bright-flash ERG a-wave, took thirty minutes to recover** - "indicating that products of bleaching, thought to be free opsin (unbound to 11-cis-retinal), continue to activate phototransduction, shutting off rod circulating current". On the other hand, "cone current, assessed with cone-driven bright-flash ERG a-waves, recovers within 100 ms following similar exposures, suggesting that free opsin is less able to shut off cone current."

These results confirm the results of densitometric and psychophysical studies. "Post-bleach ERG recovery has been explored in age-related macular degeneration and in trials of visual cycle inhibitors for retinal diseases. ERG tracking of dark adaptation may prove useful in future clinical contexts."

Experimental 'resuscitations' of retinal elements of human donor eyes after 'irreversible' damage have already been reported: these are still sensational 'breaking news' - reports from basic research; there is no hope of clinical application yet - perhaps once in the distant future. A more cautious procedure with light intensities is advisable - as a prophylactic recommendation.



Reference:

(Abbas F et al (2022) Revival of light signalling in the postmortem mouse and human retina. *Nature* <https://doi.org/10.1038/s41586-022-04709-x> : during the first five minutes after massive 'bleaching': "rod circulating current was undetectable in the first 5min" - this can be seen as an objective criterion in connection with the temporal processes of disability glare psychophysics. ipMRGC: intrinsic photosensitive Melanopsin expressing Retinal Ganglion Cells.

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Boyce PR (2003), "Unified+glare+rating"&pg=PA177 Human Factors in Lighting Archived 2018-01-13 at the Wayback Machine, 2nd edition, Taylor and Francis, London p. 177

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* This "*homo-mensura theorem*" comes from the Greek philosopher Protagoras (c. 481-411 BC), who belonged to the Sophists. He was found in his lost pamphlet entitled "The Truth." https://universal_lexikon.de-academic.com/226710/Der_Mensch_ist_das_Ma%C3%9F_aller_Dinge

"In general lighting, the risk of blue light damage does not play a role. This is confirmed by the bodies responsible for occupational health and safety (e.g. LiTG, SCENIHR, DGUV). This was also the conclusion of the "preliminary opinion" (Scientific Committee on Health, Environmental and Emerging Risks) published in July 2017 by the scientific commission SCHEER, which was commissioned by the European Commission to carry out a risk assessment of LEDs.

<https://michaelbach.de/2020/04/07/blauer-bloedsinn.html>

Epilogue: Industry and politicians take note of the limits of vision, cognition and adaptation, 'retinal recovery times', etc. - virtual as well as real - 'hope dies last'.

Gender: beyond

Interest: no conflict

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