

Medical Devices

(Health Tech)



INOPTEC smart glasses – for health tech.
Number of optoelectronic components:

- 8 x photo sensor –or– 2 x CCD cams
- 4 x LC shutter cells
- 1 x photo sensor (calibrated ambient light)
- 2 x eye-tracker including IR source
- 8 x LED – 0.3-watt white as add-on device
- 2 x LED – 3.0-watt RGB as add-on device

> 20 photonic components per smart glass!

Ralf G.J. Knoll: “How INOPTEC can avoid painful **light-triggered migraine attacks** – or harmful light exposure after **eye surgery.**”

INOPTEC also showcased this example on [YouTube](#)
([EPIC's Online Technology Meeting](#)) on 06.12.2021



Problem:

Light sensitivity as
- a permanent condition
&
- after eye surgery.



Health Tech: 5 - 20% of population suffer under light sensitivity.

Solution I (daylight)



Regular Sunglasses

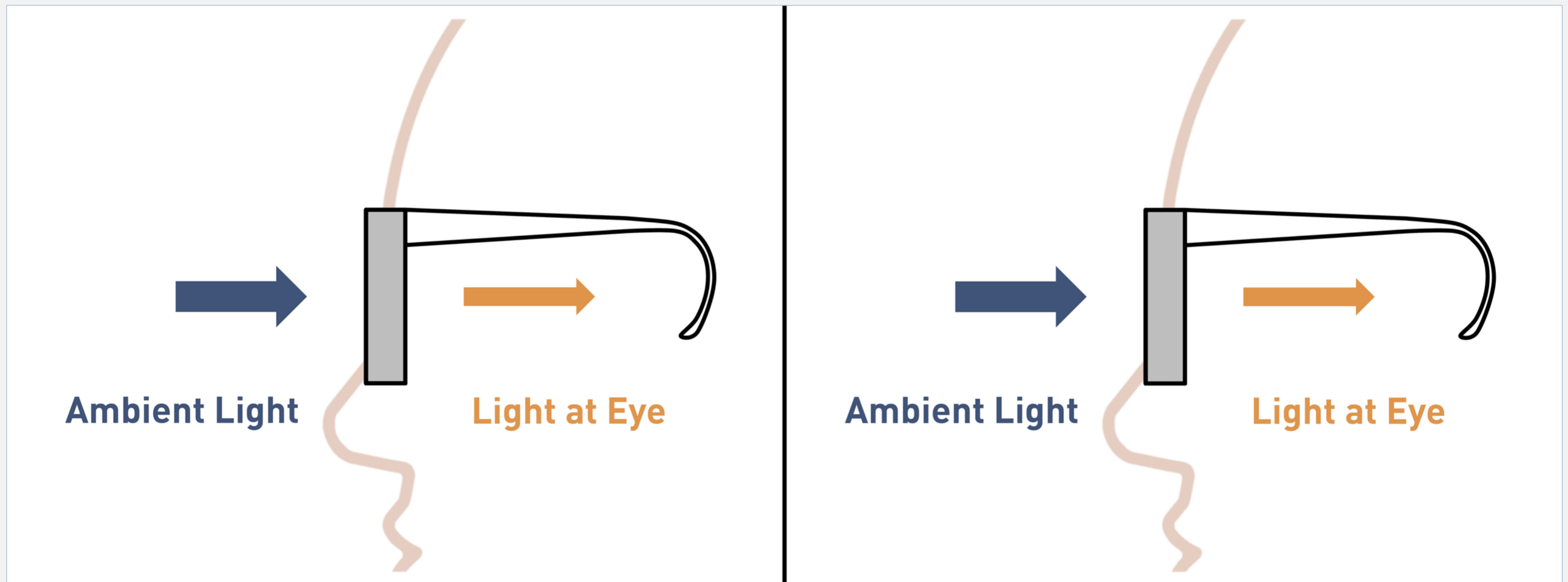
They have a fixed light absorption.

Ambient Light changes are transmitted (just attenuated) to the **Light at Eye**.

INOPTEC Smart Glasses

They have a dynamic light absorption.

Ambient Light changes are **not** transmitted (cancelled out) to the **Light at Eye**.

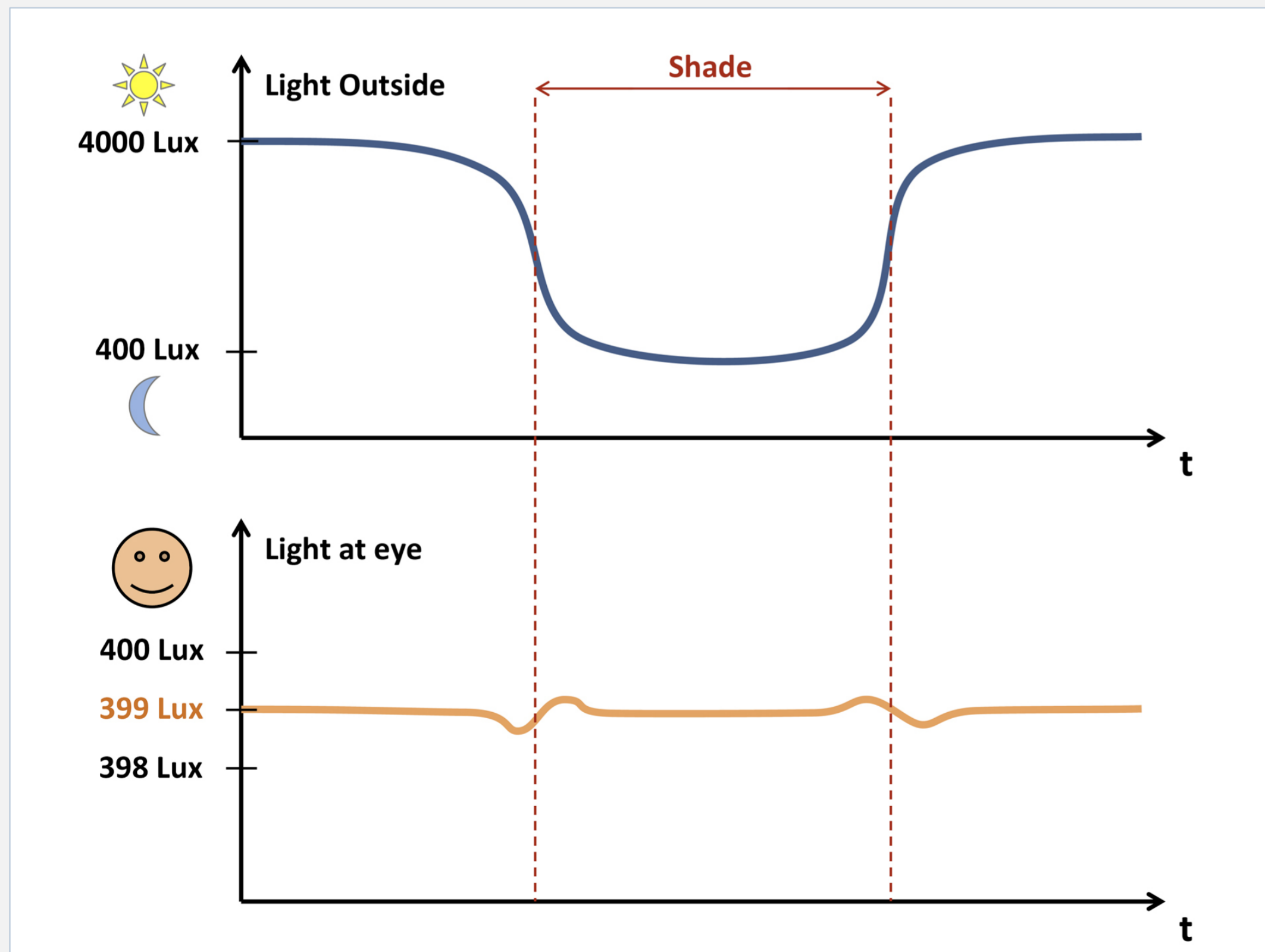


Light at eye = constant intensity !

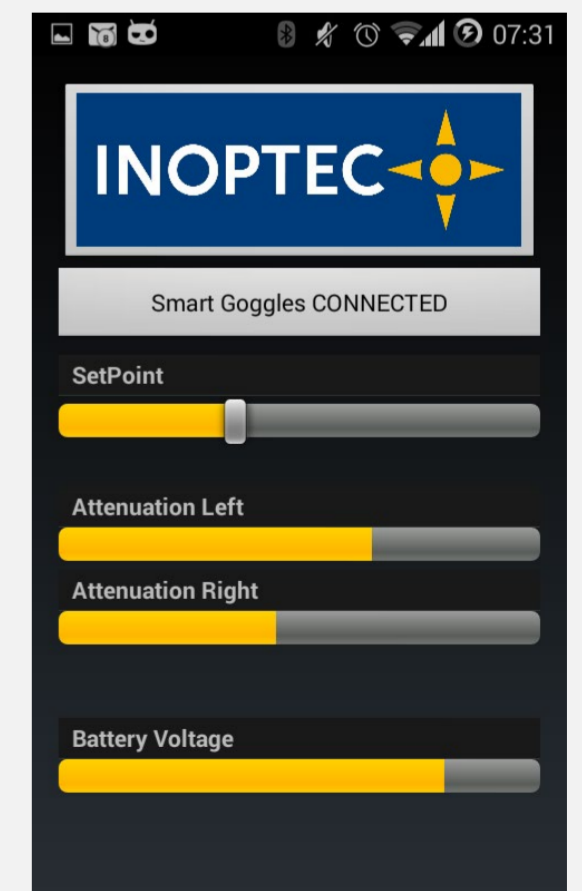
Solution II (daylight)



- Glasses react in „real-time“ to **cancel out** ambient light changes.
- Constant illumination: → **Medical fixation for the human iris !**



Individual
“set points”
(e.g., keep the
illumination always
constant at 400 Lx)
can be selected via
Mobile App.



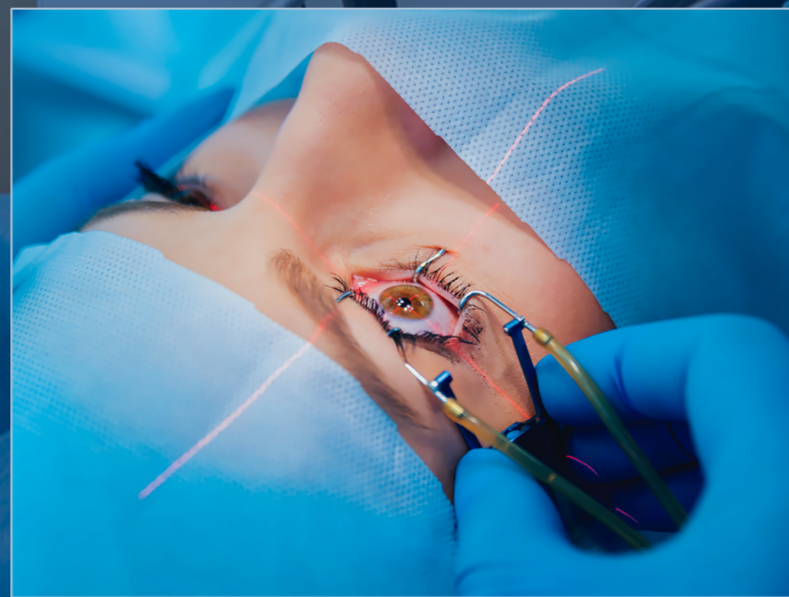
Technology MONOPOLY!



	INOPTEC (> 2017)	Polymer dye etc. (1990s)	Photochromic (1960s)	Conventional (1940s)
Tint	dynamic	dynamic	dynamic	static
Tint spectrum	continuous	2 discrete levels	continuous	1 discrete level
Contrast ratio	100 – 1000 C	C	~ C	-
Response time	1 ms	100 ms	~ 1 min	x
Boost and fully control synched light	✓	x	x	x
Suppress unsynched light vs. sync.	✓	x	x	x
Future applications	ALL sorts of industry at DAY & NIGHT	x	x	✓

Market entry: Health & Life Science!

Light sensitive people (B2C),
and eventually later
(B2B) post eye surgery, etc.



ANYONE WHO NEEDS PROTECTION

Eye/Brain Conditions, which require **CONSTANT low-light ILLUMINATION !**

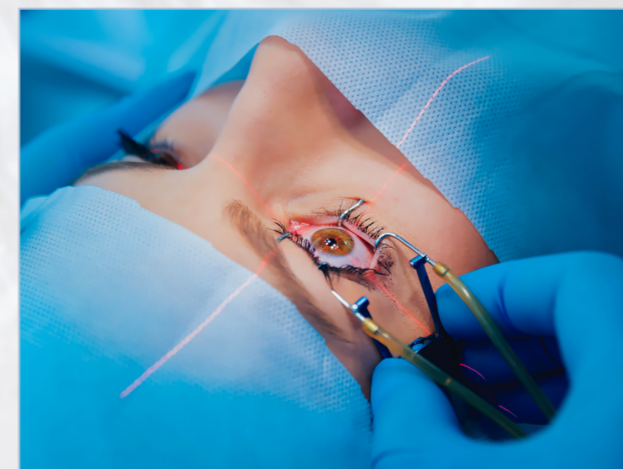
Conditions in which people can be very light-sensitive:

I. Daily use (B2C):

- Migraine
- Photosensitive Epilepsy (PSE)
- Maintaining a circadian rhythm (cyclic or anticyclic)
- Vertigo, Chronic fatigue syndrome (CFS)
- Optic Chiasm Glioma
- Age-related macular degeneration (AMD)
- Colour Blindness (colour vision deficiency)

II. Recovery after eye surgery (B2B):

- Laser vision correction (LASIK)
- Cataract = Intraocular lens (IOL) implantation
- Retinal detachment / AMD related operations
- Orthoptics: e.g. lazy eye (remote control)
- Cornea trauma or inflammation



Why is the 'migraine market' very important?

Not healable – but attacks can be avoided = 3% of world!



MIGRAINE FACT SHEET:

1) Migraine = every 10th person / hefty forms every 20th person = **5%**

2) Migraine is **NOT** healable – mainly genetically inherited.

3) Migraine attacks triggered by too much light = **65%**

Total % of light-sensitive migraine clients = **5% x 65% = 3% of world!**

Why is the 'migraine market' very important?

PPE – no clinical trials – no more pain / opioids



CONSEQUENCES & HOW WE HELP:

- A. Not healable => Personal protection equipment (PPE) => no clinical trials,
no FDA approval needed!
- B. Patients willing **'to pay almost any price'**, because of => **no more pain!**
... and smart protection means => **no more opioids!**
- C. If migraineurs need to leave their "dark room" => glasses can also be worn
during a migraine attack!

Why migraineurs can't wait to buy?

Only ONE electronic sunglass + open eyes + hands free!



CURRENT SITUATION – versus – FUTURE with INOPTEC:

Migraineurs are currently using up to 4 differently tinted sunglasses (slightly to strongly tinted) to “adapt manually”!

When changing, they must close their eyes (protection from exposure) – and they usually drop their bags as they need both hands for this => **dangerous & annoying impairment!**

CURRENT SITUATION:

Migraineurs are using typically **4** sunglasses (category 1-4) changed manually with **closed eyes!**



€ 100

€ 100

€ 100

€ 100

FUTURE SITUATION:

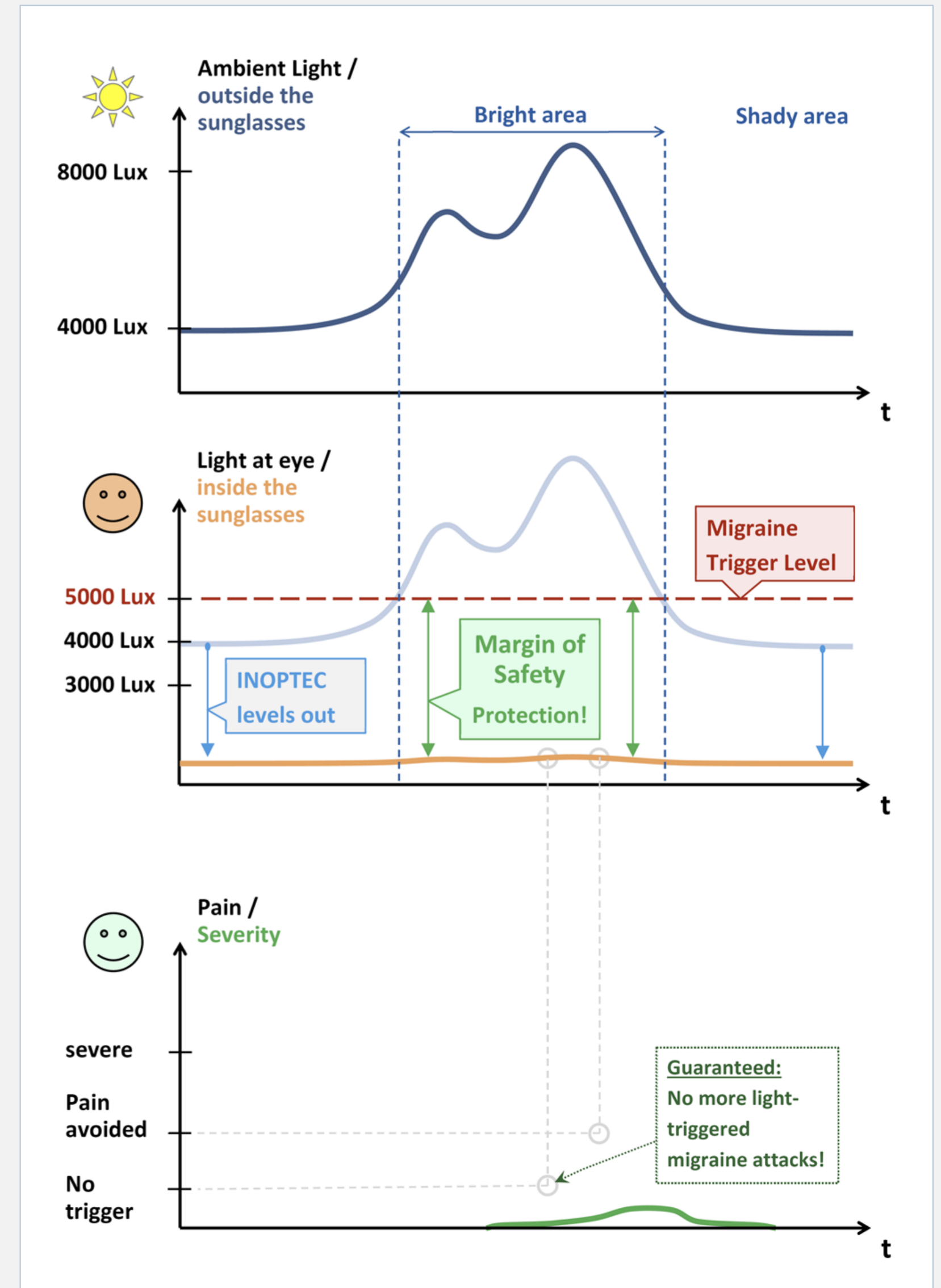
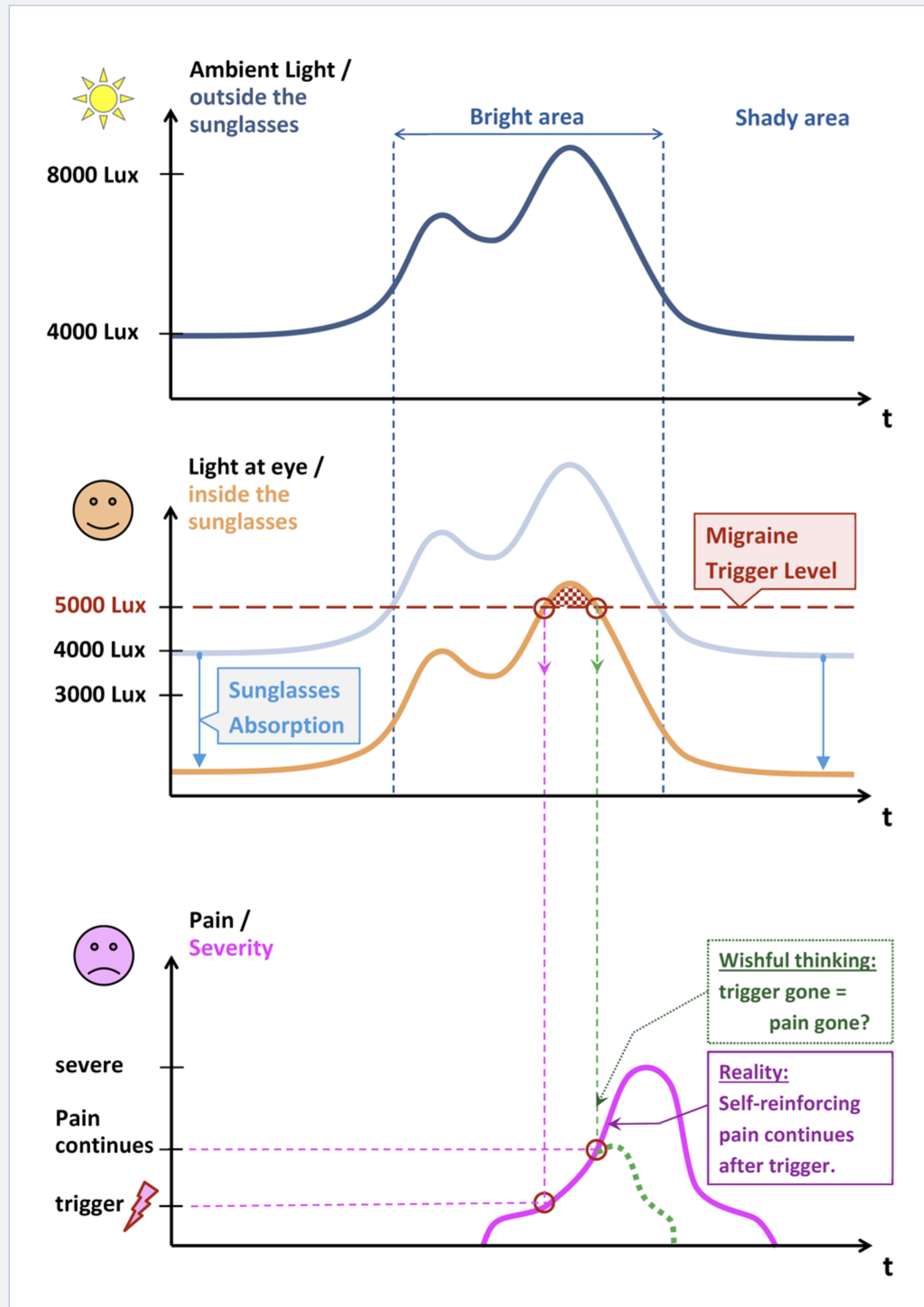
Migraineurs will be using only **1** sunglass (automatically tinted) permanently worn with **open eyes!**



€ 400 + X

Sunglasses versus Smart Glasses:

... always below migraine trigger level!



Our latest design (example)



Traction



Vision enhancement effect has been demonstrated on public events – visitors and clients were impressed!



Daylight demo goggle levels out the glare from a light source.



Protected from the “sun” – but seeing everything.

Exhibitions:

- SPIE, Defense DDS, Baltimore, USA
- Google Campus, London, UK
- Wearable Tech Show, London, UK
- New Scientist Live, London, UK
- Innovate UK, Manchester, UK
- ILA Airshow, Berlin, DE
- BAND, Nuremberg, DE
- Biohacker, Stockholm, SE



What Next ... ?



Outlook: In the future we will strive to implement all kinds of light modulators – so that we can not only adjust intensity and contrast, but probably also ...

All degrees of freedom: 6DOF in the field of vision / smart glasses

Adjustable via mobile app + definitely fully automated (hands free):

1)	Modulate light intensity (constant)	(1ms):	readiness:	●	●	●	●	●
2)	Modulate light contrast via LEDs	(1ms):	readiness:	●	●	●	●	●
3)	Change lens colour (FL-41 to green)	(1 sec):	readiness:	●	●	●	●	●
4)	Auto rotate plane of lin. polarisation	(10 ms):	readiness:	●	●	●	●	●
5)	High speed quantum switch/shutter	(50 µs):	readiness:	●	●	●	●	●
6)	Auto focus (electronic RX) via ET	(n.n.):	readiness:	●	●	●	●	●

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