Automatic Presbyopia Correction with Opto-Electronic Lenses

Pablo Artal*

LABORATORIO DE OPTICA
UNIVERSIDAD DE MURCIA, SPAIN

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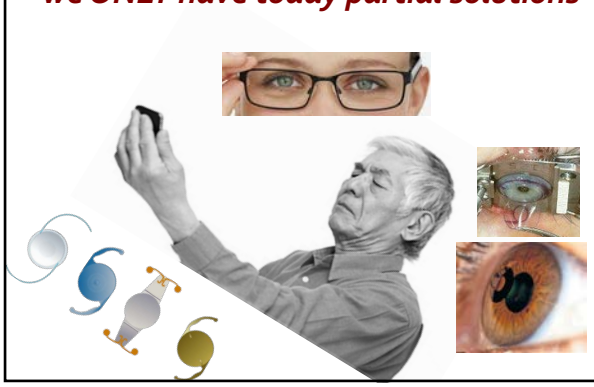
* Prof. Artal is the founder of Voptica and a consultant to RxSight , LEH & Visiometrics.

LABORATORIO DE OPTICA, UNIVERSIDAD DE MURCIA

http://lo.um.es @pablo_artal

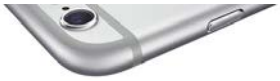
Correction of Presbyopia…
we ONLY have today partial solutions

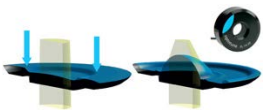


Adjustable Power Spectacles?

…require MANUAL adjustments!

…but already good solution in phone's cameras!
(opto-electronic adjustable/tunable lenses for autofocus)

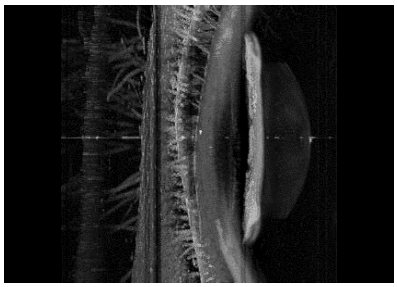




2030?

… also solved in the eye in the near future?

Automatic, precise, fast defocus correction…
just like in the "young" lens!



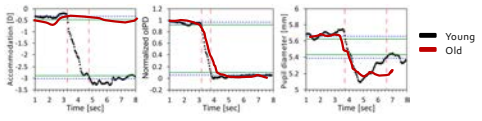
2030?

… also solved in the eye in the near future?

Automatic, precise, fast defocus correction…
just like your "young" lens!

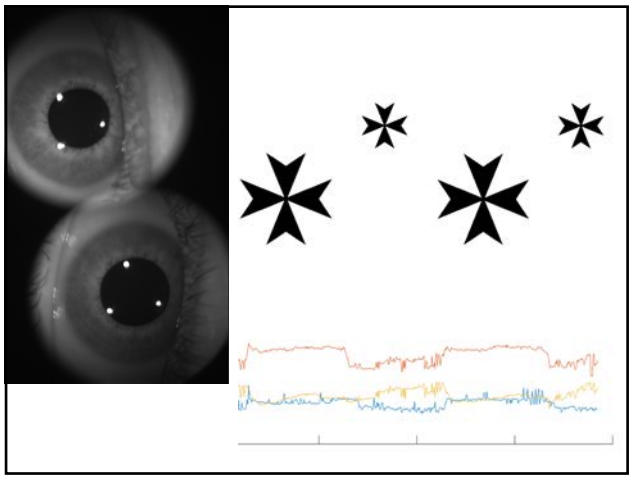
NOW… a working demonstrator using electro-optical lenses based on pupil responses

While accommodation declines with age, pupil size response and convergence still work properly!

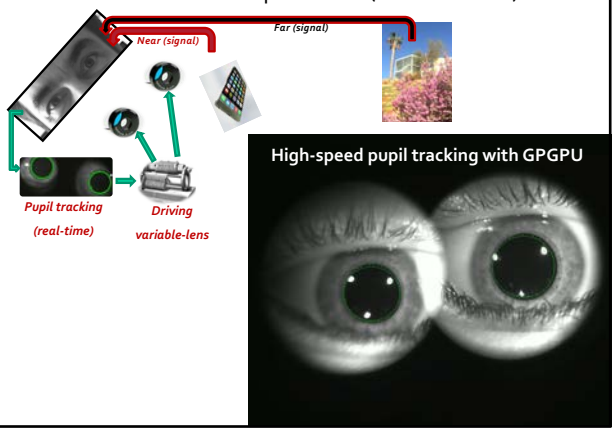


Accommodation *Convergence* *Pupil size*

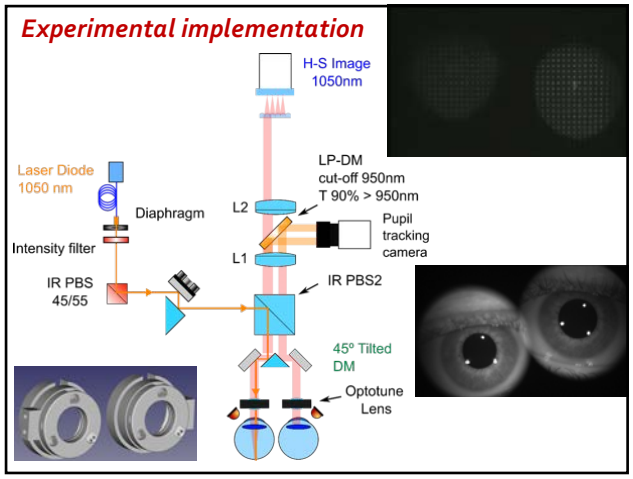
These pupil-related parameters could be used to automatically drive presbyopia correction



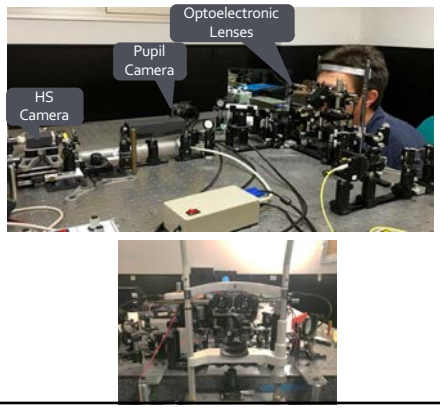
Schematics of the procedure (demonstrator)



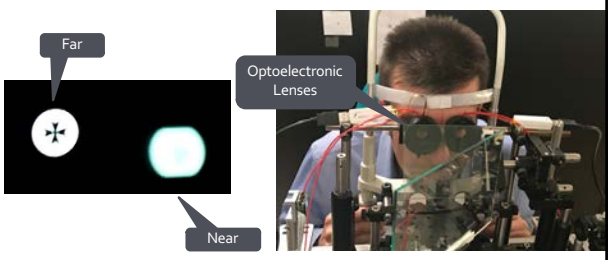
Experimental implementation



Experimental implementation



Experimental implementation

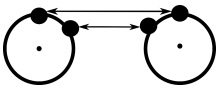


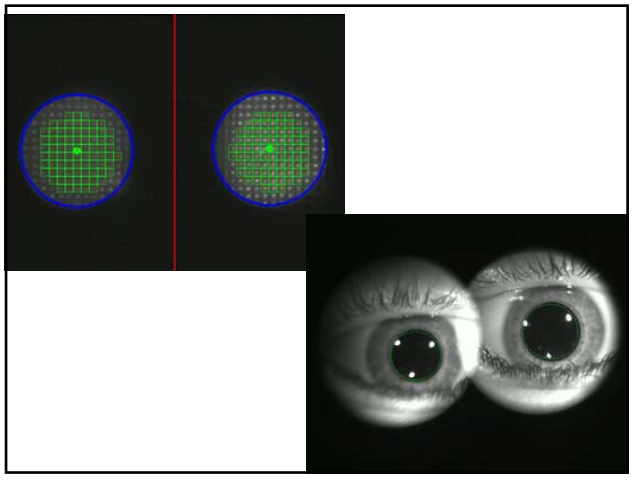
- Required lens power estimated from **pupil size**

Far

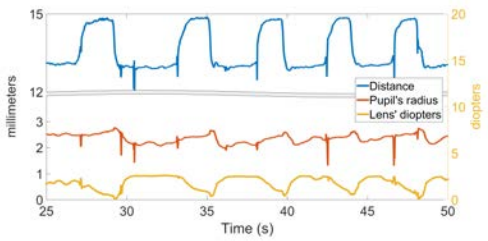
Near

- Required lens power estimated from **pupil inter-distance (convergence)**

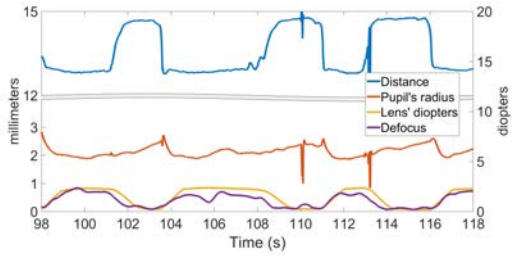




Lens control using both pupil's size and inter-distance



Measurement of eye+lens response (with a real time Hartmann-Shack system)

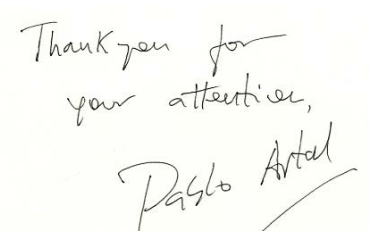


Conclusions

We have demonstrated the potential of using pupil's responses to automatically drive optoelectronic lenses to correct presbyopia.

Presbyopic subjects had objects placed at different distances at focus automatically when they simply changed fixation under natural binocular viewing.

This is a demonstration in a table-top system of a method that could be implemented in spectacles or intraocular devices in the future.



@pablo_artal