BACKGROUND

The pupil system

The pupil: more than just light adaptation

Dilation: sympathetic nervous system (fight or flight)
Constriction: parasympathetic nervous system (rest and digest)

Stark’s experiment (1962)
The pupil system

Figure from Barbur & Stockman chapter in Encyclopedia of the Eye (2010)
Figure from Gamlin

Pupil pattern responses

Technical Challenges
Some related pupil changes in depth, and may have been measured by other effects 22
of the pupil pattern responses. However, pupil pattern responses may lack the sensitivity and specificity of the signals. 3, 12, 13, 14, 15, 16, 17
The pupil pattern responses are again similar but show how the pupil system

Melanopsin and ipRGC’s
Sustained pupil response in macaque retinal activity of ipRGC’s

Stark’s experiment (1962)

Assessing visual delays using pupil oscillations
Jeffrey B. Mulligan, NASA Ames Research Center

Results: Oscillations produced by delayed feedback

More results: white noise analysis

BIG QUESTIONS:

How can we use pupil measurements to assess operator state (fatigue, stress)?

What are the effects of complex visual signals on pupil responses?

Technical Challenges

In this work, we seek to investigate electrical signals of the pupil system,

Technical approach

To examine a pupil response to independent random signals

Technical analysis

The data were analyzed by cross-correlating the response with the projection of the stimulus in a variety of color directions.

Typical video images used for pupilometry: The camera is a SONY EX1/EYE

References

Kahneman, D., Peavler, W. S., and Onuska, L. (1968) Effects of verbalization and incentive on the pupil response to mental activity. 24


Melanopsin and ipRGC’s
Sustained pupil response in macaque retinal activity of ipRGC’s

Stark’s experiment (1962)

Assessing visual delays using pupil oscillations
Jeffrey B. Mulligan, NASA Ames Research Center

Results: Oscillations produced by delayed feedback

More results: white noise analysis

BIG QUESTIONS:

How can we use pupil measurements to assess operator state (fatigue, stress)?

What are the effects of complex visual signals on pupil responses?

Technical Challenges

In this work, we seek to investigate electrical signals of the pupil system,

Technical approach

To examine a pupil response to independent random signals

Technical analysis

The data were analyzed by cross-correlating the response with the projection of the stimulus in a variety of color directions.

Typical video images used for pupilometry: The camera is a SONY EX1/EYE

References

Kahneman, D., Peavler, W. S., and Onuska, L. (1968) Effects of verbalization and incentive on the pupil response to mental activity. 24