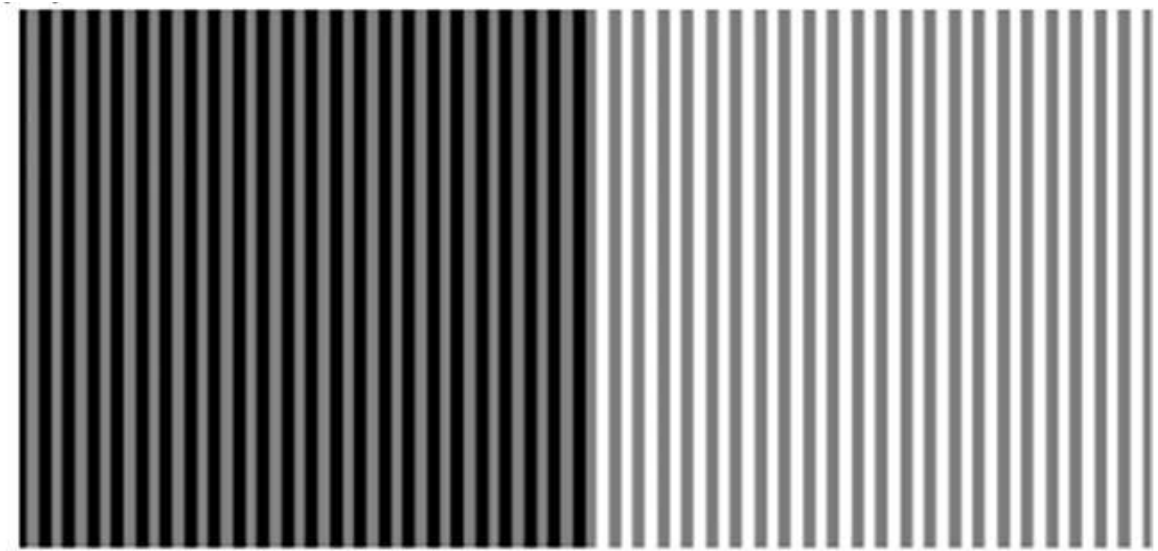
Comparing the performance of computational models of human brightness perception through parametric variations in visual stimuli

contrast

shift away from surrounding context

https://www.upf.edu/en/web/etic/more-news/-/asset_publisher/PpDYvlsaQAQ6/content/id/7432778

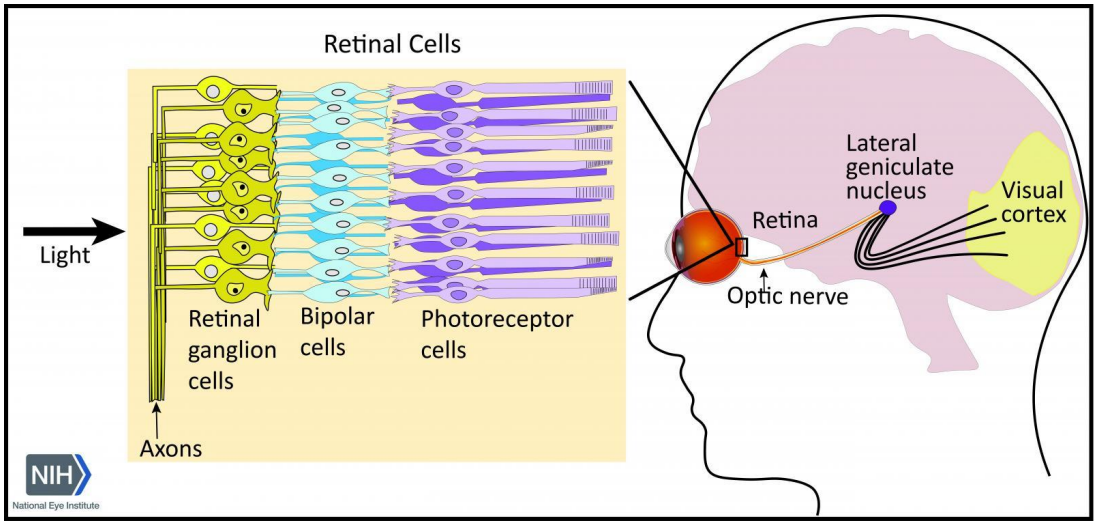
assimilation

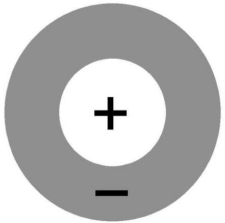


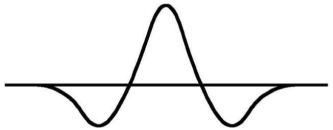
shift towards surrounding context

https://www.upf.edu/en/web/etic/more-news/-/asset_publisher/PpDYvlsaQAQ6/content/id/7432778

ganglion cells



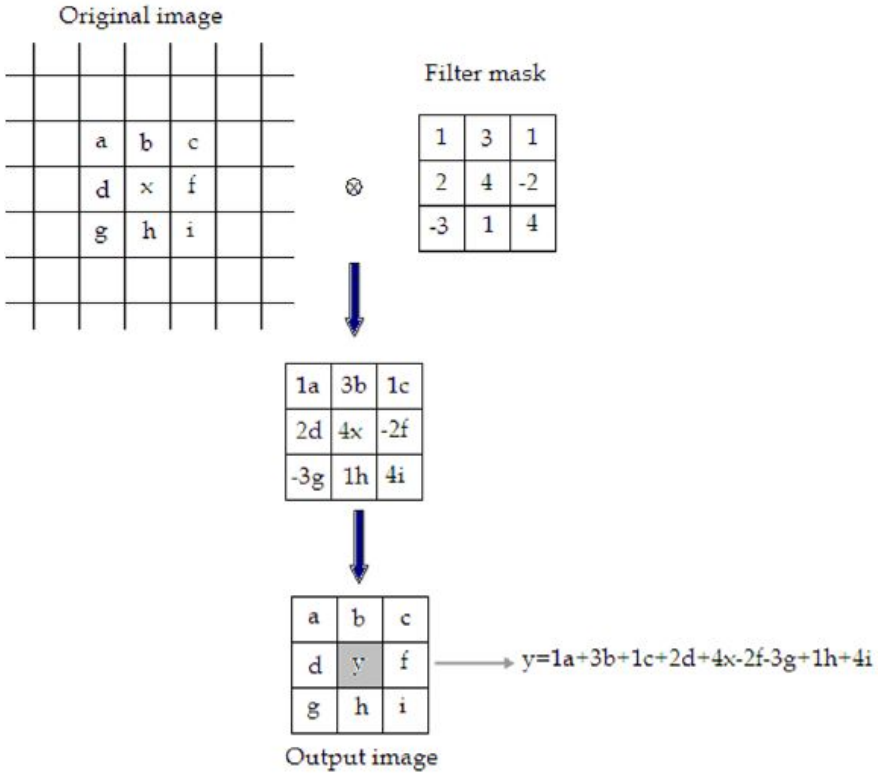




https://www.nei.nih.gov/about/news-and-events/news/scientists-discover-gene-therapy-provides-neuroprotection-prevent-glaucoma-vision-loss

https://books.google.de/books?hl=de&lr=&id=0wx17lC075EC&oi=fnd&pg=PA339&dq=adelson+2000+lightness+perception&ots=RqCNzwJ0Qw&sig=SWLDrUh4lwKqabWYaW7eFAL7Hmk#v=onepage&q=adelson%202000%20lightness%20perception&f=false

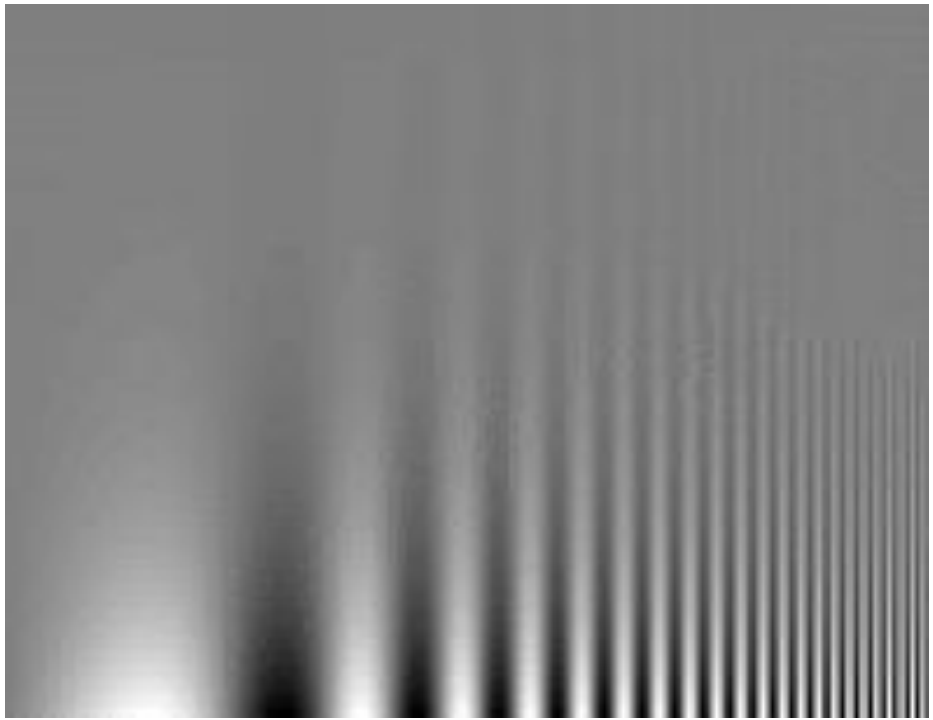
spatial filtering models



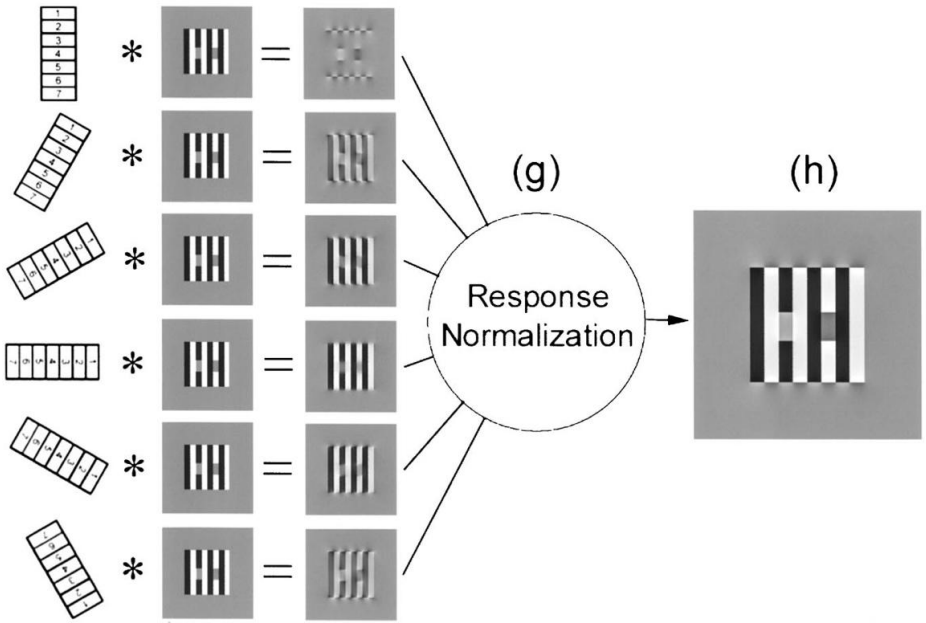
- new grayscale value for each pixel calculated
- depending on pixel itself and neighbors

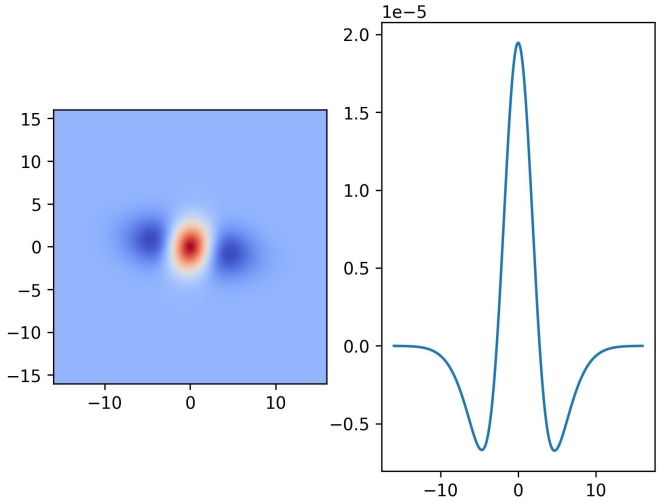
https://www.researchgate.net/figure/Illustration-of-filtering-process-in-spatial-domain-3441-Mean-filter-Mean-filter-is_fig4_221918148

spatial frequency



http://www.psy.vanderbilt.edu/courses/hon185/SpatialFrequency/SpatialFrequency.html



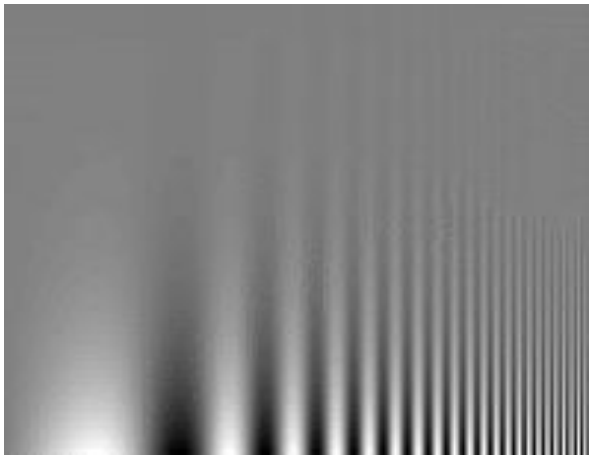


https://www.sciencedirect.com/science/article/pii/S0042698999001194

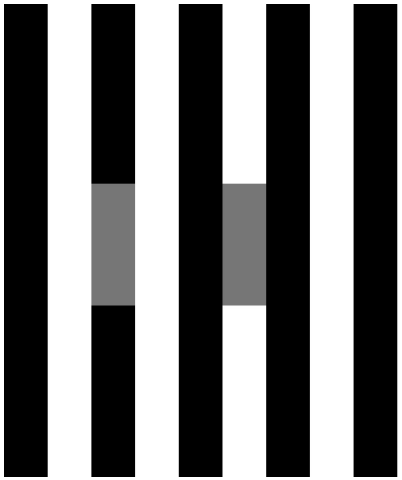
For what types of stimuli and for what variations of stimuli parameters do the models differ?

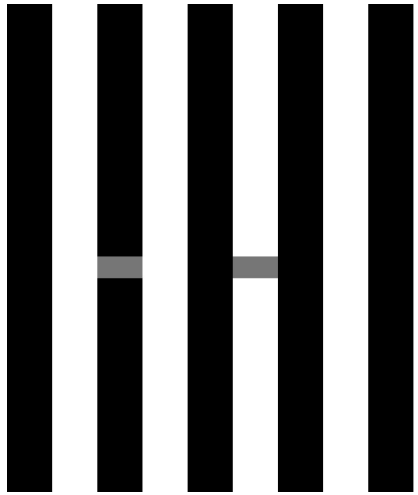
stimulus parameters

spatial frequency

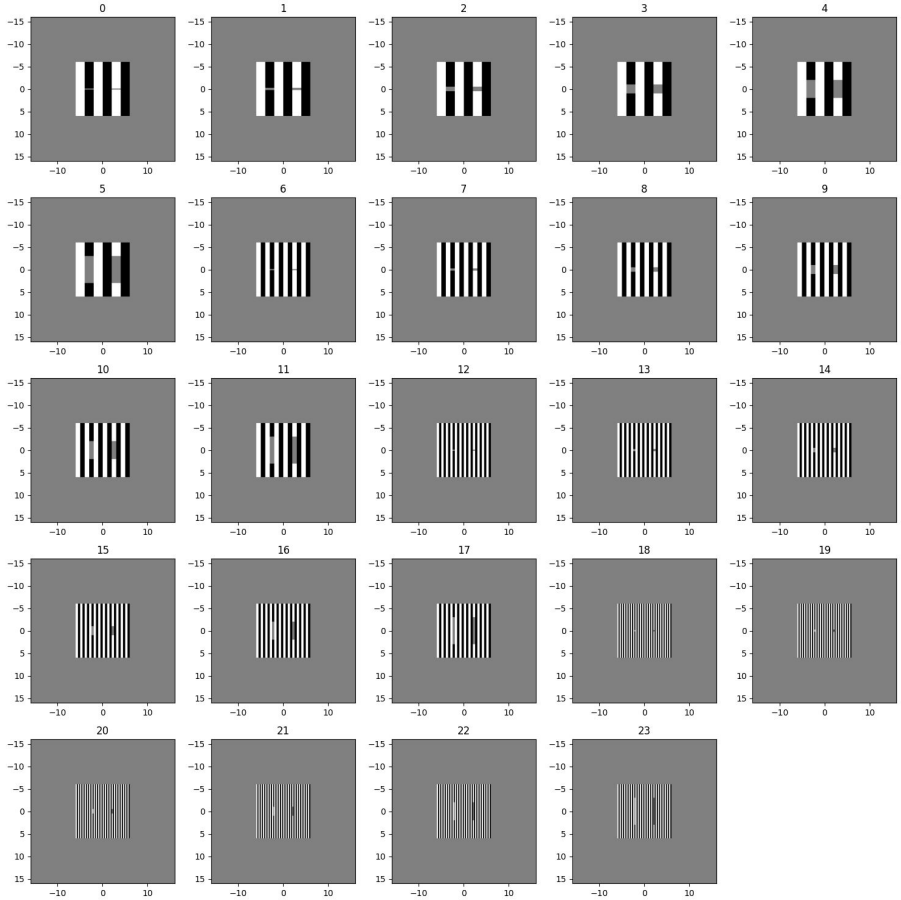


target size





http://www.psy.vanderbilt.edu/courses/hon185/SpatialFrequency/SpatialFrequency.html


0
1
2
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21
22
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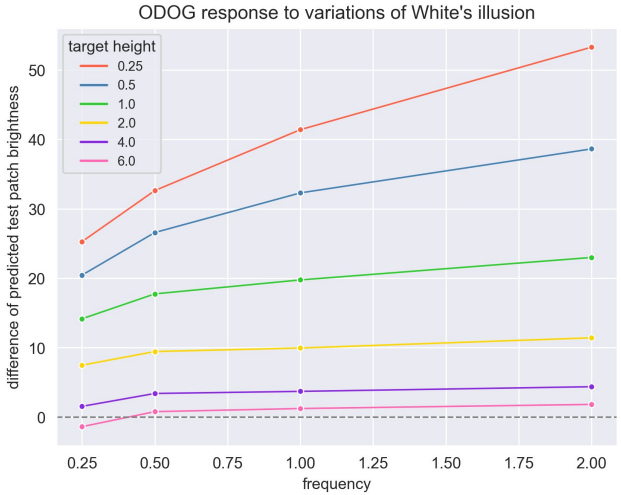
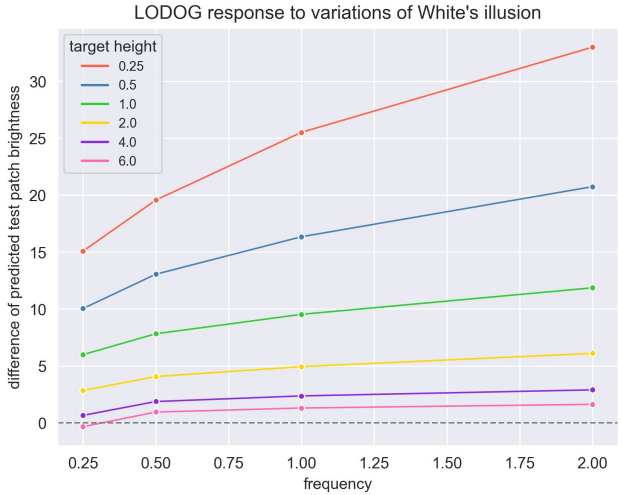
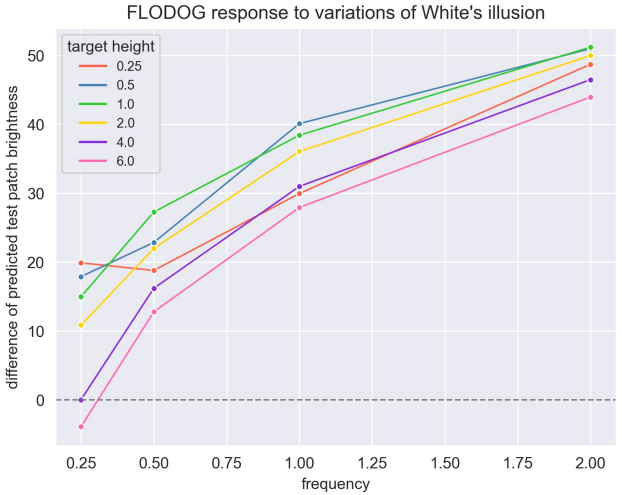
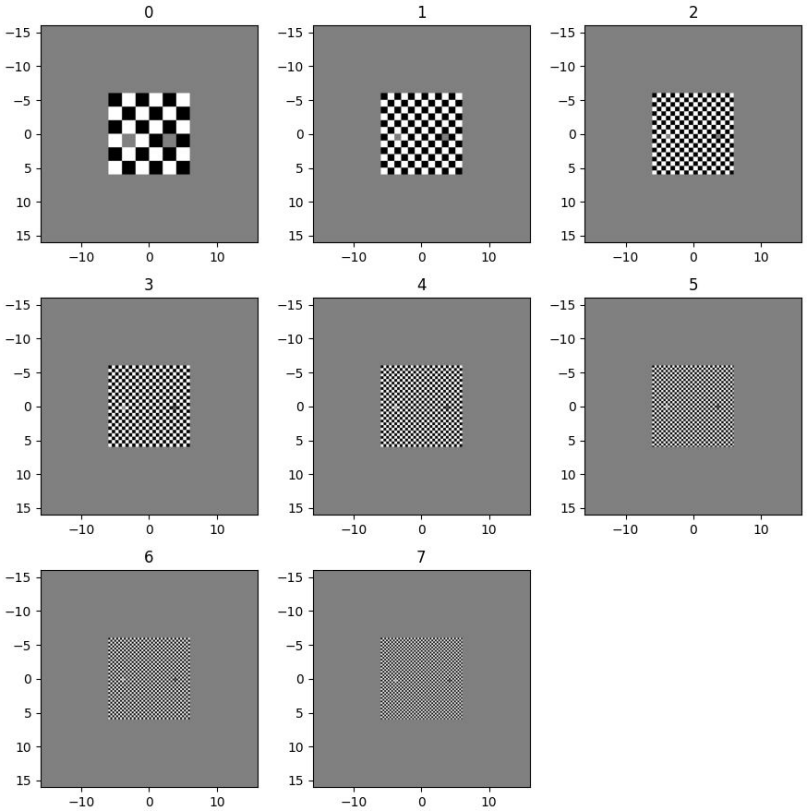

ODOG response to variations of White's illusion
target height
0.25
0.5
1.0
2.0
4.0
6.0
difference of predicted test patch brightness
frequency


LODOG response to variations of White's illusion
target height
0.25
0.5
1.0
2.0
4.0
6.0
difference of predicted test patch brightness
frequency


FLODOG response to variations of White's illusion
target height
0.25
0.5
1.0
2.0
4.0
6.0
difference of predicted test patch brightness
frequency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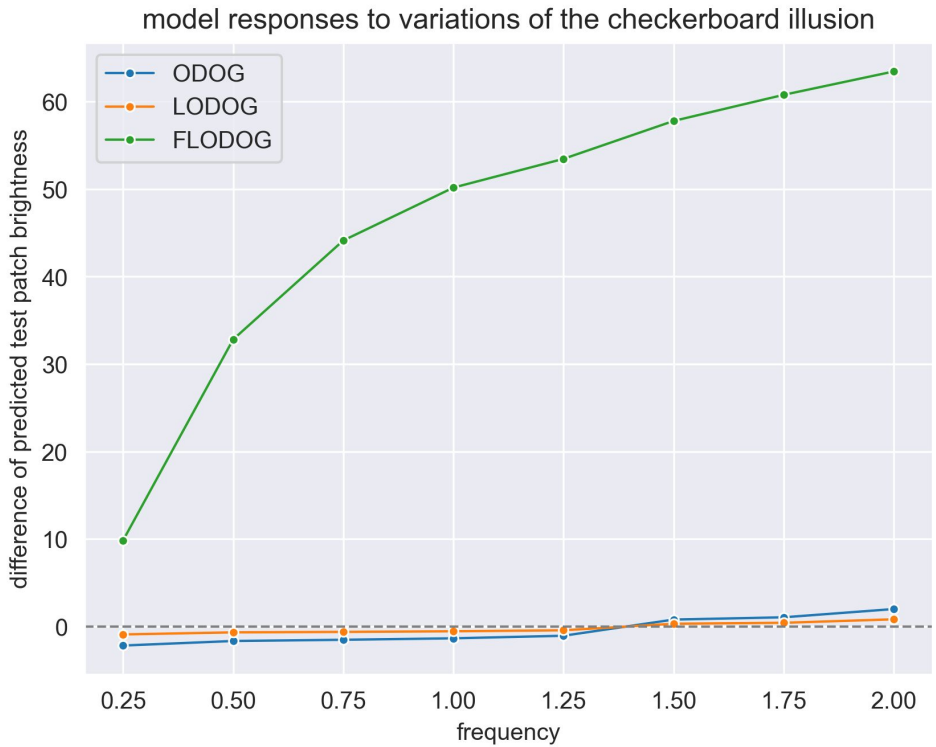
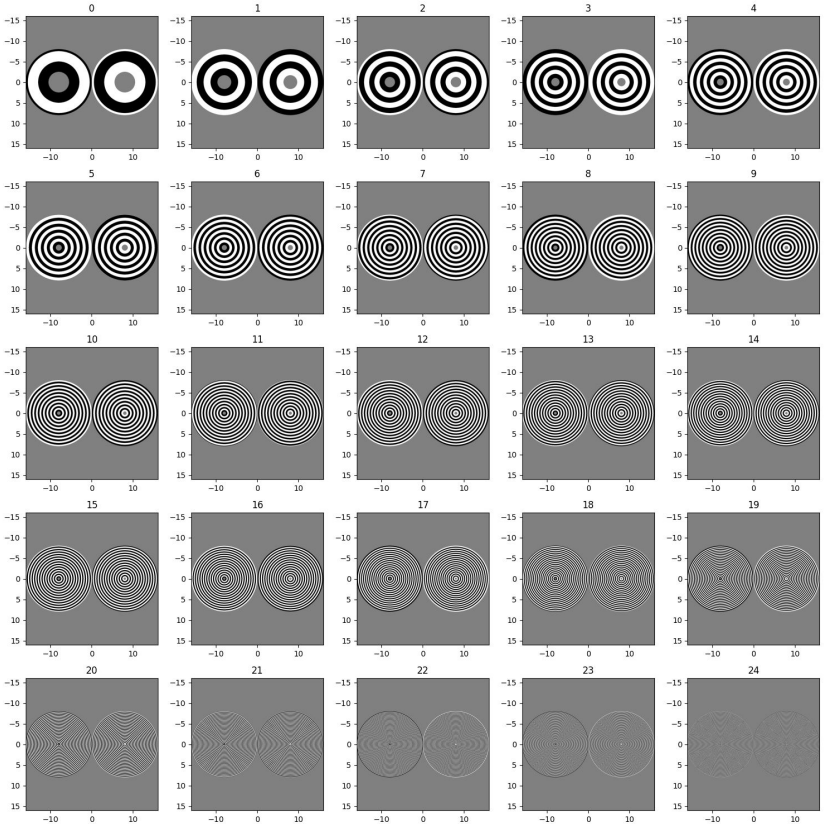
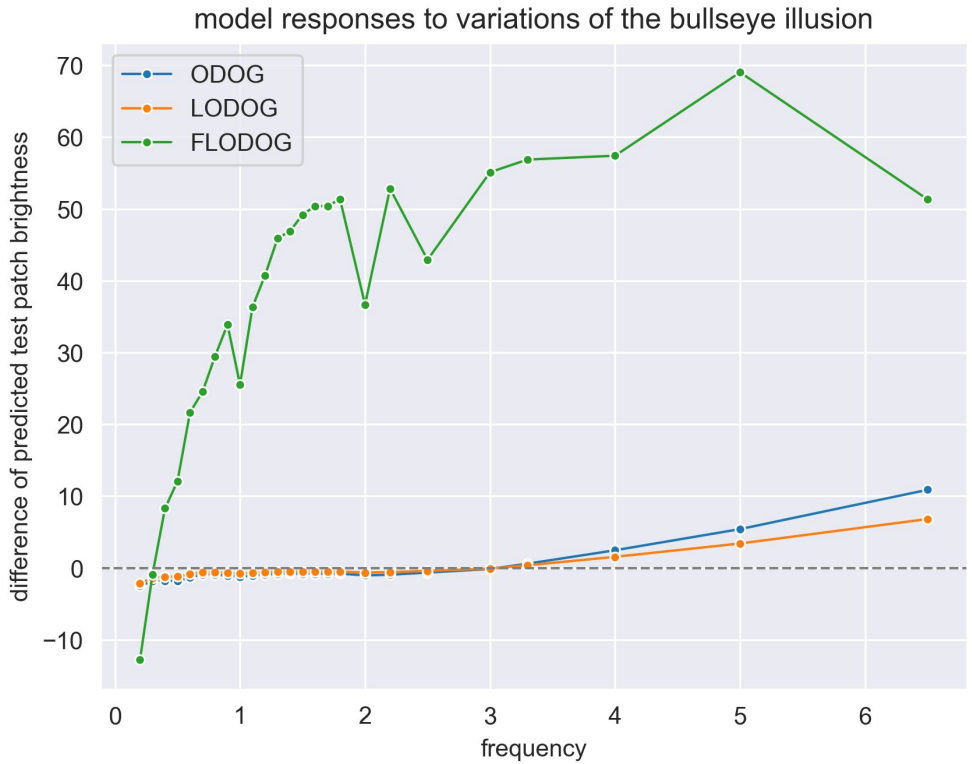
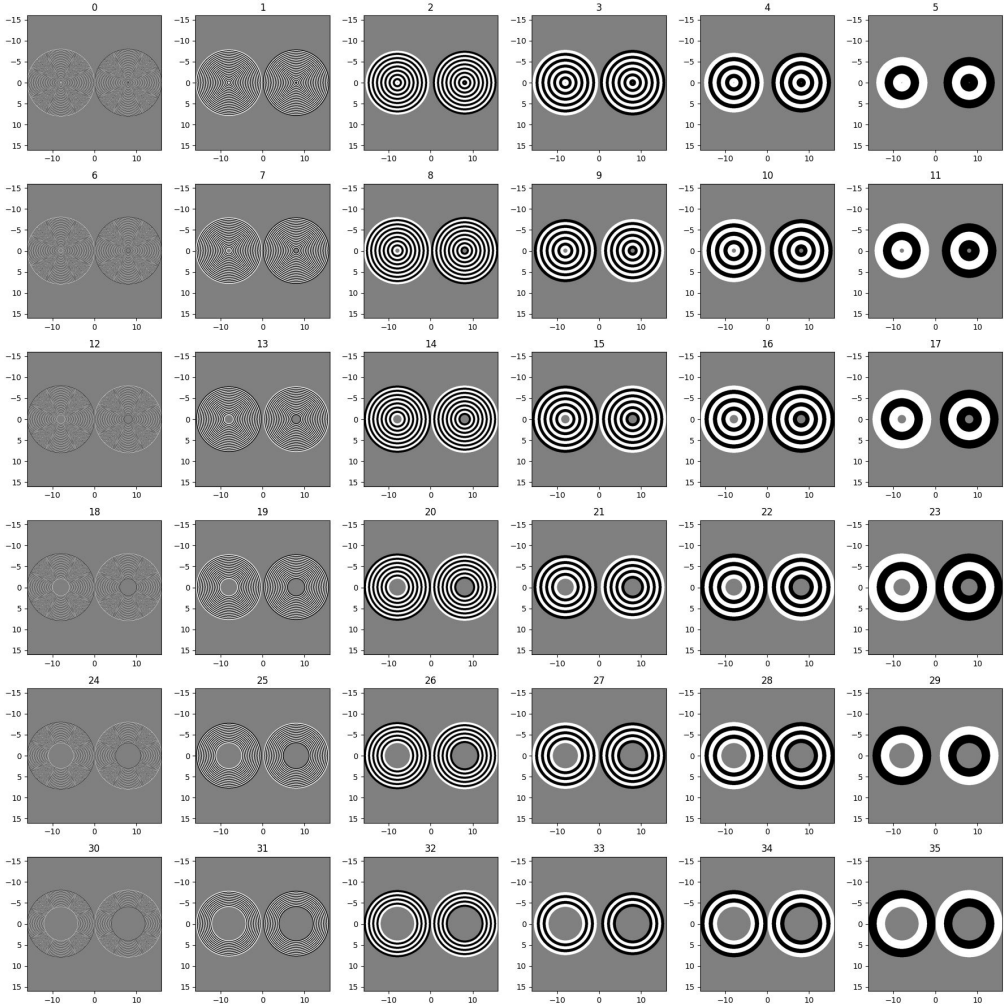

model responses to variations of the checkerboard illusion
ODOG
LODOG
FLODOG
difference of predicted test patch brightness
frequency
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00




model responses to variations of the bullseye illusion
ODOG
LODOG
FLODOG
difference of predicted test patch brightness
frequency
70
60
50
40
30
20
10
0
−10
0
1
2
3
4
5
6


0
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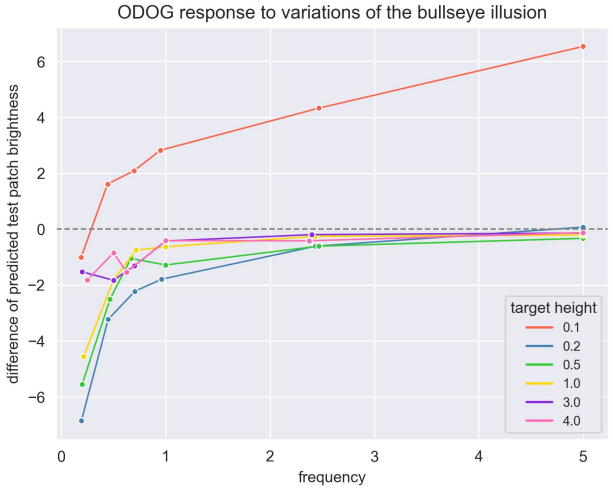
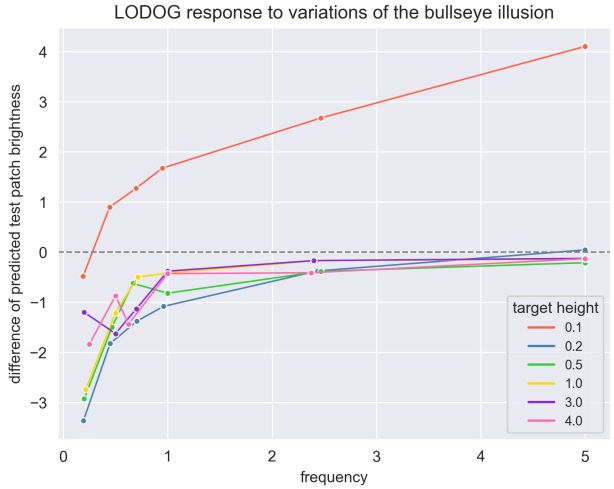
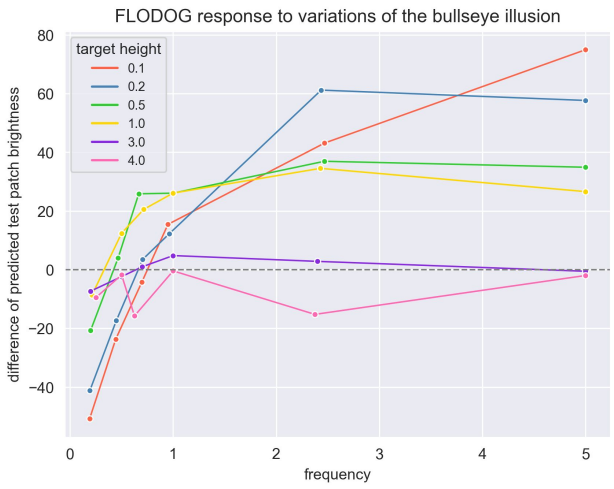

ODOG response to variations of the bullseye illusion
difference of predicted test patch brightness
frequency
target height
0.1
0.2
0.5
1.0
3.0
4.0


LODOG response to variations of the bullseye illusion
difference of predicted test patch brightness
frequency
target height
0.1
0.2
0.5
1.0
3.0
4.0


FLODOG response to variations of the bullseye illusion
difference of predicted test patch brightness
frequency
target height
0.1
0.2
0.5
1.0
3.0
4.0

summary of some results

- ODOG and LODOG very similar
- FLODOG more likely to predict assimilation
- high spatial frequency -> (stronger) assimilation
- FLODOG less consistent to changes in target size

https://www.sciencedirect.com/science/article/pii/S0042698907000648

https://www.sciencedirect.com/science/article/pii/S0042698999001194

https://doi.org/10.21105/joss.05321