

Theoretical Background

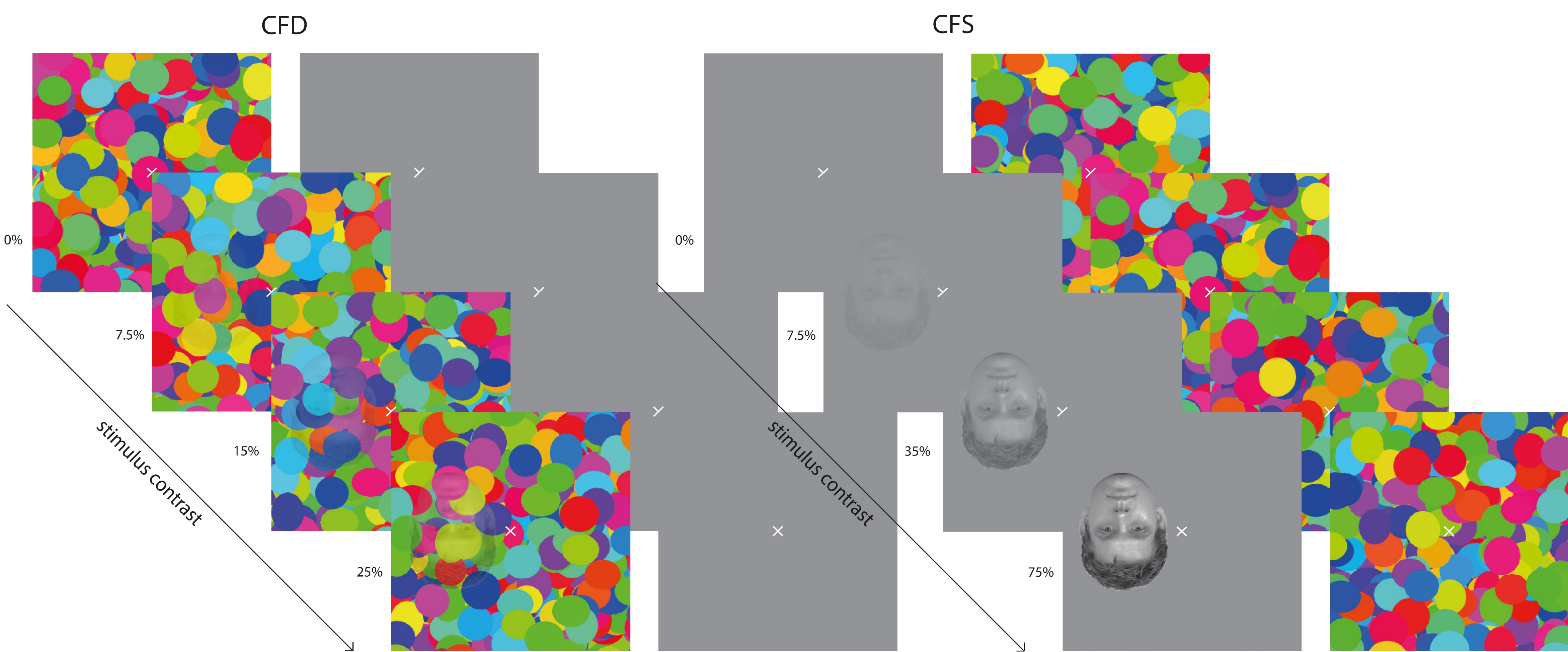
- CFS supresses visual stimuli from conscious processing with a flickering mask presented to the other eye (Tsuchiya & Koch, 2005).
- The break in CFS is where suppressed information becomes available (Jiang et al., 2007).
- Is the break in CFS an all or nothing phenomenon or is it transient?
- What can CFS tell us about unconscious processing? (Stein et al., 2011; Yang et al., 2014)
- Some stimulus properties enhance the time to break supression (b-CFS).
- Is this because of unconscious processing or just a general detection advantage of these properties?
- To infer unconscious processing, Dissociation Logic can be applied: A difference between a measure of conscious and one of unconscious processing could prove unconscious processing.
- It is necessary that the conditions with the different measures are closely matched and phenomenally alike.
- So far it has been a challenge to developpe an appropriate control condition.

Effect	Level	CFD						CFS					
		μ	$\Delta\mu$	s_e	t	p	d	μ	$\Delta\mu$	s_e	t	p	d
Task	loc	0.165	0.030	0.004	7.64	< 0.001	1.91	0.334	0.112	0.018	6.14	< 0.001	1.54
	cat	0.195						0.446					
Orientation	upr	0.176	0.009	0.003	3.36	< 0.01	0.84	0.364	0.053	0.011	4.60	< 0.001	1.15
	inv	0.185						0.417					

Approach

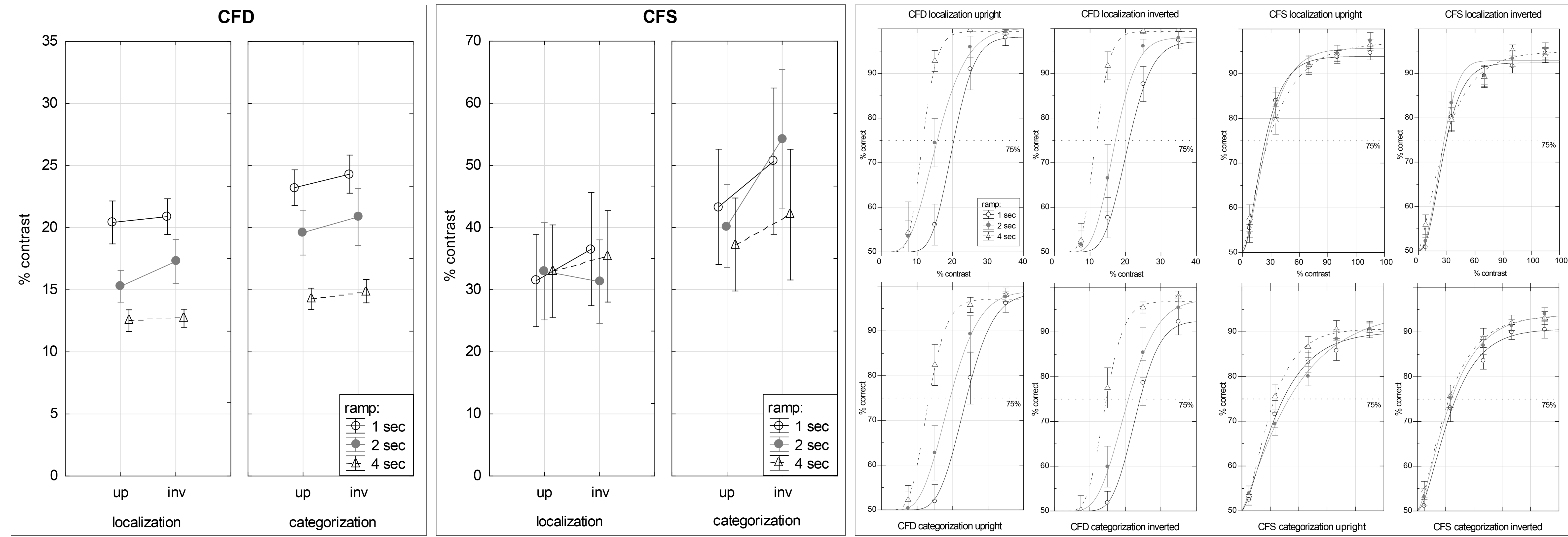
- Utilizing Continuous Flash Dominance (CFD) as control condition, the visual processing is conscious inspite of the typical binocular rivalry impression.
- Testing performance for tasks of different complexitiy in order to infer on the nature of the break in CFS (gradual or not):
 - Basic level categorization was compared to localization in a 2×2 AFC.
 - This was done for inverted and upright stimuli, beacuse of their identical low level properties.
- We probed different fade in ramps to see if performance is dependent only on signal strength or also on the available processing time.

Question: Using Continuous Flash Dominance as control condition for CFS, can unconscious specific processing be found during CFS?



Method

16 students participated. Localization and basic-level categorization performance (2×2 AFC) were compared in CFS and CFD. We used houses and faces in upright and inverted orientation, faded in on the left or the right side. Presentation was aborted at fixed contrast levels and fade in ramps were varied (1s, 2s and 4s). CFD and CFS were presented blockwise. Psychometric curves were approximated by a Weibull function from individual percentage correct data for each condition. Ramp x task x orientation ANOVAs were calculated for CFS and CFD, using the estimated contrast at 75% correct performance as dependent measure.



Results

- Localization is better then basic-level categorization (Cohen's d for CFS and CFD are comparable)
- Performance on upright stimuli is better (Cohen's d for CFS and CFD are comparable)
- Only in CFD there is a ramp effect
- The ramp x task interactions are similar, the task difference is less for slower ramps.
- No ramp nor orientation effect for localization in CFS.
- In CFS the variance of performance is greater.
- The shape parameters of the Weibull functions are notably different: 5.5 (CFD) vs. 2.1 (CFS)

Conclusion

If there is indeed unconscious processing during suppression, it is not so much different from processing during dominance, because most of the effects we found were alike in CFS and CFD. A difference is that in CFS at least about 30% contrast is needed for the detection of basic stimulus properties. The “break” in CFS is most likely gradual as it is in visual perception under normal viewing conditions.

References: Tsuchiya, N. and Koch, C. (2005). Continuous flash suppression reduces negative afterimages. Nat. Neurosci. volume 8, 1096–1101.
Jiang, Y., Costello, P., and He, S.(2007). Processing of invisible stimuli: advantage of upright faces and recognizable words in overcoming interocular suppression. Psychol. Sci.18, 349–355.
Stein T., Hebart M. N., Sterzer P. (2011). Breaking continuous flash suppression: a new measure of unconscious processing during interocular suppression? Front. Hum. Neurosci. 5:167.
Yang E., Brascamp J., Kang M. S., Blake R. (2014). On the use of continuous flash suppression for the study of visual processing outside of awareness. Front. Psychol. 5:724.