

reconciling the divergent CFS results. [No conflict of interest.]

Is conscious perception gradual or binary?

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According to the global neuronal workspace theory, conscious perception requires a large all-or-none change in neural activity. In contrast, for the last several decades, the most prominent mathematical models of perceptual tasks have assumed that perceptual representations are gradual and binary patterns of behavioural reports originate from the decision stage. In the present study, we used cognitive modelling to evaluate the evidence for an all-or-none process underlying conscious perception in a series of experimental paradigms that have previously been argued to provide evidence for either gradual or binary conscious perception. In a masked orientation discrimination task, a masked colour discrimination task, a masked numerical discrimination task and an attentional blink paradigm with a word detection task, fitting cognitive models revealed that binary models were conclusively outperformed by gradual models in accounting for the distribution of visibility judgments. Moreover, we reanalysed audibility judgments from an auditory detection experiment that had previously been presented as evidence for a binary threshold underlying conscious perception. Again, model fitting showed that the data was best accounted for by gradual models. Overall, we find no evidence for an all-or-none process underlying conscious perception.

Contextual Cueing May Not Be Unconscious

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Contextual cueing often aims to demonstrate that participants learn contextual cues implicitly, or unconsciously. We propose a method to test whether learning was indeed unconscious or not. Our method—the Sensitivity Comparison—is needed because the standard method is flawed: It seeks to demonstrate a reaction time (RT) effect in a visual search task and a close-to-chance performance in a subsequent recognition task. The RT effect shows that participants have recognized the contextual cues, which is considered unconscious due to the close-to-chance direct recognition performance. But this interpretation is flawed because the close-to-chance (yet above chance) direct recognition performance indicates residual conscious

awareness that may fully explain RT effects. To test whether the RT data truly provides evidence for implicit recognition beyond what participants report explicitly, one should classify (predict) repeated vs. new cues based on the RTs. Only when the resulting sensitivity from this classification is larger than the sensitivity in the awareness task, there can be evidence for implicit learning (for a related argument see Meyen, et al., in press, *Journal of Experimental Psychology: General*). We present reanalysis methods for two variants of the awareness task (the cue recognition task and the target generation task) and discuss alternative arguments involving correlations between performances in the awareness task vs. visual search task. Using our method, we reanalyze multiple influential studies in the field. We conclude that there is little to no evidence for recognition beyond what participants are consciously aware of. [This project is supported by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) through the CRC 1233 “Robust Vision”, project number 276693517; the Institutional Strategy of the University of Tübingen (DFG, ZUK 63); and the Cluster of Excellence “Machine Learning: New Perspectives for Science”, EXC 2064/1, project number 390727645.]

Talk Session 20: Color

Different temporal integration of rod signals in luminance and chromatic pathways

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To understand the integration of rod input (R) in luminance (L+M+S) and chromatic [L/(L+M)] pathways in the temporal dimension, we measured reaction times (RTs) to rod-isolating and/or pathway specific signals. A four-primary photostimulator based on the overlapped images of two spectrally-modified CRTs, which allowed independent stimulation of R, L, M and S photoreceptors, was used to generate rod (R), luminance (L+M+S) and chromatic [L/(L+M)] stimuli or the combination of rod and postreceptoral stimuli [L+M+S+R and R+L/(L+M)]. Light levels were from 0.5 cd/m² to 6 cd/m². The stimulus was a “C” target presented until participant’s response or up

to 4 s, measuring 4° of mean diameter. The target differed from the background only by its selected stimulation in a range of 3 or 4 positive and negative contrasts. Participants had to discriminate the position of the aperture of the C-Landolt ring while they fixate at a cross in the center of the “C”, and respond as soon as they could. The reaction time (RT) was computed from the stimuli onset to the participant's response for each trial. RTs for L+M+S+R were higher than that for R or L+M+S stimuli. On the other hand, RTs for R+L/(L+M) were lower than that for R and L/(L+M) stimuli. Integration of rods signals differs in both pathways. For the luminance pathway, rod input reduced the processing speed, suggesting a suppressive rod-cone interaction. Surprisingly, the responses of the chromatic pathway were faster when rods were involved, suggesting a major role of rods in mesopic color perception. [CONICET PUE 0114 ILAV. Ministerio de modernización de Argentina – Fulbright Commission BEC.AR Program.]

Newly-learned shape-colour associations show signatures of reliability-weighted averaging without forced fusion or a memory colour effect

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Reliability-weighted averaging of multiple perceptual estimates (cues) improves precision. Research suggests that newly-learned statistical associations (e.g. new cues or priors) are rapidly integrated in this way for efficient decision-making. Yet, it remains unclear if integration of newly-learned statistics into decision-making directly influences perception. Do newly-learned statistics influence how participants perceive stimuli, as well as how they make decisions? In two experiments, we implicitly taught observers novel associations between shape and colour. Observers made colour matches by adjusting the colour of an oval to match a simultaneously presented reference. As the colour of the oval changed across trials, so did its shape according to a novel mapping of axis ratio to colour. Observers showed signatures of reliability-weighted averaging – a precision-improvement in both experiments and reweighting of the newly-learned shape cue with changes in uncertainty in Experiment 2. To ask whether this was accompanied by perceptual effects, Experiment 1 (N=34) tested for “forced fusion” by measuring colour discrimination thresholds with and without incongruent shape cues. Experiment 2 (N=30) tested for a “memory colour effect”, observers adjusting the colour of ovals with different axis ratios until they appeared grey. There was no evidence for forced fusion and the opposite of a memory colour effect. These results suggest that while people rapidly learn new statistical regularities to optimise their

perceptual decisions, these are not immediately (with short training) accompanied by familiar perceptual effects. How much experience is needed to see familiar perceptual effects with newly-learned cues is an open question for future research. [This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No. 820185) and a Leverhulme Trust Research Project Grant (RPG-2017-097).]

Living with colour-vision deficiency at school: a thematic analysis of accounts of colour-deficient adults, children, and their parents

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Background: Colour-vision deficiency (CVD) is an X-linked condition affecting 8% of males (0.4% females). Depending on the type and severity, individuals' ability to discriminate between colours can be significantly compromised. In the UK, compulsory screening for CVD at primary school entry stopped when a 1958-birth-cohort study concluded that CVD has no measurable impact on educational attainment (Cumberland et al., 2004). However, there has since been a drastic increase in the use of colour resources in educational environments, especially since the introduction of digital screens. Here we explore the day-to-day experiences of CVD individuals and ask whether a revision of the current screening policy should be considered. Method: We conducted a qualitative study using online interviews and focus groups with 26 CVD adults, 12 CVD children and 12 parents of CVD children. Transcripts were subject to thematic analysis combining reflexive (Braun and Clarke, 2006) and codebook approaches. Results and Conclusion: Four themes relating to individuals' experiences at school were identified; (1) “lack of societal awareness”, (2) “importance of early diagnosis”, (3) “barriers to learning within education” (4) “careers” (part of a “wider impacts” theme). These themes highlight the value of an early diagnosis of CVD and the need for increasing educators' awareness of the academic limitations that CVD may impose on affected individuals, particularly in early education. Our findings will inform the development of a new questionnaire to measure the impact of CVD on school-aged children in the UK on a larger scale to quantify the need for early screening. [Part of a PhD funded by the Leverhulme Trust.]