1) Background

- In macaques, more neurons are tuned to frontal (θ) and profile (90°) views, fewer are tuned to 3/4 views (45°) and even fewer to intermediate views (Perrett et al. 1991).
- Frontal, profile, and to some degree 3/4 views should therefore have a more precise representation than intermediate views.
- This should provide a behavioural advantage, but does this advantage occur outside of viewpoint discrimination?
- Viewpoints that are more precisely represented should be used in police lineups and in computational models.

2) Aim

- Investigate if the representation of faces is more precise at frontal, 3/4 and profile views compared to intermediate views.

3) Stimuli/Task

- 10 participants aged between 18 and 33 years old (mean (SD) = 26.5 (5.5)).
- Participants identified the veridical, unwarped image (left or right). The warp level varied across trials using an adaptive staircase.
- 120 trials per block, with 40 trials of 3 viewpoints per block.
- 76 blocks total: 19 x upright left-facing, 19 x upright right-facing, 19 x inverted left-facing, 19 x inverted right-facing.

4) Hypotheses

- Thresholds for discriminating veridical from warped images should be lower for frontal, 3/4 and profile views than intermediate views.
- The inversion effect should be greater for intermediate views.

5) Data analysis

- Collapsed across left-right facing trials.
- Calculated threshold (warp level at 75% accuracy) across all trials for the viewpoint.
- Initially performed a 2 (upright vs inverted) x 19 (views) within-subjects ANOVA.
- Also performed multiple linear regression to compare models based on: 1) A linear fit 2) A cosine fit 3) Inter-feature distances (horizontal only) i) the total visible width ii) the nose tip to actor’s left tragus iii) the nose tip to left pupil iv) total mouth visible.
- Also added a 'M' shaped regressor based on hypotheses.
- Also looked at the inversion effects:
  1) Upright threshold - Inverted threshold
  2) Inverted threshold / Upright threshold

6) Results

- The ANOVA showed a significant inversion effect. Thresholds were significantly lower for upright stimuli than inverted stimuli F(1,19) = 56.60, p < .001, $\eta^2_p = .78$.
- There was also a significant effect of viewpoint F(18,162) = 25.61, p < .001, $\eta^2_p = .74$ and a significant interaction between viewpoint and orientation F(18,162) = 3.49, p < .001, $\eta^2_p = .28$.
- In general, thresholds increased as faces became more profile.

7) Discussion

- The general increase in thresholds for more profile faces suggests that more frontal faces are represented more precisely than profile faces.
- Contrary to our predictions, thresholds were slightly higher for 0°, 45°, and 90° than intermediate views, indicating these poses were more difficult to distinguish from warped versions.
- These results suggest that the viewpoints processed with more precision may not be the ones neurons are preferentially tuned to.
- The best viewpoint to use in police line-ups or computational models may be slightly non-frontal (20°).

References

- Cusack, 2014.
- Warp Level (A.U.)
- Cosine
- Linear
- Inter-feature distances