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Multiletter identification studies often find correctly identified letters being reported in wrong positions. However, how position uncertainty impacts crowding in peripheral vision is not fully understood. The observation of a flanker being reported as the central target cannot be taken as unequivocal evidence for position misperception because the observers could be biased to report a more identifiable flanker when failing to identify the central target. In addition, it has never been reported whether a correctly identified central target can be perceived at a flanker position under crowding. Empirical investigation into this possibility holds the key to demonstrating letter-level position uncertainty in crowding, because the position errors of the least identifiable central target cannot be attributed to response bias.

We asked normally-sighted observers to report either the central target of a trigram (partial report) or all three characters (whole report). The results showed that, for radially arranged trigrams, the rate of reporting the central target regardless of the reported position in the whole report was significantly higher than the partial report rate, and the extra target reports mostly ended up in flanker positions. Error analysis indicated that target-flanker position swapping and misalignment (lateral shift of the target and one flanker) underlay this target misplacement. Our results thus establish target misplacement as a source of crowding errors and ascertain the role of letter-level position uncertainty in crowding.

Keywords: crowding, whole report, partial report, position uncertainty, letter identification

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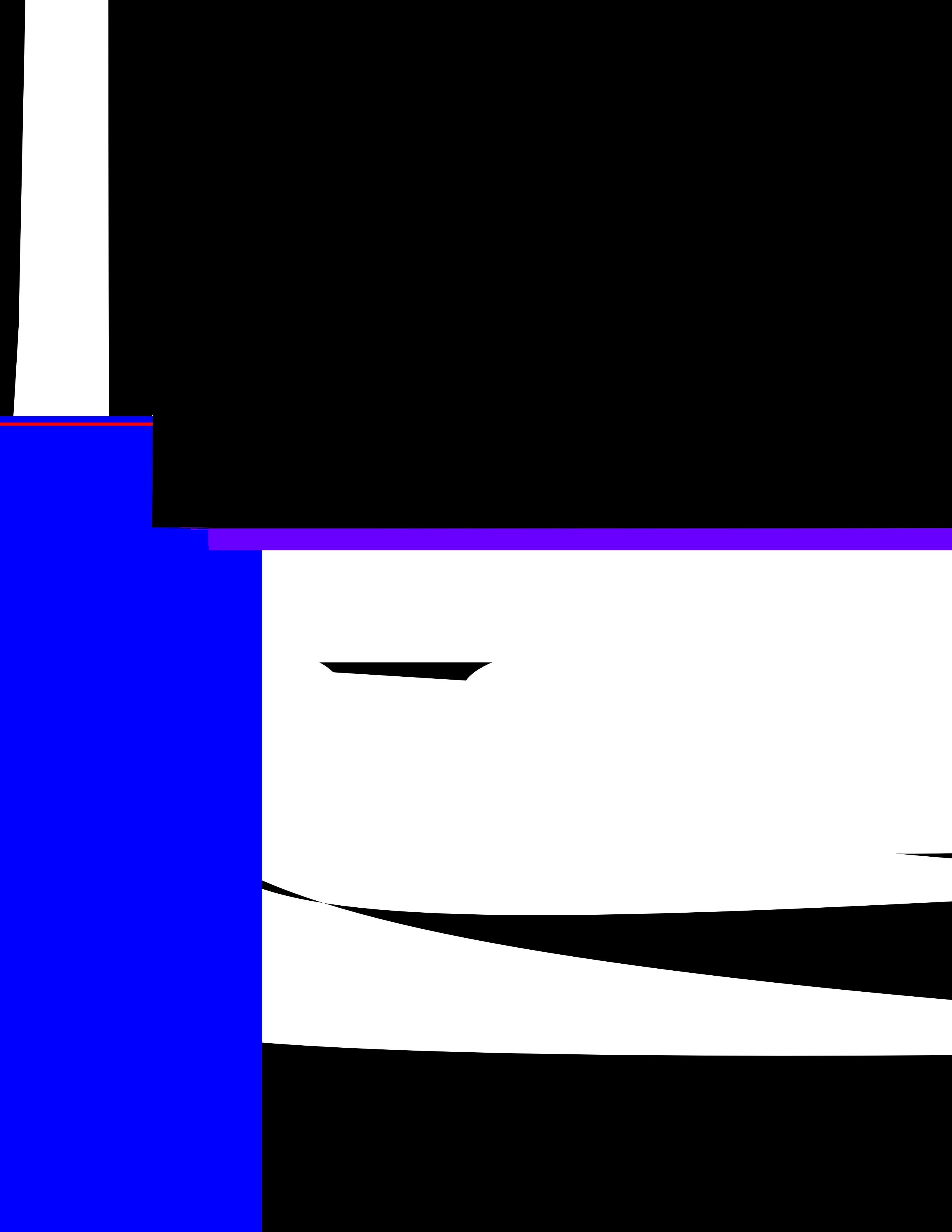

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(2) (1 ,), - (2) (2) (1/9) 2.73 ± 0.39 2.22 ± 0.37, , 1.0 (p = 0.004 0.018,). ($p = 0.50$). ,

(7/9) 0.58 ± 0.05, ($p < 0.001$). - (2) (1 ,), - (2) 4.90 ± 0.37, 1 ($p < 0.001$). 0.91 ± 0.25, ($p = 0.76$), 0.44 ± 0.05, ($p < 0.001$).

E 2:

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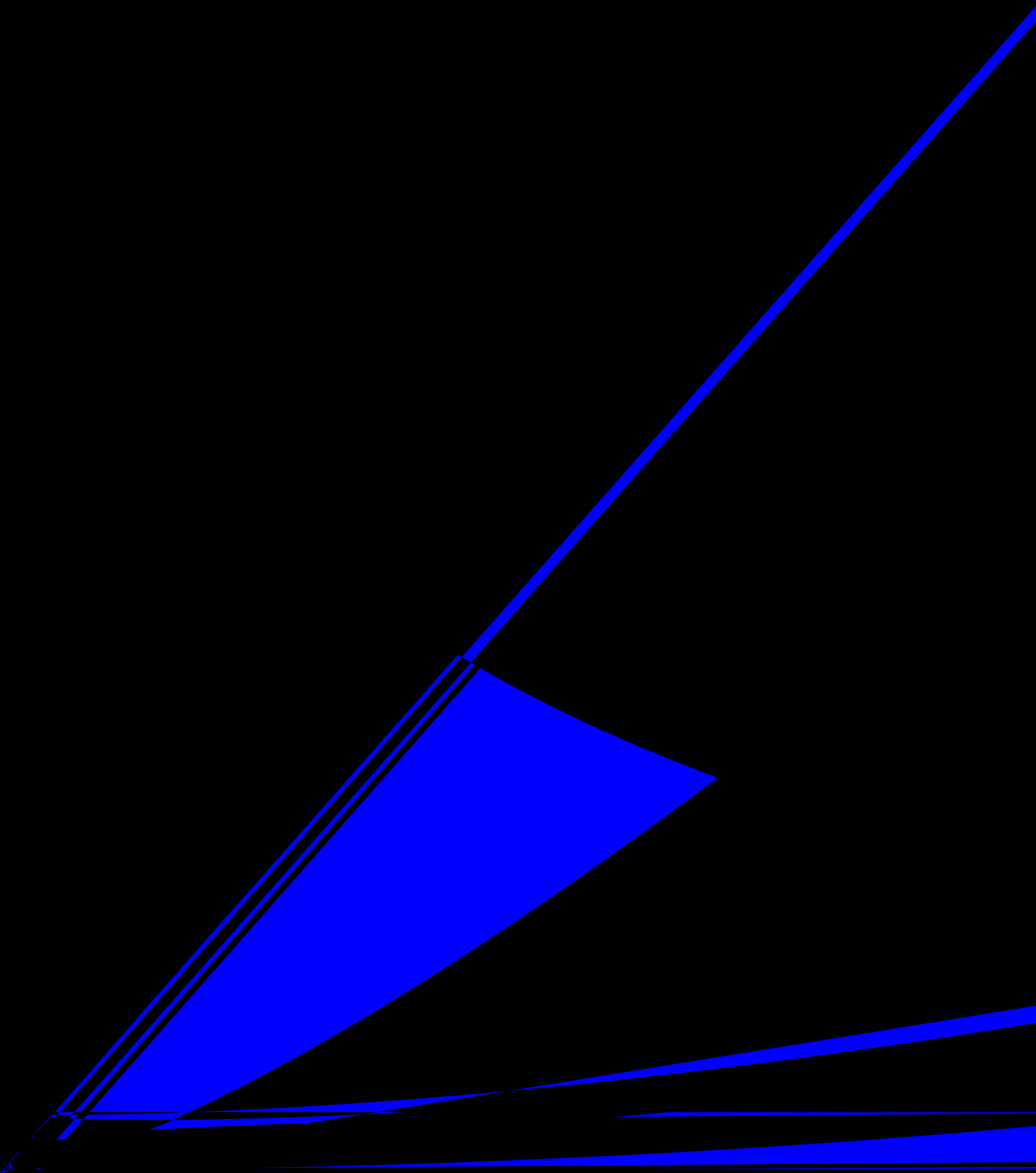

). 0.2 0.8 - , - - - ($F_{1,5} = 32.5$, $p = 0.002$; 1 2). , , ($F_{3,15} = 25.9$, $p <$ 0.001). , - - - , - . . - (- : $p <$ 0.001; - : $p < 0.001$;). 0.2 0.8 - , - - ($F_{1,5} = 27.78$, $p = 0.003$, 2 ,), 0.6 0.8 - (2 ; $F_{4,20} = 8.99$, $p = 0.001$).

E 3:

, , ≤ 200 . , - . - - - (1) 1600- . . . (3) - . 66.9% 56.5 ± 5.6 . 1600- , , 26.0 ± 1.2 - 200- (1). - - - ($p < 0.001$,) 1600- (3), 0.2 0.8 - ($F_{1,3} = 771.7$, $p < 0.001$). 200- 1600- 0.2 0.8 -

($F_{1,3} = 5.64$, $p = 0.098$,). , - ($F_{3,9} = 22.2$, $p < 0.001$) - - - - (. ., 0.6 0.8) 1600 (3). , 0.6 0.8 - 53.2 ± 5.3 63.5 ± 6.3 1600 , , 0.4 0.6 - 53.6 ± 5.6 63.4 ± 6.1 200 , . , - - - - 1600 , . 1600- - , / (., 1971). - - - (, 1969). .

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