Accounting for your own visuomotor abilities: a risk-factor for children in traffic

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The ability to navigate traffic safely and efficiently improves until late in childhood - but what drives this development is unclear. We tested whether this might in part be explained by an improved ability to estimate and account for one's own visual and motor abilities when deciding how and when to move. 6- to 10-year-olds and adults performed a time-limited rapid reaching task that emulates the visuomotor problems faced in traffic scenarios. In the main task, participants located a hidden target within a set time (2s). Every 0.1s a location cue (a small dot) appeared, randomly drawn from a bivariate Gaussian distribution centred on the target, until a reach was initiated. To maximise their score, subjects had to minimise the total variance of their endpoint reaches around the hidden target, by trading-off time spent sampling visual information about the target's location, and time spent moving to hit the target within the time limit. As such, they had to trade-off their own visual and motor variance. Participants were divided into two groups, one receiving a smaller distribution of dots (reliable cues), and one a larger distribution (unreliable cues). We compared performance to the individual ideal strategy that optimises score; to compute this strategy, we measured variance in (a) visual localization and (b) movement precision for all possible sampling vs. movement time trade-offs. The trade-off at which an individual's total visuomotor variance was lowest was taken as the ideal strategy. While adults' sampling/movement times matched this ideal in both visual cue-reliability conditions, young children consistently moved before gathering sufficient visual information. Using this quantitative approach, we thus show enhanced risk of negative outcome in a visuomotor task in childhood because children were still learning to take their visuomotor abilities into account. This factor is likely to affect child performance in traffic.