Combining information from different senses: dynamic adjustment of combination weights, and the development of cross-modal integration in children.

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Many studies have shown that the human brain can integrate information from different senses in a statistically optimal fashion. Two important questions remain: how does the brain calculate appropriate weights for the integration? – and when does this capacity develop over time? We addressed the first question by taking advantage of the fact that vision is impoverished for a brief but well defined period around the time of saccades. We investigate audio-visual integration over this period and show that both the perceived position and the precision of localizing a visuo-audio source are well predicted by maximum likelihood estimation around the time of saccades, and that the dynamics of the combination follow a characteristic and predictable timecourse. This result suggests that the brain can rapidly update perceptual weights to take into account dynamic changes in reliability. We studied development of integration in school-age children using two tasks: a size judgement and orientation discrimination. In neither task did children below eight years of age integrate visual and haptic information: for the size task, haptic information dominated (although the precision from this source was worse than from vision), and for orientation discrimination vision (the least precise sense) dominated. We suggest that prior to 8 years of age, the different perceptual systems calibrate each other, at the expense of optimal integration.