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### Eye movements predict target selection in a reach search task

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Eye movements occur naturally as part of coordinated actions like looking and reaching. Laboratory studies usually investigate the role of eye movements in action using highly contrived tasks instead of more natural behaviors. To study the role of eye movements in reach planning under more natural conditions, we trained two monkeys to play a game involving a reach search for juice rewards while monitoring their eye movements. On a given trial we illuminated three identical targets on a touch screen and instructed them to choose one by reaching. Only one of the targets contained the reward which was determined randomly each trial. If the animal guessed wrong on the first reach, additional reaches were allowed.

Both animals had similar strategies for selecting reach targets. They were more likely to reach to the target closest in distance and located ipsi-laterally to the reaching arm. Eye movements made before the first reach formed a scan path. We were interested to learn how well these scan paths predicted the reach sequence that followed on a trial-by-trial basis. We trained hidden Markov models for eye movements made before different reach sequences. We then presented a test scan path and calculated the likelihood it was generated by each model. For 25 different pairs of conditions, scan paths before the first reach predicted the reach sequence that followed correctly on up to 90% of trials. This suggests the animals were planning not just one reach, but a sequence of reaches before making the first reach. These data indicate eye movements can participate in the reach selection process and may provide a window into early stages of reach planning.