

# Learning to Detect and Combine the Features of an Object

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To recognize an object, we first detect and then combine its features. Familiar objects are recognized effortlessly, but unfamiliar objects — new faces, foreign letters — are hard to distinguish, and must be learned through practice. Here, we dissociate two distinct failures of human object recognition in a letter learning task: failing to detect the features and failing to combine them. Ordinarily, detection and combination are inseparable because the human observer performs both, without any assistance. To achieve the dissociation, we gave the observer a bionic crutch: the human does one of the steps while the ideal observer (the optimal algorithm) does the other. The dissociation reveals a large disparity. Measuring threshold contrast (the faintness of the faintest identifiable letter) as it improves with practice, we find that combining is six times more efficient than detecting, and that the rate of learning to combine is four times that of learning to detect. This disparity explains much of the variation of rates reported in perceptual learning studies, including effects of complexity and familiarity.