Nonspatial Inhibition of Return (IOR) in Attentional Orienting

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Abstract

Inhibition of return (IOR) has been reported when a target is preceded by an irrelevant stimulus (cue) at the same location: Target detection is slowed, relative to uncued locations. It is suggested that IOR is a general phenomenon that helps to provide a broad sampling of stimuli in the environment. In recent years, however, the generality of the IOR phenomenon has been questioned. Although there is considerable research demonstrating inhibition of cued locations, and a mountain of evidence for inhibition of cued objects, inhibition of cued nonspatial attributes, like color, shape and orientation, has rarely been explicitly demonstrated. Using a paradigm that has shown robust location-based IOR when relatively richer displays are presented, the present thesis addresses three noticeable gaps in the IOR literature relating to nonspatial feature visual search.

First, although there is some evidence suggesting IOR influences nonspatial attribute-based visual search, the effects observed have been small and inconsistent, have not followed the same time course as more standard IOR, and there is some evidence that the effect may depend on presenting a “neutral attractor” between the cue and target. In Experiments 1(1a,1b) and Experiment 2(2a), participants

demonstrated a robust color-, and shape - based inhibitory effect that, unlike previous findings, followed a time course similar to that for location-based IOR. Moreover, the effect does not seem to require the presentation of a neural attractor. Experiment 3 and Experiment 2b demonstrated that less or no attribute-based IOR appeared if the cue and target were less salient. The results showed that if the stimuli offer featural differences that are salient enough, the perceptual system uses them to encode the displays, and IOR can be applied to those features.

Second, the nonspatial-based IOR effect does not seem to be independent of location, as it only occurs when cue and target share not only features, but location. The results suggest that attentional selection can be applied to stimulus properties such as color, shape, and orientation, but that the attentional operations are specified in location-based coordinates. Given location-based IOR appeared in all experiments, repetition of nonspatial features may reflect an additional phenomenon. When the cue and the target do not share location, they can not be the same object, indicating featural IOR is rather object based.

Third, in Experiment 4, 5 and 6, when attribute discrimination tasks were required, the attribute-based IOR was gone. So far, there have been a limited number of studies examing the attribute-based discrimination research, and the results of them are mixed. Our results clearly indicated that the attribute-based inhibitory effect does not generalize to higher mental demanding tasks. We suggested that this type of cuing effects can be considered as different manifestations of attentional capture on non-spatial attributes processing, that is, under attribute-based higher demanding tasks

observers allocate attestation to locations, rather than to attributes; hence IOR is predominantly location-based.

To conclude, these findings shed considerable light on IOR: nonspaital attribute-based IOR can be demonstrated under certain conditions, with rich displays, and with enough stimulus salience. Critically, the effect of inhibition directed to an attribute is tied to the location of the prior stimulus. The effect also depends on the difficulty of the target processing (simple detection task vs. discrimination task).

中文摘要

對空間某一靶子進行線索化，隨後對該靶子的反應產生促進作用（反應速度加快），但是，一段時間（通常是 300 毫秒）以後，這種易化作用出現反轉，即易化轉變成抑制作用（反應速度變慢）。這種視覺加工現象被稱之爲返回抑制（Inhibition of Return, IOR）。一般認爲返回抑制是一種普遍現象，利於人們有效的注意和搜索。近年來，一些學者們開始質疑它的普遍性。目前儘管對基於位置的返回抑制的研究已經很多，但是對返回抑制能否發生在非空間的特徵（如顏色，形狀，和朝向等等）的研究很少，結果也很不確定。

本研究使用一種新的範式（Samuel 和 Weiner, 2001）系統考察了非空間特徵的返回抑制現象。除範式效度證實性實驗外，本研究使用了 6 個實驗：（1）證實性實驗成功重複了原實驗結果，證實範式有效可用；（2）實驗一至實驗三使用覺察任務考察顏色、形狀和朝向的返回抑制時間和空間模式，結果發現，非空間返回抑制在較複雜刺激背景條件下，在線索靶子間隔 700 毫秒即可出現，可持續到 3500 毫秒後。但是只有線索和靶子特徵差別顯著情況下，非空間返回抑制才能呈現；並且非空間特徵返回抑制局限在靶子和干擾物“位置同一”的情況下。另外，中間分心物對抑制效應作用不顯著。（3）實驗四至實驗六使用辨別任務，考察顏色、形狀和朝向的返回抑制時間和空間模式。結果發現，任務改變，非空間返回抑制現象消失，只有促進效應存在；典型的基於位置返回抑制任然存在。

本研究首次觀察到非常顯著的非空間返回抑制現象。這種抑制遵從了典型的基於位置的返回抑制時間特徵。研究證實觀察到的抑制現象，不同於特徵重複

盲現象(repetition blindness:RB)。這種返回抑制與位置關係密切。之前的報告不能發現特徵返回抑制，是因爲實驗方法及任務可能不足夠引發這種抑制現象。本研究的理論意義是證實了返回抑制可以在特徵水平發生，支持了返回抑制的普遍性觀點。但是特徵抑制現象跟位置關係非常緊密，本研究認爲在視覺搜索中，特徵抑制基於位置；進一步，特徵抑制具有客體性（object-based）。