综　述

视觉注意的时间结构和动态神经机制

1, 2, 3, 4, *　　　　1, 2, 3, 4　　　　1, 2, 3, *

1　　　　　　　　　　　　　　　　　　　　　　　　　　2IDG/　　　　　　　3
4　　　　-　　　　　　　　　　　　　　100871

摘　要

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　　　　(4)

关键词

中图分类号　Q427

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　　　　Attention shapes what we see and what we act upon by allocating limited resources to certain parts of visual display in a selective and adaptive manner. While most previous studies in visual attention mainly focused on the attentional distribution over space or features, recent studies have revealed that temporal dynamics also plays a crucial function in visual attention. This paper reviews the representation, function and neural mechanism of temporal dynamics in visual attention from the following four aspects: (1) Tracking dynamic structure of external stimulus by attention; (2) Intrinsic dynamic characteristics of attention; (3) Time-based multiple object representation; (4) Relationship between visual dynamics and classical attentional phenomena. We propose that the dynamic structure and temporal organization are fundamental to visual attention, and the research on it might provide new solutions to many unresolved issues in visual attention research.

　　　　　　　visual attention; temporal structure; temporal organization; neuronal oscillation; behavioral oscillation; multiple object attention

[1, 2]

注意的时间动态特性

动态注意理论

DAT

[12]   DAT

[3]   Posner   [4]

[5]   Eriksen   [6]

(

)   [12, 15]   Hickok   [16]

Müller   [7]

(steady state visual evoked potential, SSVEP)

McMains   [8]

[17]

(

)

[9]

(biased competition model)   (nor-
malization model)[10,11]

[12–14]

)

[13] Busch [25]

EEG

Lakatos [22]

Busch [26]

7 Hz

7 Hz

[27] (transcra-
nial magnetic stimulation, TMS) [28] [29]

[14] 5~15 Hz

7 Hz [25] 11 Hz [30]

[13]

[23] " "

" "

(
)

注意的内乘动态特性

[31]

VanRullen [24]

[32] Wutz [32]

4 Hz

6~10 Hz

180° Landau

(

)

Fiebelkorn [35]

基于时间动态的多物体加工

[36]

300~1 100 ms

( )

- 10 ms

- 8 Hz

[14, 33]

4 Hz

基于时间的多物体加工的行为证据 " "行为振荡 "

Song [37]

( )

(" ")

Landau [34]

SOA (reaction time)

-

400 ms

750 ms (" ")

1 000 ms 16.7 ms ("

105 ")

(stimulus onset asynchrony, SOA) 60 Hz

(8~10 Hz)

-band

-band

-band

[38]

-band   3~5 Hz   基于时间的多物体加工的神经机制

-band

Landau [34]

-band

[39]   [40]

[41]   [42]   [43]

3~4

[44]

(covert   Landau [47]

attention)

[45]

7 Hz   [46]

0.5 s

4 Hz   4 Hz

4 Hz

(phase resetting)

Dugué [48]

TMS

(V1/V2)

5 Hz

DAT

Landau [47]

"“自上而下”和“自下而上”注意
"   "

Jia

Winner-Take-All

200~300 ms

基于时间的多物体加工和经典注意现象的关系

视觉搜索

Buschman [50]

[51]

Dugué [52]   (   )

6 Hz

6 Hz   (
)
TMS
6 Hz

6 Hz

6 Hz
Dugué [53]

7 Hz

500 ms

"　　　"

5 Hz

[58]

GABA

Kienitz　　[59]　　　　V4

3~6 Hz

结语

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(　　　　　　　　)

(

)　　　　　　　　　200~

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