

PSE1646 – Percepção e Cognição - 2018

# Visão Estereoscópica e Percepção de Profundidade

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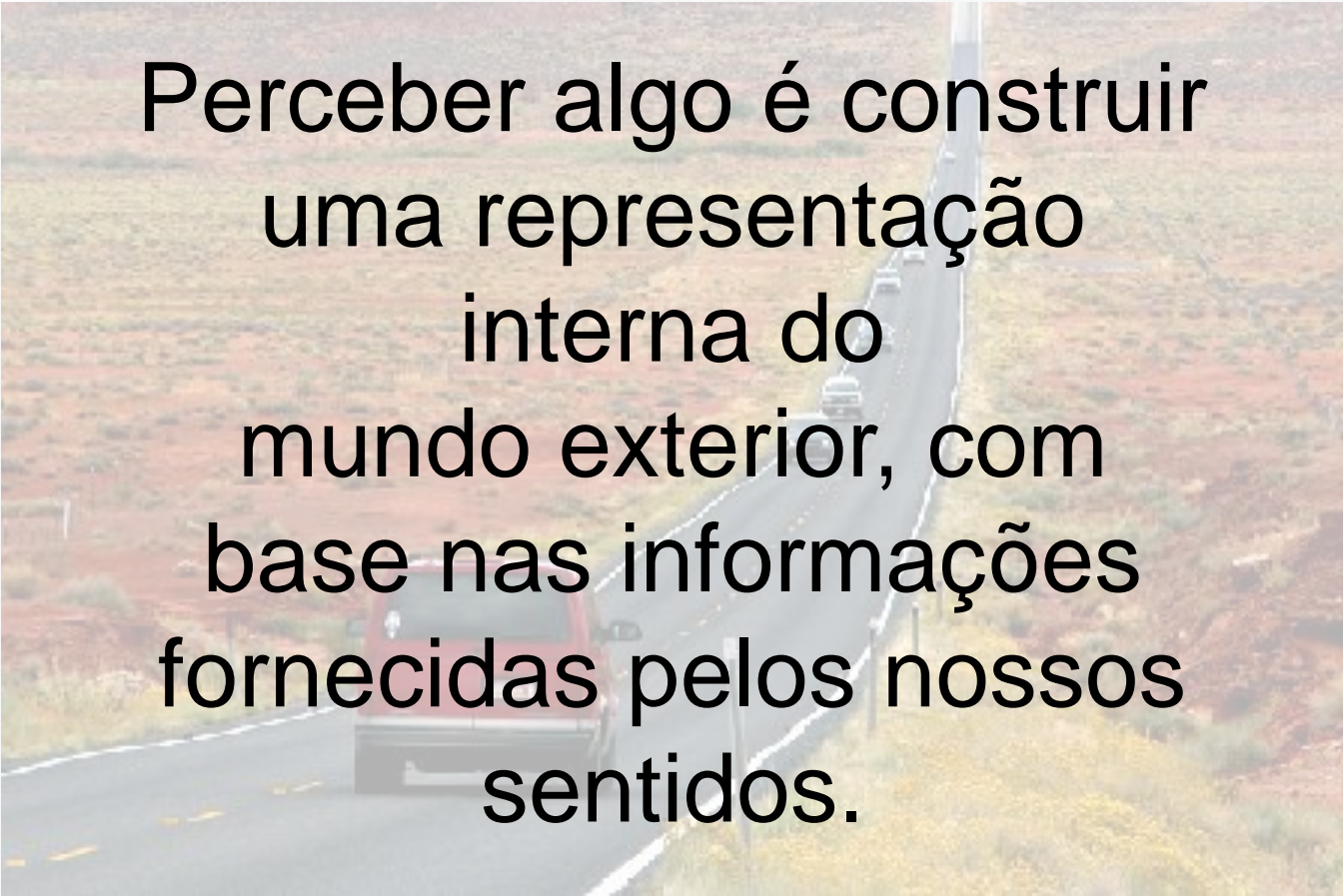
Universidade de São Paulo



INSTITUTO DE PSICOLOGIA

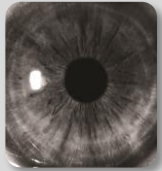


# Percepção



Perceber algo é construir uma representação interna do mundo exterior, com base nas informações fornecidas pelos nossos sentidos.

# Tópicos



## Dicas de profundidade

- Dicas monoculares
- Dicas binoculares



## Estereopsia

- Disparidades absoluta e relativa
- Tipos de estereopsia



## Usando a visão estereoscópica

- Estereogramas
- Limites da estereopsia



## Bases fisiológicas

- Processamento inicial
- Além de V1



## Conclusão

# Dicas de profundidade

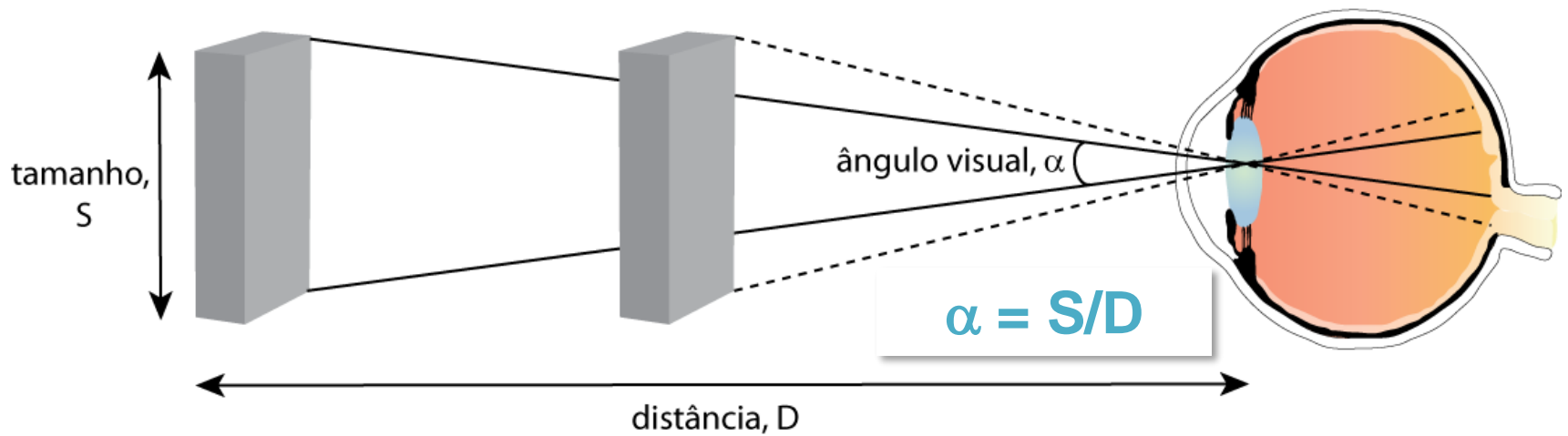
## Monoculares



## Binoculares



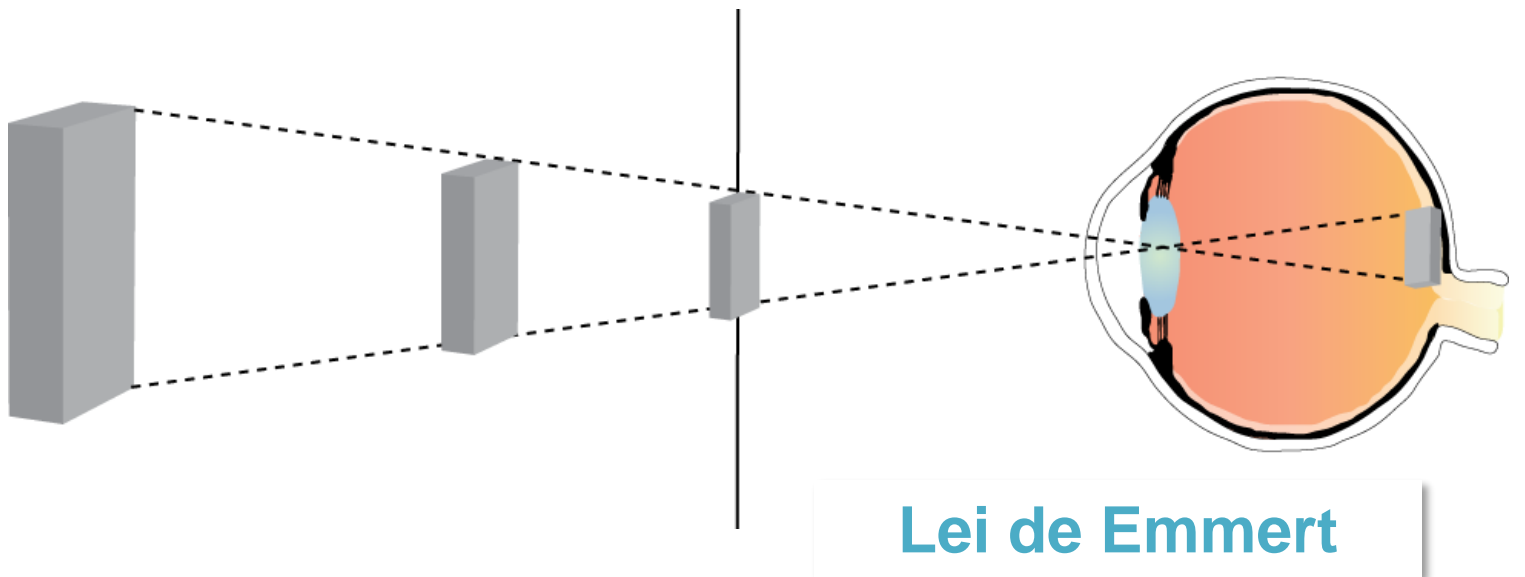
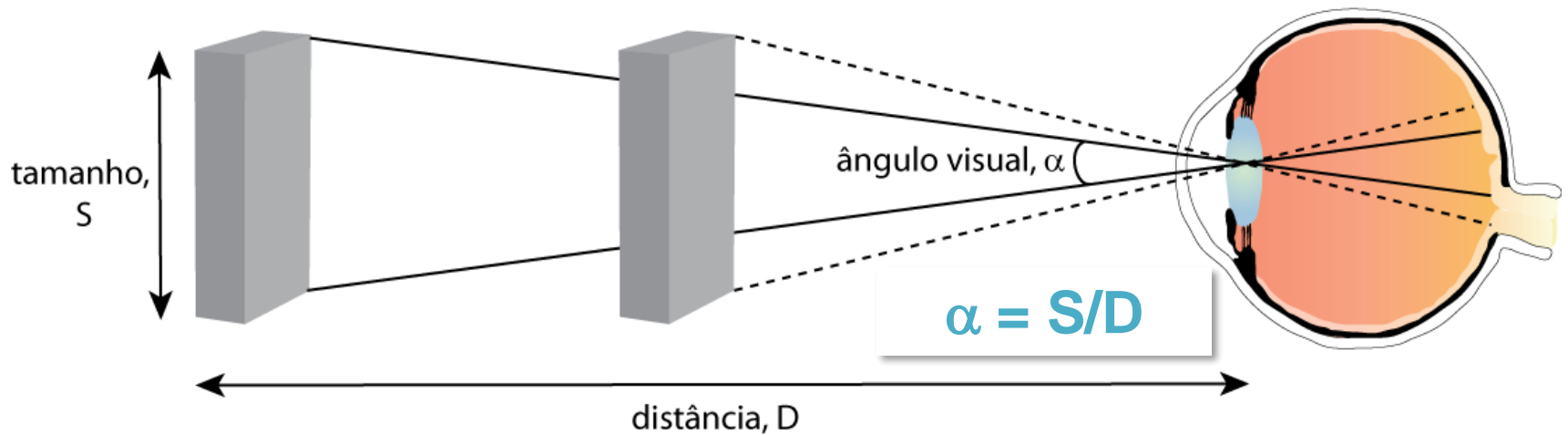
# Dicas pictoriais I: tamanho



# Dicas pictoriais I: tamanho



# Dicas pictoriais I: tamanho

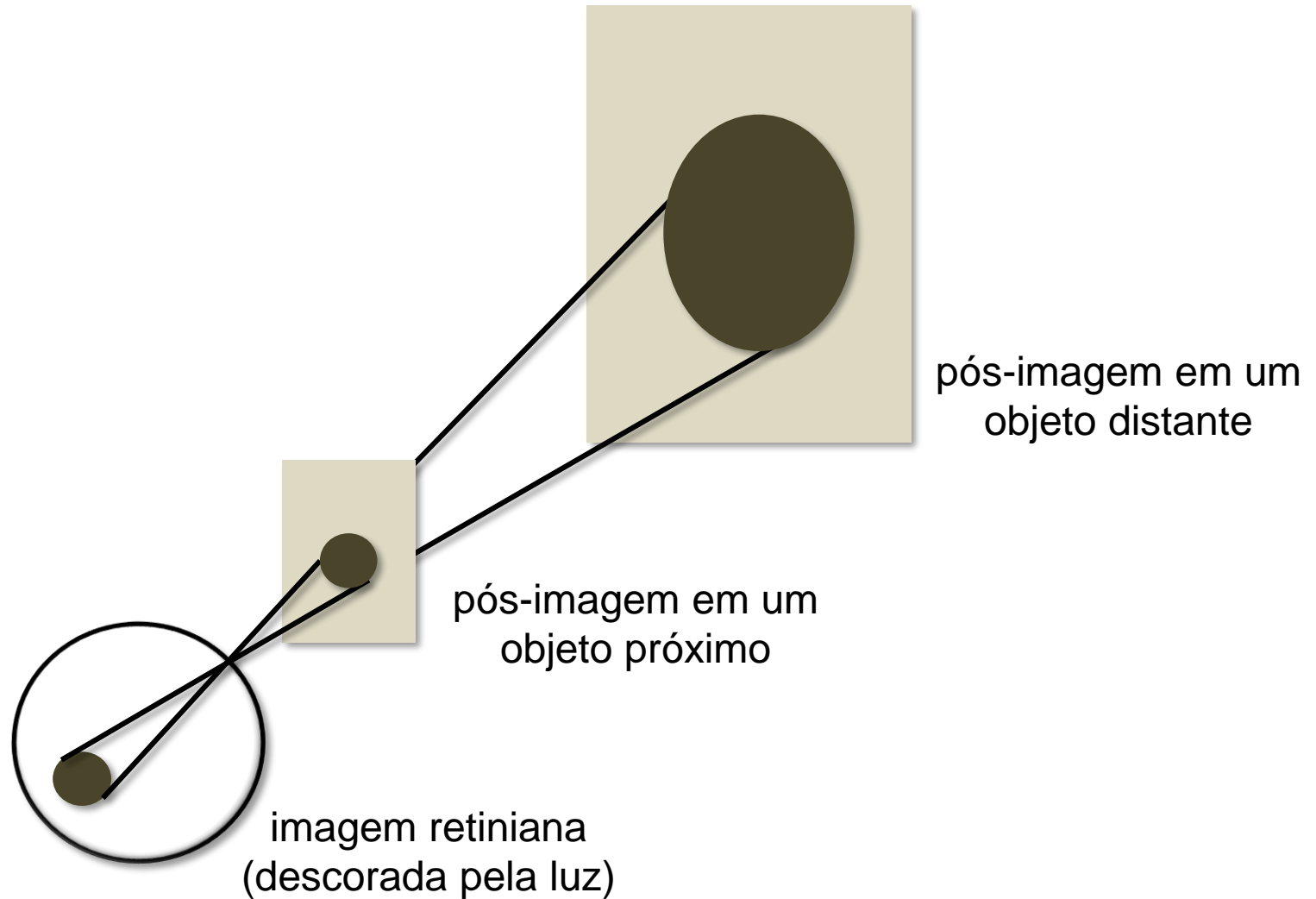


# Dicas pictoriais I: tamanho

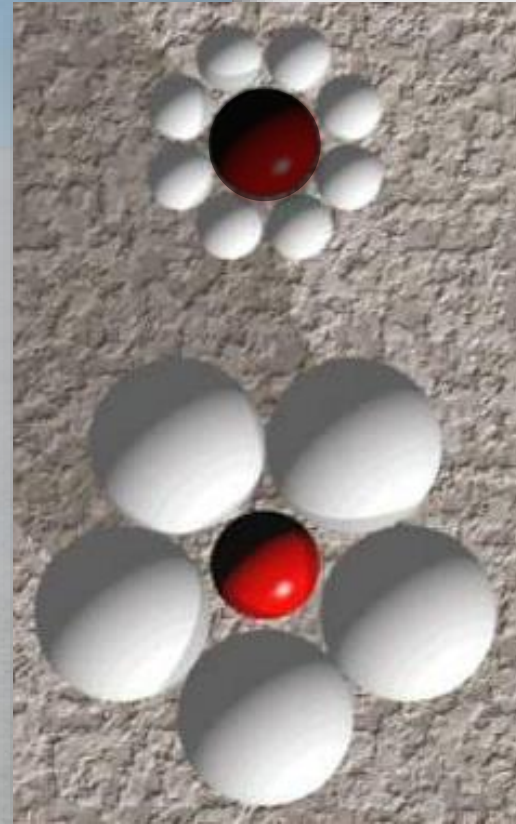




# Dicas pictoriais I: tamanho



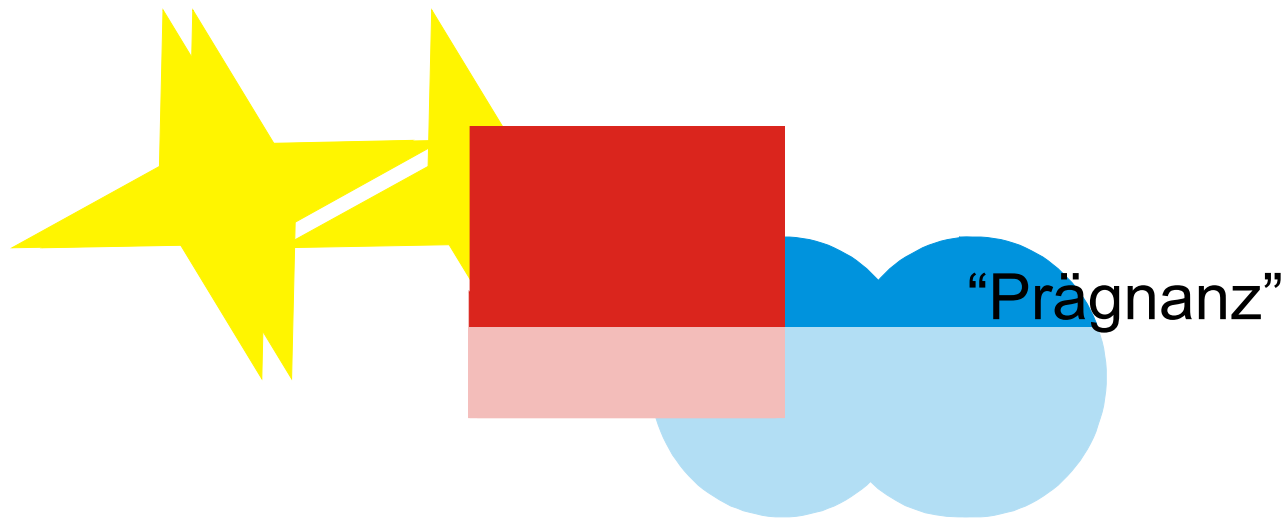
# Dicas pictoriais I: tamanho



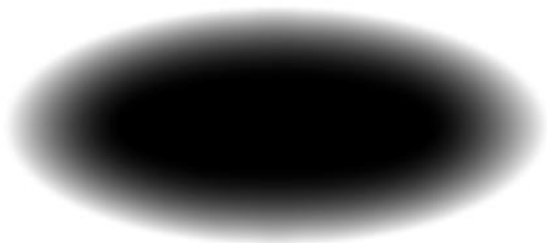
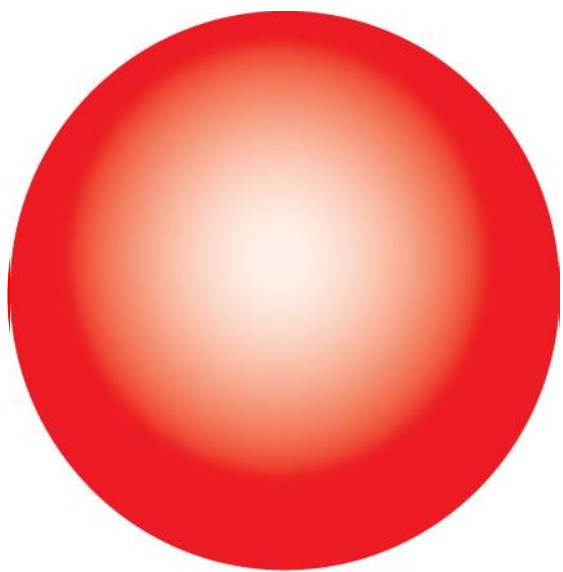
# Dicas pictoriais II: oclusão



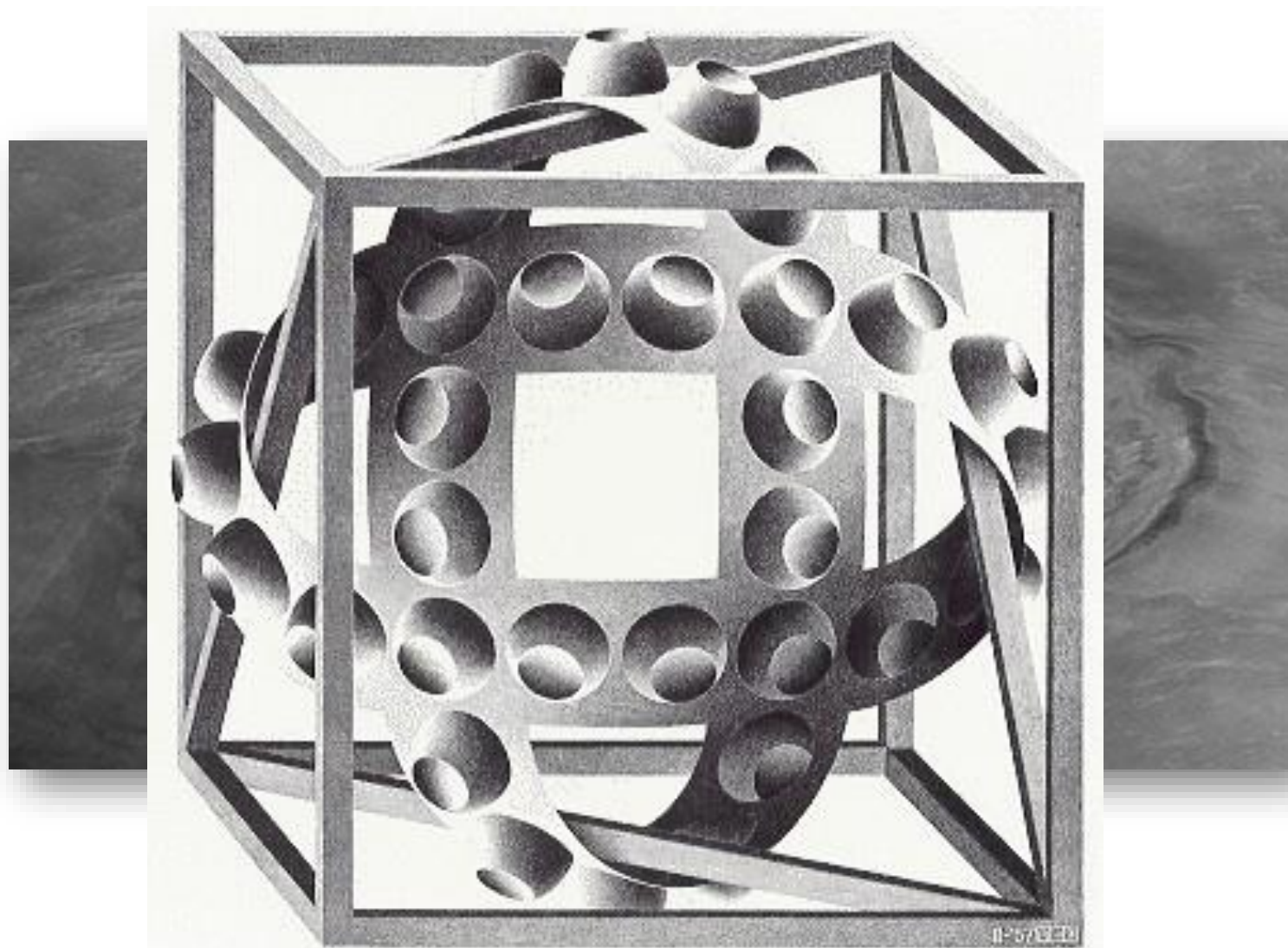
# Dicas pictoriais II: oclusão



# Dicas pictoriais III: luz e sombra



# Dicas pictoriais III: luz e sombra



# Dicas pictoriais III: luz e sombra



# Dicas pictoriais III: luz e sombra





# Dicas pictoriais IV: claridade



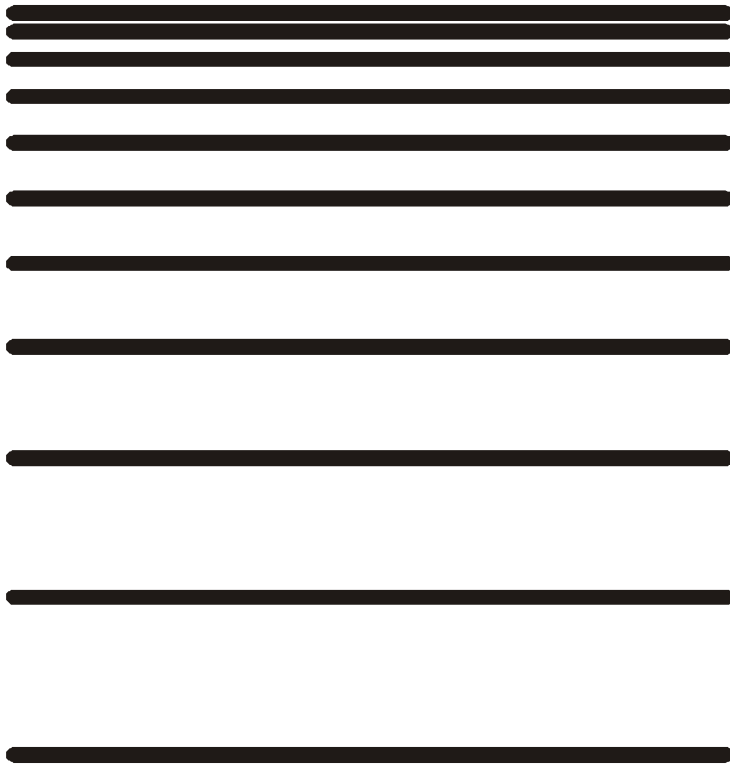
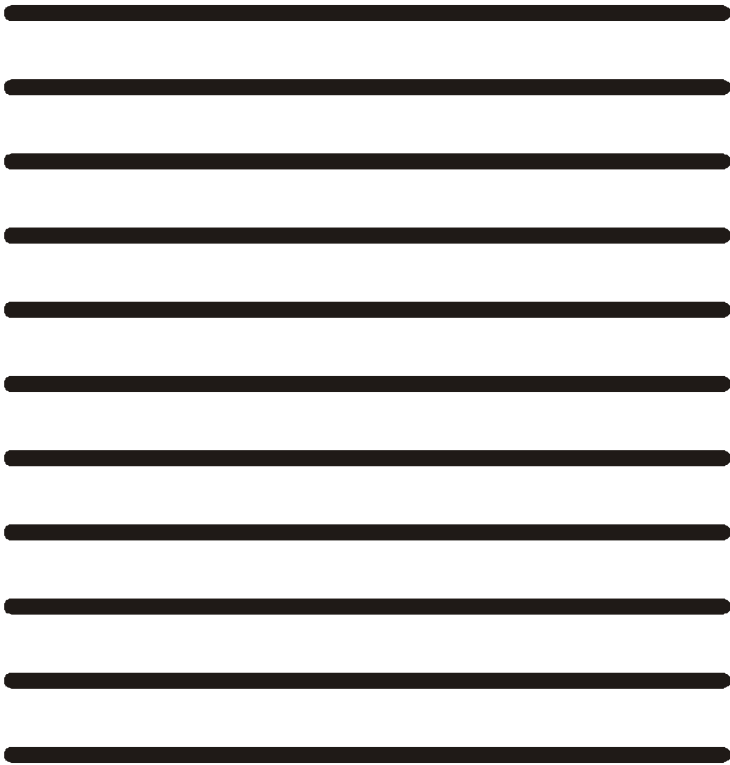
# Dicas pictoriais V: elevação



# Dicas pictoriais VI: perspectiva



# Dicas pictoriais VI: perspectiva



# Dicas de profundidade

## Monoculares

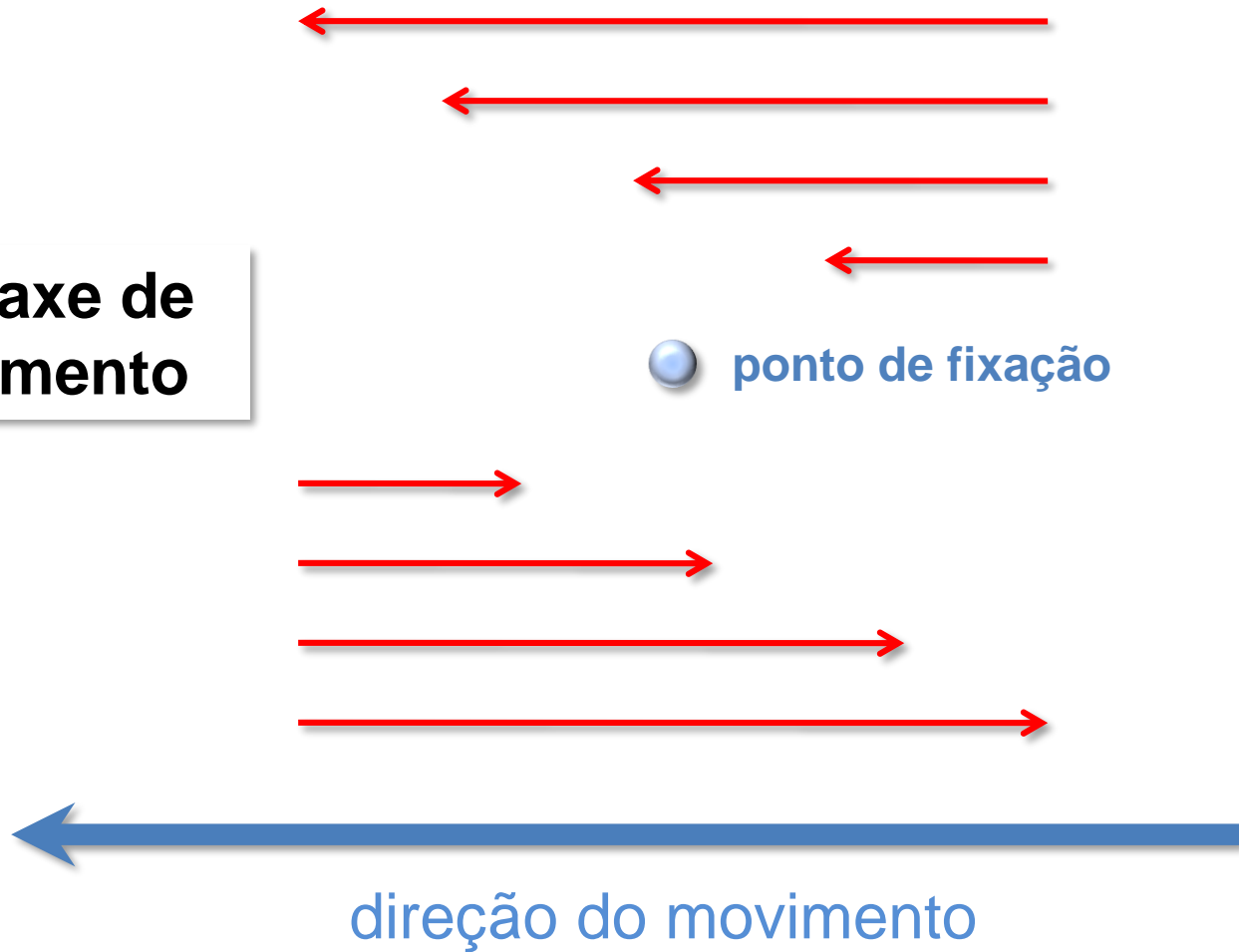


## Binoculares



# Dicas cinéticas I: paralaxe de movimento

**paralaxe de movimento**



# Dicas cinéticas I: paralaxe de movimento



# Dicas cinéticas II: efeito cinético



***Michael Bach***



# Dicas de profundidade

## Monoculares

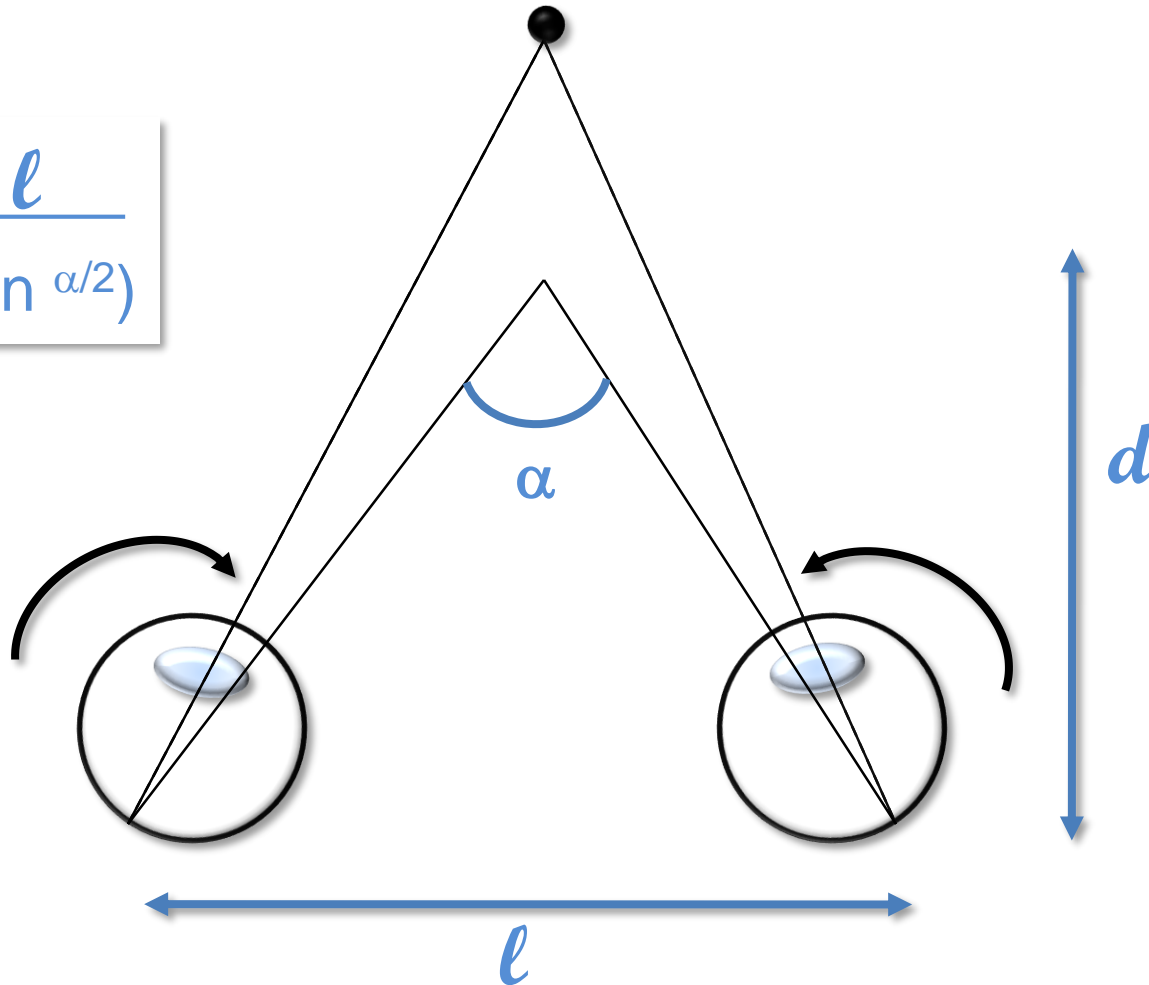


## Binoculares



# Dicas binoculares I: convergência

$$d = \frac{l}{2(\tan \alpha/2)}$$



# Dicas de profundidade

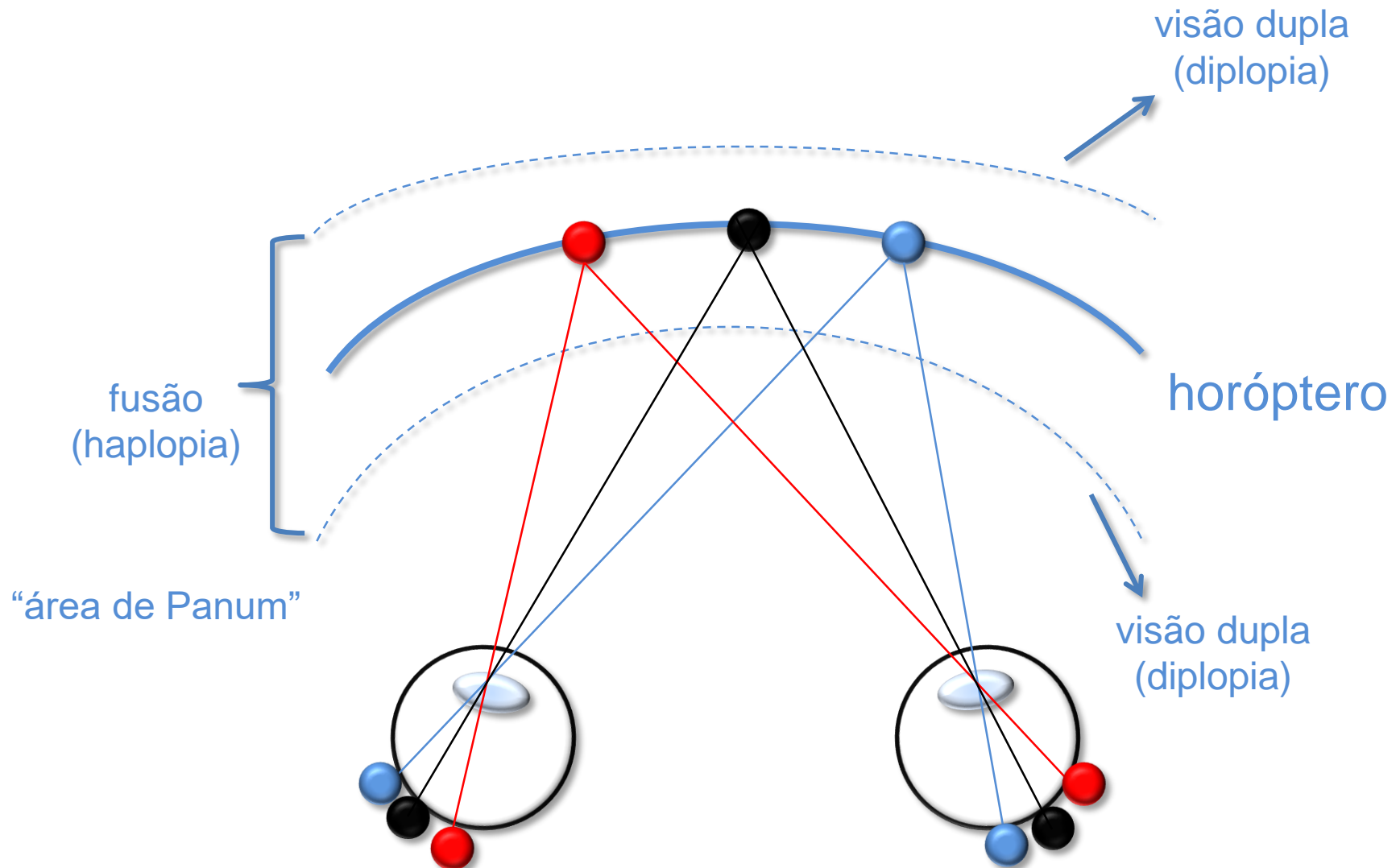
## Monoculares



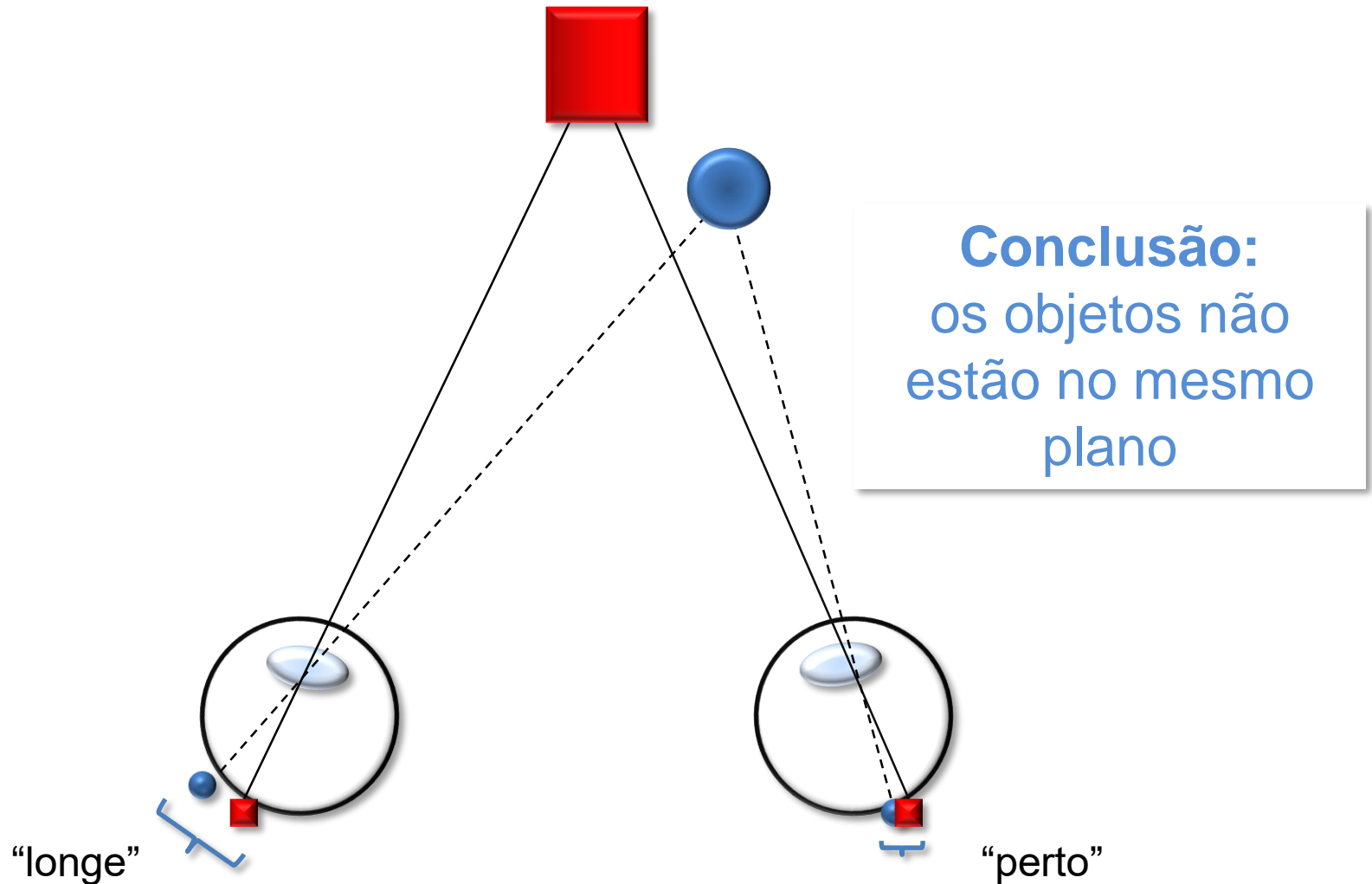
## Binoculares



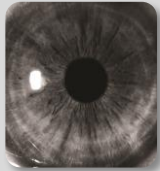
# Dicas binoculares II: disparidade



# Dicas binoculares II: disparidade

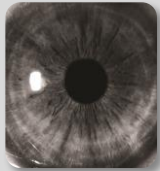


# Tópicos



**Dicas de profundidade**

- Dicas monoculares
- Dicas binoculares



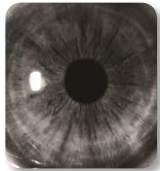
**Estereopsia**

- Disparidades absoluta e relativa
- Tipos de estereopsia



**Usando a visão estereoscópica**

- Estereogramas
- Limites da estereopsia



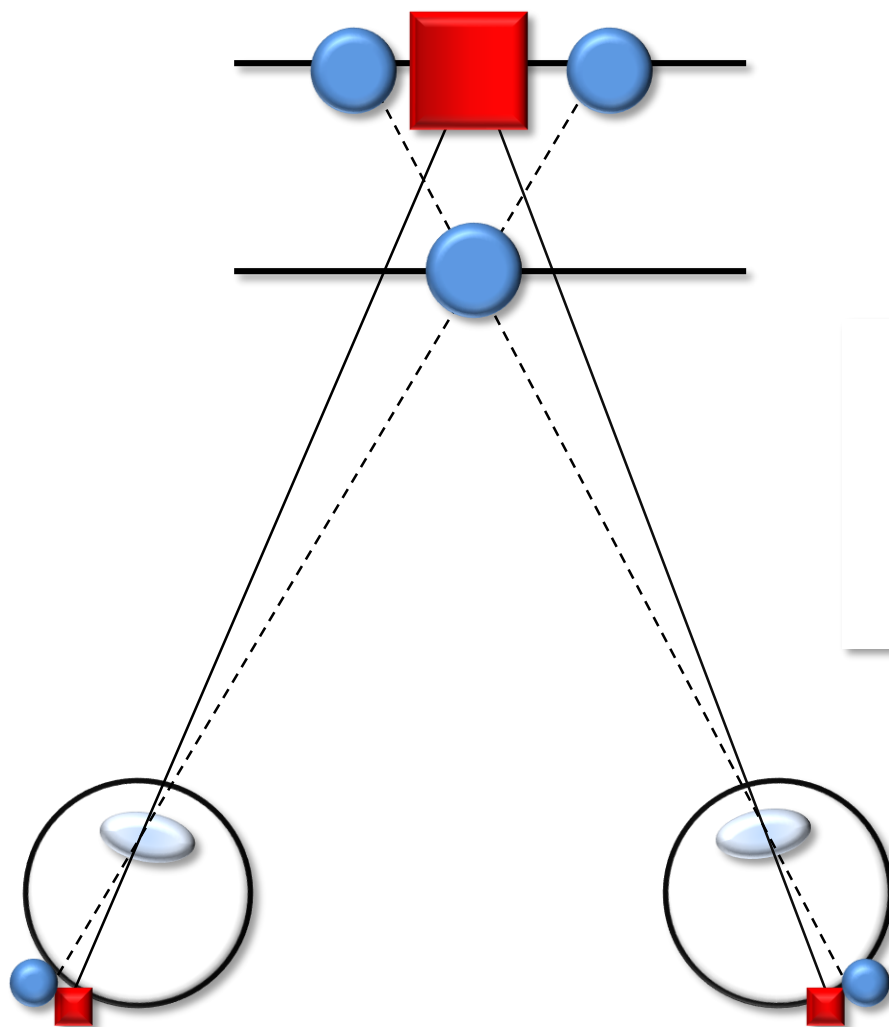
**Bases fisiológicas**

- Processamento inicial
- Além de V1



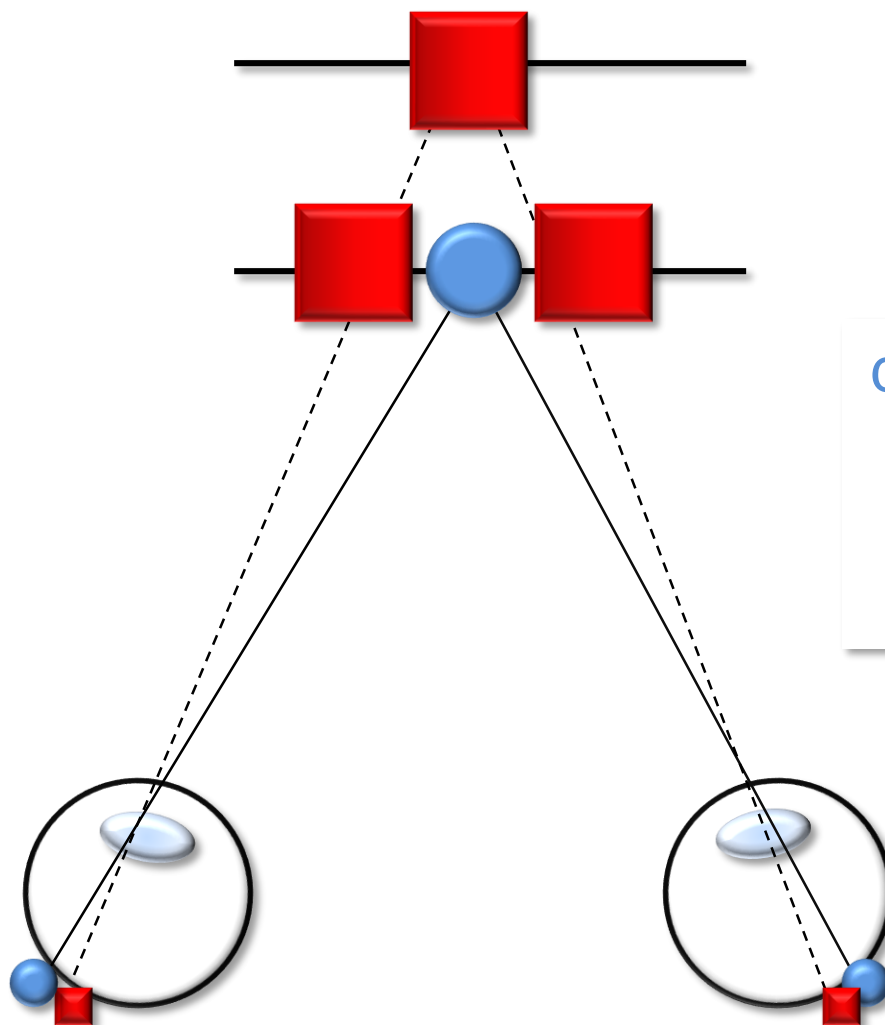
**Conclusão**

# Disparidade absoluta



disparidade  
cruzada  
ou  
próxima

# Disparidade absoluta



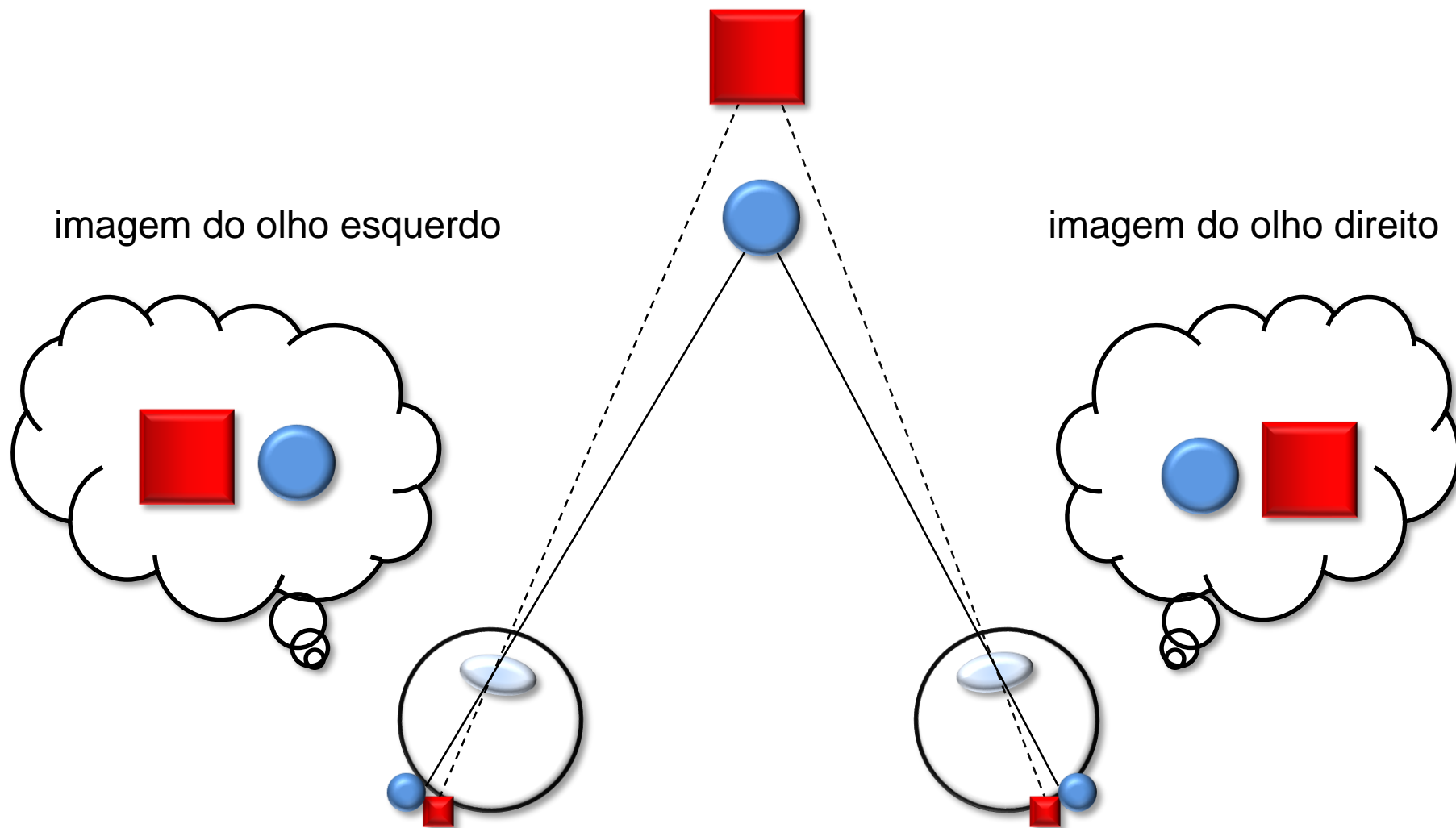
disparidade não  
cruzada  
ou  
distante



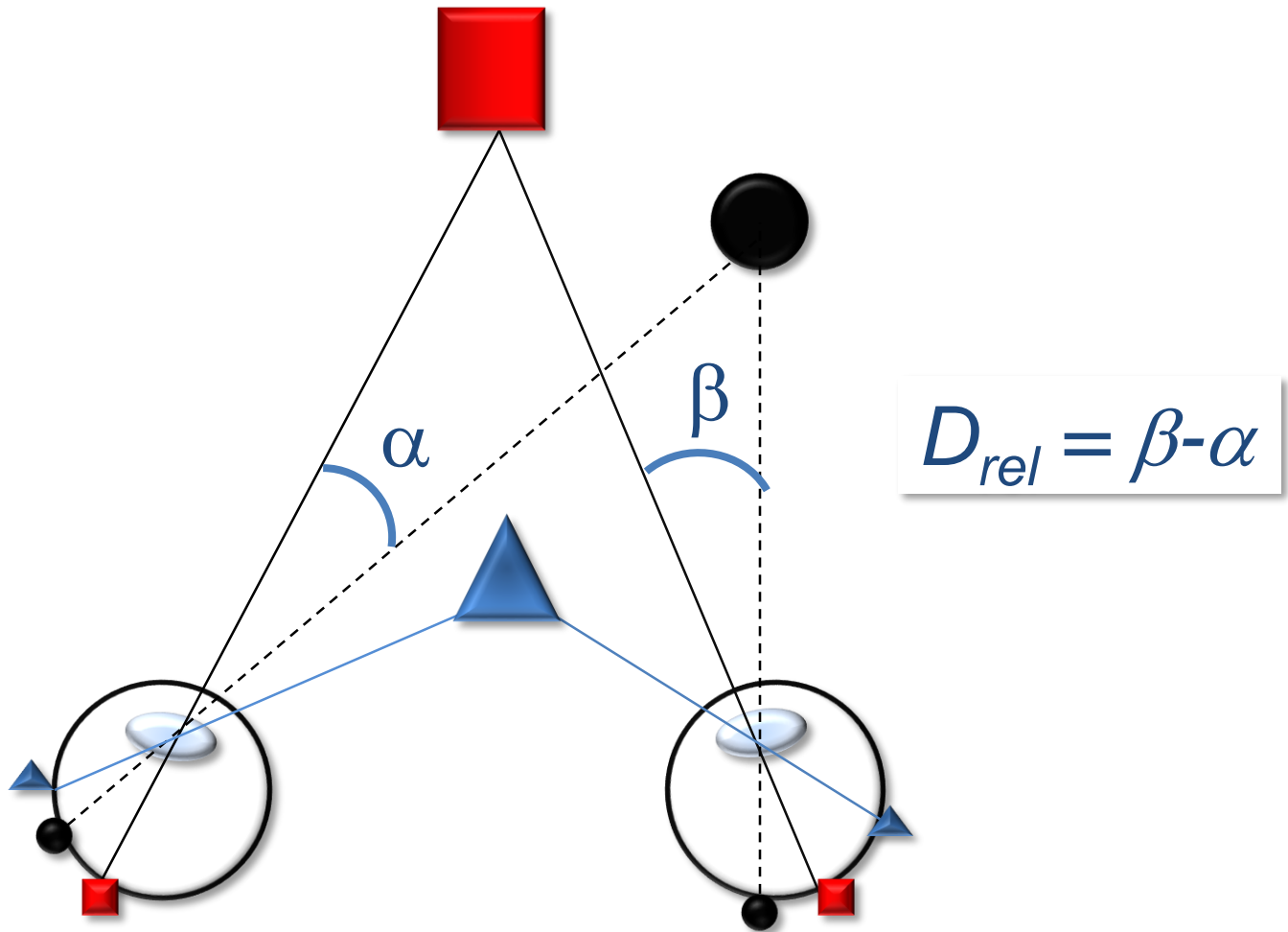
# Disparidade absoluta

imagem do olho esquerdo

imagem do olho direito



# Disparidade relativa



# Tipos de visão estereoscópica

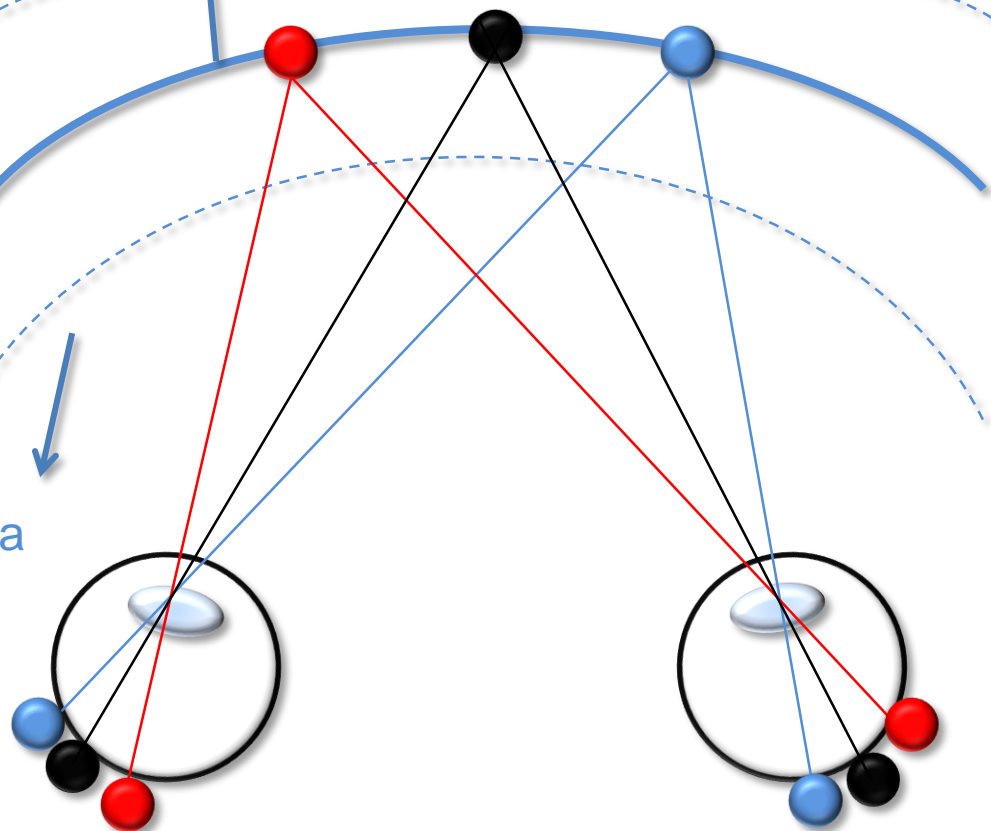
visão dupla  
(diplopia)

horóptero

“área de  
Panum”

fusão  
(haplopia)

visão dupla  
(diplopia)



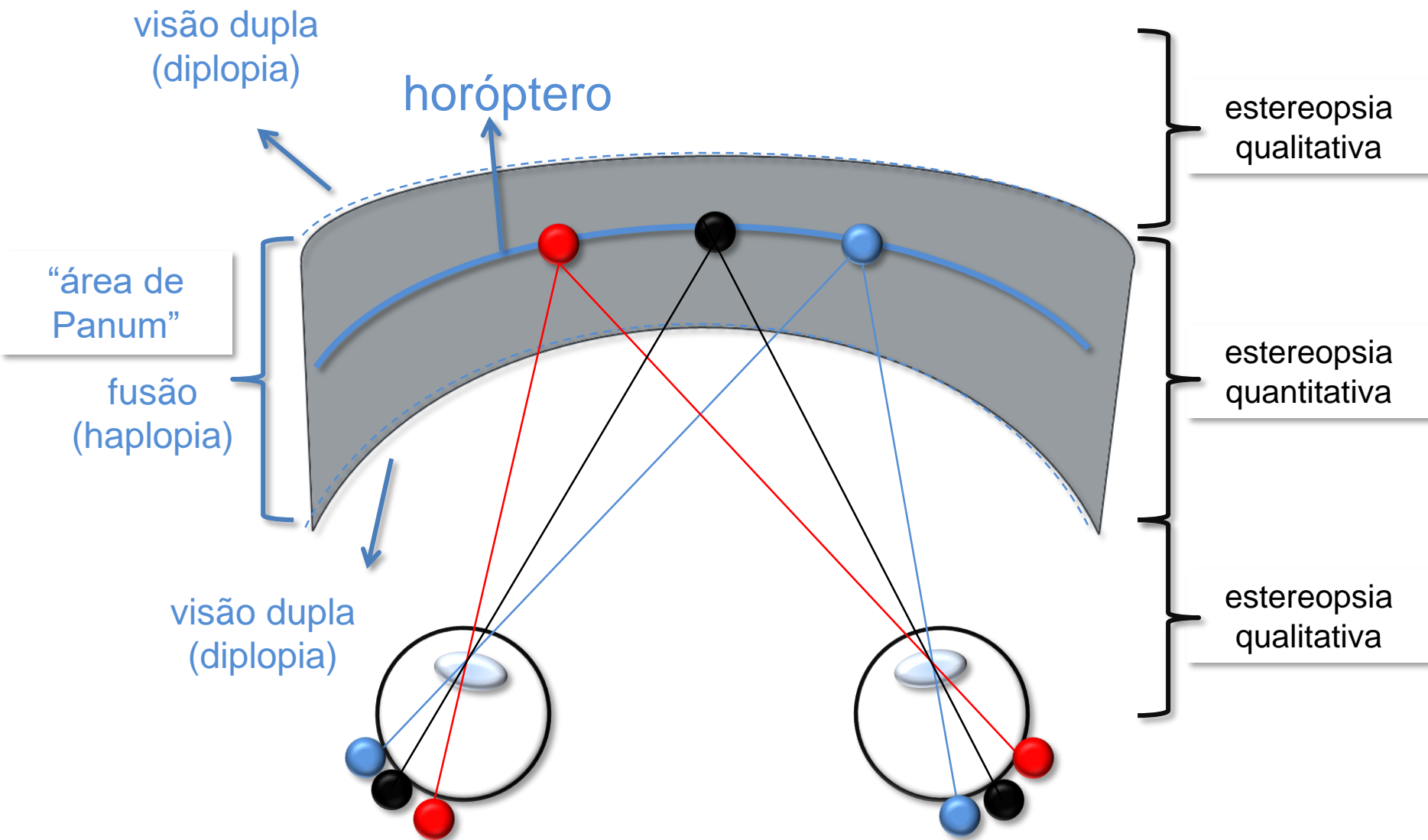
# Tipos de visão estereoscópica

**Estereopsia quantitativa**

**Estereopsia qualitativa**

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# Tipos de visão estereoscópica



# Tipos de visão estereoscópica

## Estereopsia estática

Resultante da observação de objetos estáticos

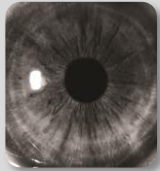
Imagens possuem localizações diferentes em cada retina

## Estereopsia dinâmica

Resultante de movimento na direção do observador

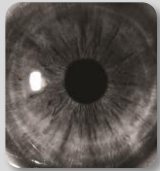
Imagens possuem localizações e velocidades diferentes em cada olho

# Tópicos



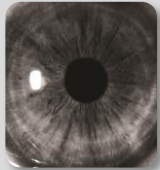
## Dicas de profundidade

- Dicas monoculares
- Dicas binoculares



## Estereopsia

- Disparidades absoluta e relativa
- Tipos de estereopsia



## Usando a visão estereoscópica

- Estereogramas
- Limites da estereopsia



## Bases fisiológicas

- Processamento inicial
- Além de V1



## Conclusão

# Usando a visão estereoscópica





# Estereogramas



Estereoscópio (Wheatstone, 1838)

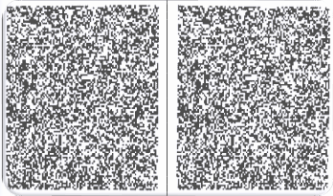
# Estereogramas



# Estereogramas

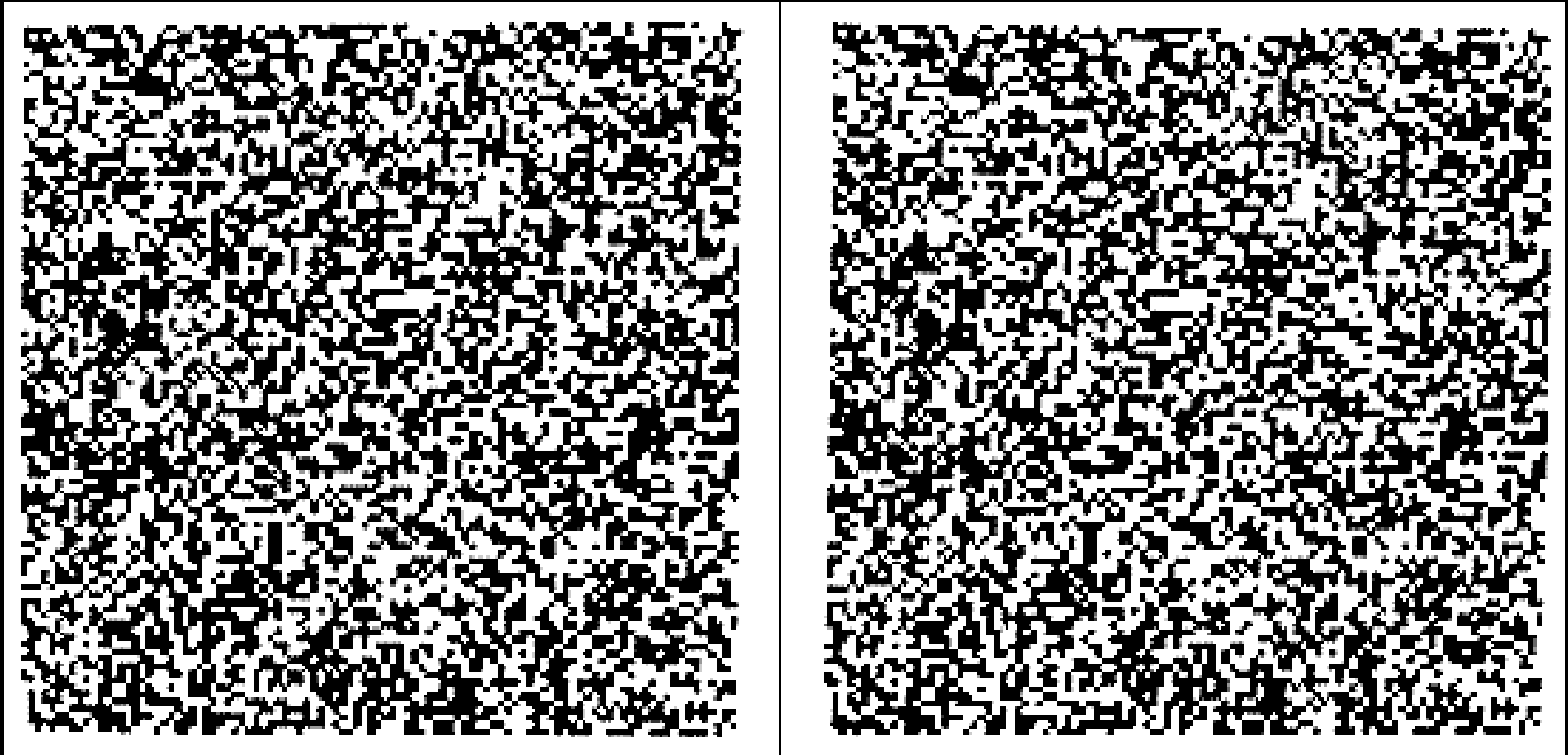


Estereoscópio (Wheatstone, 1838)



Estereogramas aleatórios (Julesz, 1959)

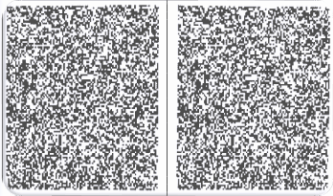
# Estereogramas



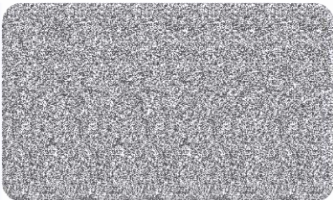
# Estereogramas



Estereoscópio (Wheatstone, 1838)



Estereogramas aleatórios (Julesz, 1959)



Estereogramas aleatórios únicos ou autoestereogramas aleatórios (Tyler and Clarke, 1979)

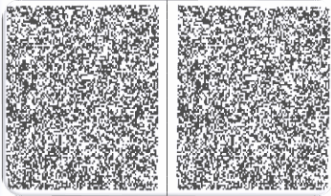
# Estereogramas



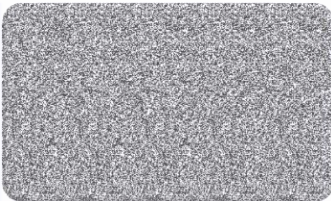
# Estereogramas



Estereoscópio (Wheatstone, 1838)



Estereogramas aleatórios (Julesz, 1959)

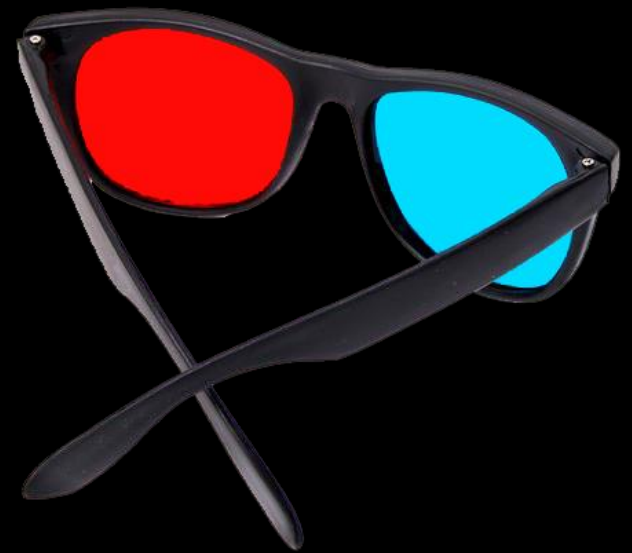


Estereogramas aleatórios únicos ou autoestereogramas aleatórios (Tyler and Clarke, 1979)



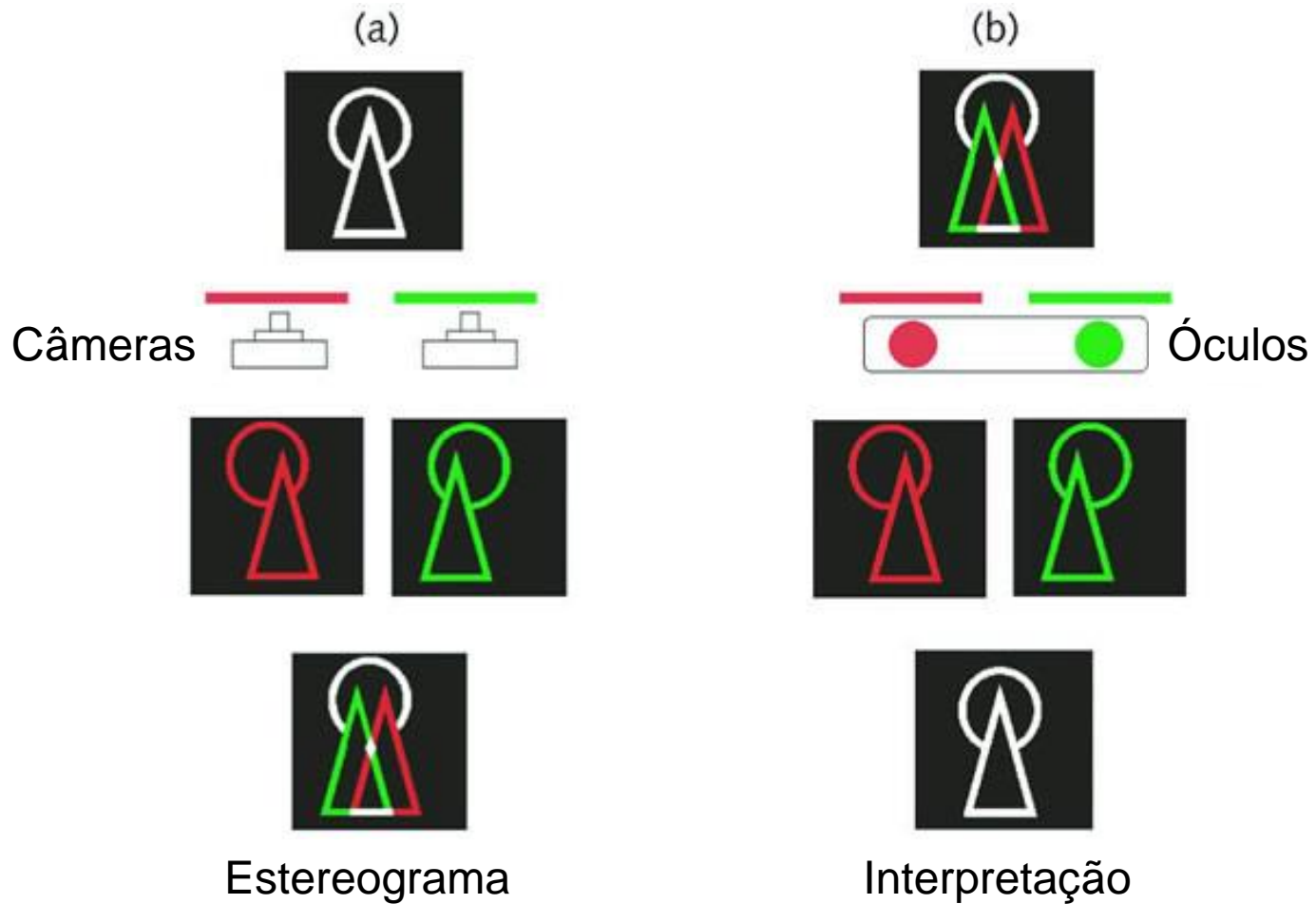
Anáglifos (Rollman, 1953)

# Estereogramas



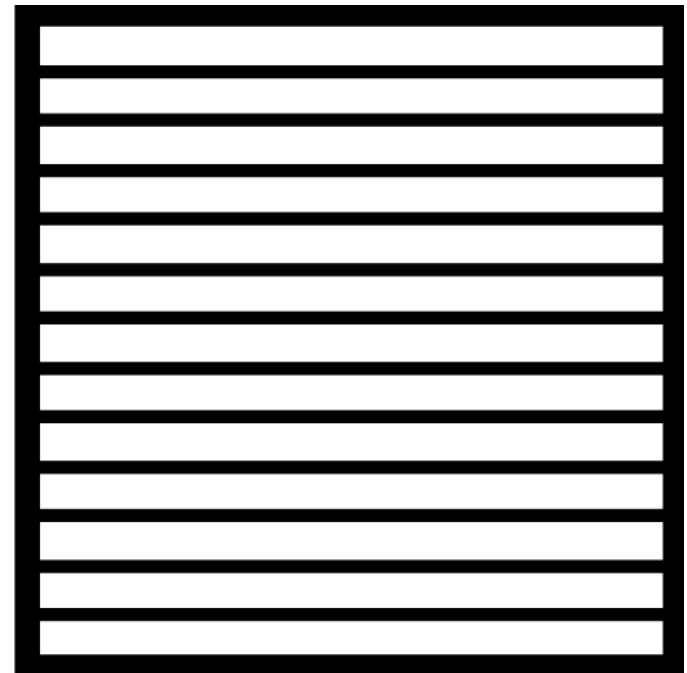
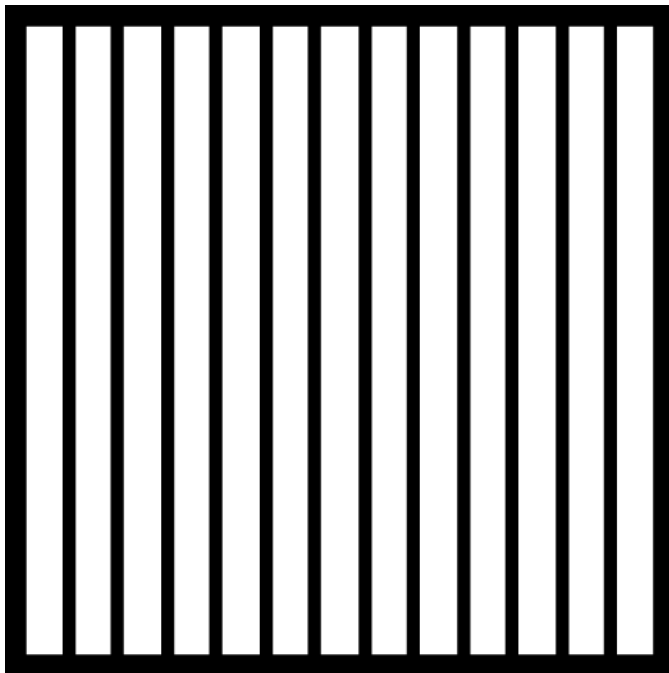


# Estereogramas



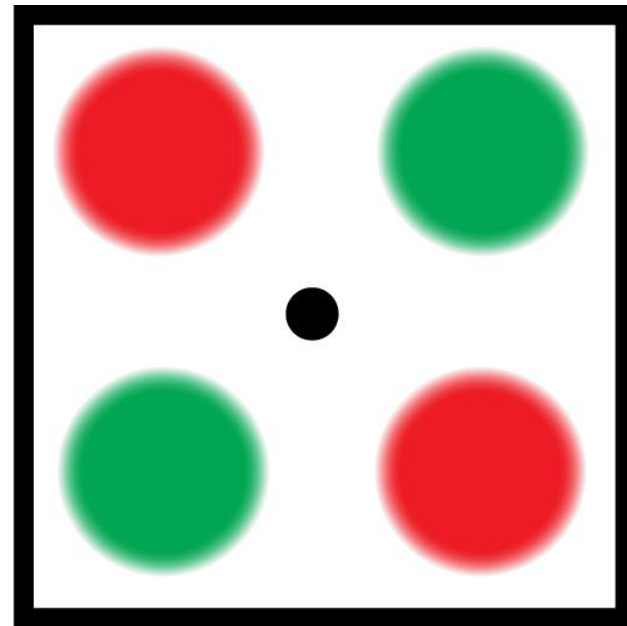
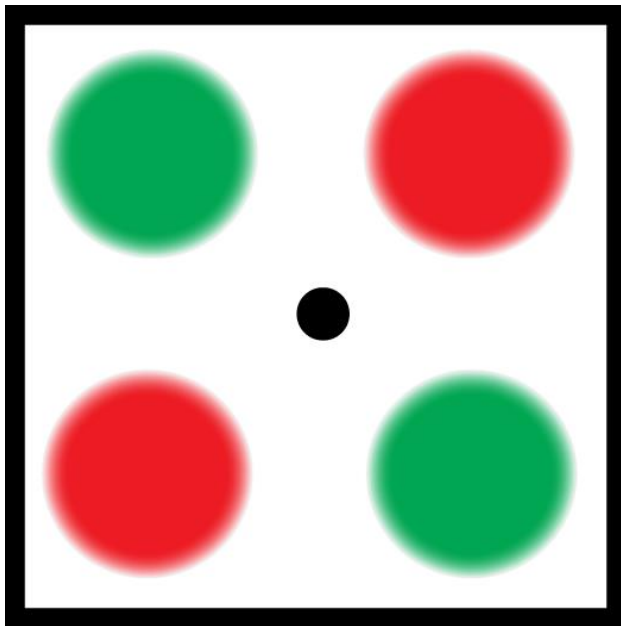
# Limites da estereopsia

- Rivalidade binocular
  - Rivalidade binocular de contorno



# Limites da estereopsia

- Rivalidade binocular
  - Rivalidade binocular de contorno
  - Rivalidade binocular de cores

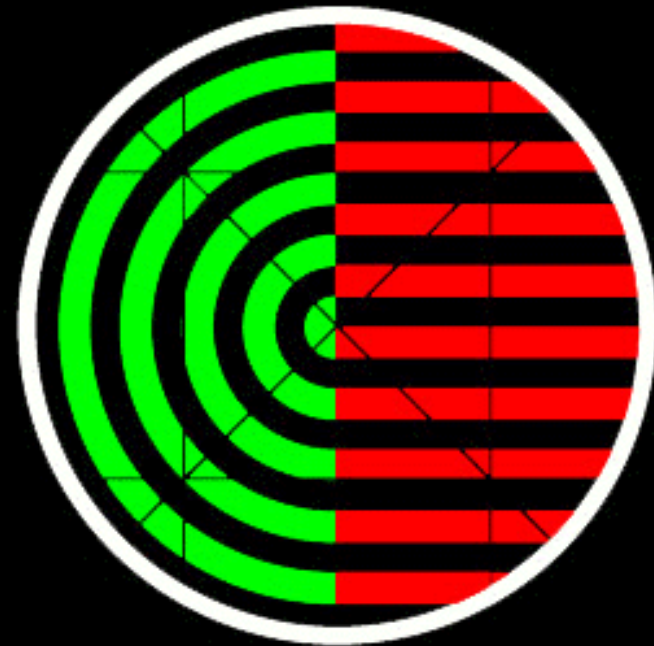


# Limites da estereopsia

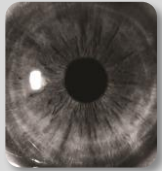
- Rivalidade binocular
  - Rivalidade binocular de contorno
  - Rivalidade binocular de cores
  - Rivalidade binocular de intensidade



# Limites da estereopsia



# Tópicos



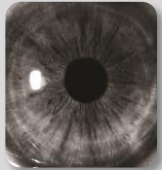
**Dicas de profundidade**

- Dicas monoculares
- Dicas binoculares



**Estereopsia**

- Disparidades absoluta e relativa
- Tipos de estereopsia



**Usando a visão estereoscópica**

- Estereogramas
- Limites da estereopsia



**Bases fisiológicas**

- Processamento inicial
- Além de V1



**Conclusão**

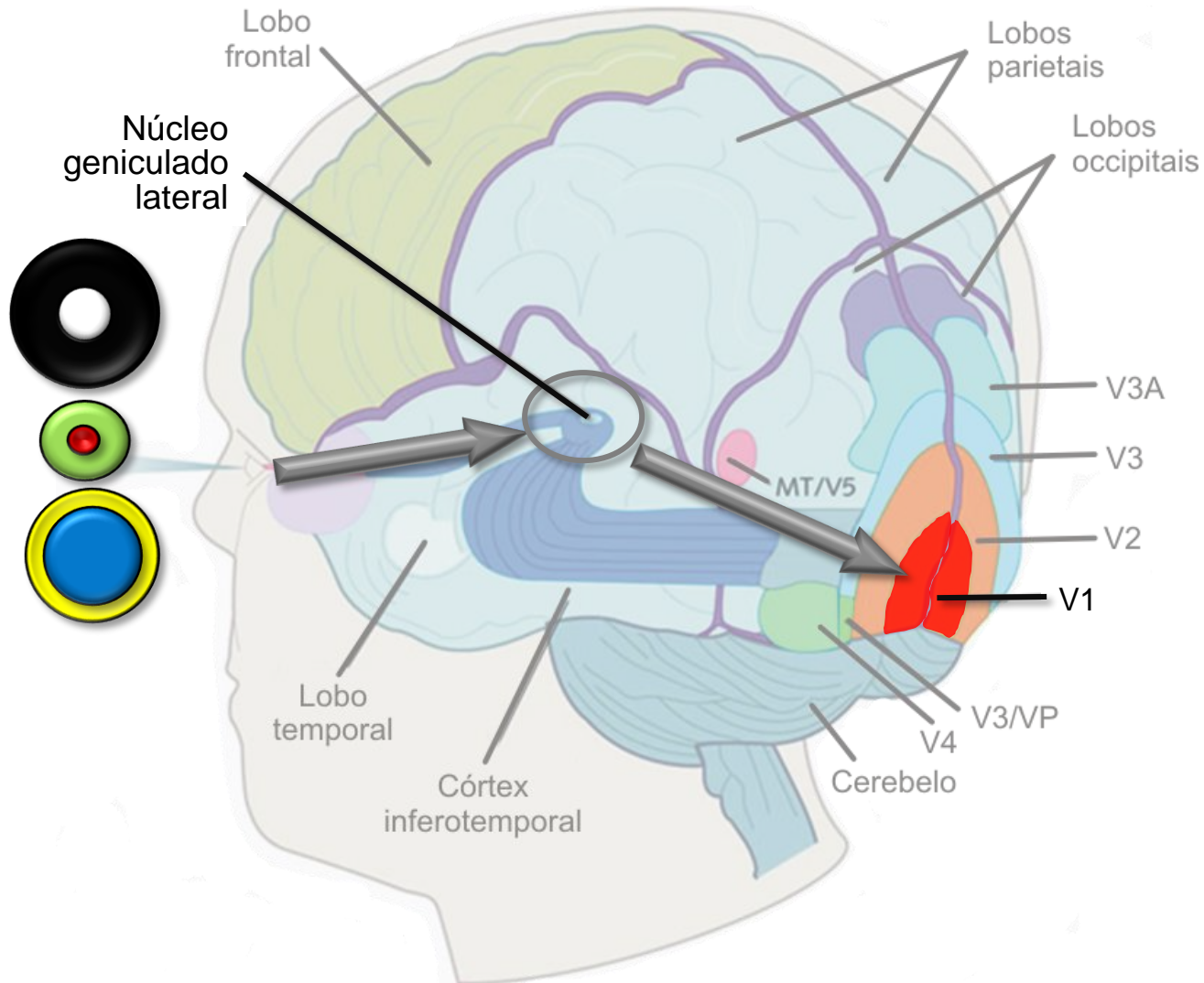
# Bases fisiológicas

“substrato fisiológico”

“base neural”

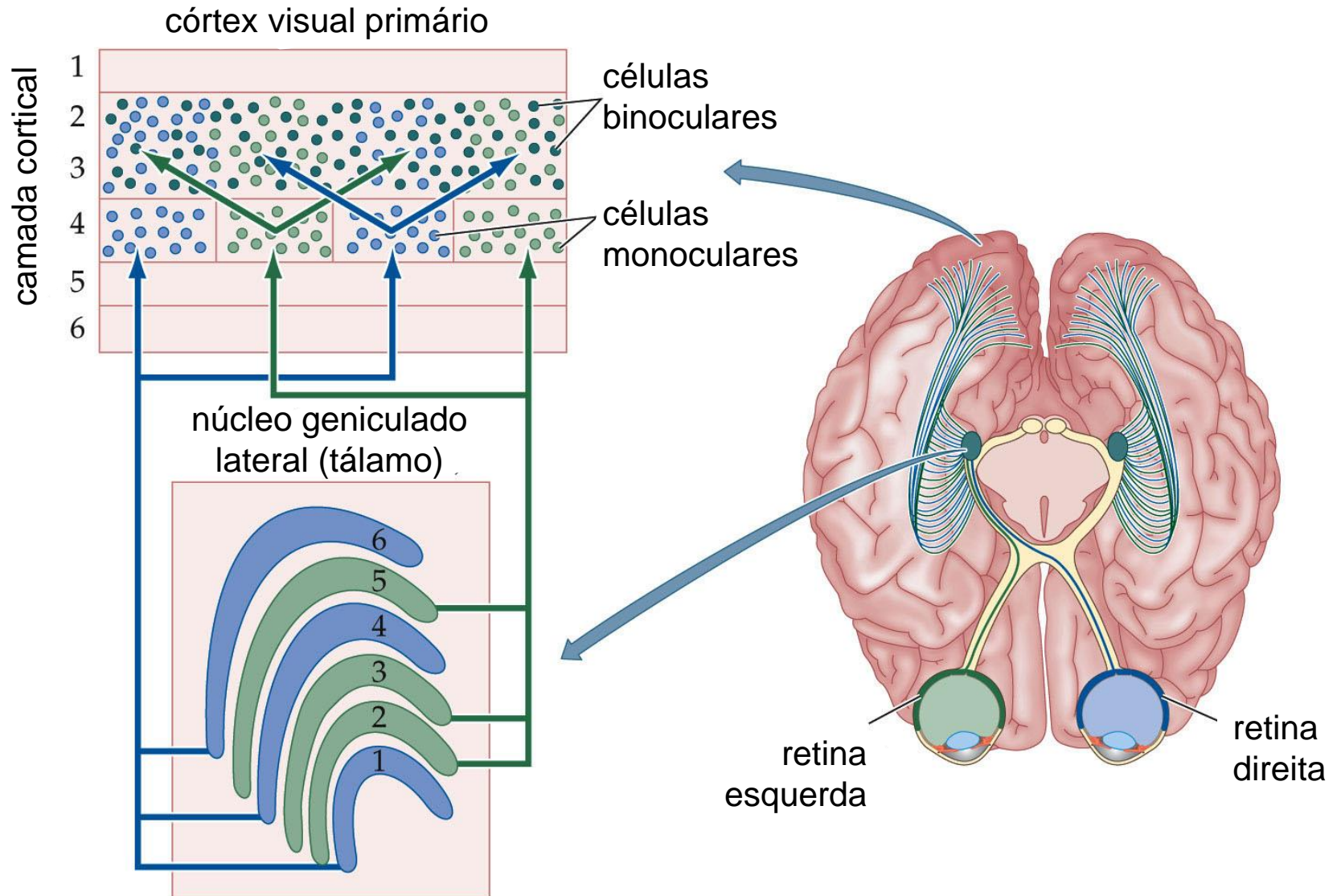


# Processamento inicial

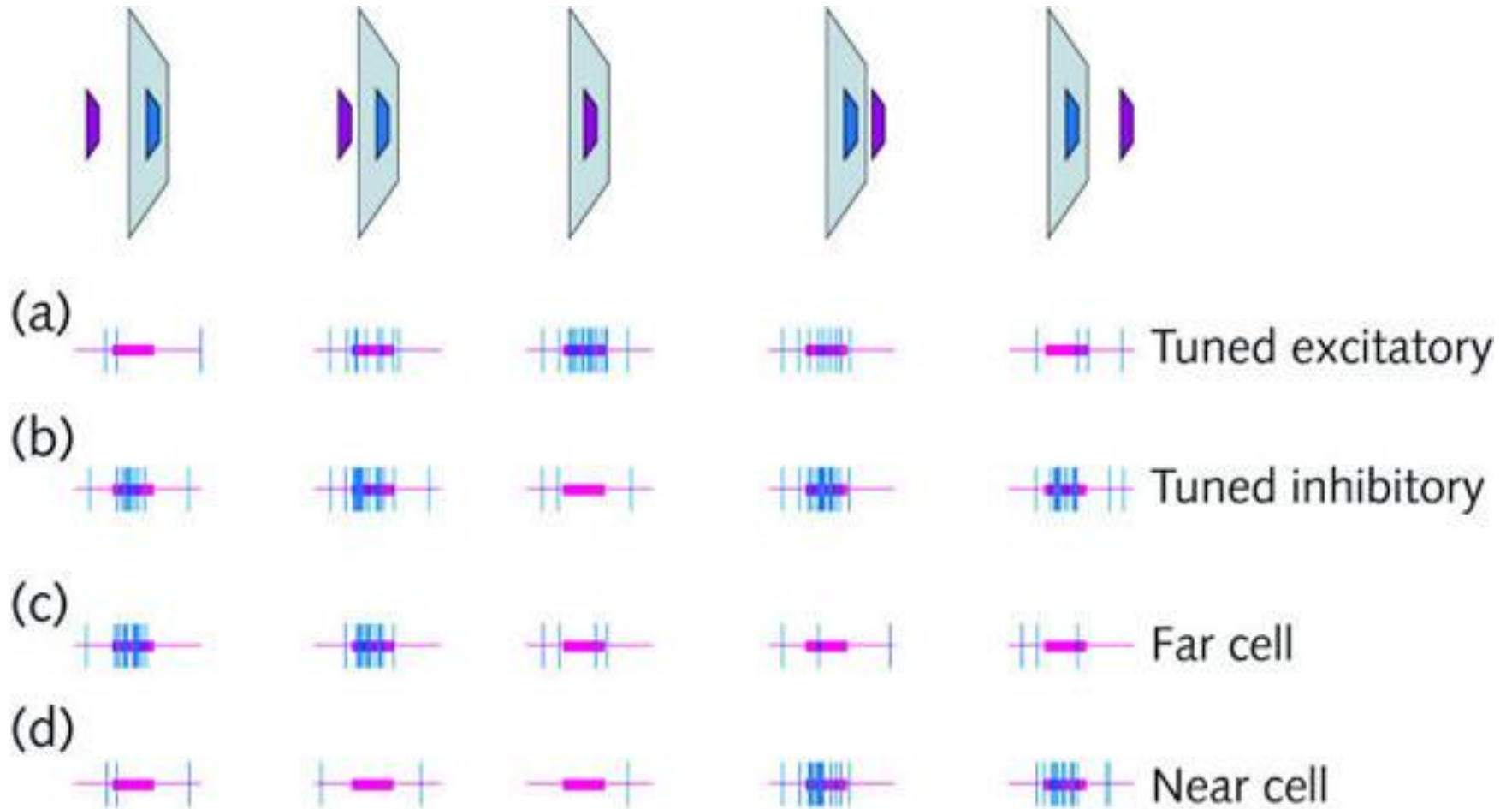




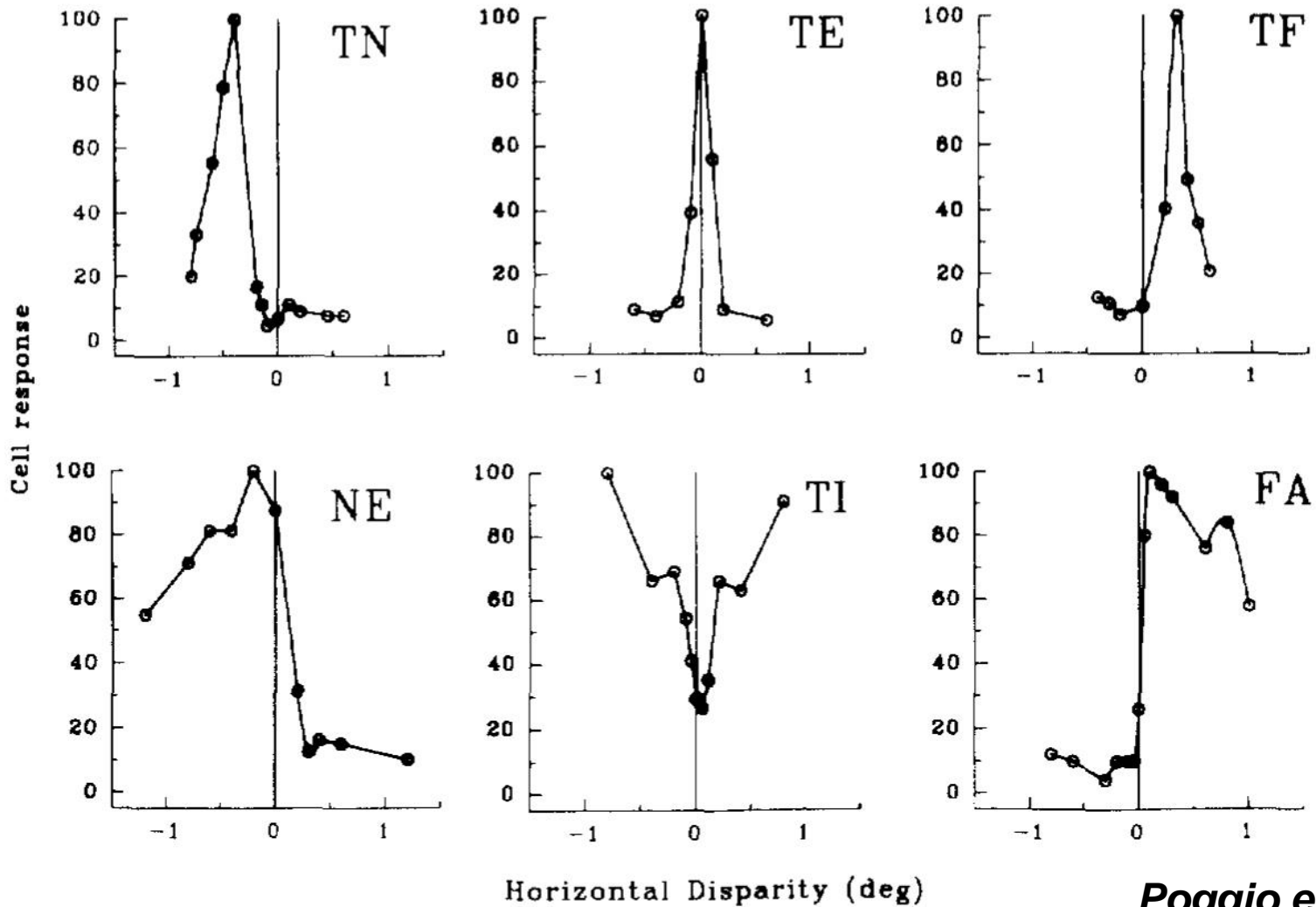
# Processamento inicial



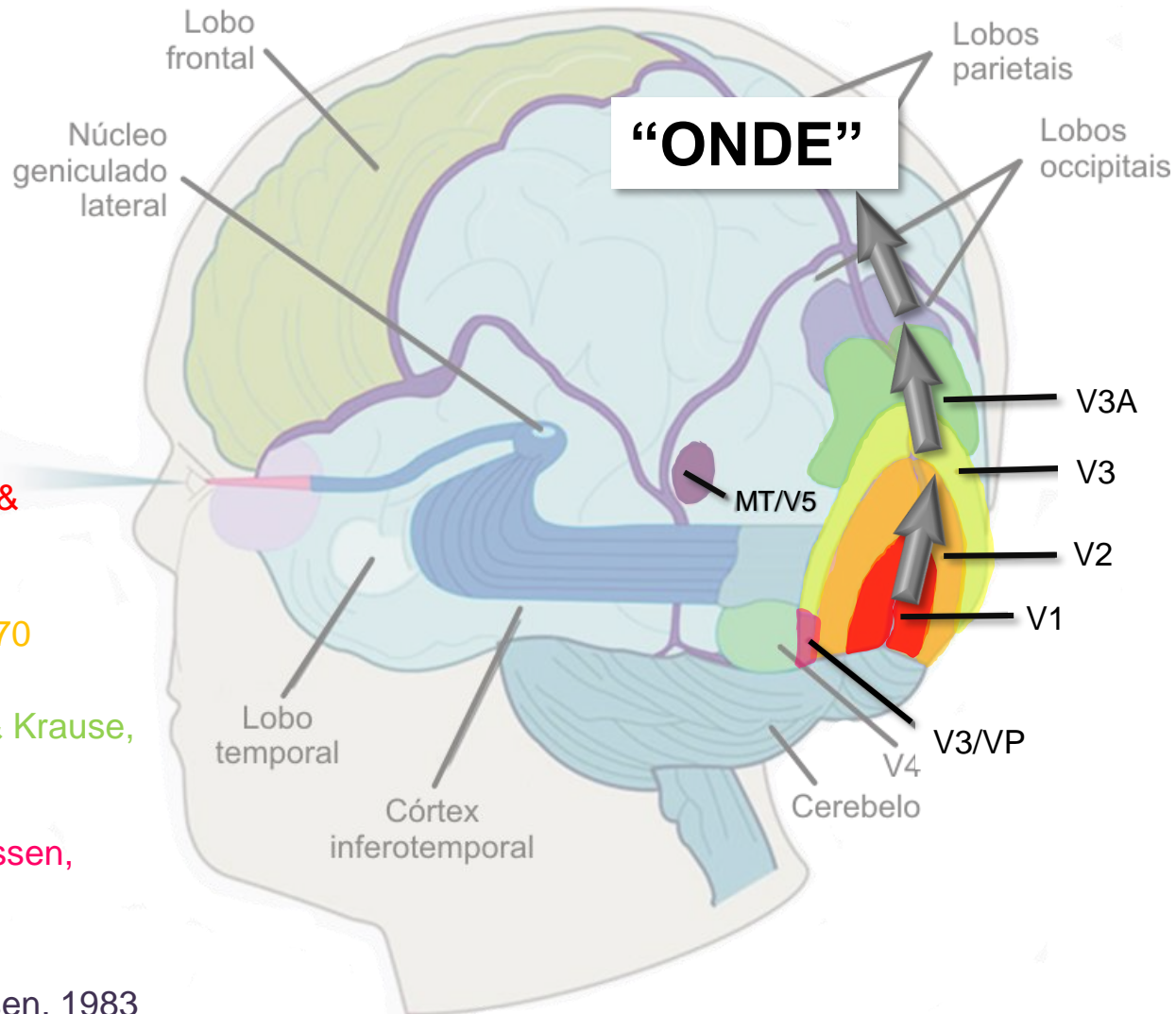
# Processamento inicial



# Processamento inicial



# Além de V1



Barlow, Blakemore & Pettigrew, 1967

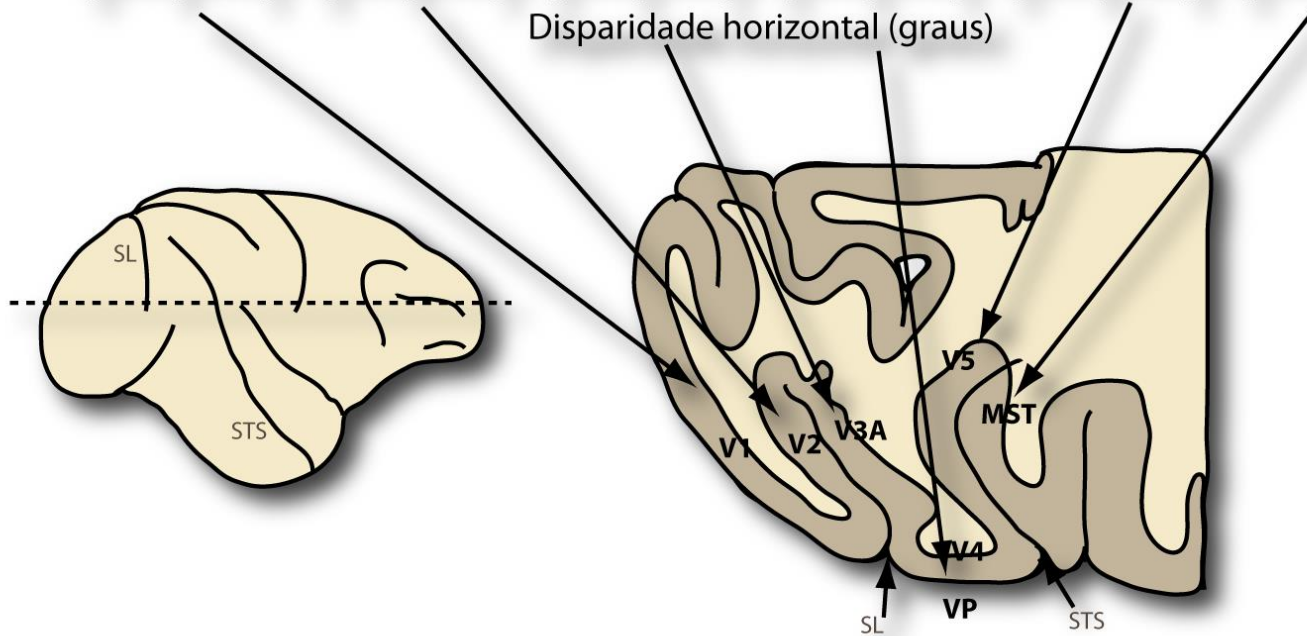
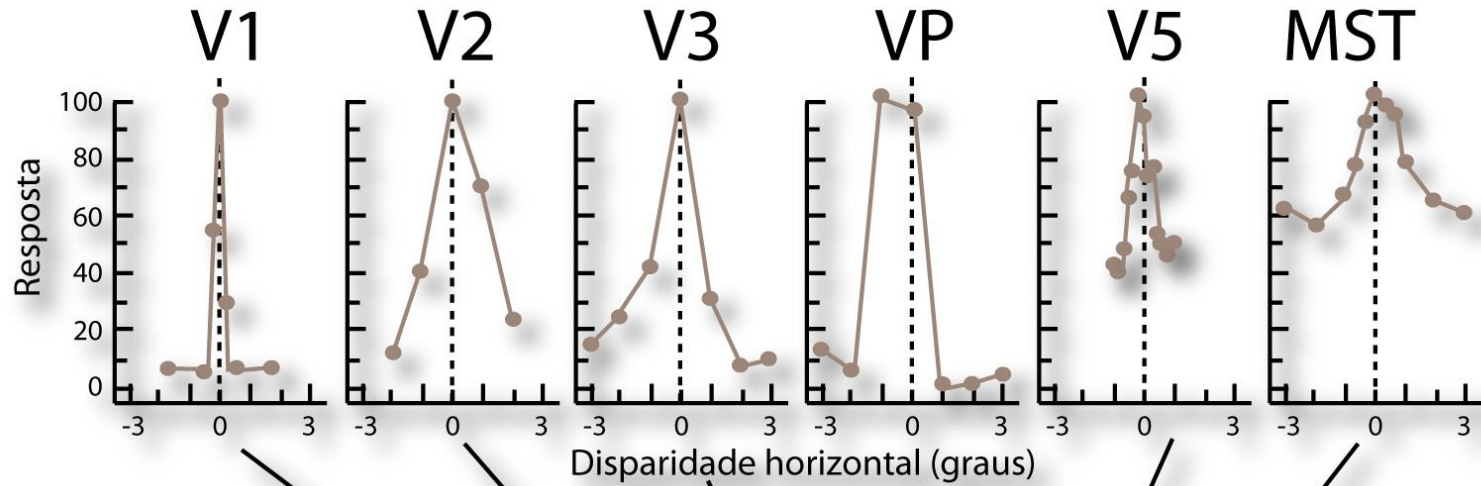
Hubel & Wiesel, 1970

Poggio, Gonzales & Krause, 1988

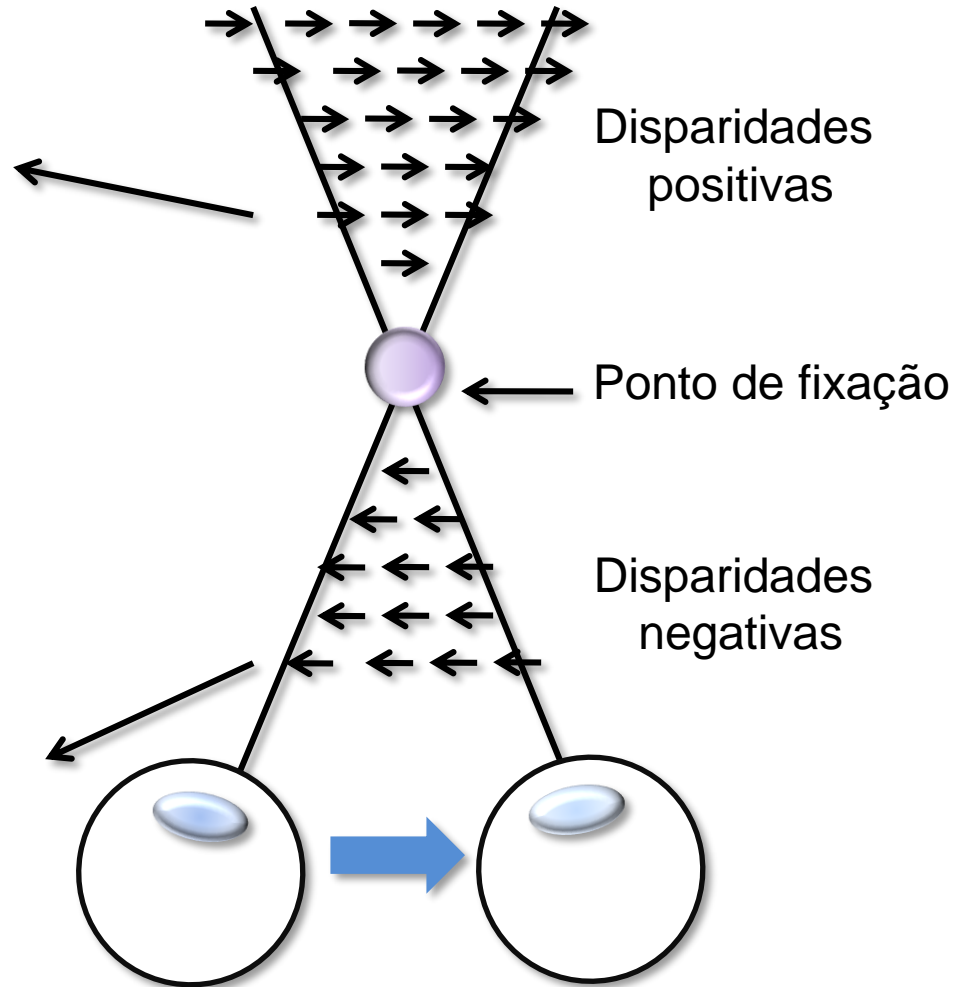
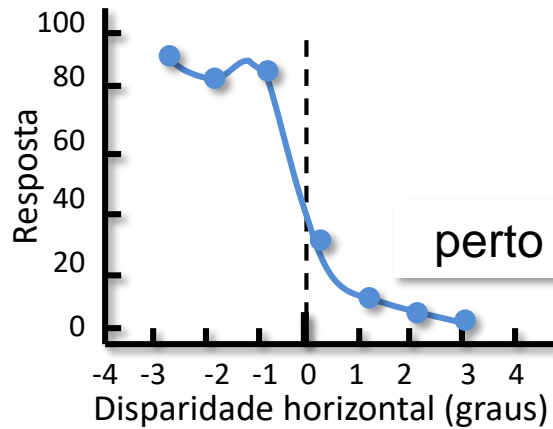
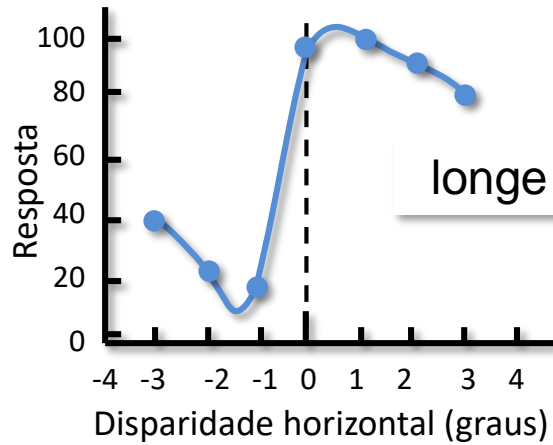
Burkhalter & Van Essen, 1986

Maunsell & van Essen, 1983

# Além de V1



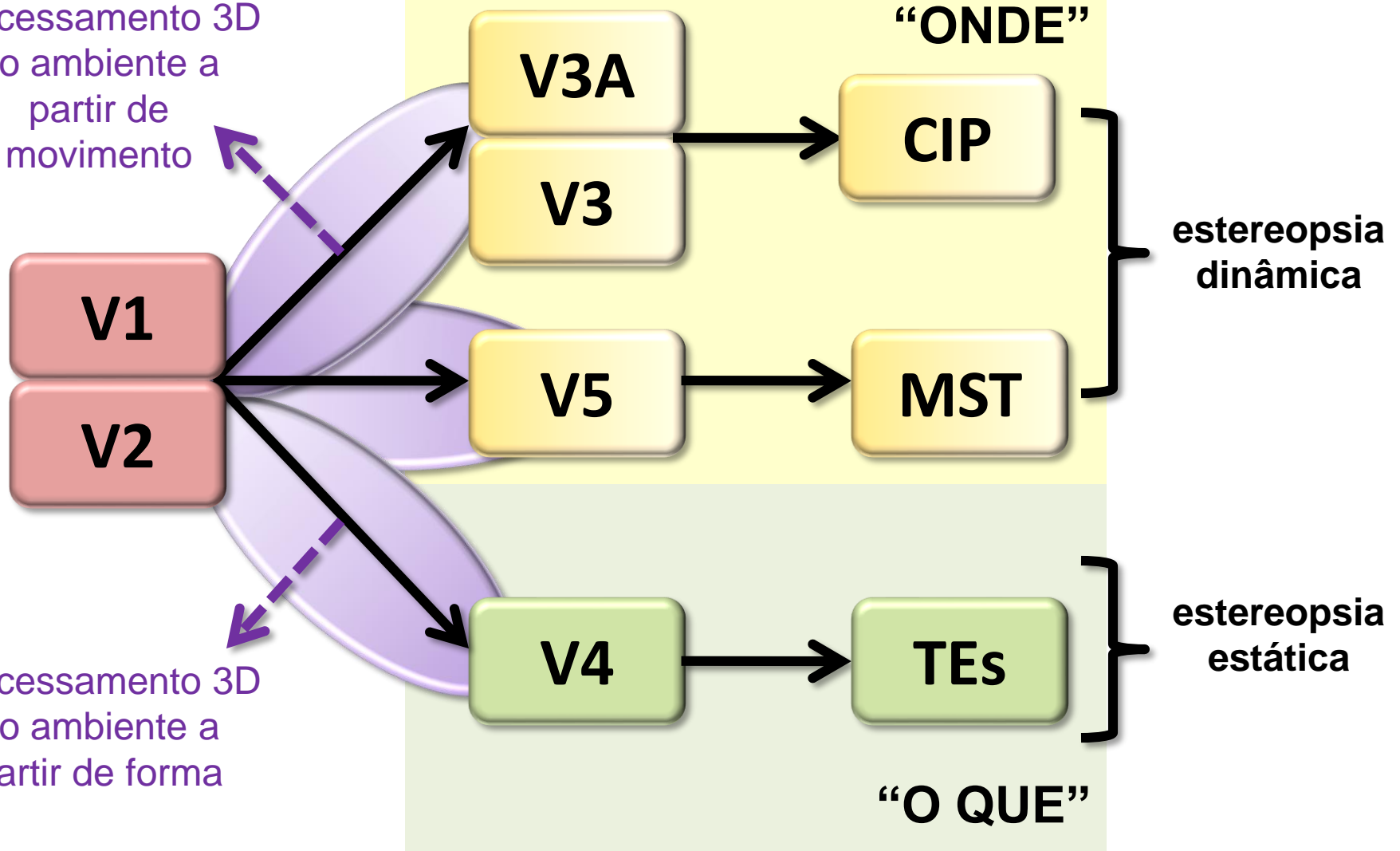
# Além de V1



*Roy & Wurtz, 1990*

# Além de V1

Processamento 3D  
do ambiente a  
partir de  
movimento



Processamento 3D  
do ambiente a  
partir de  
forma

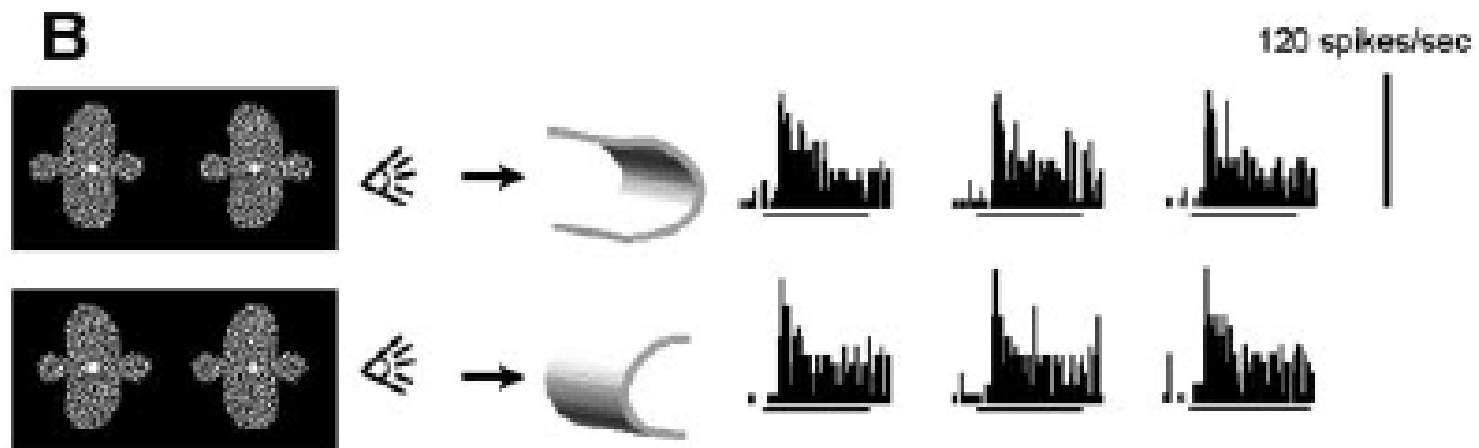
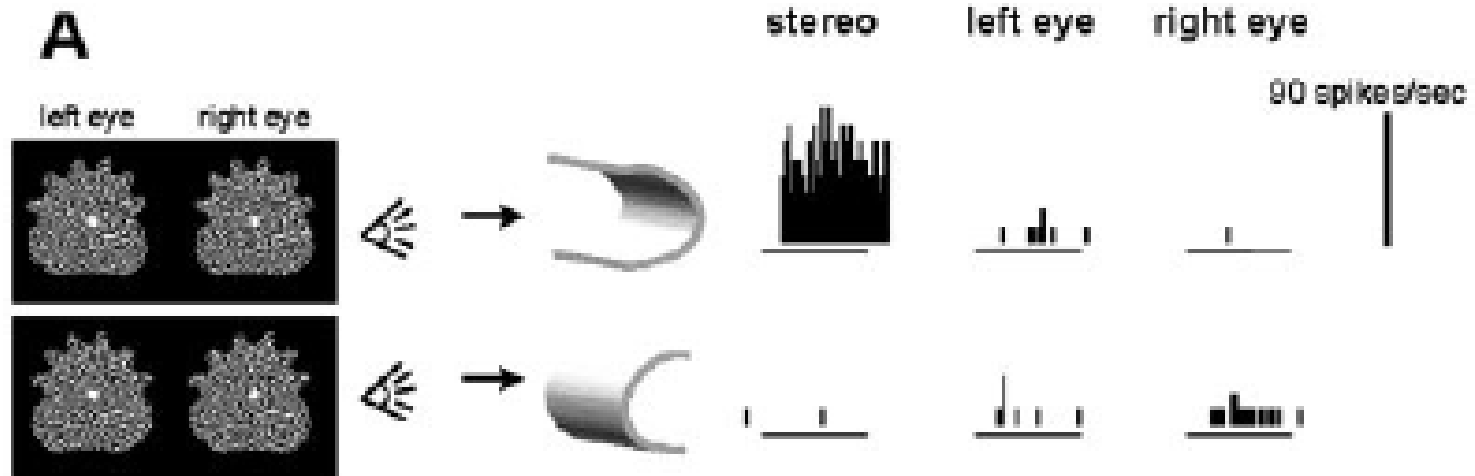
estereopsia  
dinâmica

estereopsia  
estática

“ONDE”

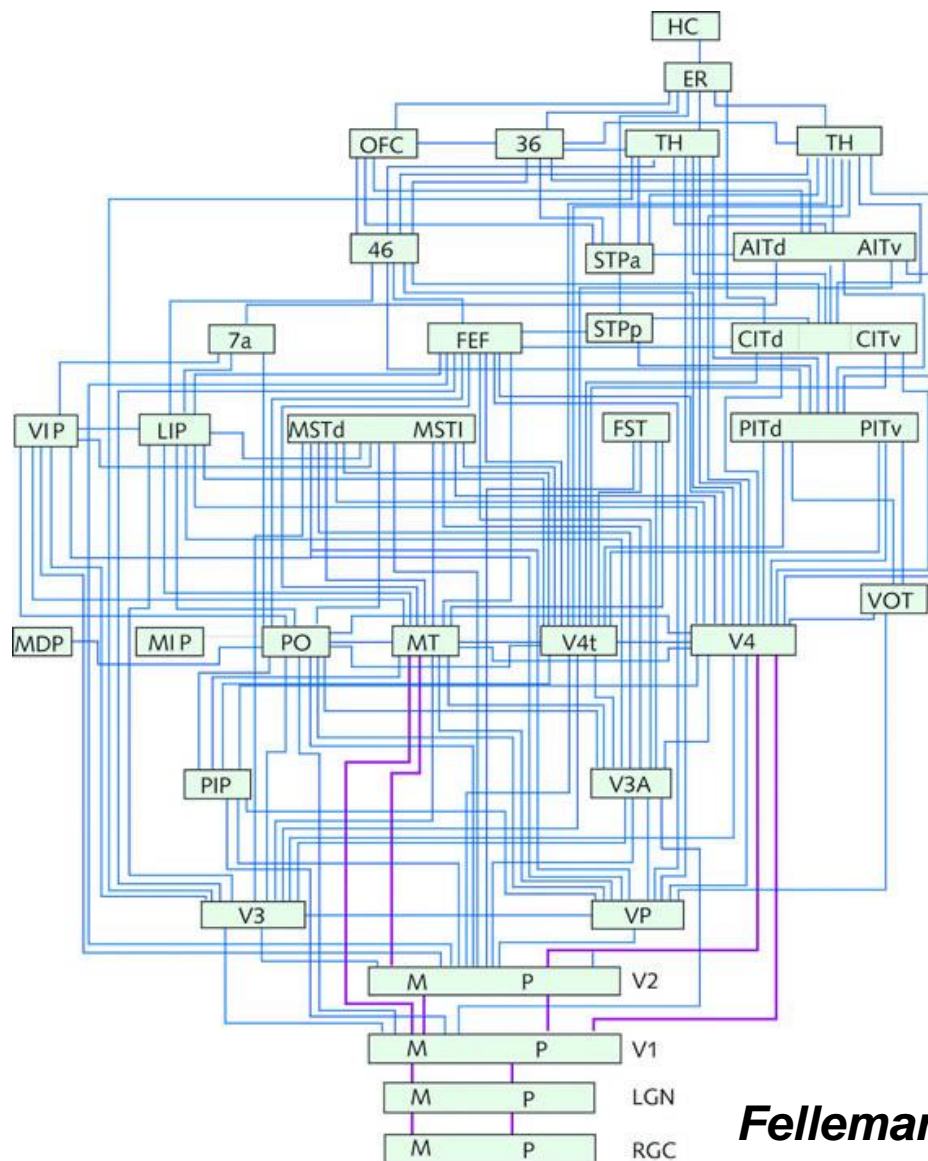
“O QUE”

# Além de V1



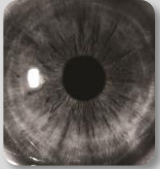


# Além de V1



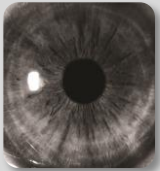
**Felleman & van Essen, 1991**

# Tópicos



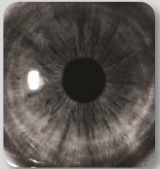
**Dicas de profundidade**

- Dicas monoculares
- Dicas binoculares



**Estereopsia**

- Disparidades absoluta e relativa
- Tipos de estereopsia



**Usando a visão estereoscópica**

- Estereogramas
- Limites da estereopsia



**Bases fisiológicas**

- Processamento inicial
- Além de V1



**Conclusão**

# Conclusão

- Nós usamos tanto dicas monoculares quanto binoculares para transformar a imagem 2D retiniana em um mundo 3D;
- A estereopsia é um caso especial da percepção de profundidade, que usa informação sobre disparidades relativas retinianas;
- Tipos diferentes de estereopsia apontam para múltiplas vias de processamento;
- A estereopsia está intimamente ligada ao processamento cortical de formas e movimento;
- Passos integrativos importantes ocorrem, portanto, na vias ventral e dorsal do cérebro.

# Referências

## Livros e revisões:

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- Webvision - <http://webvision.med.utah.edu/>
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