



## **Humans - VR Strengths & Limitations**

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## **Overview**

*What are the strengths and limitations of humans that are most relevant to virtual environments and how we design for use?*

*How do we evaluate systems based on user-centric analysis?*

# Perception



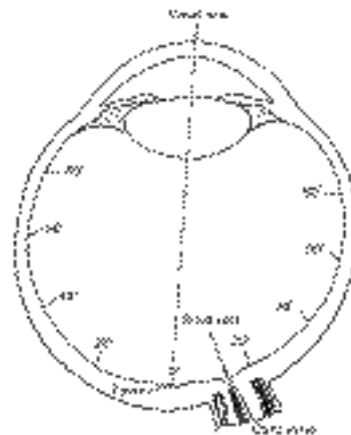
*Vision*

*Hearing*

*Haptics/Touch*

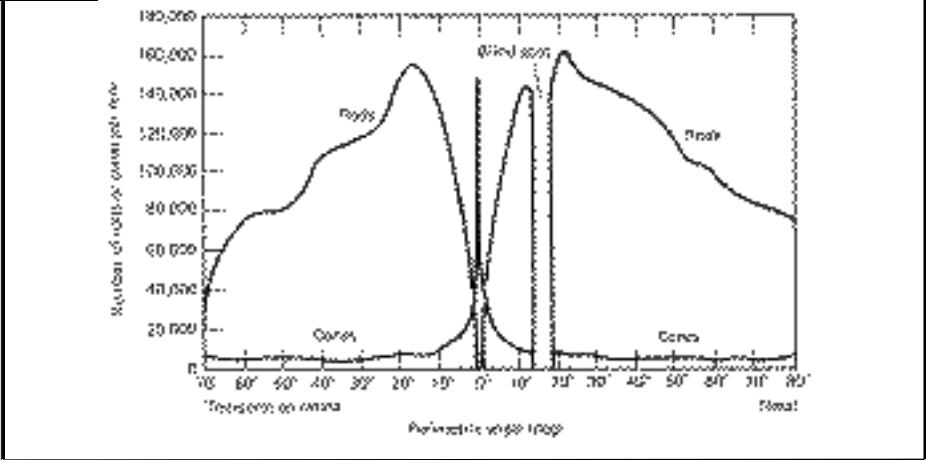
*Olfaction*

# Vision

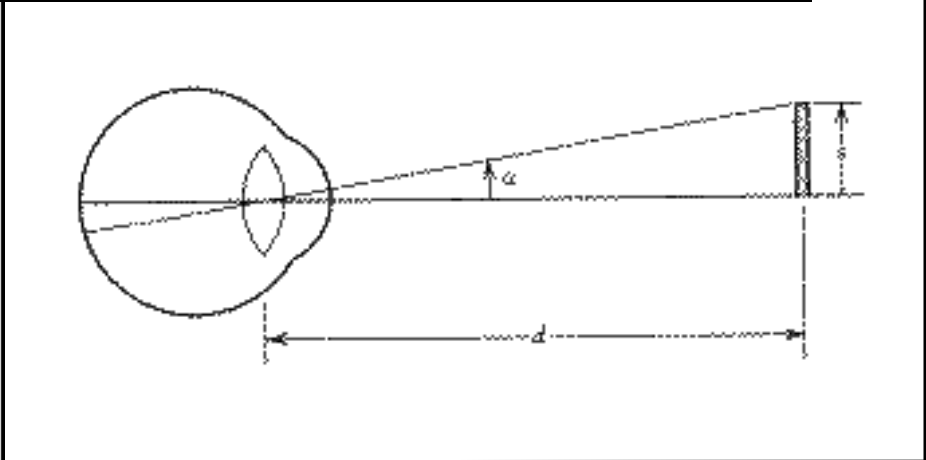




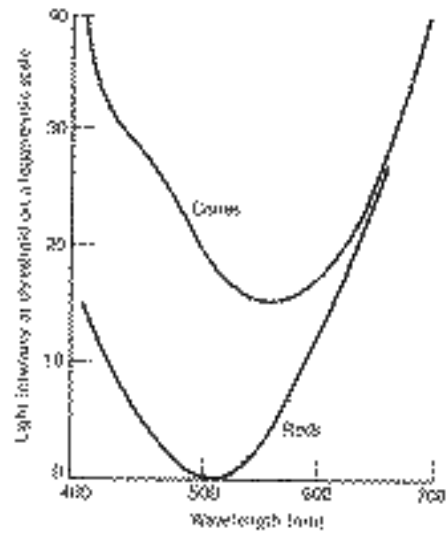
## Rods & Cones



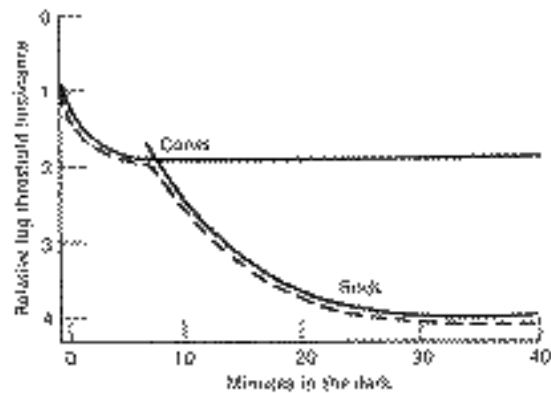
## The Visual Angle



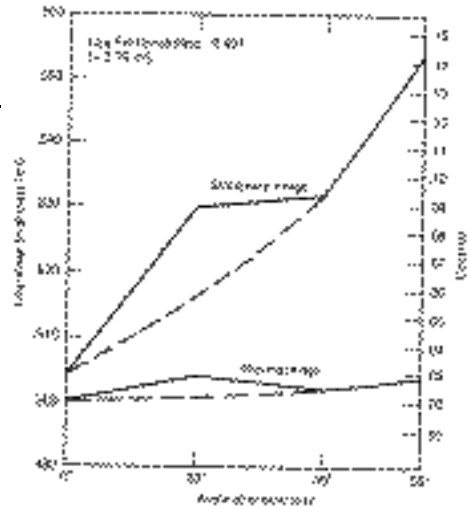
## Intensity



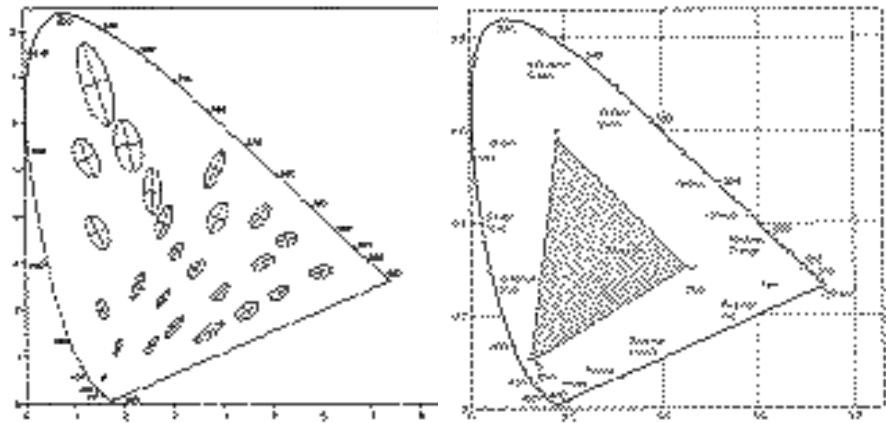
## Dark Adaptation



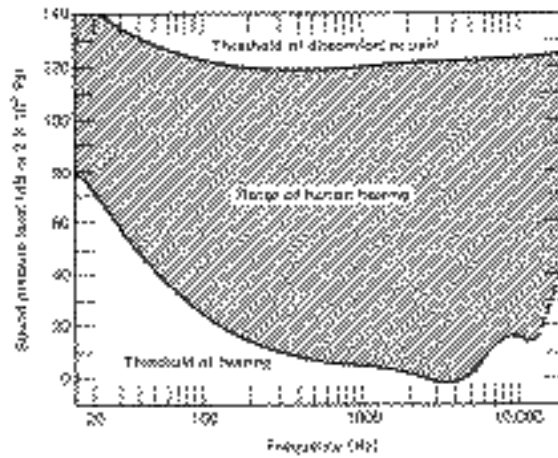
# Contrast Sensitivity



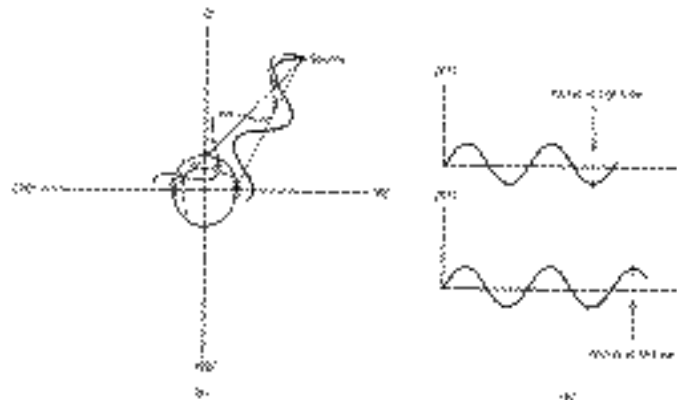
# Color Perception



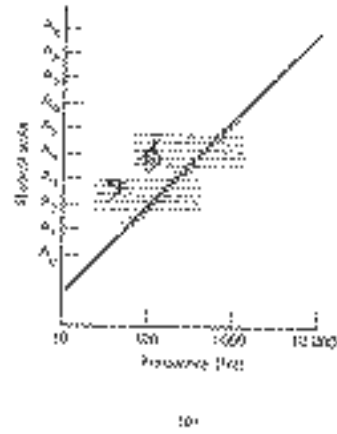
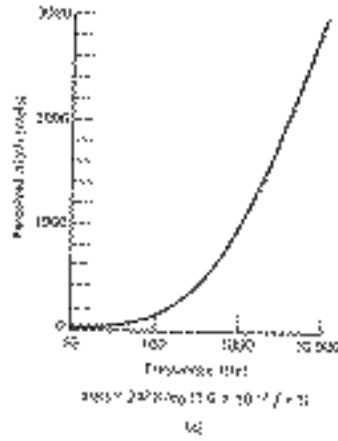
# Aural Perception



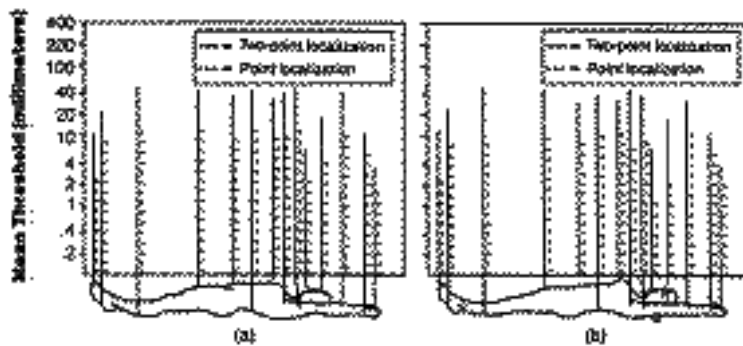
# Binaural Hearing



# Pitch Perception



# Force Perception



# Motor Functions

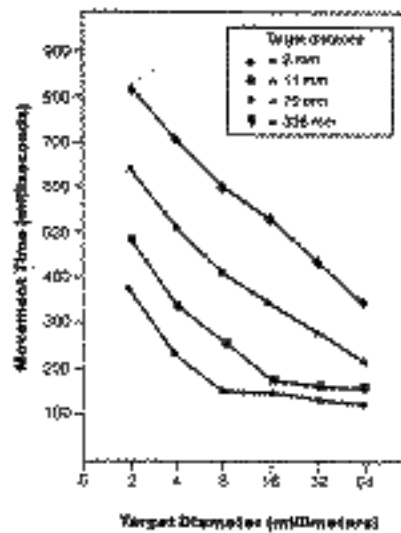


*Walking*

*Pointing*

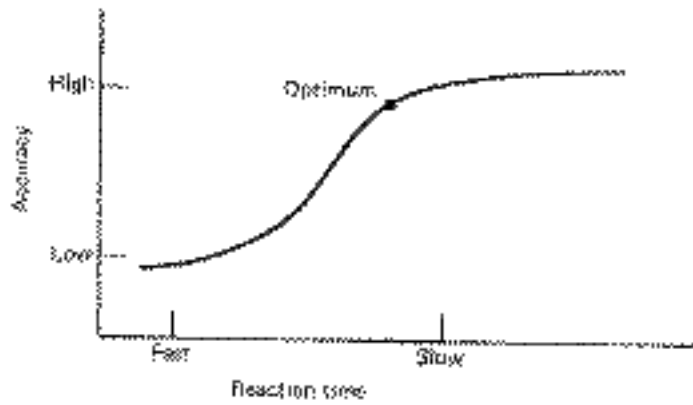
*Manipulation*

# Pointing

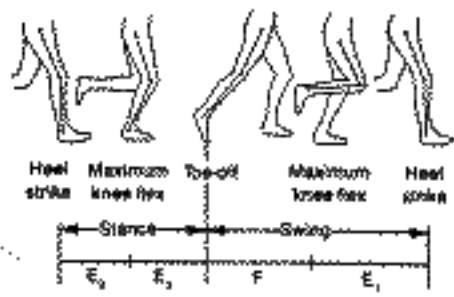
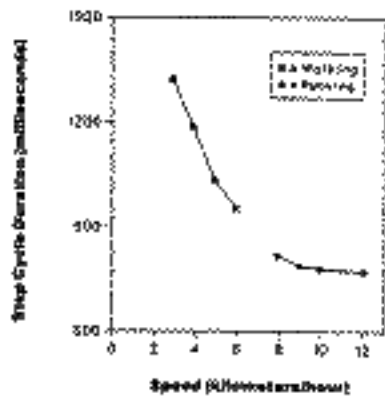




# Reaction Time



# Walking



## **Cognition**

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*Memory*

*Attention*

*Planning*

*Training/Learning*

## **Two Crucial Bottlenecks**

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*Navigation*

*Cybersickness*

## **Navigation - rarely the primary task**



*Consists of wayfinding and locomotion*

*Navigation cues*

*Organization of space, content structuring*

*Path following*

*Search behaviors*

*Exploration, Different from searching?*

## **Cybersickness**



*Visual-vestibular mismatch*

*Field of view issues*

*Flicker effect*

*Latency issues*

*Proprioception*

*Control in locomotion*



## **VEs for Training**

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*Used very often as motivation for systems, but very little data supports this use*

*Navigation training*

*Surgical training*

*Flight simulation*



## **User-Centric Evaluation**

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*A system is not judged by its functionality but rather by its benefit to its users*

**USER PERFORMANCE IS THE  
EVALUATION CRITERIA**