Psychology in Ergonomics

Sensation and Perception

Memory

Attention

Intro

MA in Cognitive Psychology – Heart rate variability and mental effort

PhD in progess in Cognitive Psychology – Physiology and Human-Computer Interaction

UX Researcher @Emarsys

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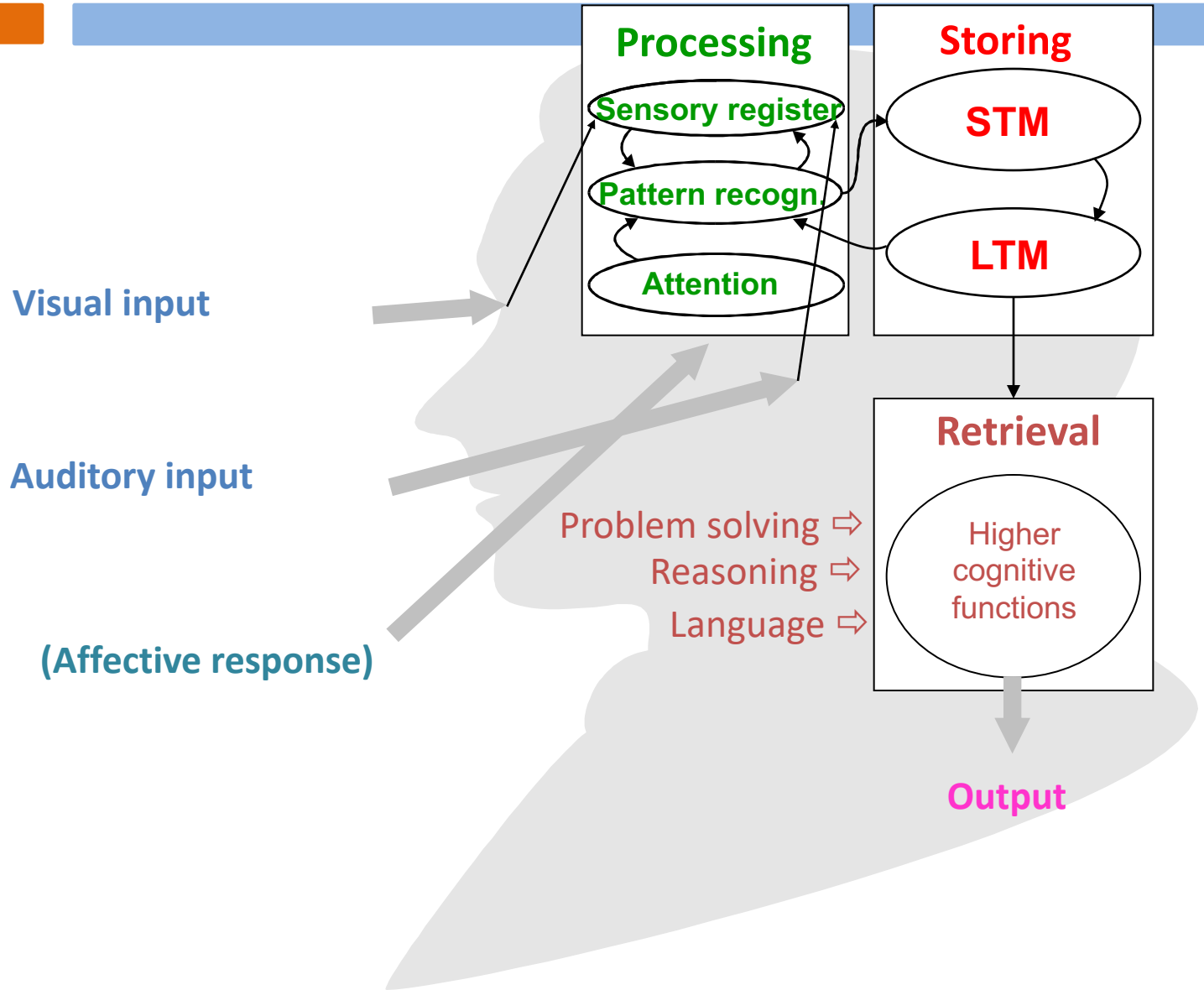
A model of human information processing



The „laws” of basic perception

The „laws” of basic perception

Weber-Fechner law: „How effective a 5 USD incentive will be at different levels of monthly subscription fees?” (+Stevens’s power law)

Fitts’s law: „How easy it is to click on that CTA button?”

Hick’s law: „How easy it is to decide between 40 types of pizza compared to 5?”

Weber-Fechner law (~1850)

Does the participant perceive the difference between two stimuli?

JND: *Just Noticeable Difference*

We are looking for the characteristics of sensation: the psychologically perceived intensity of stimuli in function of the actual physical signal.

Weber's Law and constants

jnd(x)/x = c

$$\Delta I/I = c$$

I original intensity of stimulation (I=x),

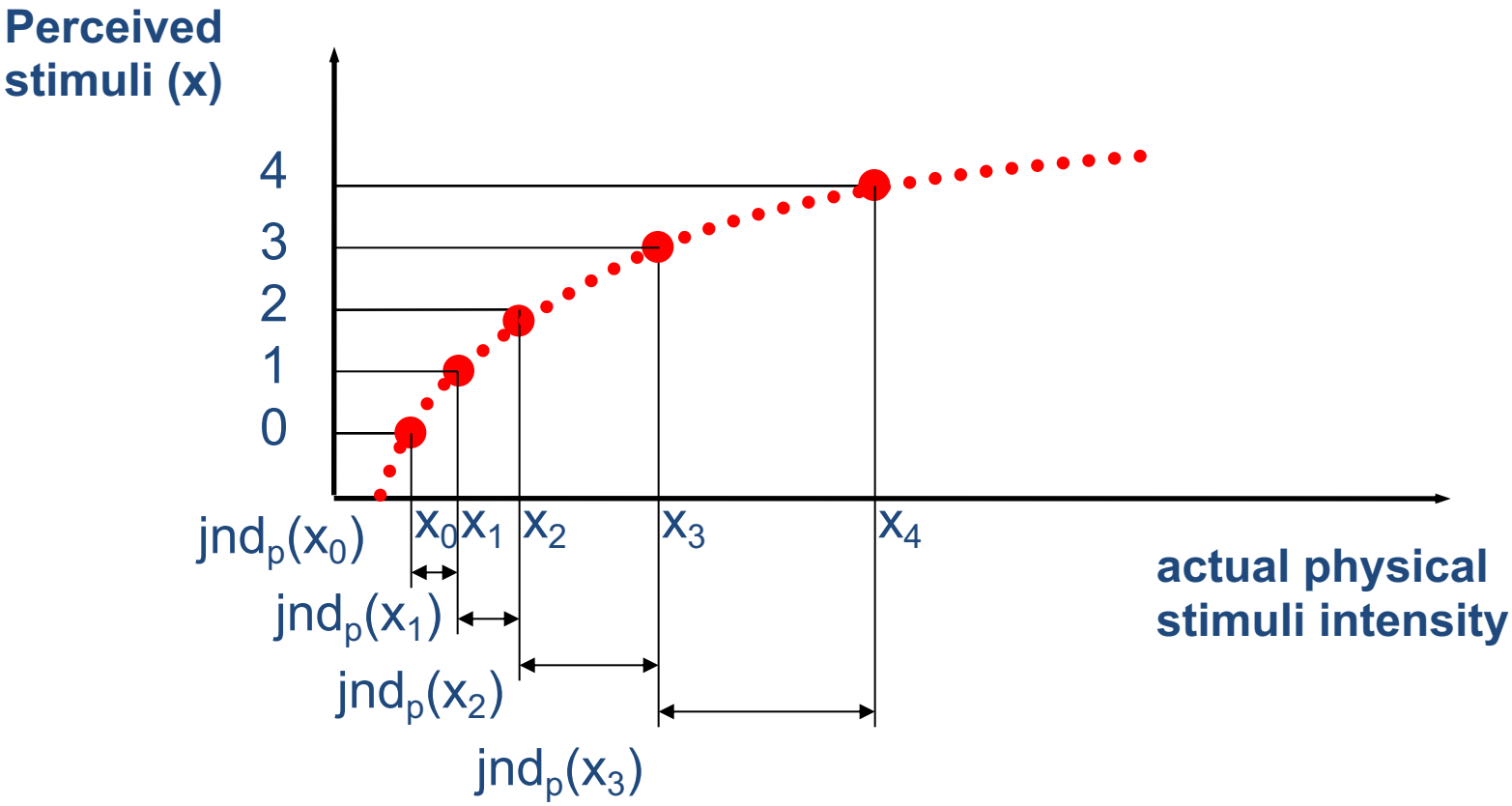
ΔI addition required for the difference to be perceived ($\Delta I = jnd_p(x)$).

C constant

Weber constants

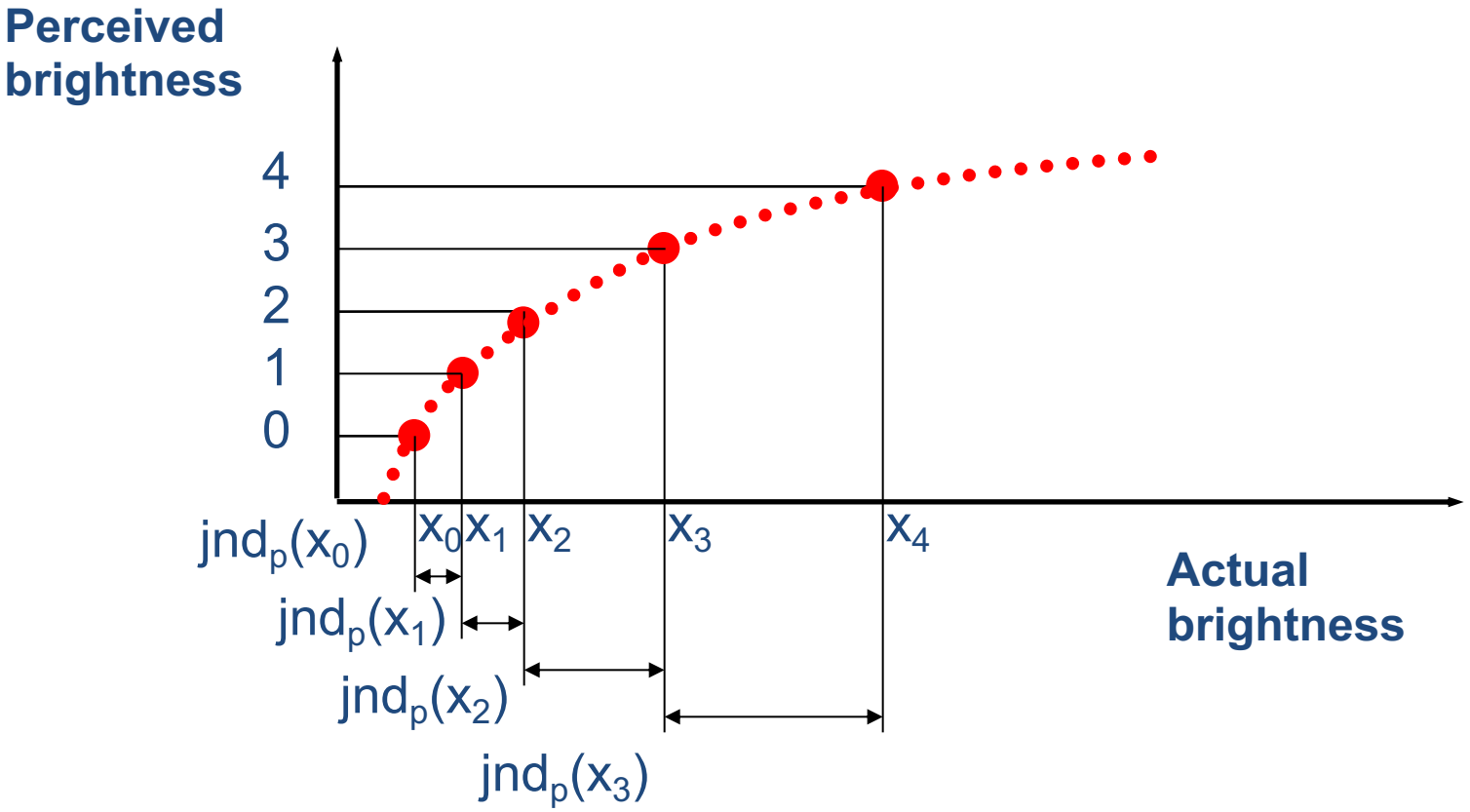
Stimuli	**constant**
• Pitch above 500 Hz	0,003
• Lifted weight, around 300 g	0,019
• Detection of the position of the hand	0,070
• Smell of gum at 200 olf	0,104
• Taste of solution of salt, around 3 mol/liter	0,200

Weber-Fechner law



Perception (x) = c•logI

Weber-Fechner law



Perception (x) = c•logI

Stevens's law (~1950)

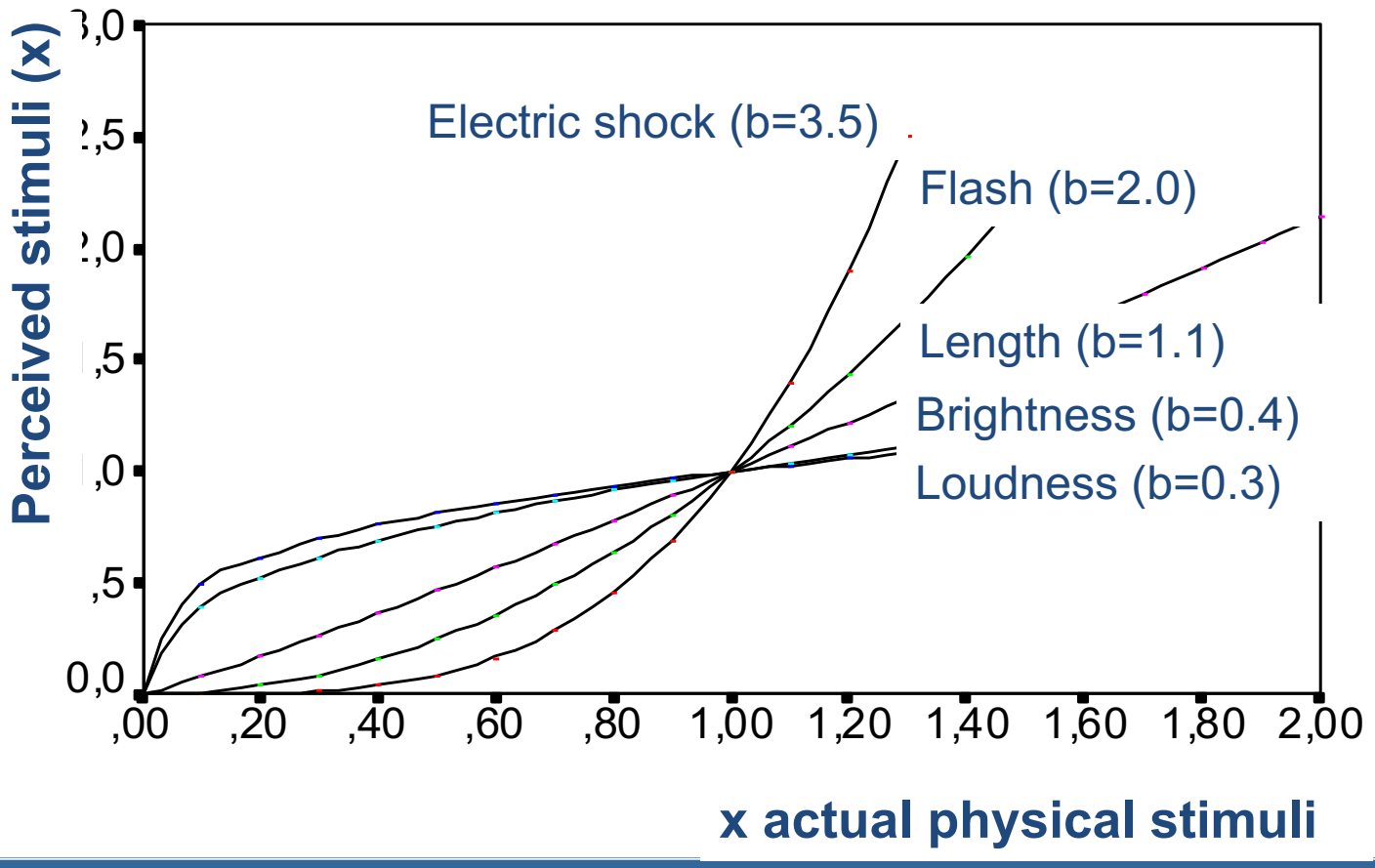
The Weber-Fechner law is very accurate in certain modalities, but lacking in others

Stevens' Power Law: Another mathematical description of the relation between percieved and actual intensity growth

No need to measure thresholds**: magnitude estimation** and **magnitude production** („knock-knock")

$$P(I) = kI^b$$

Stevens's law



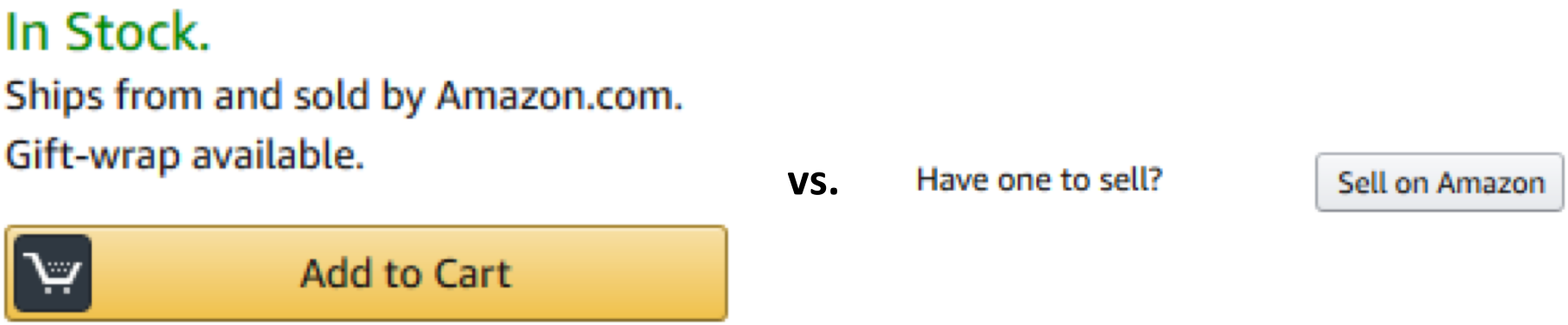
W-F law and the implications for design

1. Make sure that what has to seen different is noticeably different!

2. Don't **design for** actual intensity difference, but **percieved intensity** difference!

3. Lie to the users if it better fulfills their perception

Fitts's law


In Stock.
Ships from and sold by Amazon.com.
Gift-wrap available.
Add to Cart
vs.
Have one to sell?
Sell on Amazon

Fitts's law

„Things that are big and close to you are easy and fast to reach while things further from you and small are difficult to reach"

Index of Difficulty

Distance

$$ID = \log_2\left(\frac{D}{W} + 1\right)$$

Width

2 cm far, 2 cm = 1 bit ID
8 cm far, 2 cm = 3 bit ID
16 cm far, 0.5 cm= 7 bit ID

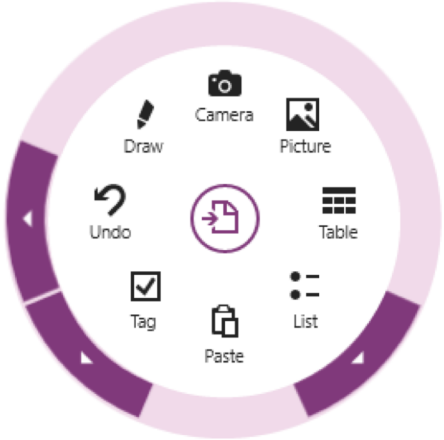
Fitts's law and the implications for design

1. Make critical actions easy to perform (**large hitbox**)

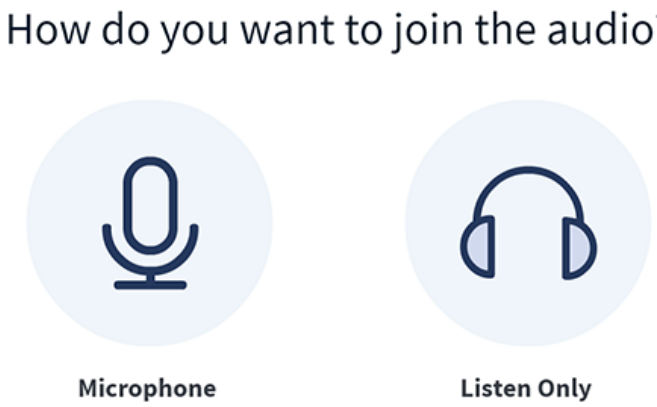
2. **Pop-up menu**=0 travel distance!

3. **Screen edges** are the easiest to hit. Use them!

4. Use **radial menus**?



Hick's law

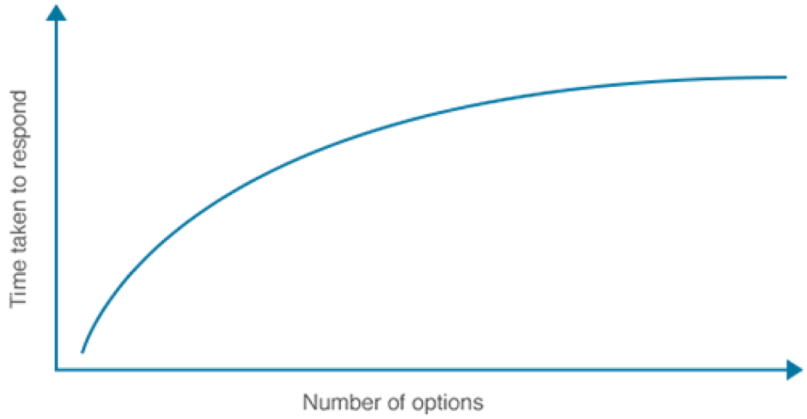

How do you want to join the audio?
Microphone
Listen Only

vs.


cheesecakes
cheesecakes and desserts
SPECIALTY DESSERTS

Hick's law

„The more choices a person has the slower decision times will be"



Time

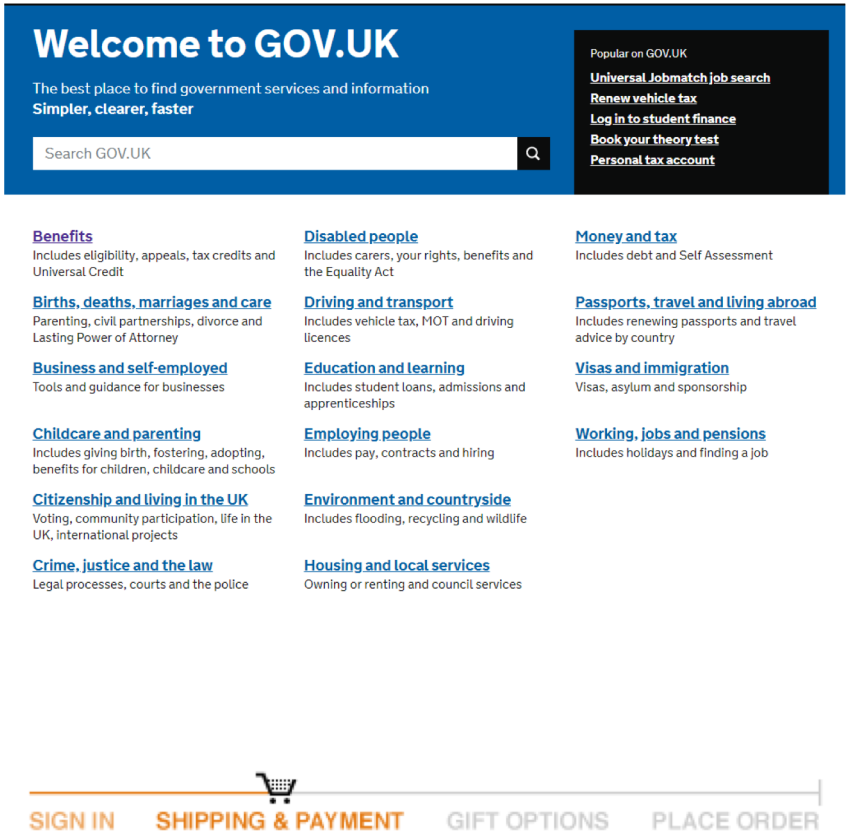
# of items+1

$$T = b \log_2(N + 1)$$

b=coefficient specific to those type of situations

Hick's law and the implications for design

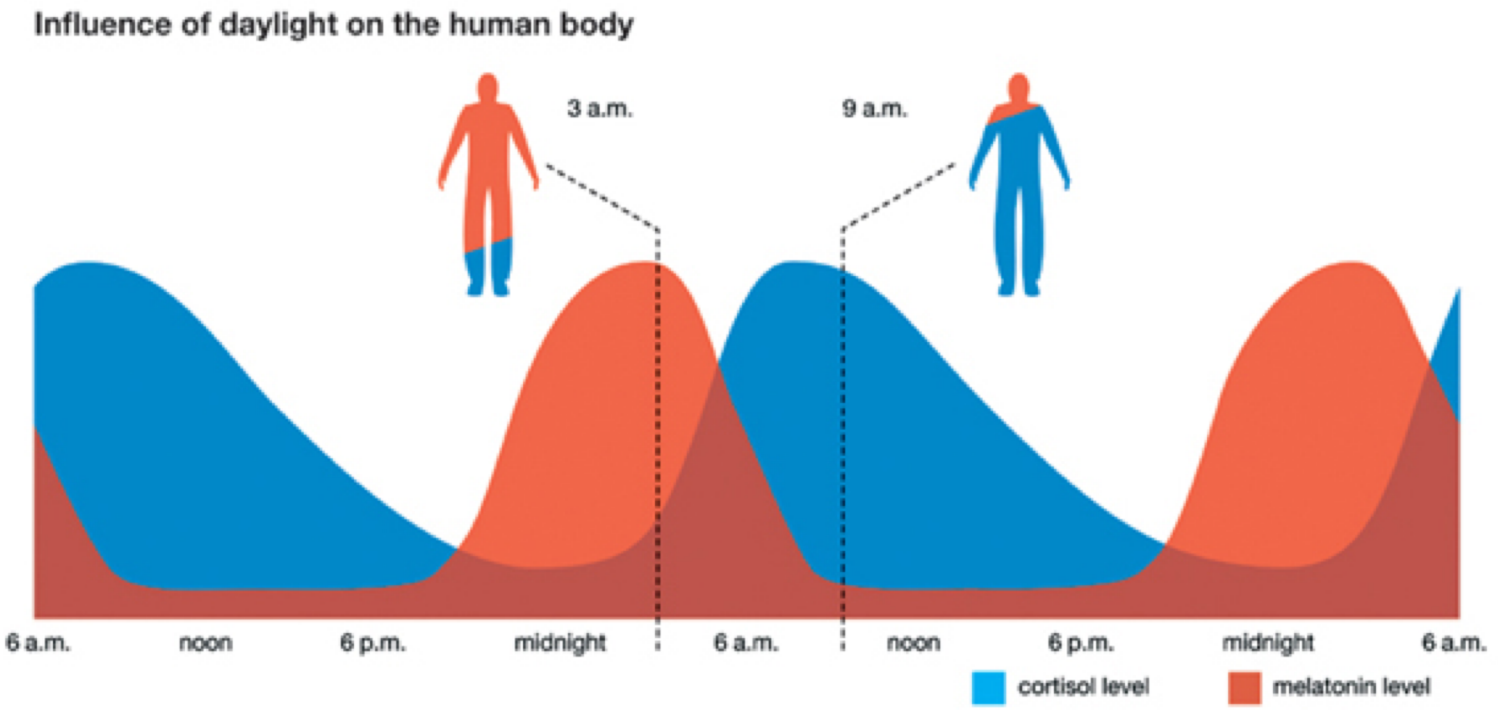
1. **K.I.S.S**: „keep it short and simple"
2. **Use categories** instead of item
3. **Chunk up decisions** to different screens
4. **Hide** rarely used items under „More options…"



Color

The effect of color

Blue (~480 nm) is for activation, red/orange is for rest (mixed 600-700 nm)



The effect of color

Is there a significant win percentage difference between red and blue teams?

Win rates

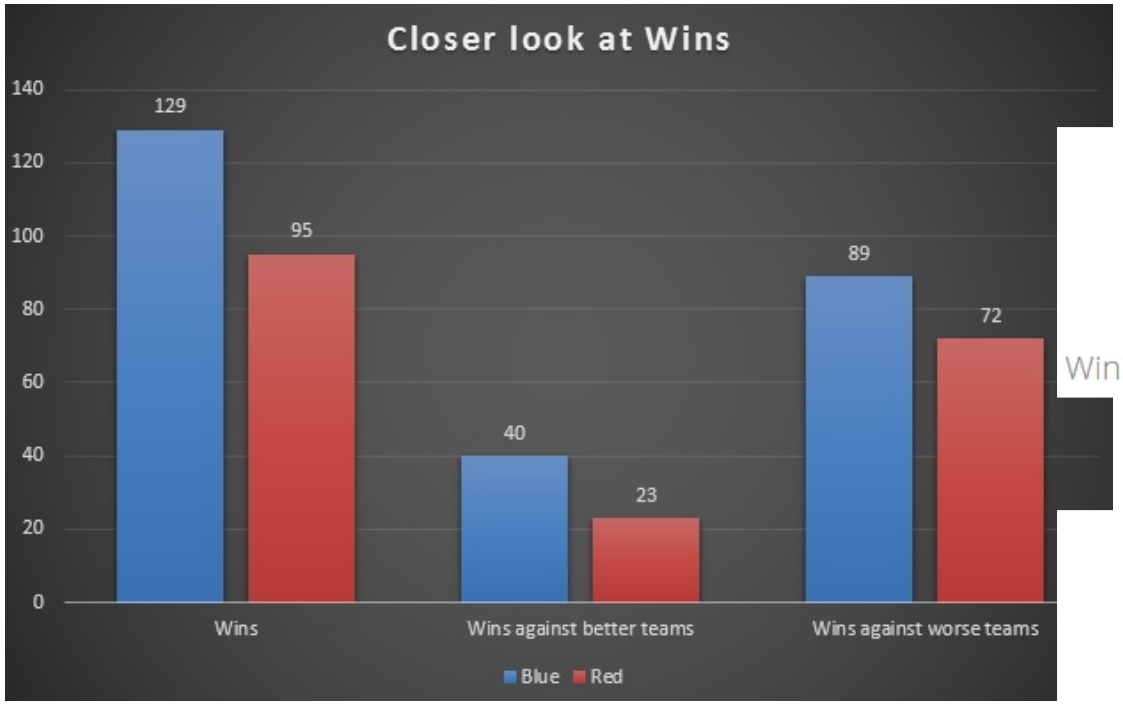
Unreal Tournament 2004

- The red team wins 55% of matches (based on 1347 professional games)
- **Possible explanation**:
  - Red is a signal for aggression and danger in nature
  - The opposingg side will be slightly intimidated by the red color and underperform
  - Judges on taekwondo tournaments: manipulated recordings – that contestant who's dress was painted red, received more points overall

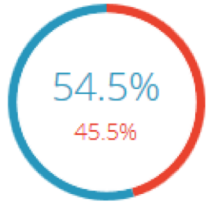
Win rates cont.

League of Legends

- The **blue team** wins more often and defeats higher ranked red teams

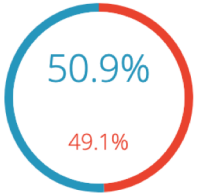


LCS Feb. 2018



WinRate (Draft Ranked Flex)

LCS Mar. 2019



Winrate (Ranked Solo/Duo)

UI differences

Win rates summary

+other color related effects:

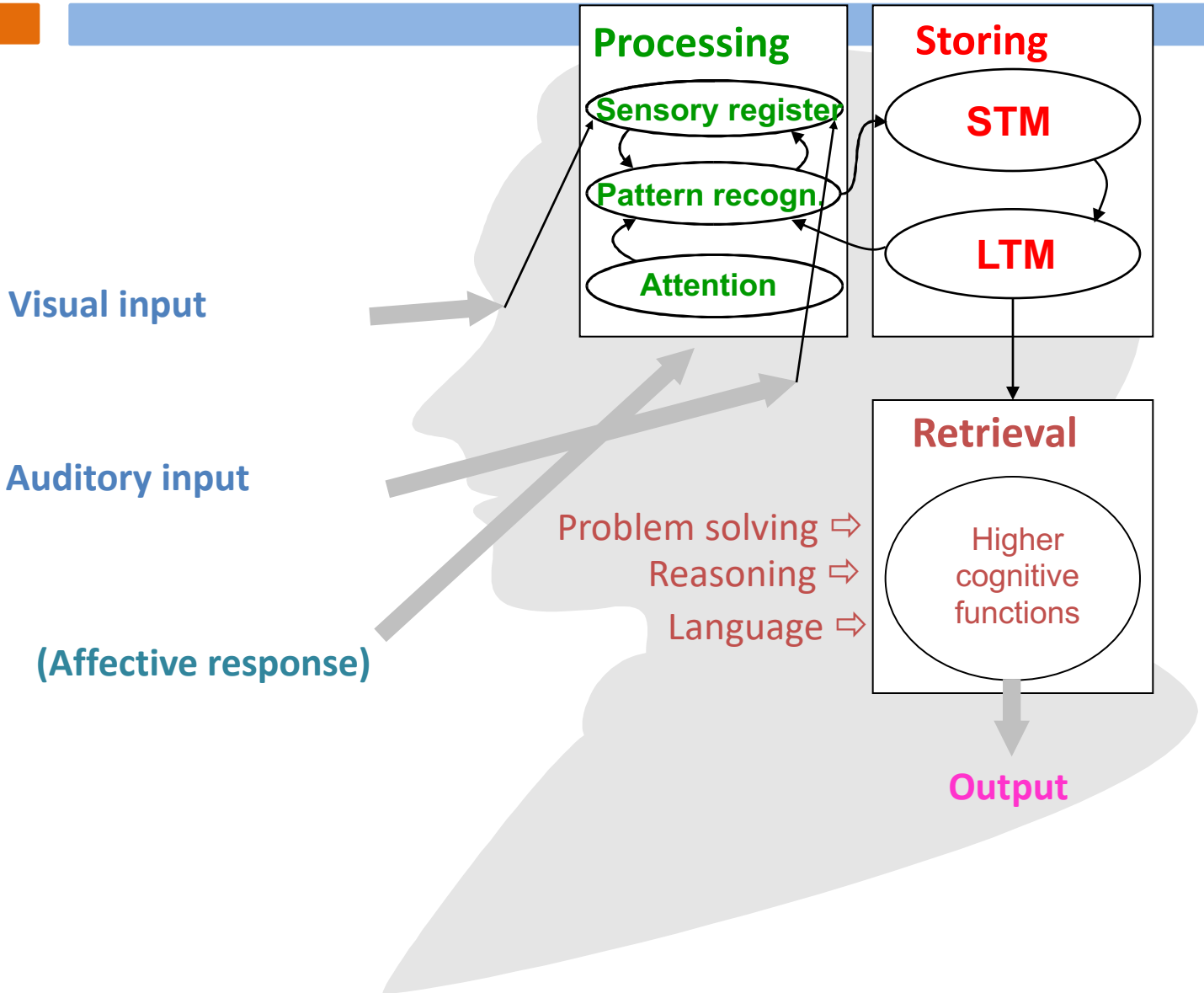
- Riot inner test: text about negative behavior during loading screen: less flame during games; text about positive behavior in blue: also less flame during games (white text was the baseline)

Summary:

- Red seems to have a very small impact that can be overwritten by any other influence

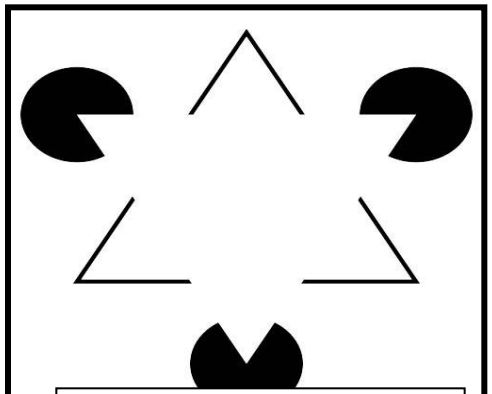
The basics of perceptual organization

A model of human information processing

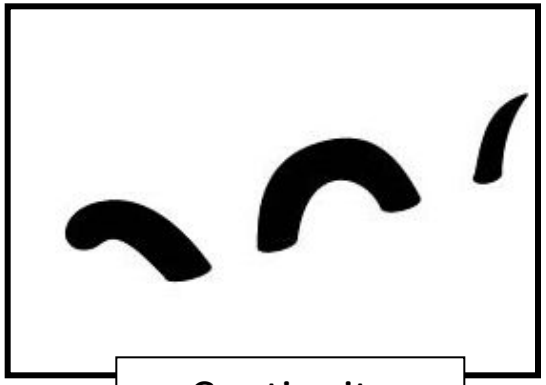


Gestalt „laws”

Proximity

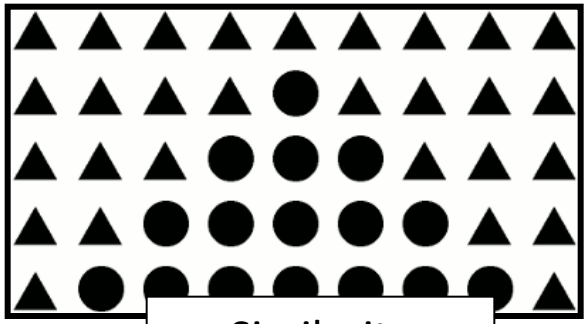


Good form



Continuity

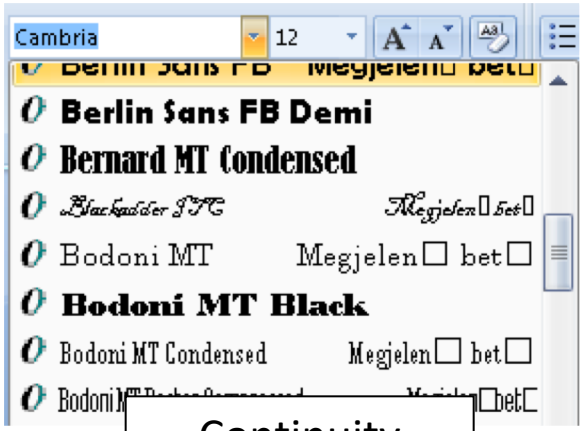
Closure



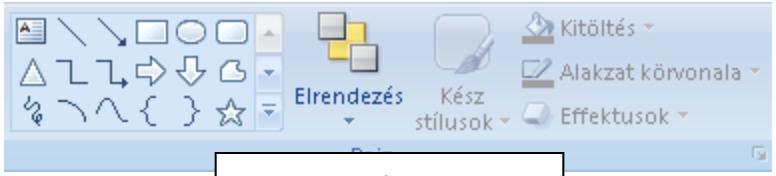
Similarity

Gestalt laws in design

Proximity



Continuity

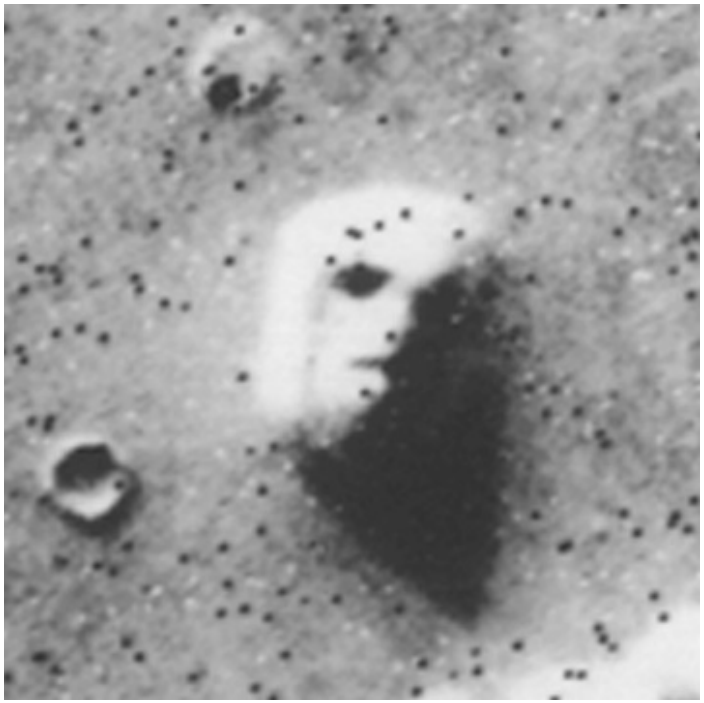


Similarity

What can you make of this?

Pareidolia

- To make sense of our environment
- Active and adaptive system: our brain hates ambiguity
- Not just for faces! For systems as well!



Conclusions about (sensation and) perception

Always design with the basic perceptual laws in mind!

Signal your intent with basic properties like, color and distance to create a good foundation

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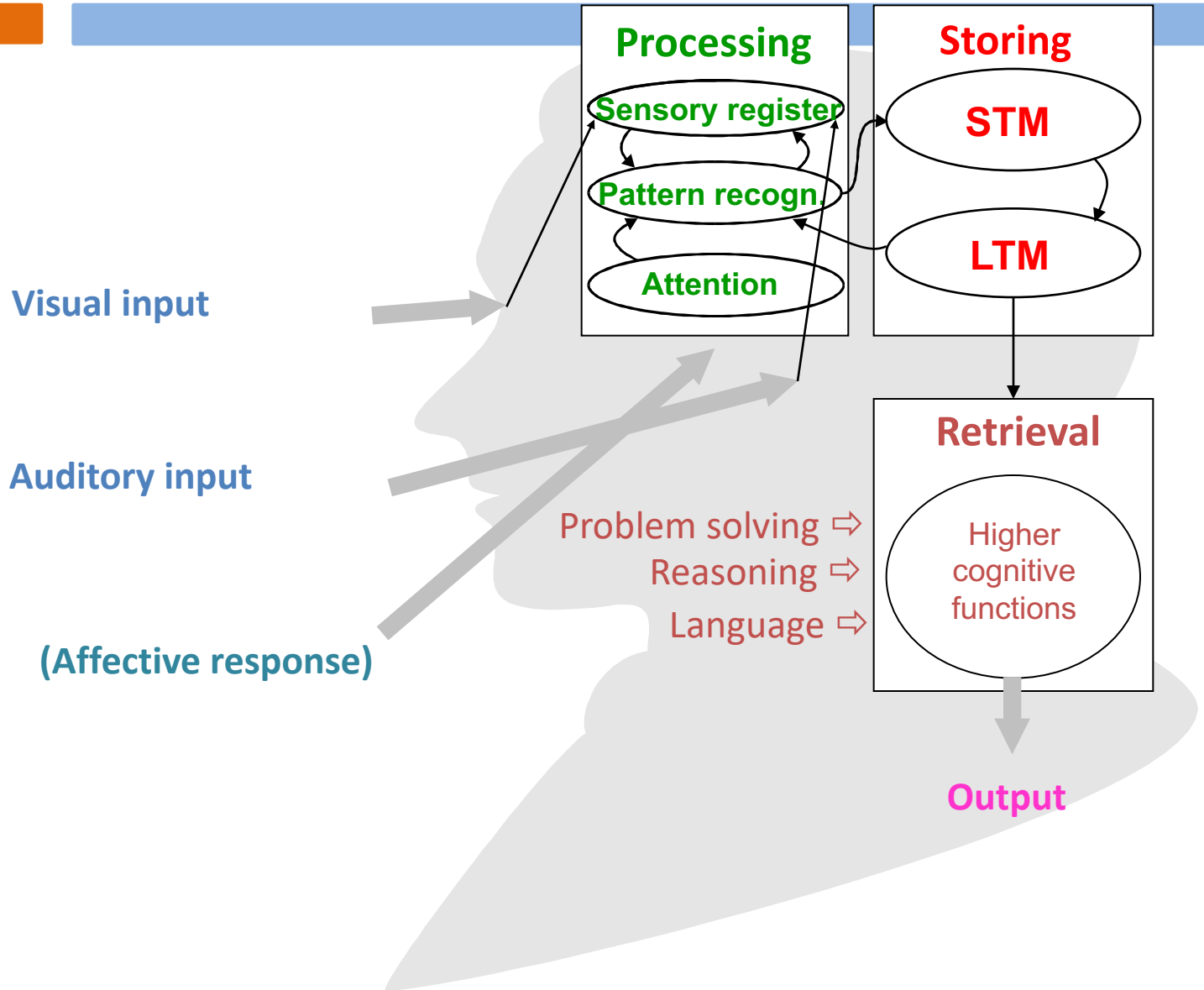
A model of human information processing



Mental representations

Mental models of systems

- Our representations are more or less based on the real world and its laws; „representation” → it serves to guide our ***expectations***, based on previous *experience* (e.g.: keyboard shortcuts, basic function buttons, „installation”)

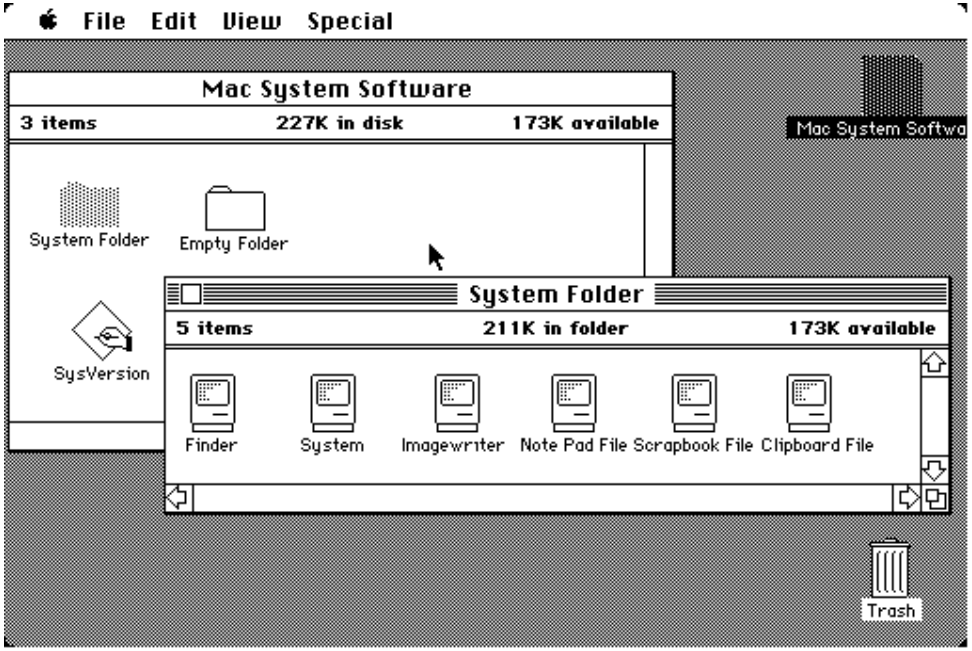
- We form mental models of ***every system*** we interact with – wrong model = lot of errors

Driving better mental models I: Metaphors

Files and Folders

Recycling bin/trash

Desktop

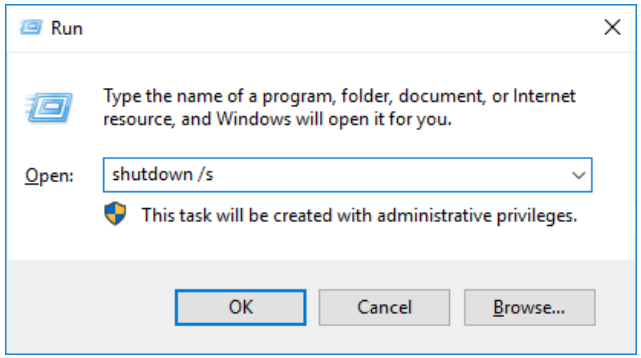


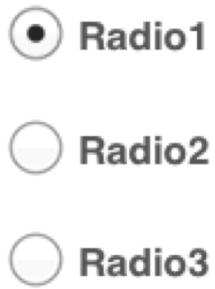
Stream

Driving better mental models II: Affordance

Objects „offer” the optimal way of interaction by their physical properties

These can be mimicked in human-computer interaction





ALL
WEAPONS
APPAREL
POTIONS
FOOD
INGREDIENTS
BOOKS

Imperial Sword (2)
Iron Dagger (2)
Iron Mace
Iron War Axe
Iron Warhammer

IRON MACE
DAMAGE 10 WEIGHT 13 VALUE 35

LT RT Equip X Drop Y Favorite

Damage 9 (+1) Carry Weight 194/300 Gold 35

≠


ALL
FILTER
NAME TYPE WGT VAL
Silver Sapphire Necklace Amulet 0.5 580
Arivanya's Silver Ring Ring 0.25 30
Hunter's Ring Ring 0.25 2725
Silver Amethyst Ring Ring 0.25 180
Dragon's Fang (Legendary) Sword 16 5422
Assassin's Dagger (Legendary) Dagger 6 2685
Dragon's Talon (Legendary) Greatsword 23 9995
Assassin's Bow (Legendary) Bow 18 10409
Pickaxe Pickaxe 10 5
Ancient Nord Arrow (898) Arrow - 1
Dwarven Arrow (221) Arrow - 4
Ebony Arrow (42) Arrow - 7
Elven Arrow (81) Arrow - 5
Glass Arrow (60) Arrow - 6
Orcish Arrow (127) Arrow - 3
Steel Arrow (189) Arrow - 2
Torch (4) Torch 0.5 2
Amethyst (20) Gem 0.1 120
Diamond (9) Gem 0.1 800
Emerald (10) Gem 0.1 600
Flawless Amethyst (8) Gem 0.1 180
Flawless Diamond (2) Gem 0.1 1000
SILVER SAPPHIRE NECKLACE
ARMOR 0
WEIGHT 0.5
VALUE 580
E Equip
R Drop
F Favorite
Armor Rating 797
Carry Weight 243/465
Gold 92257

Conclusions about mental models

- Building upon metaphors **helps beginners** the most
- They link **previous knowledge to a new**
- **Mismatch** between real world relations and control layout is a **source of error**

Psychology in Ergonomics

Sensation and Perception

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Attention

Attention

- ***Selectivity*** may vary from task to task and person to person (and has circadian variability as well)

- Top-down vs. Bottom-up attention:

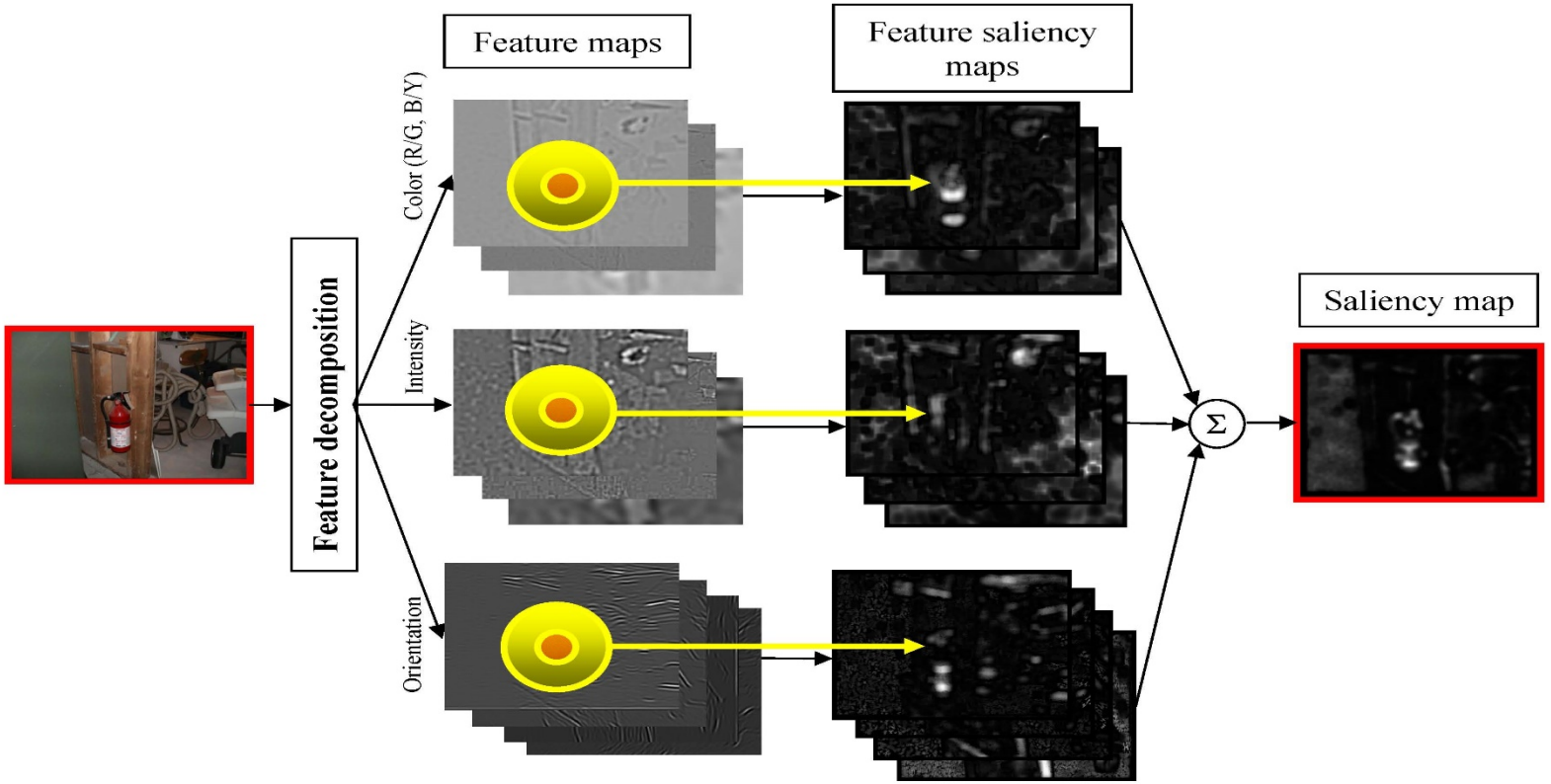
Banner blindness


THE ATTENTION TEST

Simulating bottom-up attention

Saliency maps

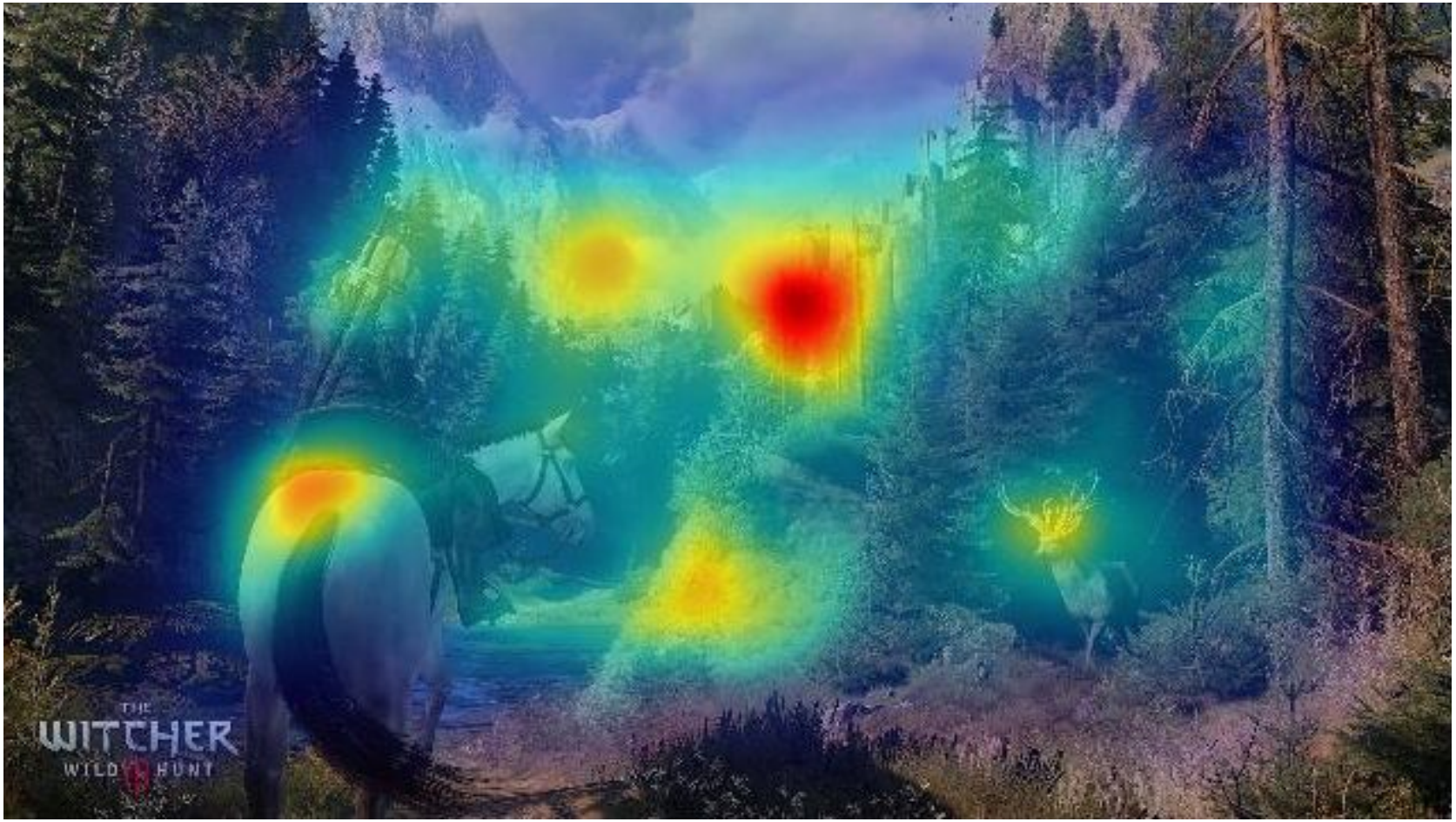
- Tries to guess based on physical properties



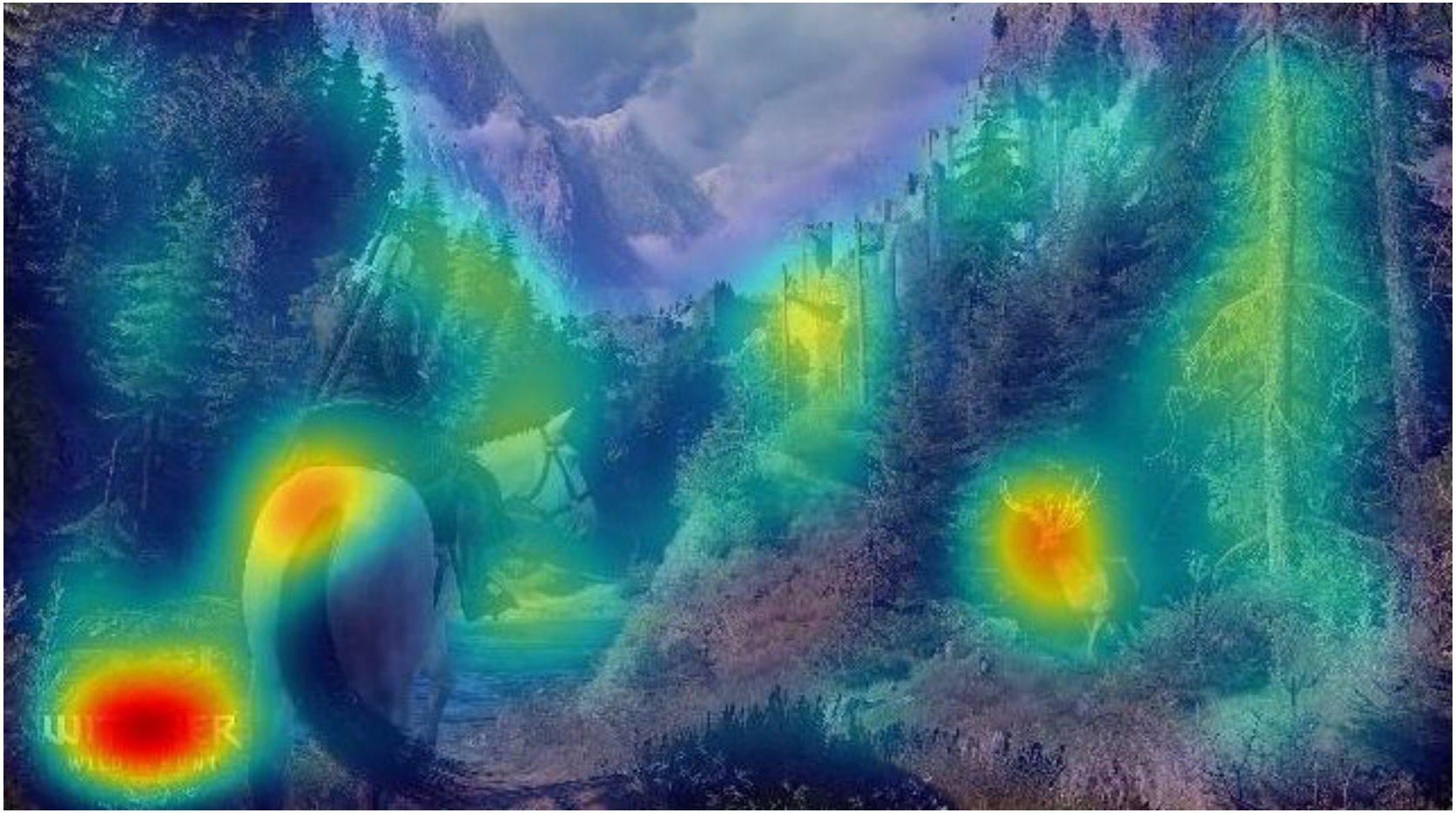
Original image

Attention of real users (N=20)

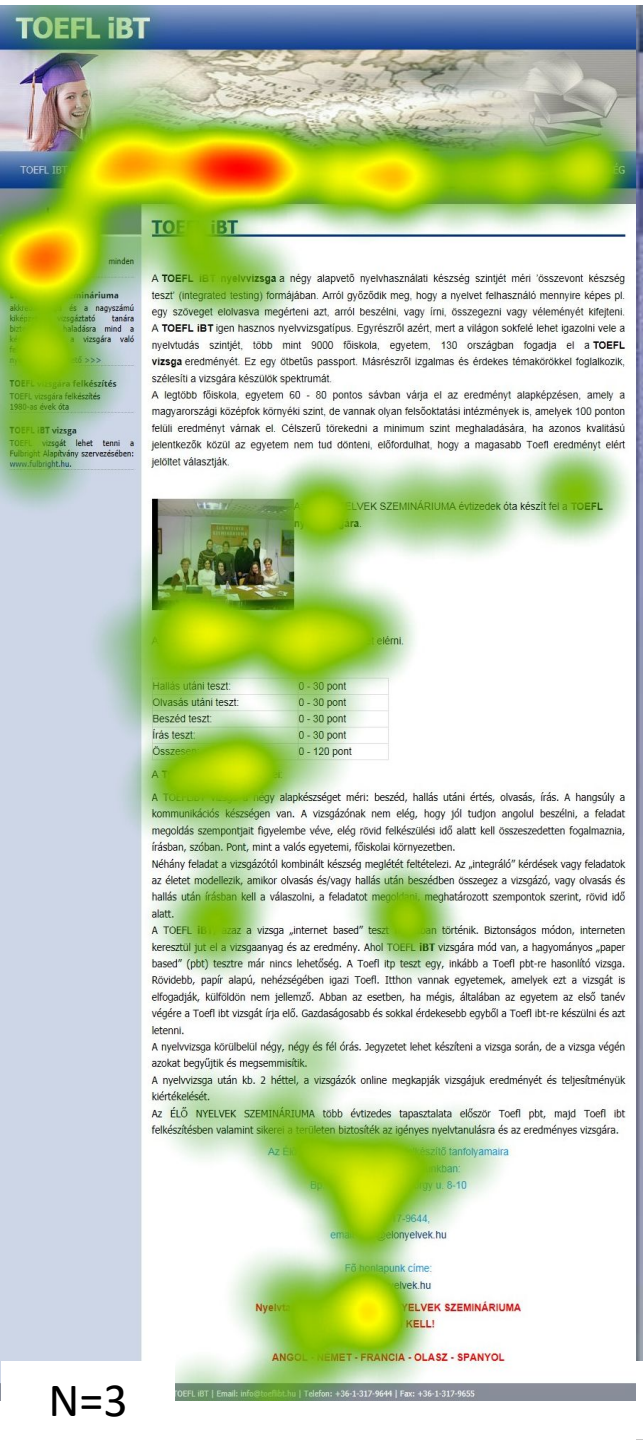
GBVS model



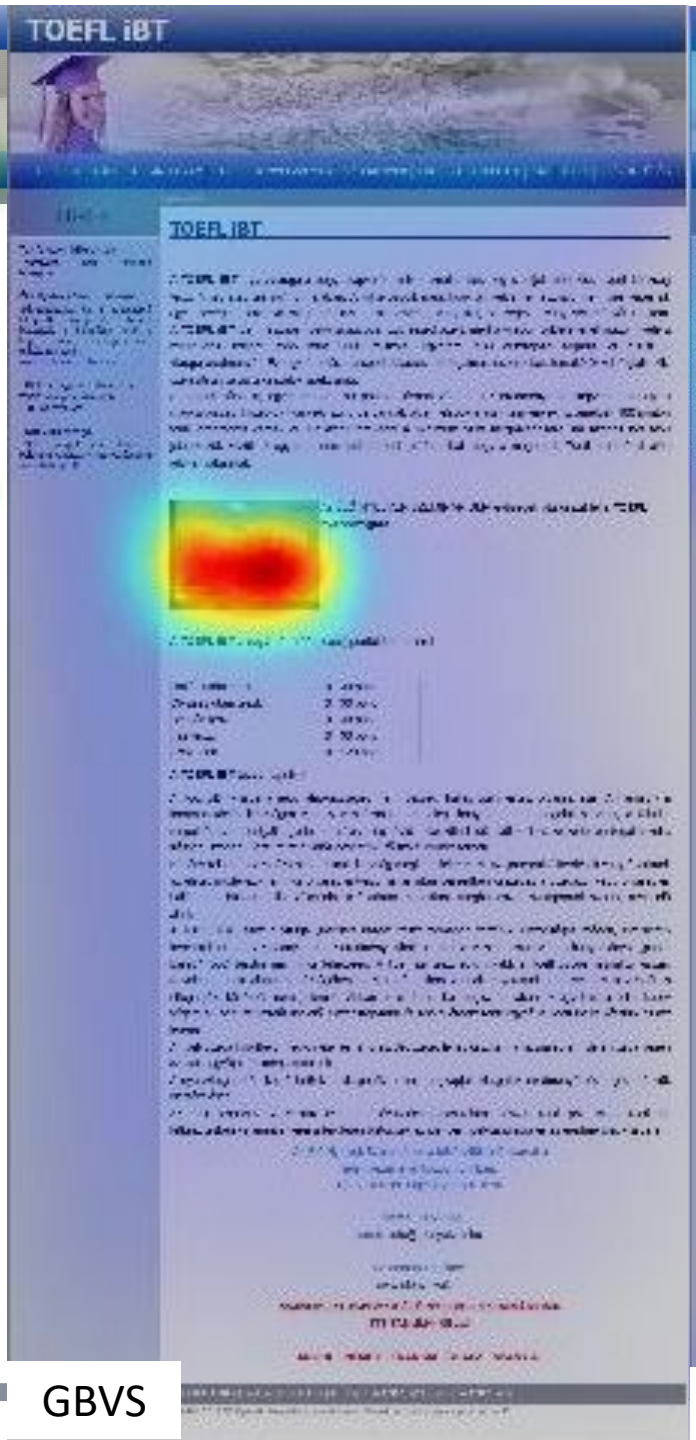
Itti-Koch model



Less accurate prediction


TOEFL iBT
TOEFL iBT
A TOEFL iBT nyelvvizsga a négy alapvető nyelvhasználati készség szintjét méri 'összevont készség teszt' (integrated testing) formájában. Arról győződik meg, hogy a nyelvet felhasználó mennyire képes pl. egy szöveget elolvasva megérteni azt, arról beszélni, vagy írni, összegezni vagy véleményét kifejteni.
A TOEFL iBT igen hasznos nyelvvizsgatípus. Egyrészről azért, mert a világon sokfelé lehet igazolni vele a nyelvtudás szintjét, több mint 9000 főiskola, egyetem, 130 országban fogadja el a TOEFL vizsga eredményét. Ez egy ötbetűs passport. Másrészről izgalmas és érdekes témakörökkel foglalkozik, szélesíti a vizsgára készülők spektrumát.
A legtöbb főiskola, egyetem 60 - 80 pontos sávban várja el az eredményt alapképzésen, amely a magyarországi középfok környéki szint, de vannak olyan felsőoktatási intézmények is, amelyek 100 ponton felüli eredményt várnak el. Célszerű törekedni a minimum szint meghaladására, ha azonos kvalitású jelentkezők közül az egyetem nem tud dönteni, előfordulhat, hogy a magasabb Toefl eredményt elért jelöltet választják.
Hallás utáni teszt: 0 - 30 pont
Olvasás utáni teszt: 0 - 30 pont
Beszéd teszt: 0 - 30 pont
Írás teszt: 0 - 30 pont
A TOEFL iBT négy alapkészséget méri: beszéd, hallás utáni értés, olvasás, írás. A hangsúly a kommunikációs készségen van. A vizsgázónak nem elég, hogy jól tudjon angolul beszélni, a feladat megoldás szempontjait figyelembe véve, elég rövid felkészülési idő alatt kell összeszedetten fogalmaznia, írásban, szóban. Pont, mint a valós egyetemi, főiskolai környezetben.
Néhány feladat a vizsgázótól kombinált készség meglétét feltételezi. Az „integráló" kérdések vagy feladatok az életet modellezik, amikor olvasás és/vagy hallás után beszédben összegez a vizsgázó, vagy olvasás és hallás után írásban kell a válaszolni, a feladatot meghatározott szempontok szerint, rövid idő alatt.
A TOEFL iBT vizsga a vizsga „internet based" teszt formában történik. Biztonságos módon, interneten keresztül jut el a vizsgaanyag és az eredmény. Ahol TOEFL iBT vizsgára mód van, a hagyományos „paper based" (pbt) tesztre már nincs lehetőség. A Toefl itp teszt egy, inkább a Toefl pbt-re hasonlító vizsga. Rövidebb, papír alapú, nehézségében igazi Toefl. Itthon vannak egyetemek, amelyek ezt a vizsgát is elfogadják, külföldön nem jellemző. Abban az esetben, ha mégis, általában az egyetem az első tanév végére a Toefl ibt vizsgát írja elő. Gazdaságosabb és sokkal érdekesebb egyből a Toefl ibt-re készülni és azt letenni.
A nyelvvizsga körülbelül négy, négy és fél órás. Jegyzetet lehet készíteni a vizsga során, de a vizsga végén azokat begyűjtik és megsemmisítik.
A nyelvvizsga után kb. 2 héttel, a vizsgázók online megkapják vizsgájuk eredményét és teljesítményük kiértékelését.
Az ÉLŐ NYELVEK SZEMINÁRIUMA több évtizedes tapasztalata először Toefl pbt, majd Toefl ibt felkészítésben valamint sikerrel a területen biztosíték az igényes nyelvtanulásra és az eredményes vizsgára.
ANGOL - NÉMET - FRANCIA - OLASZ - SPANYOL

N=3


TOEFL iBT

GBVS


TOEFL iBT

I-K

Conclusions about memory and attention

- Proper **menu design** and **metaphors** help beginners to form **helpful mental models** that guide future interactions

- An expert can operate even the worst system with great efficiency; look for beginners!

- Always think about what is the **main goal of the user**. Anything unrelated to it, will blend in (like the moonwalking bear)

- Faster and effortless is not always the better! „Testing effect” (Roediger & Karpicke, 2006)