

IFT 2905: INTERFACES PERSONNE-MACHINE PERFORMANCE HUMAINE

<http://tiny.cc/ift2905>



Image © Katerina Kamprani, www.theuncomfortable.com

Mikhail Bessmeltsev

Certaines diapos de Bernhard Thomaszewski

Est-ce une bonne interface?




Est-ce une bonne interface?



Est-ce une bonne interface?



Est-ce une bonne interface?

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Passenger(s)


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Duplicate names must not be entered for passengers [?](#)

Passenger 1

Title First name Last name

Travel Insurance

	INSURANCE	INSURANCE PLUS
Medical Expenses up to £2,500,000 <small>(excess of £75, double excess for aged 65+)</small>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Personal Belongings up to £1,500 <small>(excess of £75)*</small>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Cancellation circumstances <small>(excess of £15)</small>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Ticket Refund <small>In case of Ryanair</small>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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Please select a country of residence


- United Kingdom
- Ireland
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- Sweden
- Austria
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- Czech Republic
- Denmark
- Don't Insure Me
- Finland
- Hungary
- Latvia
- Lithuania
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Brignull
Harry

Already insured? Don't insure me* in the drop down box.

BOOKING SUMMARY

► Passenger(s)

 London (Stansted) → Faro
Sun, 31 Aug 2014 20:55 - 23:45

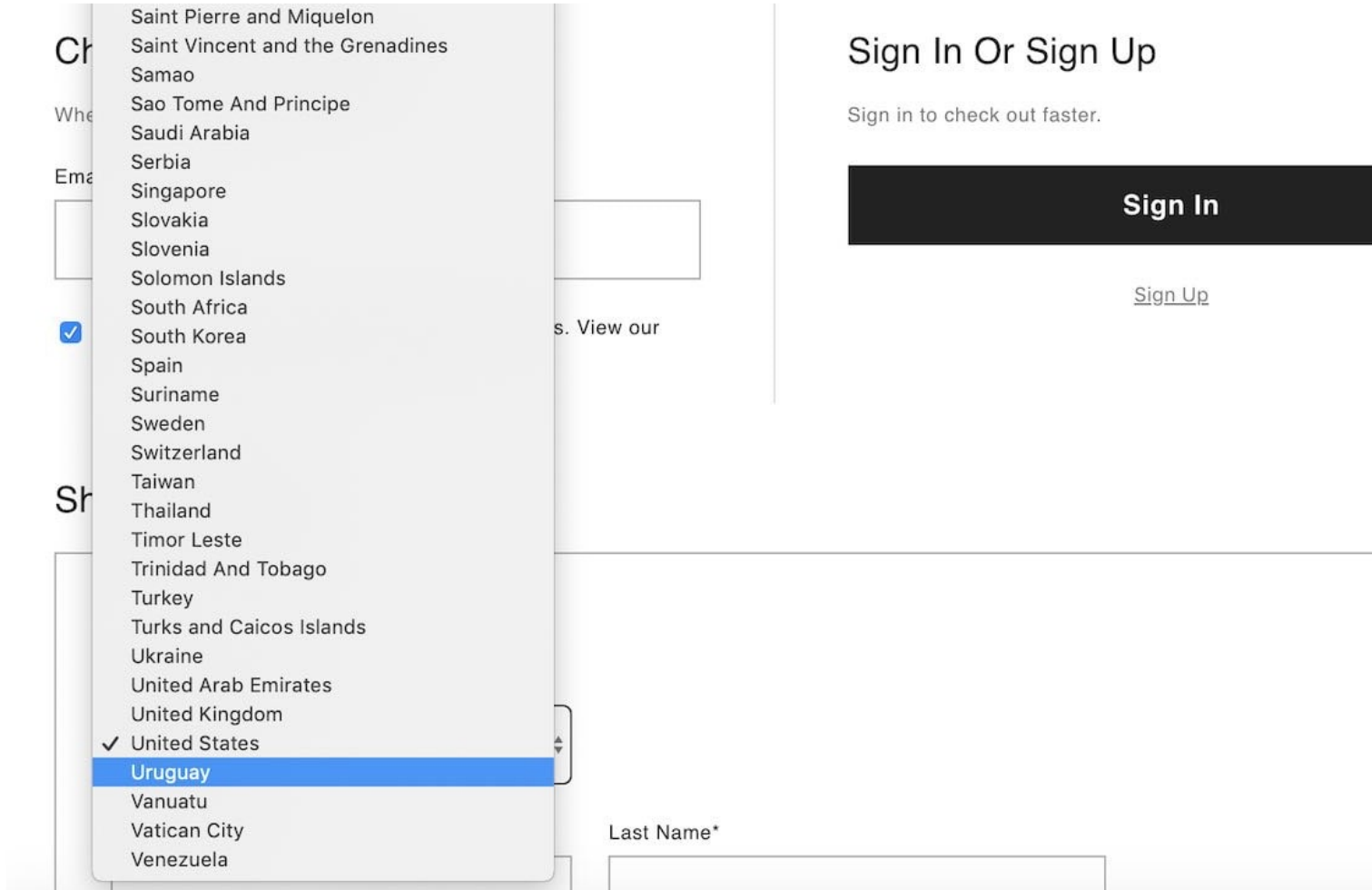
▼ 1 Adult, 29.99 GBP

1 x Adult Fare 29.99 GBP

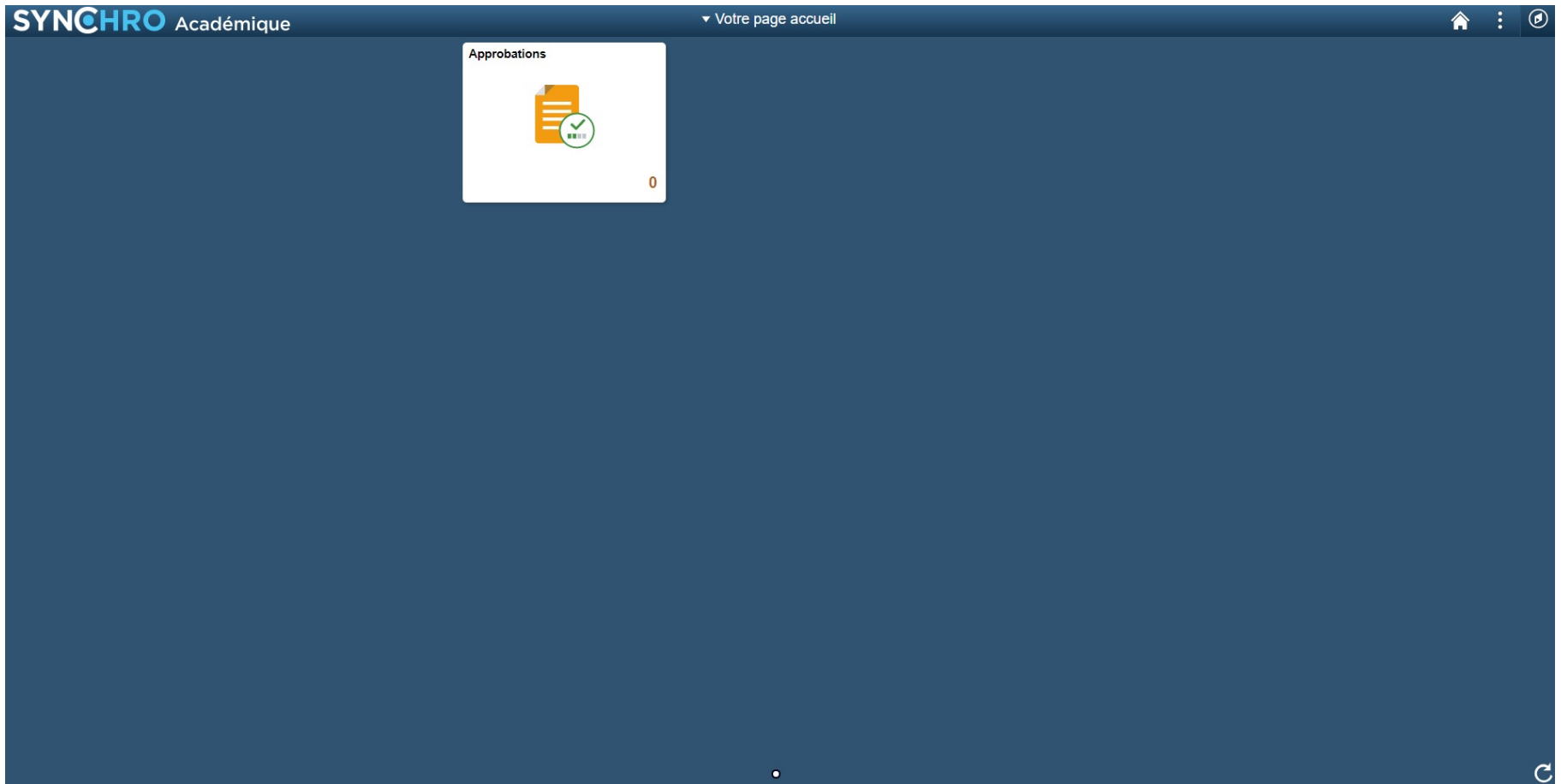
Discount Pay by debit card: 29.99 GBP
 Pay by credit card: 30.59 GBP

TOTAL 29.99 GBP

Est-ce une bonne interface?



Est-ce une bonne interface?



Synchro/UdeM

Est-ce une bonne interface?

The screenshot displays the Studium web interface. At the top, the navigation bar includes 'Université de Montréal | Studium' on the left and 'Accueil Mes cours Liste des cours Aide Français (fr) Mikhail Bessmeltsev' on the right. A left sidebar contains a menu with items like 'IFT2905-A-H21', 'Participants', 'Badges', 'Compétences', 'Notes', 'Téléchargement', 'Introduction', 'Ressources', and 'Démonstrations'. Below this is a secondary menu with 'Accueil', 'Mon Studium', 'Calendrier', 'Fichiers personnels', and 'Mes cours', with a list of course codes under 'Mes cours'. The main content area is titled 'IFT2905-A-H21 - Interfaces personne-machine' and shows a breadcrumb trail: 'Accueil / Mes cours / IFT2905-A-H21 / Introduction / Nouvelles / La première vidéo (ou deux)'. A search bar is present with the text 'Recherche (forums)'. The section is labeled 'Nouvelles' and 'La première vidéo (ou deux)'. A post titled 'La première vidéo (ou deux)' by Mikhail Bessmeltsev, dated Wednesday, January 13, 2021, 12:36, is displayed. The post content reads: 'Bonjour à tous! Voilà les formalités: https://umontreal.zoom.us/rec/share/FLSncpriHaEm89ut07L9-iMkKmyJXzUEGimfc6ARfCNQdVbwk60hTEKjNXSI4FT_0kIM4S3clqsj_pnm et l'introduction à notre cours: https://umontreal.zoom.us/rec/share/shU87cuVYRwMd2hLtyhDKYzV7-RSgD1QvB46j-h-5zTJ8XnyoxnrRTYYOIJQbZOZ.pZsxtOy3m5UthvWv Svp regardez-les avant notre cours le lundi (18 janvier), qui sera à 10.30, sur Zoom (tiny.cc/ift2905_zoom). À plus tard! Les diapos sont là: http://tiny.cc/ift2905'. Below the post are buttons for 'Permalien', 'Modifier', 'Supprimer', 'Répondre', and 'Exporter vers le portfolio'. Navigation links for 'Début du cours' and 'Équipes et Démo du 21 Janvier' are visible at the bottom of the post area.

Mais pourquoi?

PERFORMANCE HUMAINE & COGNITION

La performance humaine est l'ensemble des capacités mentales et physiques tel que liées aux processus **cognitifs**

Exemples:

à quelle vitesse peut-on appuyer sur un bouton? (fait partie)

combien de temps peut-on survivre à -24C? (ne fait pas partie)

Qu'est-ce que la cognition?

LA COGNITION

Qu'est-ce que la cognition?

La cognition est l'ensemble des processus mentaux qui se rapportent à la fonction de connaissance

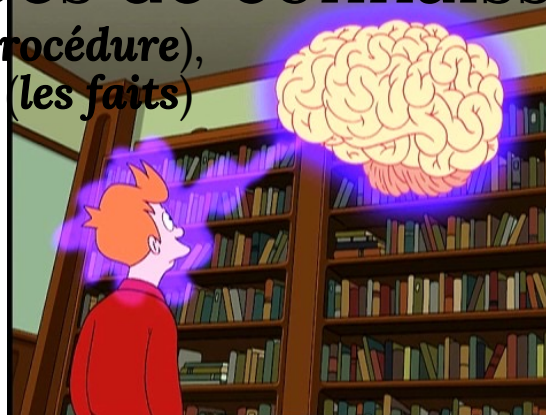
C'est à dire

acquérir des connaissances
utiliser des connaissances

Différents types de connaissances

le savoir-faire (**de procédure**),
le savoir technique (**les faits**)
les langues

...

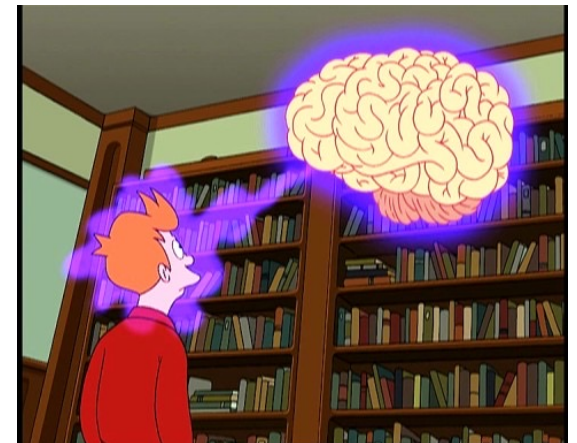


LA COGNITION

Qu'est-ce que la cognition?

Les composants de la cognition

- perception
- langage
- apprentissage
- mémoire
- résolution de problème
- prise de décision
- attention



LA COGNITION

Pourquoi la cognition est-elle importante pour l'interaction personne-machine?

- nous voulons créer des interfaces qui soutiennent les utilisateurs humains dans ce qu'ils font
- nous devons connaître les capacités et les limites humaines fondamentales
- but: créer des systèmes interactifs et faciles à utiliser qui s'adaptent d'une façon optimale aux tâches et aux besoins des utilisateurs

L'ORDINATEUR CONTRE L'HUMAIN

Les points forts des humains

- Détection de signal sous bruit
- Reconnaissance de configurations (p.e., scènes) complexes
- Concentration sur l'essentiel
- Adaptation à des situations inattendues
- Aptitude à apprendre
- Mémoriser des informations cohérentes
- Intuition
- ...

Les points forts des ordinateurs

- Détection/reconnaissance de signaux connus
- Réaction rapide et fiable aux signaux connus
- Supériorité si les problèmes peuvent être formulés algorithmiquement
- Mesurer et compter
- Stocker de grandes quantités de données incohérentes
- Répétition fiable et sans fatigue des opérations
- ...

SYSTÈMES MOTEURS ET SENSORIELS

Systemes sensoriels

Vue (visuelle)
Audition (auditive)
Touche (haptique)
Odeur (olfactive)
Goût (gustatif)
Équilibre et accélération
(vestibulaire)
Conscience du corps
(proprioception, sens kinesthésique)
Température
(réception de chaleur)

Systemes moteurs

- Bras, mains, doigts
- Tête, yeux
- Système vocal
- Jambes, pieds, orteils
- Mâchoire, langue

PERFORMANCE HUMANINE

Editorial: Role of Inner Ear in Self and Environment Perception

Christophe Lopez^{1*}, Michel Toupet^{2,3}, Christian van Neechel^{3,4} and Alexis Bozorg Ghazizadeh⁵

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Keywords: depersonalization, perception, self, environment, inner ear, vestibular system, otolith organs, semicircular canals, motion sickness

Editorial: Role of Inner Ear in Self and Environment Perception

Otolith organs (the vestibular system) and eye movements contribute to the perception of time. These sensations are affected in depersonalization disorder, a chronic condition characterized by memory impairment, years of cognitive decline, and a sense of time distortion.

OPEN ACCESS

Edited and reviewed by: Michael Strupp, Ludwig Maximilian University of Munich, Germany

*Correspondence: Christophe Lopez

REVIEW ARTICLE

Front. Physiol., 06 July 2020 | <https://doi.org/10.3389/fphys.2020.00770>

Effect of Exercise-Related Factors on Time Perception

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The concept of time whether considered through the lenses of physics or psychology, time perception can have serious implications in sport, fitness and work environments (i.e., workers who need to synchronize their activities with many time constrained tasks). In addition, time distortions may play a role in exercise adherence. Two predominant models (the "beat frequency model" and the "number of beats model") emphasize the perception of the number of beats per second (BPM) of activating and coordinating cortical structures, respectively. A number of factors (i.e., state of health and fitness, mental concentration and exercise intensity) affect time perception. However, with the importance of time perception for performance in many areas. Since work, sports, and exercise can involve an integration of various factors, interventions that need further investigations. The multiplicity of variables in this underdeveloped but fruitful field for future research. Thus, the objective of this review is to summarize the psychological factors affecting human perception of time and the

Topical Review

PAIN[®]

OPEN

Symptom perception, placebo effects, and the Bayesian brain

Giulio Ongaro^{1*}, Ted J. Kaptchuk^{2,3}

1. Introduction

The standard and ideal biomedical model of symptom perception treats the brain largely as a passive stimulus-driven organ. It embraces the notion that the brain absorbs sensory signals from the body and converts them, directly, into conscious experience. Accordingly, biomedicine operates under the assumption that symptoms are the direct consequences of physiological dysfunction and improvement is the direct consequence of the restoration of bodily function. Despite its success, the biomedical model has failed to provide an adequate account of 2 well-demonstrated phenomena in medicine: (1) the experience of symptoms without pathophysiological disruption, and (2) the experience of relief after the administration of placebo treatments. This topical review advances the idea that "predictive processing," a Bayesian approach to perception that is rapidly taking hold in neuroscience, significantly helps accommodating these 2 phenomena. It expands on recent high-quality empirical work on predictive processing^{1,7,19,24} and outlines, more broadly, how Bayesian models offer an altogether different picture of how the brain perceives symptoms and relief.

2. The Bayesian brain

The nervous system is constantly dealing with a continuous and potentially overwhelming stream of varying signals coming from our body and senses. For the sake of adaptation, the brain must turn this confused play of sensory inputs and neural firings into a reliable perception of the world. Debate in cognitive science has revolved around how exactly the brain accomplishes this task. While previous theories, in line with the current biomedical model of disease, viewed perception mostly as a bottom-up readout of sensory signals, emerging Bayesian models suggest, instead, that perception is cognitively (mostly nonconsciously) modulated,

and might be best viewed as a process of prediction, based on an integration of sensory inputs, prior experience, and contextual cues.^{9,10,15,21}

The key suggestion is that to perceive the world, the brain follows a theory of probability known as Bayes' rule. In its mathematical form, the rule updates the likelihood of a given hypothesis (or "prior"), given some evidence, by considering the product of the likelihood and the prior probability of the hypothesis.²¹ Over rapid time scales, the brain implements Bayes' rule by continuously generating a top-down cascade of neurally encoded (mostly nonconscious) hypotheses about the state of the body and world. This top-down flow of hypotheses is met by the bottom-up stream of sensory inputs coming from the senses. Any mismatch between predicted input and actual input results in "prediction error," which prompts the system to revise its hypotheses. Bottom-up perception is thus inseparable from top-down prediction. Some of the hypotheses that account for the most abstract and general features of the world are "built-in" by evolution; others are amenable to progressive refinement through developmental learning. Throughout one's lifespan, the nervous system engages in the continuous updating of these priors to better predict the next incoming sensory inputs and minimize error.

A central implication of the theory is that what we perceive is not the world as it actually is, but the brain's best guess of it, continuously refined by incoming sensory evidence.^{10,21} Visual perception, the domain from which much of the evidence for the Bayesian brain has emerged, offers the most intuitive way to grasp its key principle. To mention a simplistic example, sticks in a forest that is infested by snakes might at first be perceived as snakes, until we get a more refined view that updates the hypothesis.

Importantly, the interplay between descending predictions and ascending signals that lie at the heart of predictive processing is flexibly modulated by the "precision" (or "inverse variance," in statistical terms) of hypotheses and sensory evidence. Faced with the task of determining how likely a given set of inputs represents a predicted state, the brain uses prior experience and subtle contextual cues to determine their precision. The example of seeing sticks as snakes represents a case where highly precise hypotheses shaped by previous experience (knowing what a snake looks like, knowing that snakes inhabit the forest) override imprecise visual inputs. Indeed, the Bayesian brain model is able to explain how, in contexts of precise predictions and imprecise

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PERFORMANCE HUMAINE

Les processus cognitives et moteurs sont complexes

Comment intégrer ces aspects dans la conception d'interfaces?

On a besoin des modèles théoriques qui simplifient et formalisent ces processus
Quelques exemples

Model
Human
Processor

GOMS

Fitts' Law

MODEL HUMAN PROCESSOR

- Développé par S. Card, T. Moran, A. Newell
(*The Psychology of Human-Computer Interaction*, 1983)

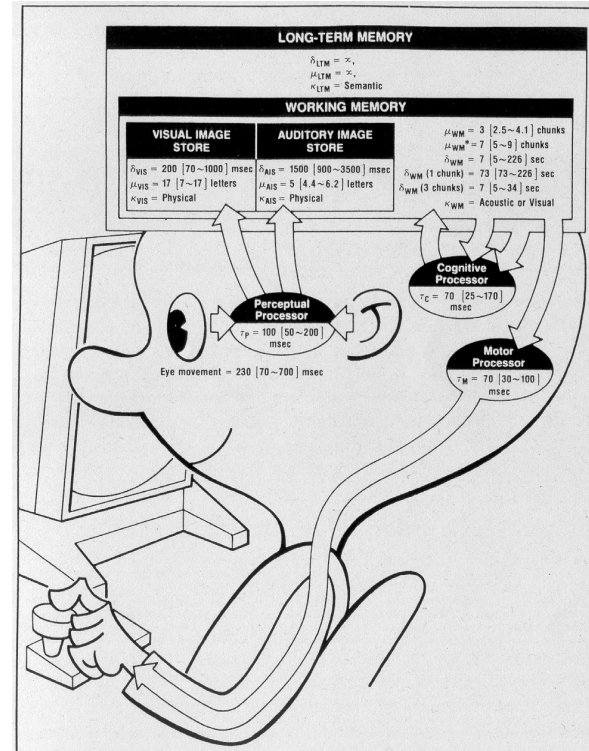
<http://www2.parc.com/istl/groups/uir/publications/items/UIR-1986-05-Card.pdf>

Modèle informatique donnant une compréhension abstraite du cycle cognitif

- perception (**input**)
- traitement (**processing**)
- action (**output**)

Peut être appliqué pour estimer:
Temps d'exécution
Taux d'erreur

...



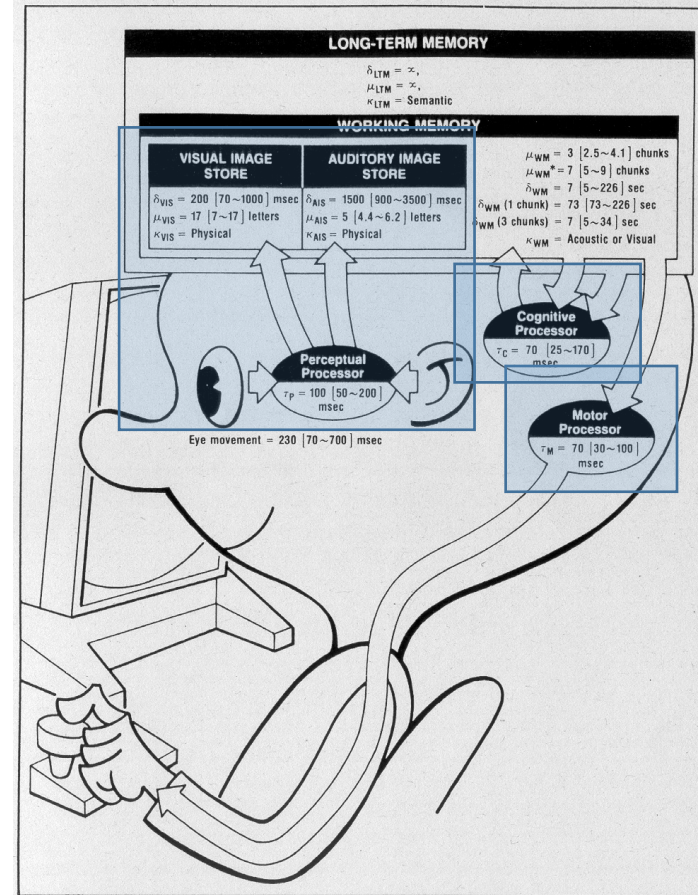
MODEL HUMAN PROCESSOR

Trois processeurs avec mémoire associée

1. Processeur perceptuel
Capteurs et tampons
2. Processeur cognitif
Travail sur contenu de la mémoire de travail
3. Processeur moteur
Génère des mouvements

Chaque processeur a un temps d'exécution associé

Le temps d'exécution globale du système est la somme des trois

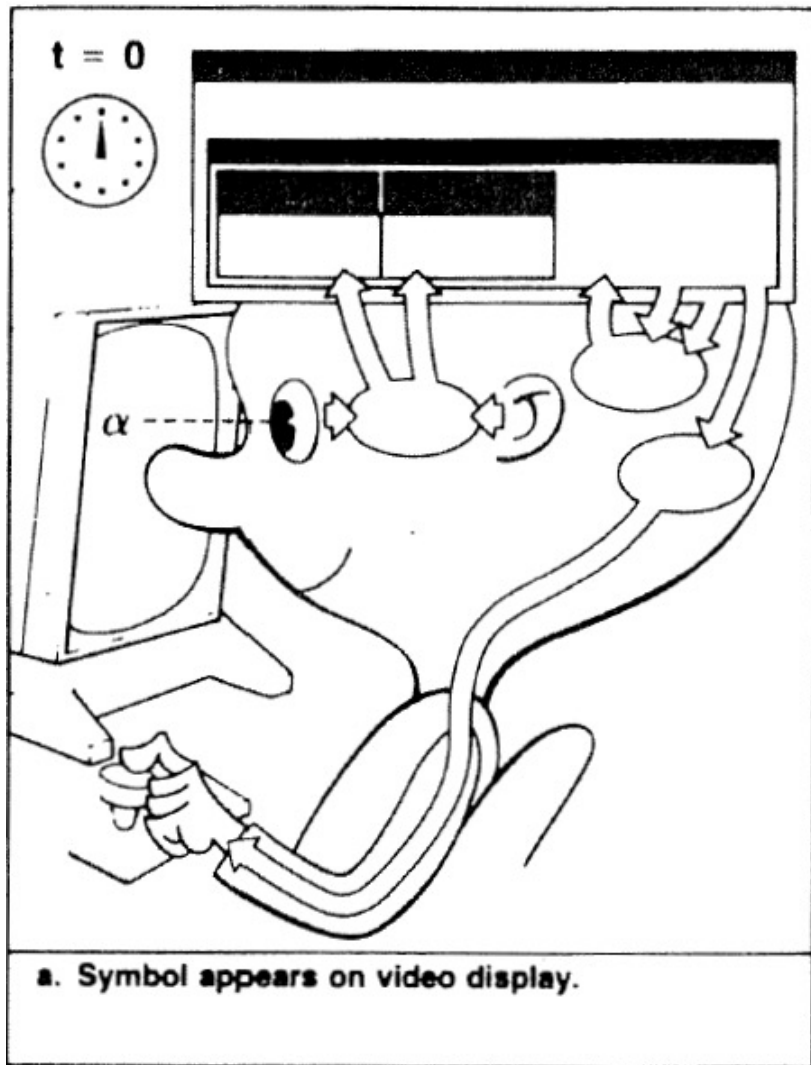


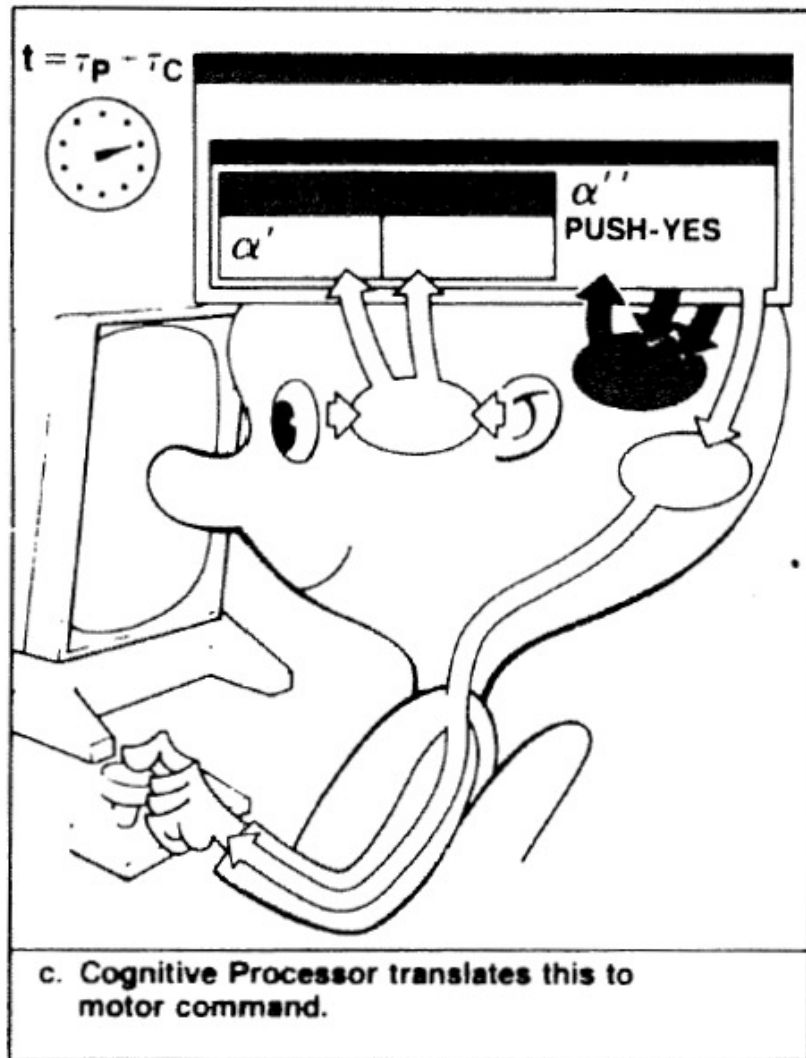
MHP – EXEMPLE

*Comment fonctionne ce modèle
informatique d'humain?*

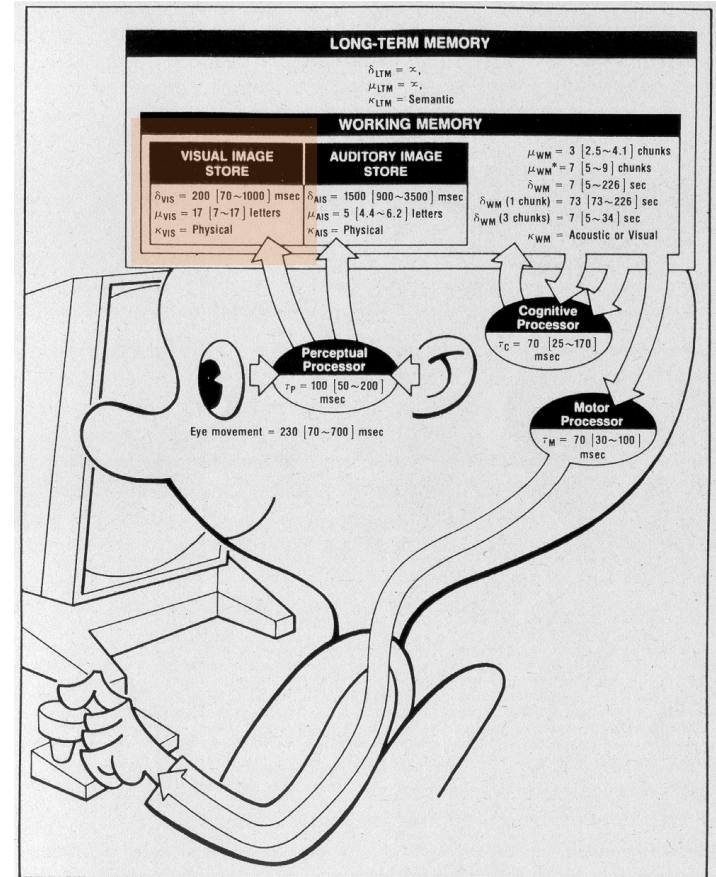
Exemple

l'utilisateur observe un caractère sur l'écran
il réagit en appuyant sur un bouton

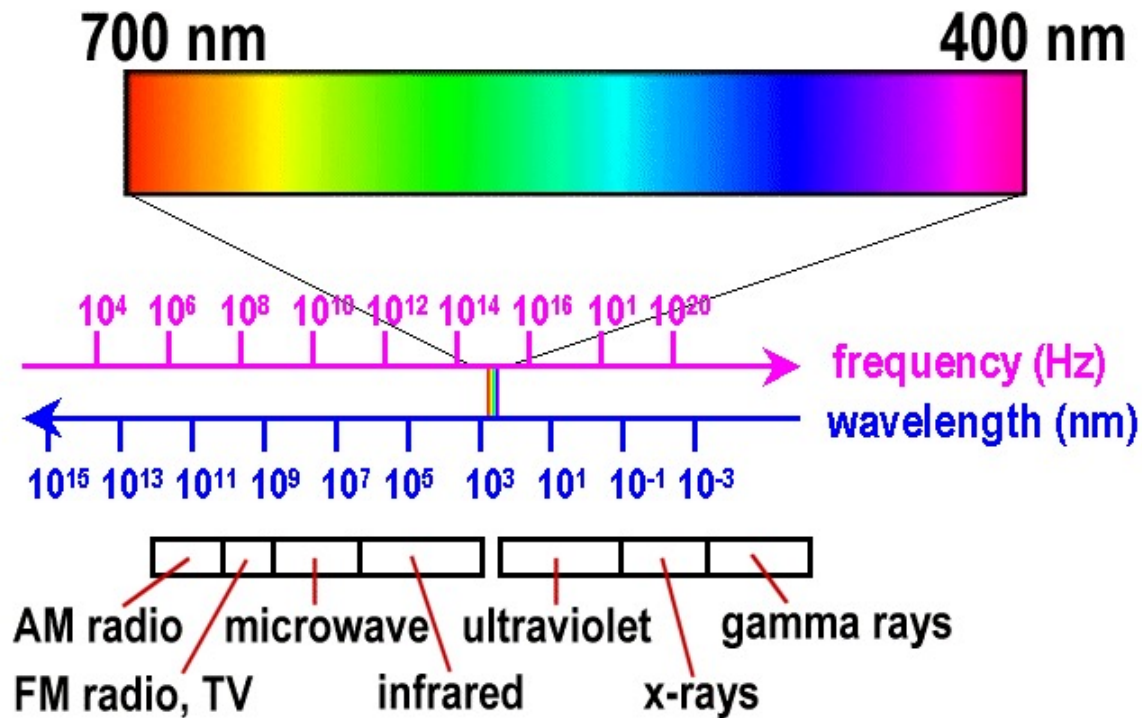




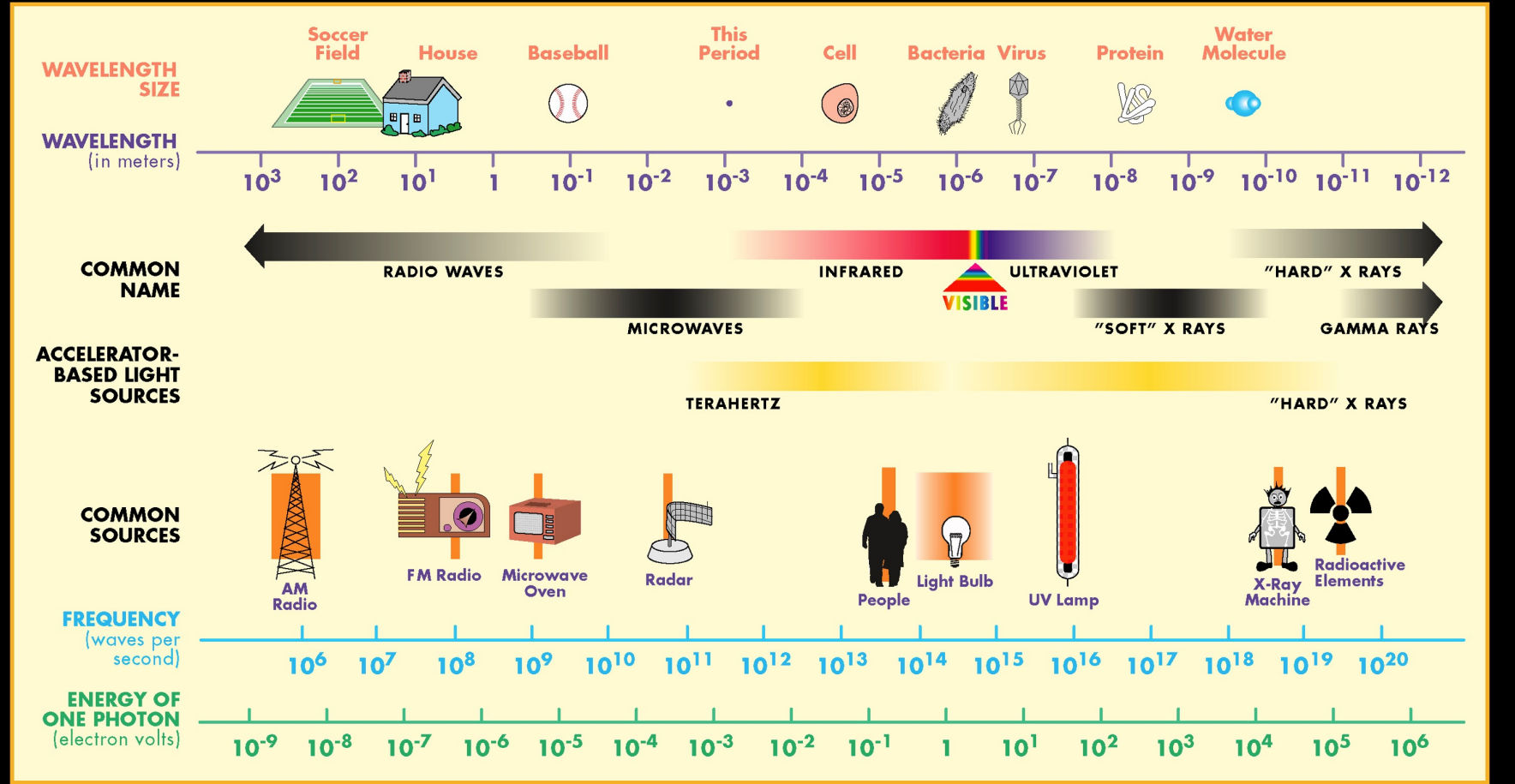
La perception et le système visuel



LE SPECTRE ÉLECTROMAGNÉTIQUE

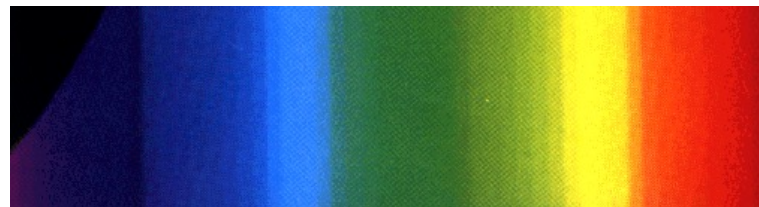


THE ELECTROMAGNETIC SPECTRUM



LA COULEUR PHYSIQUE

- L'énergie visible est une petite partie du spectre électromagnétique
- Les couleurs *monochromatiques* pures ont des longueurs d'onde entre 380nm (violet) et 780nm (rouge)

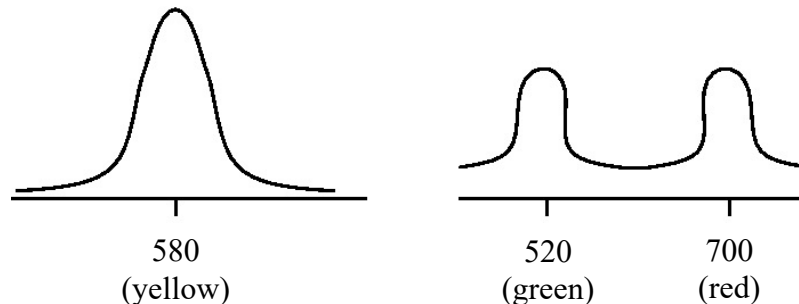


380

780

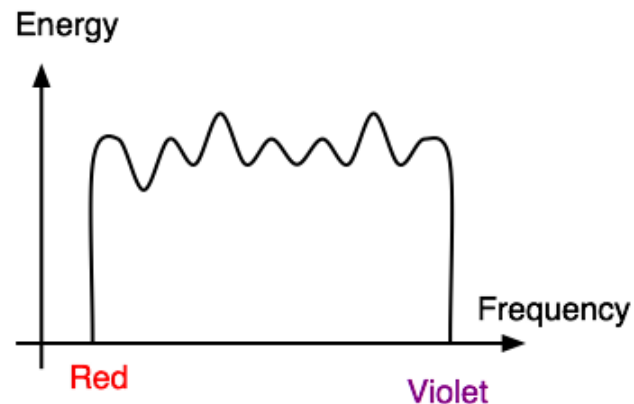
LA COULEUR VISIBLE

- L'œil peut percevoir les couleurs comme une combinaison de quelques couleurs pures
- La plupart des couleurs peuvent être obtenues via un mélange des couleurs *primaires*
- Les dispositifs de sortie utilisent ce fait



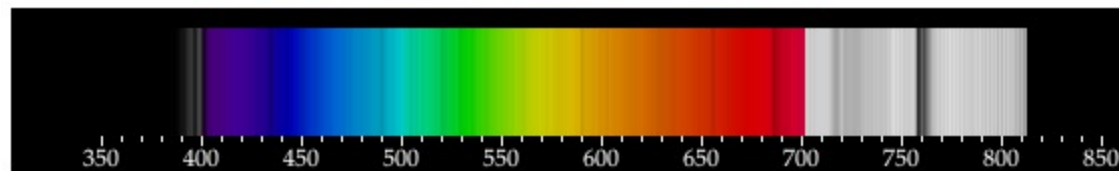
LA LUMIÈRE BLANCHE

Le soleil émet toutes les fréquences dans la gamme visible afin de produire ce qu'on perçoit comme « la lumière blanche »

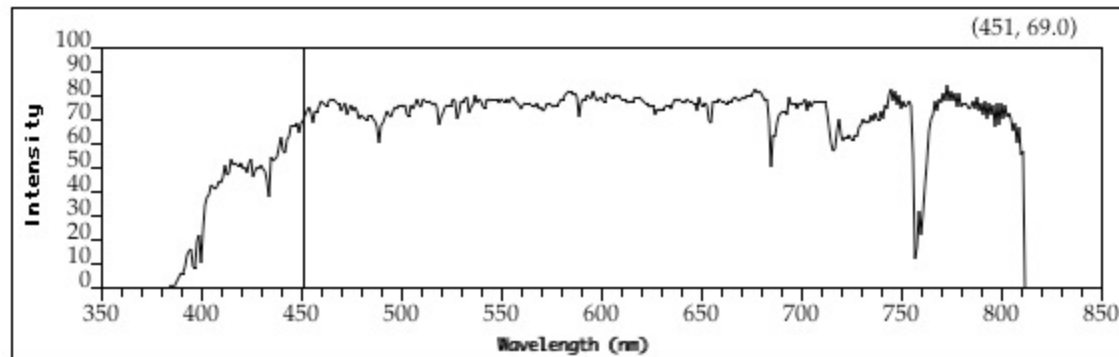


LE SPECTRE SOLAIRE

Une distribution spectrale: la puissance vs. la longueur d'onde



Emission Graph

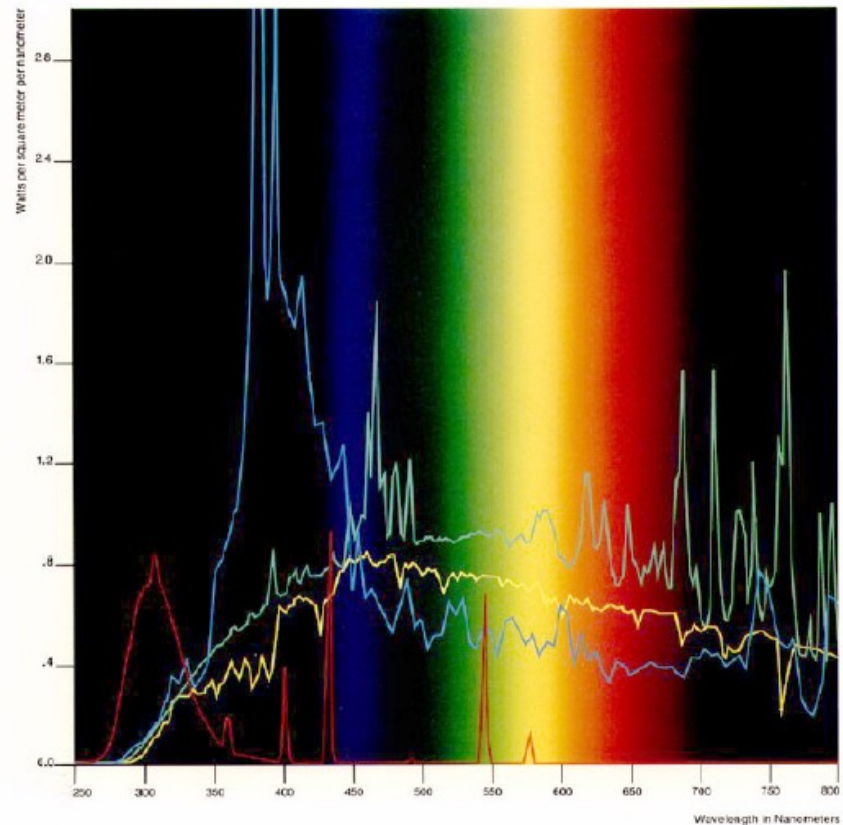


Electromagnetic Spectrum

LE SPECTRE CONTINU

Le soleil Les lumières « du jour »

A Comparison of Relative Spectral Energy Distribution



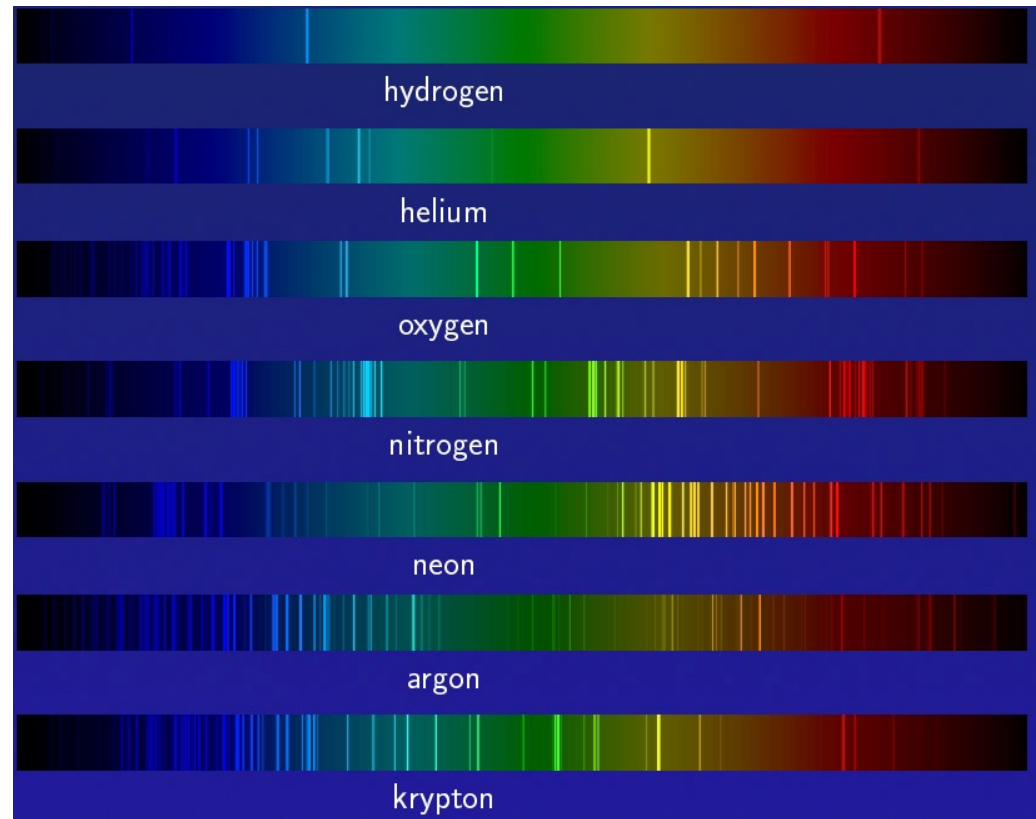
- Sunlight**
As used in Average Observer's Direct Global Radiation, Measured 65°S, 37°W.
- Sunshine Carbon Arc**
As used in Air Weather Control's Corax 3 Filter.
- Xenon Arc Lamp**
As used in Air Weather Control's 800 Watt Xenon Lamp with Solar Filter and Solar Filter, 360° (Control 10 MW).
- FS-4D Fluorescent Sun Lamp**
As used in the Atlas 1000™ and the QPhase Q-1™ Autographic Weathering Testers (see A.S.T.M. D51).

Accelerated weathering devices are used to determine the effects of sunlight on various substrates. This graph illustrates the spectral energy distribution as a function of the wavelength produced by a number of artificial light sources. The farther left the wavelength appears on the graph (i.e., shorter wavelength), the higher the energy output generated. The graph compares these energy outputs to terrestrial sunlight.

Devices that emit larger amounts of shorter wavelength light cause samples to fail in shorter periods of time, and often correlate less well than those instruments which emit wavelengths closer to the distribution of terrestrial sunlight.

LE SPECTRE LINÉAIRE

- Les gaz ionisés
- Les lasers
- Quelques lampes fluorescentes



LA PHYSIOLOGIE DE LA VISION

La rétine

Les bâtonnets

Nuances de gris, bords

Les cônes

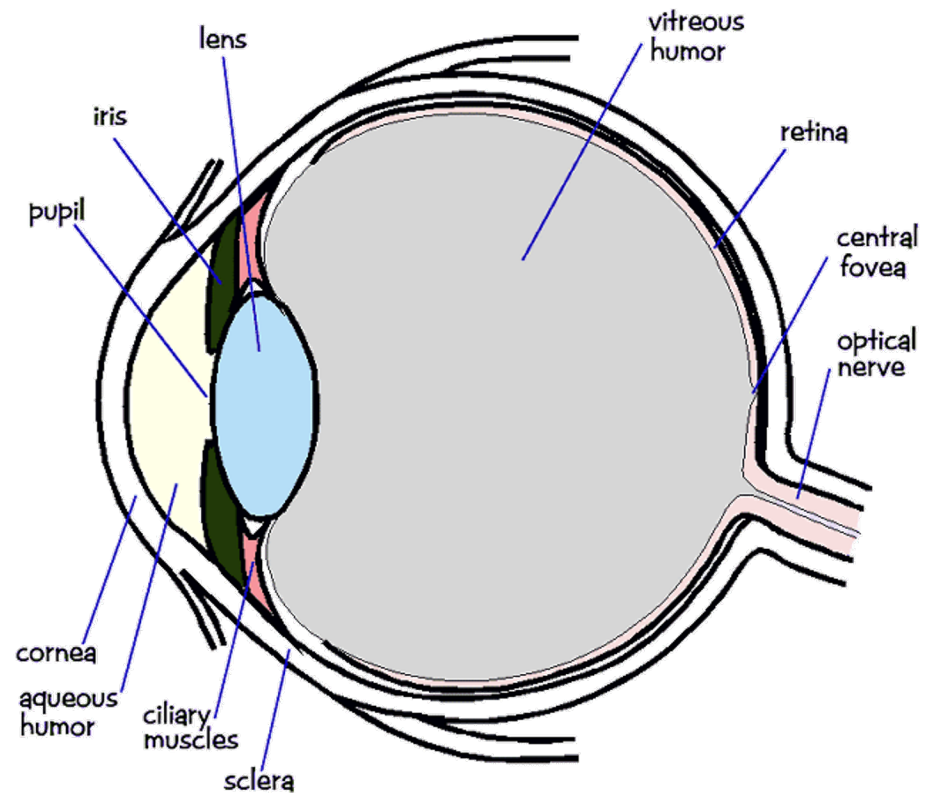
3 types

Les senseurs de couleurs

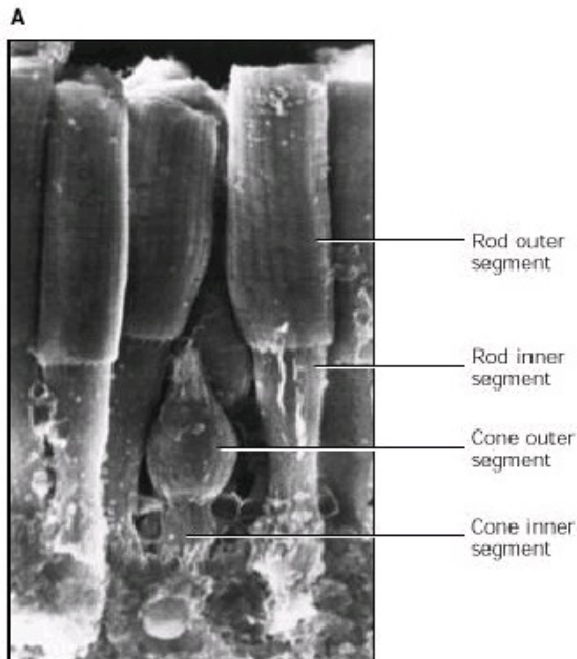
Une distribution inégale

La fovéa est dense

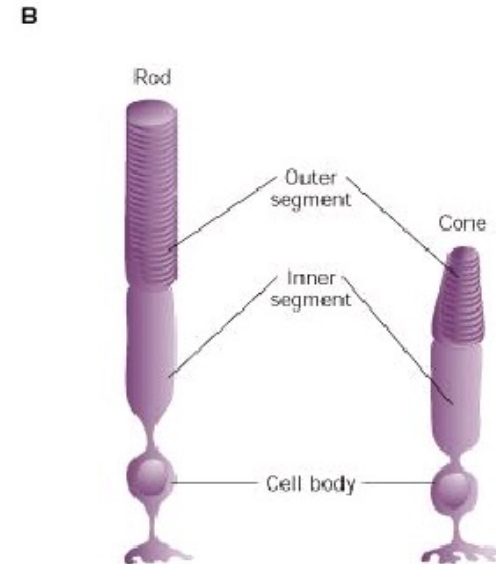
Le nerf optique transmet la lumière
traîtée au cortex visuel



LES BÂTONNETS ET LES CÔNES



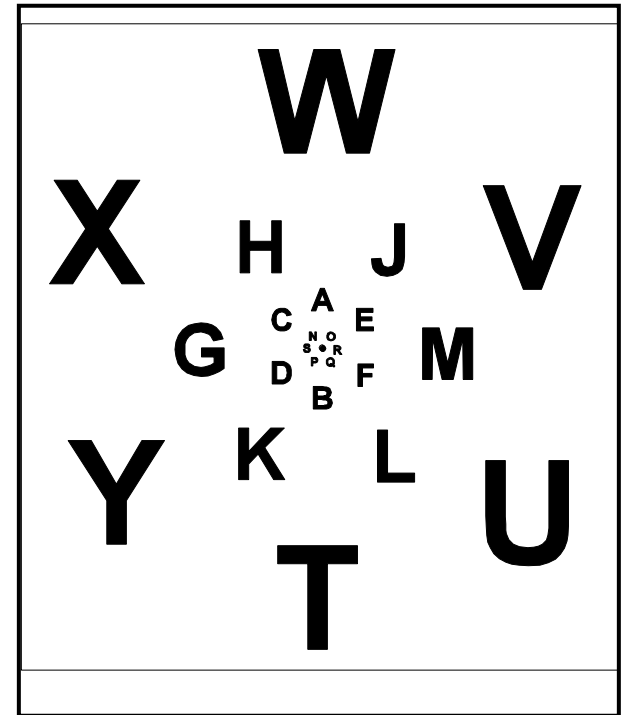
un type,
nuances de gris



trois types,
la couleur

LA VISION FOVÉALE

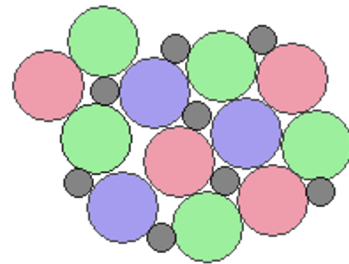
Tenez votre pouce à bout de bras



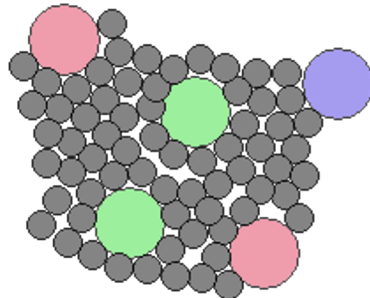
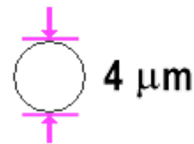
LA PHYSIOLOGIE DE LA VISION

Le centre dense de la rétine s'appelle
la fovéa

Les cônes y sont plus denses qu'à la *périphérie*



1.35 mm from retina center



8 mm from retina center

LA THÉORIE TRISTIMULUS DE LA VISION DES COULEURS

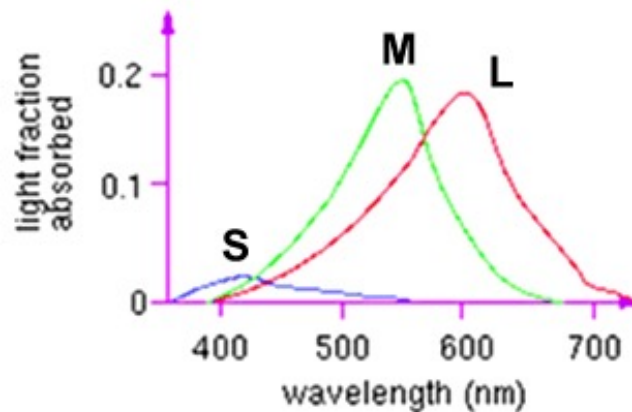
Alors même que les lumières peuvent avoir
un spectre très complexe,

il a été déterminé empiriquement que
les couleurs peuvent être décrits par
3 primaires seulement

LA TRICROMIE

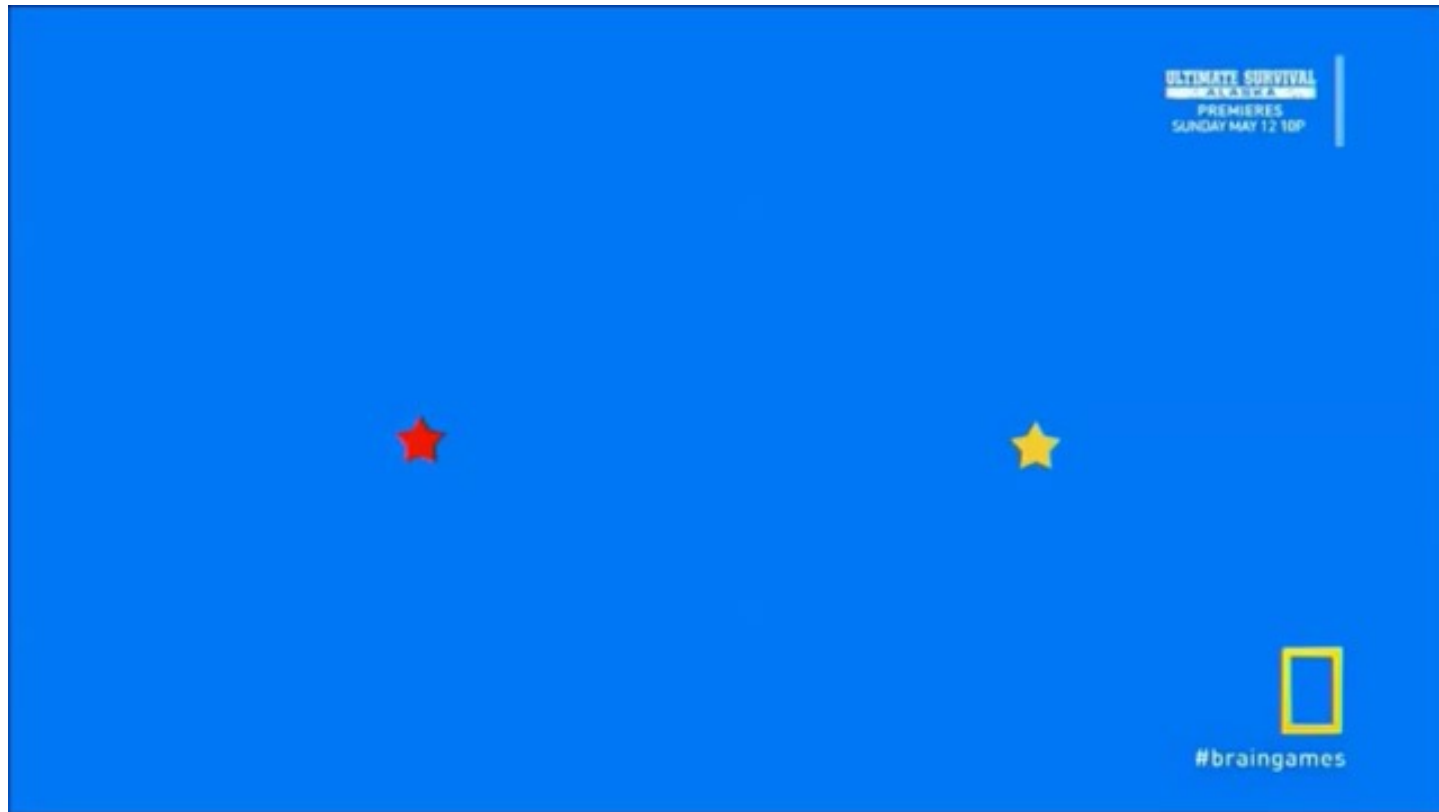
Trois types de cônes

- L ou R, plus sensible à la lumière rouge (610 nm)
- M ou G, plus sensible à la lumière verte (560 nm)
- S ou B, plus sensible à la lumière bleue (430 nm)



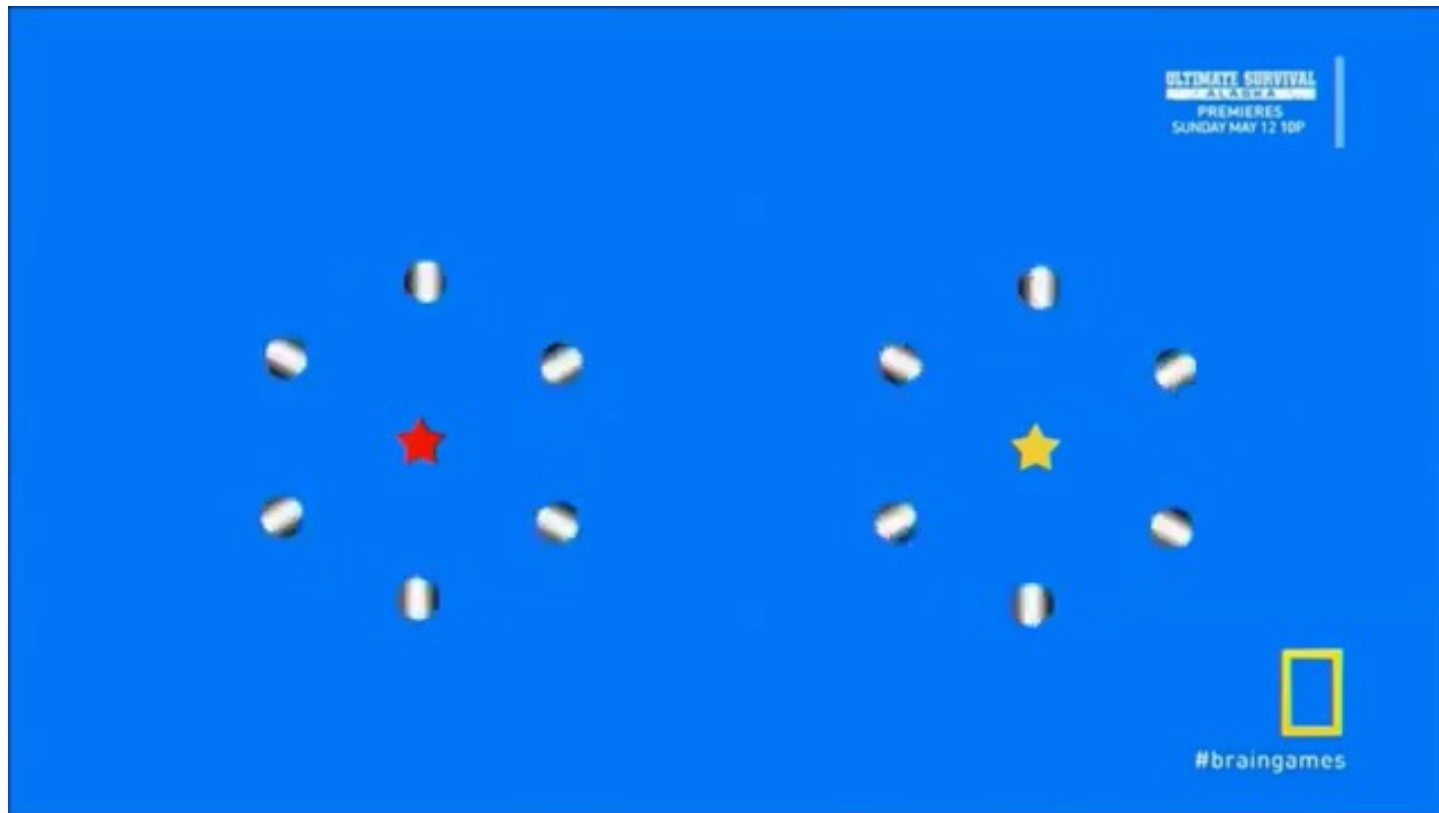
Le daltonisme = type(s) de cônes manque(nt)

VISION PÉRIPHÉRIQUE



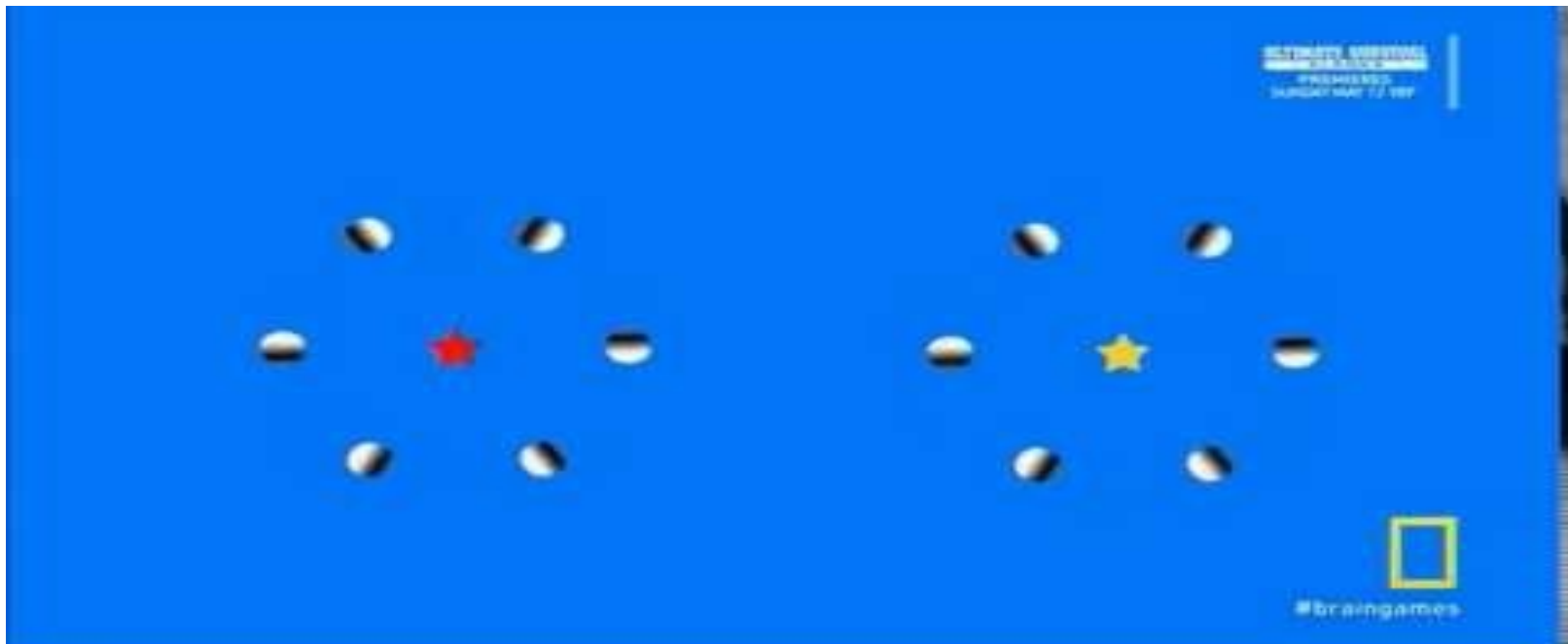
<https://www.youtube.com/watch?v=YJUAtgrpHiY>

VISION PÉRIPHÉRIQUE



<https://www.youtube.com/watch?v=YJUAtgrpHiY>

VISION PÉRIPHÉRIQUE



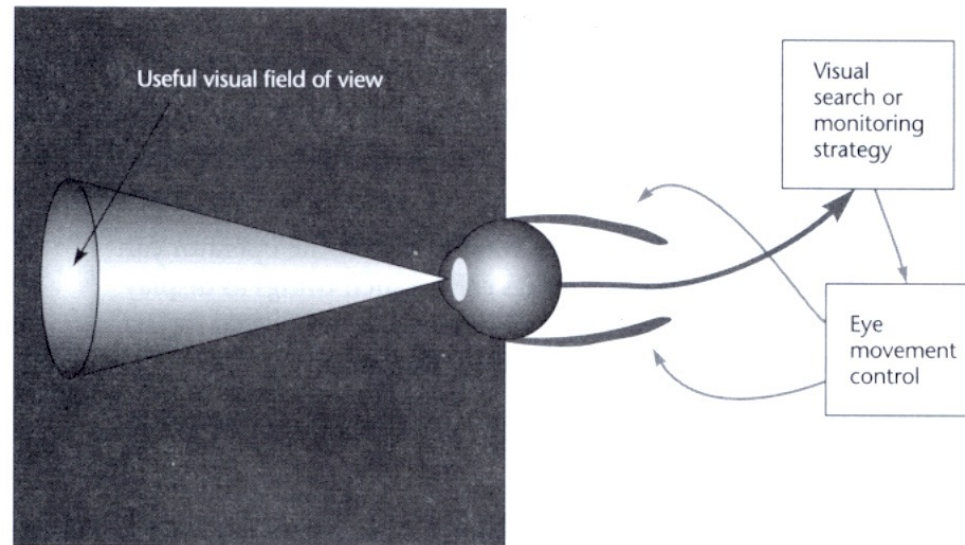
<https://www.youtube.com/watch?v=YJUAtgrpHiY>

CHAMP VISUEL UTILE

Varie avec la tâche (p.e., lecture)

Faible densité de caractères: 15° max.

Haute densité de caractères: 1° - 4°



MOUVEMENT DES YEUX

*Pour percevoir, nos yeux sont constamment
en mouvement...
mais pas de manière continue*

Saccades

Repositionnement de la fovéa
Relocalisation balistique du point de fixation
Durée: 10 - 100 ms (~ 30 ms moyen)
Vitesse: 400° - 800° par seconde
Perception très réduite

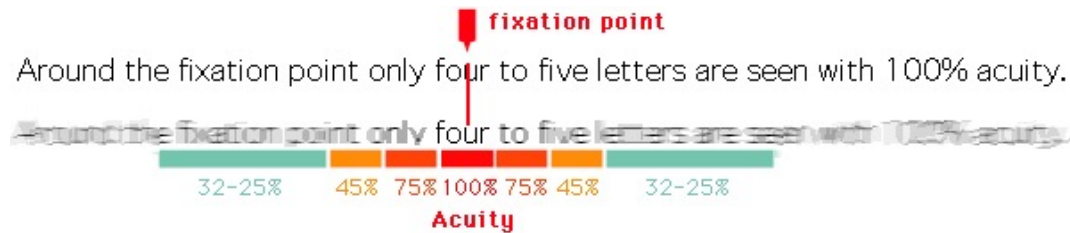
Fixations

Se reposer sur un point
Temps entre les saccades
Durée: 150 ms - 600 ms

Repartition

90% fixations, 10% saccades

IMPLICATIONS POUR LA PERCEPTION - LECTURE



fixation \approx 230 ms, saccade \approx 30 ms

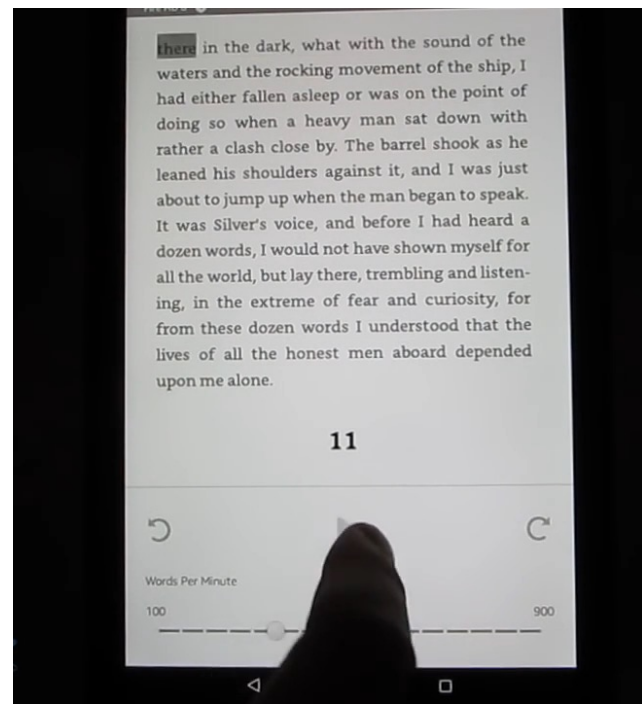
$\rightarrow \approx 250$ ms pour 12 lettres

$$12 \frac{\text{lettres}}{\text{cycle}} \rightarrow 48 \frac{\text{lettres}}{\text{sec}}$$

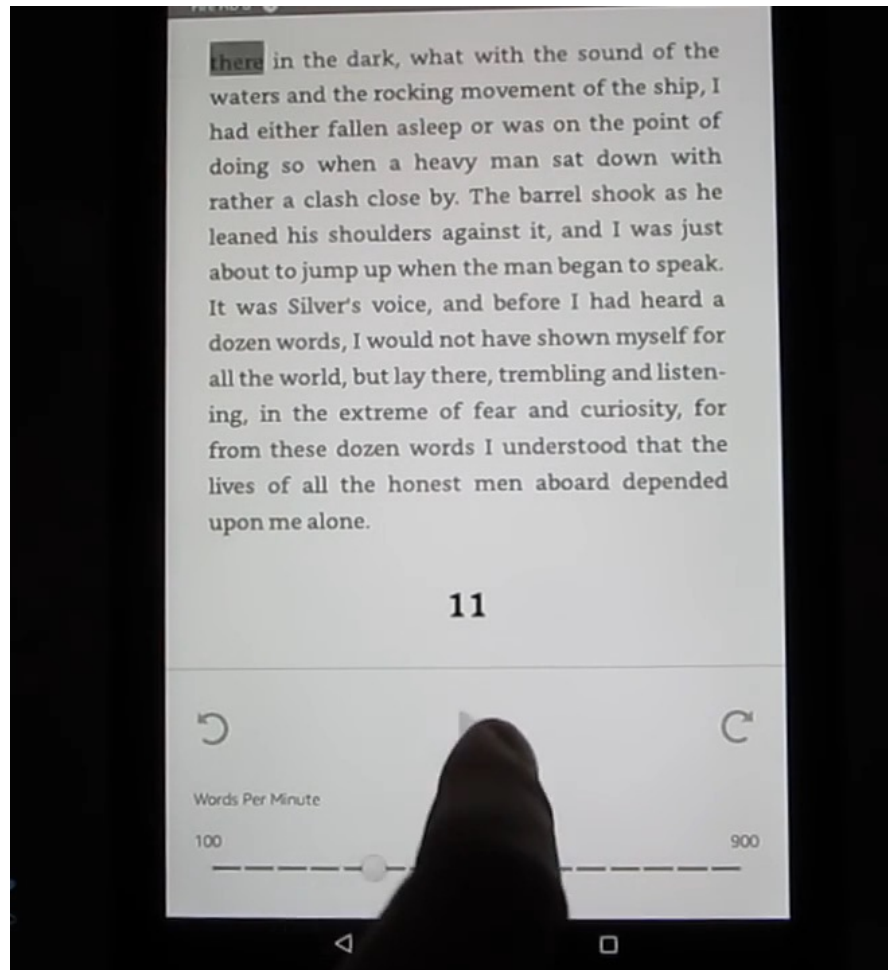
$$5 \frac{\text{lettres}}{\text{mot}} \rightarrow \approx 600 \frac{\text{mots}}{\text{min}}$$

IMPLICATIONS POUR LA PERCEPTION – LECTURE

Exemple: Word Runner d'Amazon



IMPLICATIONS POUR LA PERCEPTION – LECTURE



FIXATIONS ET SACCADES PENDANT LA LECTURE

DANS, KÖN OCH JAGPROJEKT

På jakt efter ungdomars kroppsspråk och den "synkretiska dansen", en sammansmältning av olika kulturars dans, har jag i mitt fältarbete under hösten rört mig på olika arenor inom skolans värld. Nordiska, afrikanska, syd- och östeuropeiska ungdomar gör sina röster hörda genom sång, musik, skrik, skratt och gestaltar känslor och uttryck med hjälp av kroppsspråk och dans.

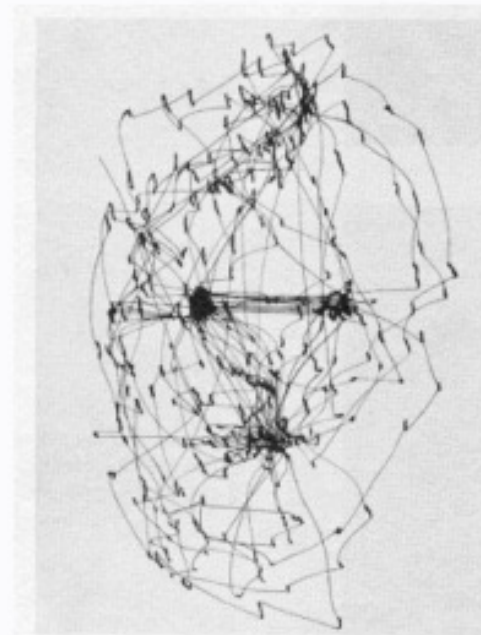
Den individuella estetiken framträder i kläder, frisyrer och symboliska tecken som förstärker ungdomarnas "jagprojekt" där också den egna stilen i kroppsrörelserna spelar en betydande roll i identitetsprövningen. Upphållsrummet fungerar som offentlig arena där ungdomarna spelar upp sina performanceliknande kroppsspråk.

READING

Selon une étude de l'Université de Cambridge, l'ordre des lettres dans un mot n'a pas d'importance, la seule chose importante est que la première et la dernière soit à la bonne place. Le reste peut être dans un désordre total et vous pouvez toujours lire sans problème. C'est parce que le cerveau humain ne lit pas chaque lettre elle-même mais le mot comme un tout.

SACCADES SUR LES VISAGES

Pour les visages: c'est les yeux et la bouche
qui sont les plus importante

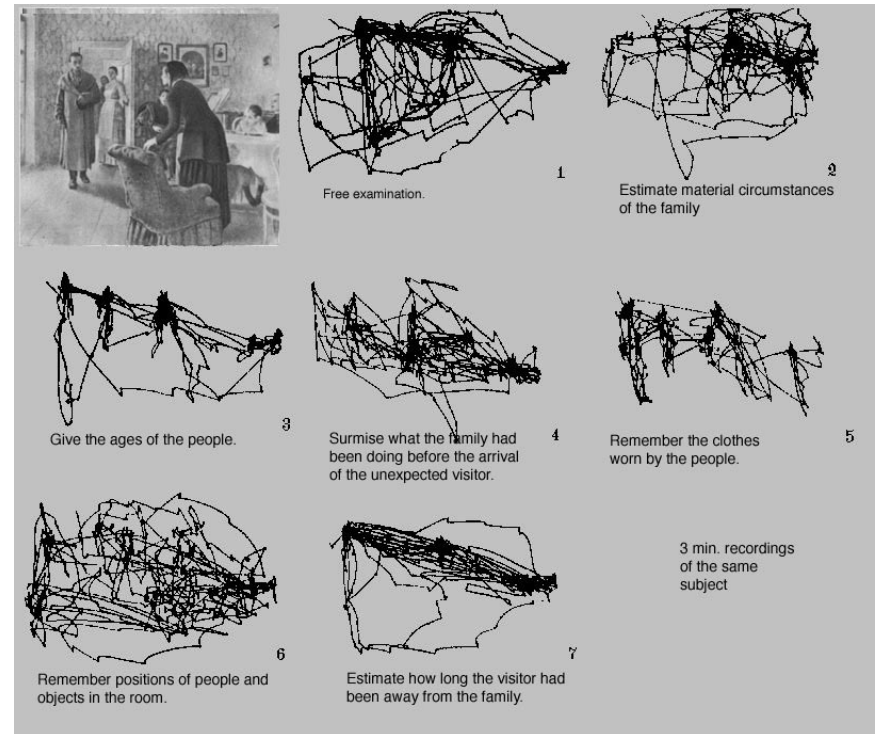
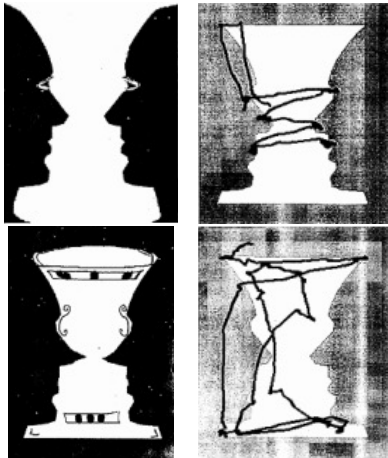


Source: http://www.paed.uni-muenchen.de/~deubel/Motorik/Integrat_web/ppframe.htm

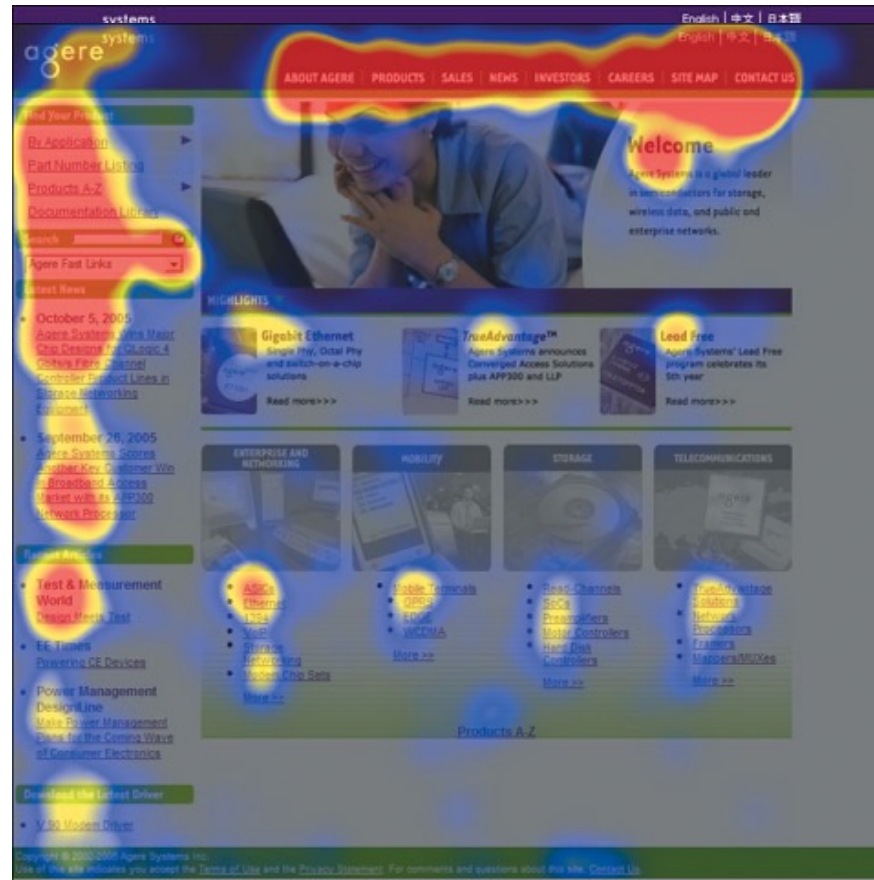
MOUVEMENT DES YEUX

Dépendance du contexte des mouvements du regard:

- Connaissance anticipée
- Etat mentale
- Tâche
- Préd disposition



MOUVEMENT DES YEUX – SITES WEB



CONCEPTION TROMPEUSE

hello there! [Sign in](#), English (Change?) skype. Take a deep breath

Home Download **Call phones** Shop Share Help

Overview

What's free, what's not?

Ways to pay

SkypeOut

SkypeIn

Skype Voicemail

Skype SMS

Skype Prima Beta

Call forwarding

Skype Zones BETA

Accessories guide

Personalise Skype

Skype Control panel

What is free and what costs you a little money

Free features

- Calling other people on Skype
- Video calls on Skype
- One-to-one and group chats
- Conference calls with up to nine people
- Forwarding calls to other Skype Names

Paid features

Show prices in and exclude VAT.

Skype Unlimited - 12 months of unlimited calls to any phone within the US and Canada for just US\$29.95. [Get Skype Unlimited](#)

Calls to international phones at low, per-minute rates. [Buy Skype Credit to start calling or view all rates](#)

Receive calls from phones with SkypeIn (comes with free Skype Voicemail). [Buy 3 months - \\$ 12](#)
[Buy 12 months - \\$ 38](#)

Send and receive voicemails. [Buy 3 months - \\$ 6](#)
[Buy 12 months for \\$ 20](#)

Forward calls to phones at Skype calling rates. [Buy Skype Credit](#)

Send SMS messages from Skype from \$ 0,047. [Buy Skype Credit](#)
[See full rates list](#)

Cool features that cost a little

Ringtones	From \$ 1.20
Pictures for your Skype profile	\$ 1.20
Gift certificates	From \$ 25
Headsets, webcams and more	From \$ 10

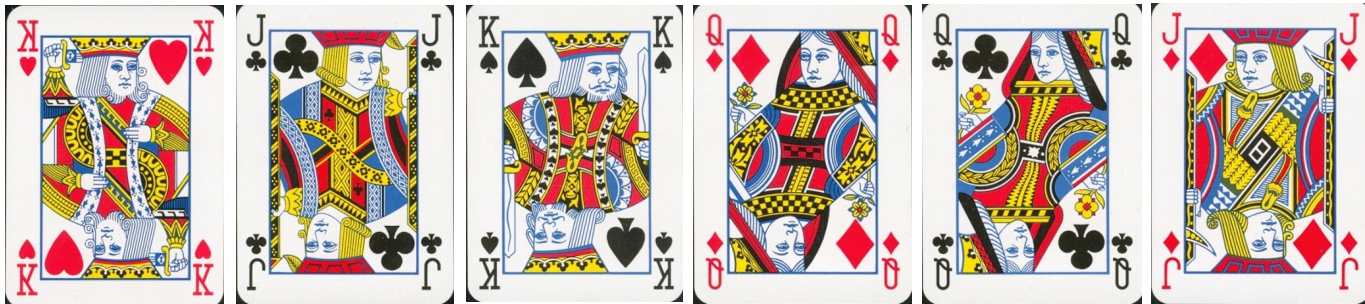
Learn about the different [ways to buy](#).

L'attention



UN TOUR DE MAGIE

Choisissez une carte parmi les six cartes ci-dessous:



Concentrez-vous sur juste cette carte!

UN TOUR DE MAGIE

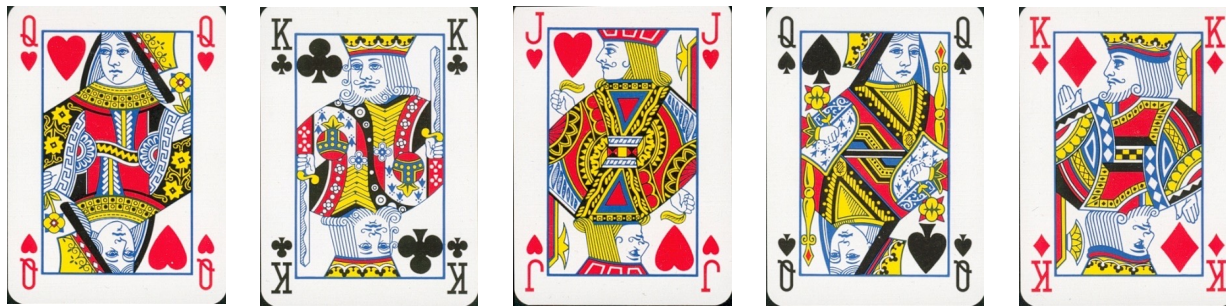
J'ai mélangé les cartes et enlevé celui que
je pense était la votre.



Pouvez-vous encore vous souvenir de
votre carte?

UN TOUR DE MAGIE

Voici les cinq cartes restantes, est-ce que
votre carte est là?

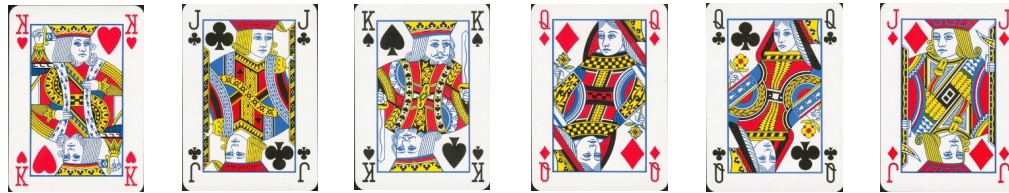


Ai-je deviné juste?
Suis-je un magicien?
Ou est-ce une illusion?

UN TOUR DE MAGIE

Vous venez de vivre la ***cécité involontaire***
Aucune des six cartes d'origine n'a été affichée!

Cartes
originales



Cartes
mélangées



CÉCITÉ INATTENTIONNELLE

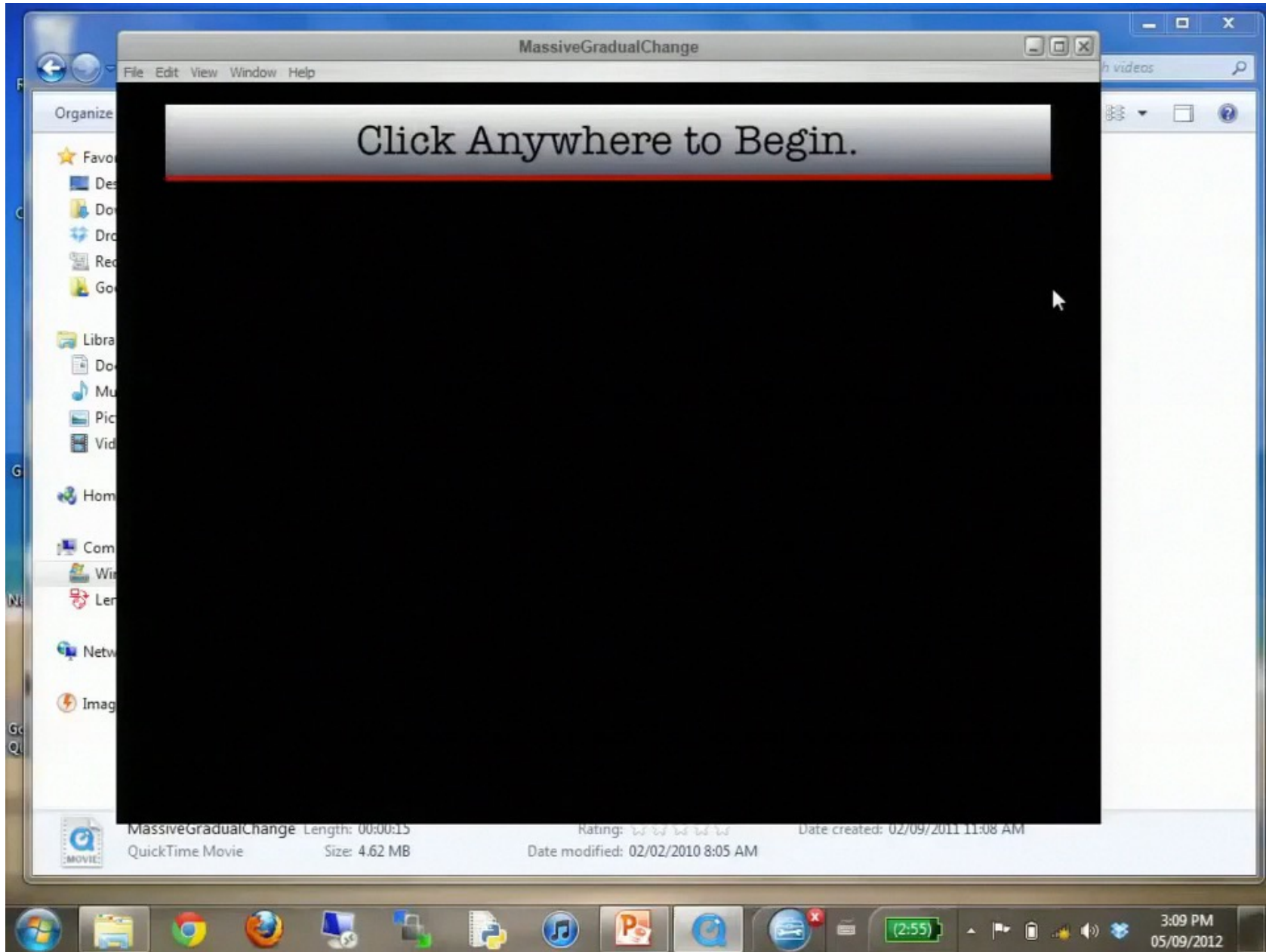


CÉCITÉ INATTENTIONNELLE



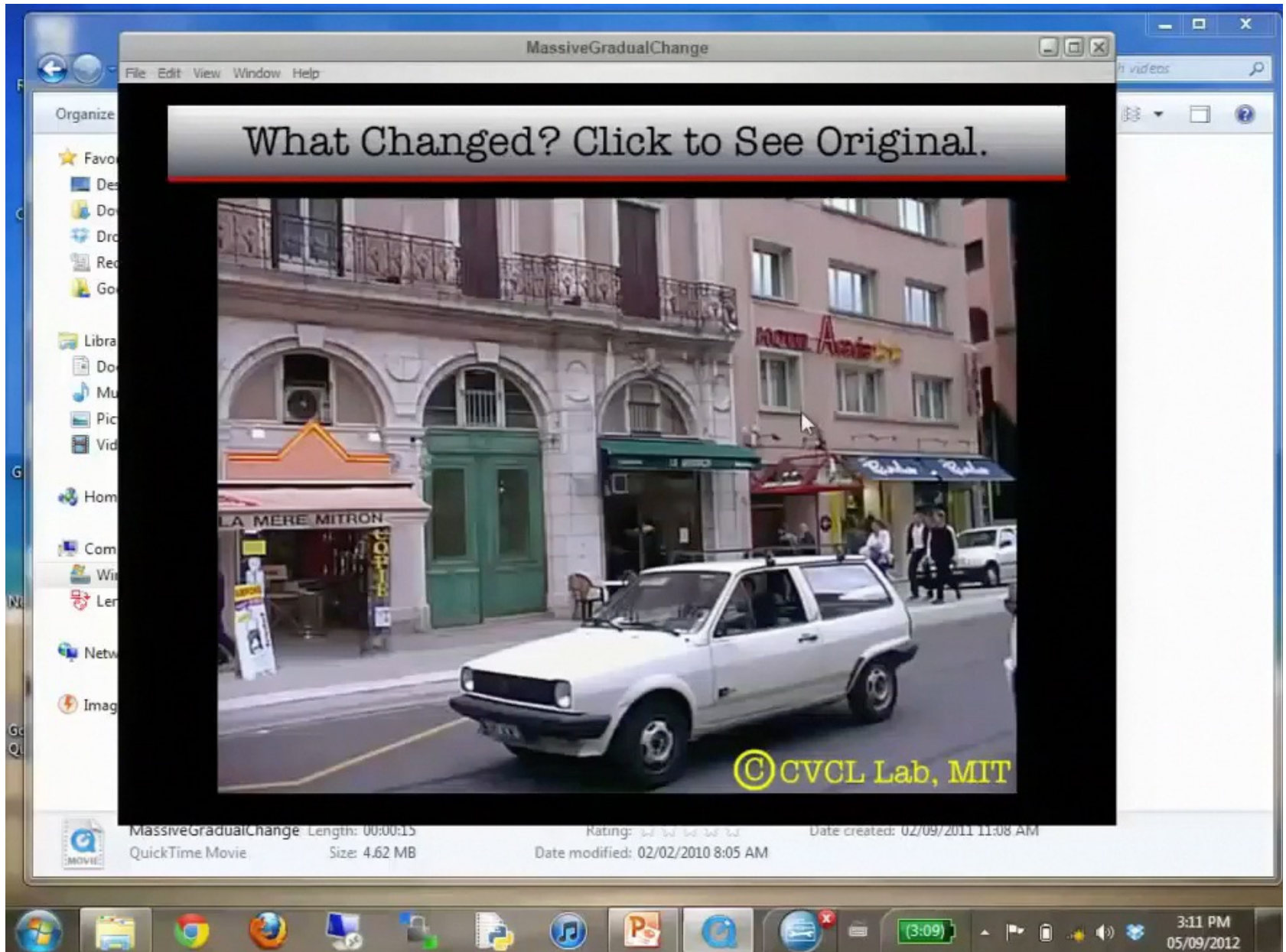
ATTENTION





Click Anywhere to Begin.

MassiveGradualChange Length: 00:00:15 Rating: [5 stars] Date created: 02/09/2011 11:08 AM
QuickTime Movie Size: 4.62 MB Date modified: 02/02/2010 8:05 AM



What Changed? Click to See Original.



©CVCL Lab, MIT

MassiveGradualChange Length: 00:00:15
QuickTime Movie Size: 4.62 MB

Rating: 0.0 0.0 0.0 0.0 0.0
Date modified: 02/02/2010 8:05 AM

Date created: 02/09/2011 11:08 AM

(3:09)

3:11 PM
05/09/2012

ATTENTION VISUELLE – RÉSUMÉ

- Il y a des lacunes remarquables dans notre perception
- L'interprétation humaine du champ visuel est plus restrictive/clairsemée que ne le suggère l'expérience subjective de "voir".
- La perception des objets nécessite des ressources considérables

Une attention est nécessaire pour voir le changement

- Si l'attention est ailleurs, des changements peuvent être manqués

Conduite

Emplacement et planification de la notification dans l'interface utilisateur
Ordinateur portable en classe!

L'EFFET DE STROOP

bleu

vert

violet

rouge

orange

L'EFFET DE STROOP

зеленый

оранжевый

синий

красный

фиолетовый

L'EFFET DE STROOP

зеленый

оранжевый

синий

красный

фиолетовый

La réciproque entre la compréhension et la perception
Utilisé comme test (de quoi?)