



**UNIVERSITÀ
DI TRENTO**

**Dipartimento di
Psicologia e Scienze Cognitive**



Erasmus+

Some Limitation of the Human Mind

Remo Job

Department of Psychology and Cognitive Science

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**UNIVERSITÀ
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Trentino Province video
presentation:

[https://www.youtube.com/
watch?v=2b2gJu-g3qE](https://www.youtube.com/watch?v=2b2gJu-g3qE)



Outline

Should we trust our minds?

Illusions everywhere

Are limits of the mind always negative?



The Human Mind: a powerful instrument

However, it is **not always reliable and trustable**



Several areas where the mind does not match reality:

Bodily illusions (e.g. Pinocchio illusion)

Olfactory illusions (e.g. labels effects - *xmas tree vs toilet cleaning*)

Auditory illusions (e.g. McGurk effect)

Visual Illusions

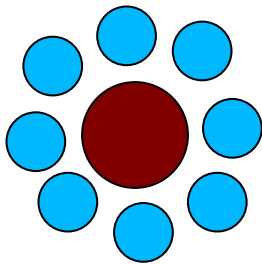
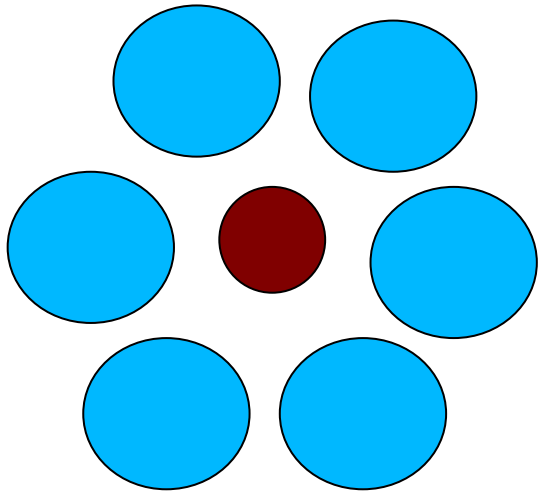
Semantic Illusions

Limits of computation

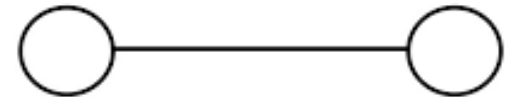
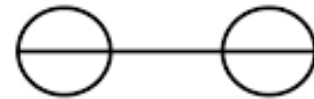
Cognitive Instabilities

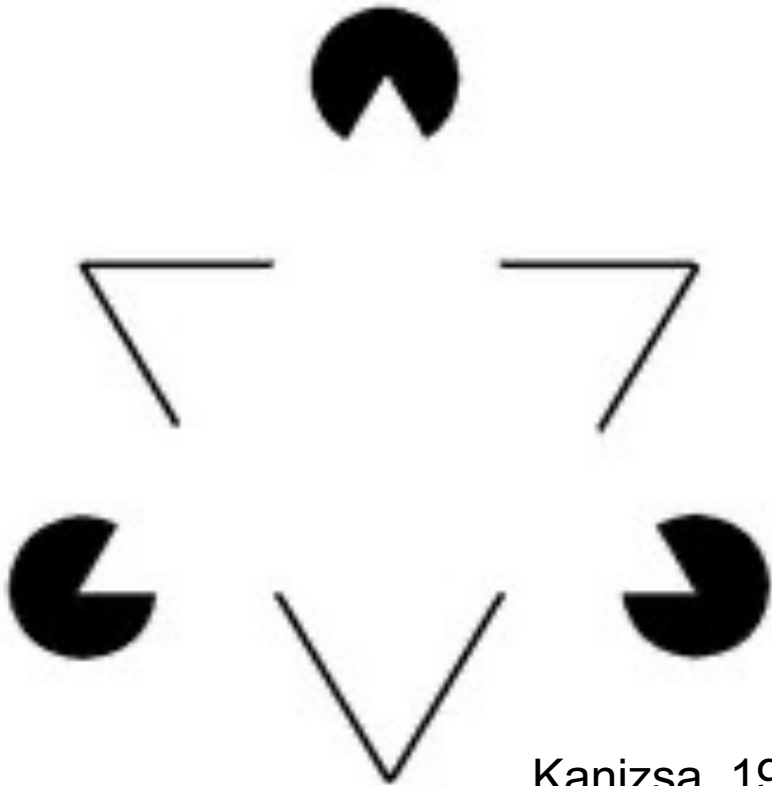
Memory Distortions

Visual/perceptual Illusions



← *What do you see?*





Kanizsa, 1955

Interplay between the organism and the environment:

← *What do you see?*

Are visual illusions universal?

Apparently no.

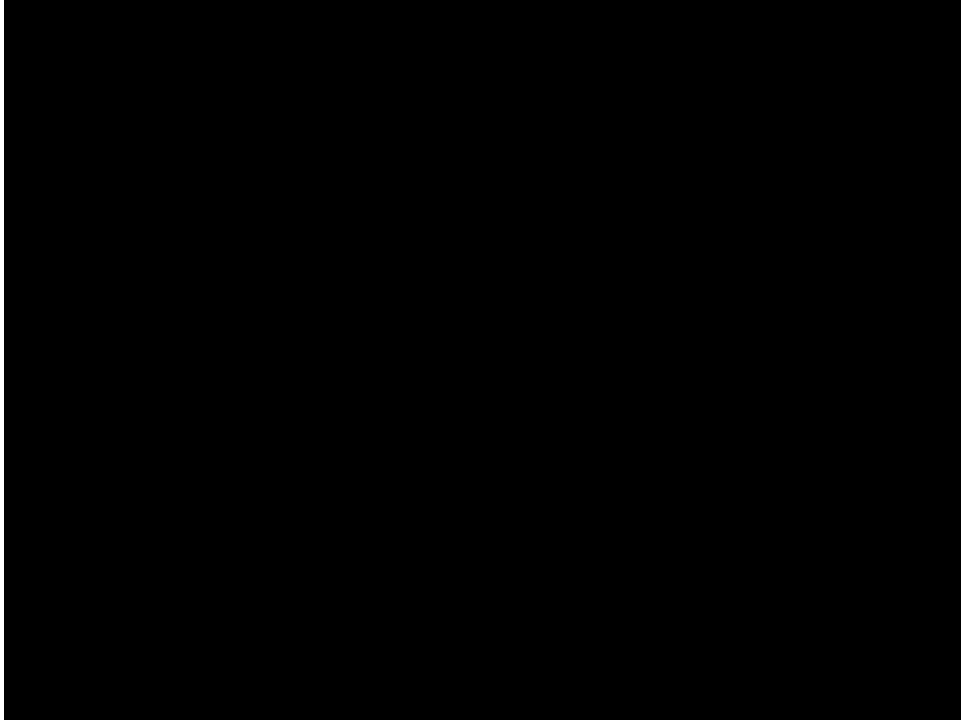
Segall et al. has shown «cross-cultural differences in visual inferencing systems learned in response to different ecological and cultural factors», in particular the prevalence of rectangularity in the visual environment inkling to interpret 2-D angles as representative of 3-D angles.

M.H. Segall, D.T. Campbell, M.J.Herskovits. *The influence of culture on visual perception*. Bobbs Merrill, Indianapolis, 1966. See also Caparos et al., *Cognition*, 2012.

Are visual illusions universal?

Group	<i>N</i>	PSE (%)	Mean
<i>Müller-Lyer illusion</i>			
<i>Evanstonians</i>	188	20.3	5.36
<i>N. U. students*</i>	27	16.2	5.00
<i>S. A. Europeans*</i>	36	13.5	4.33
Dahomeans†	40	11.9	4.23
Senegalese	125	12.2	4.18
Ijaw School†	54	6.6	3.67
Zulu	35	11.2	3.66
Toro	86	10.3	3.56
Banyankole	224	9.3	3.45
Fang	85	6.2	3.28
Ijaw	84	6.5	3.16
Songe	89	6.2	3.07
Hanunoo	49	7.7	3.00
Bete	75	3.2	2.72
Suku	61	2.8	2.69
Bushmen*	36	1.7	2.28
S. A. mineboys*	60	1.4	2.23

Segall et al. Science,
1963, 769-771



Change Blindness



So, we see things that are not there, and we do not see things that are there.

This may be perplexing....



Semantic Illusions (Erikson & Mattson, 1981)

“In which museum is Michelangelo’s portrait of the enigmatically smiling Mona Lisa?”

“What is the nationality of Thomas Edison, the inventor of the telephone?”

People usually respond “The Louvre” to the first question and “American” to the second question.

Semantic Illusions

The results are quite robust (data from Büttner, 2007):

Statements 31.3%

The famous ship Titanic tragically sank in the Pacific Ocean after hitting an iceberg “True” or “False”

Questions 47.5%

What famous ship tragically sank in the Pacific Ocean after hitting an iceberg? “Titanic” or “Bismarck”

Semantic Illusions

Several factors:

- *Focus* (Brédart & Docquier, 1989)
- *Semantic similarity* (van Oostendorp & de Mul, 1990)
- *Task demands* (accuracy vs. speed; van Jaarseveld et al., 1997)

The partial matching hypothesis (Reder & Kusbit, 1991): people accept target words that are similar enough to complete processing

Limits of computing

Multiplications

$7 \times 5 =$

$12 \times 10 =$

$12 \times 13 =$

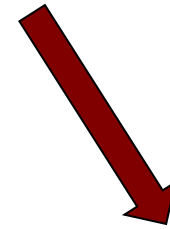
$127 \times 385 =$

$VI \times XL =$

$IX \times XV =$

$\text{twelve} \times \text{thirteen} =$

Effects of format, numerical quantities,
familiarity...



Transcoding

Mental Working Space

Strategies

7 x 5 : Rote learning

12 x 10 : 
Online computation

12 x 13 : 

127 x 385 : Written-supported computation

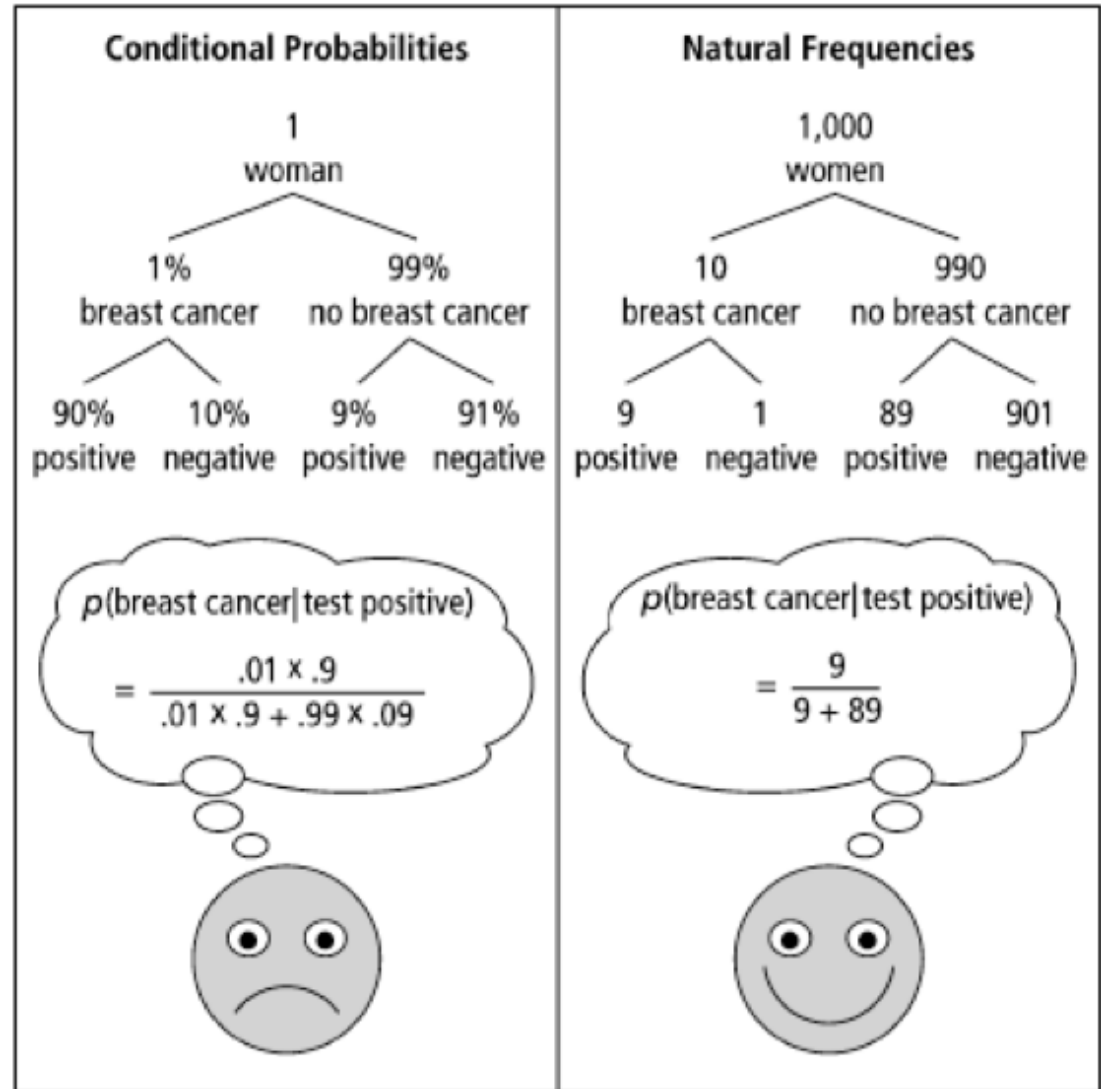
VII x V : 
Number-to-Number transcoding

IX x XV : 

twelve x thirteen : Verbal-to-Number transcoding

Limits of computing: *Probabilities vs Frequencies*

Conditional probabilities are cognitively more difficult because they are normalized to base rates and must be multiplied by the base rates.



Limits of computing: *Cognitive representations*

A farmer buys a horse for \$60, sells it for \$70, buys it back for \$80, and sells it again for \$90.

Many people says that the farmer has made a \$10 profit.

(Myers, 2002, p. 108).

Limits of computing

The limits of computing concern both the representation and the processing of information.

At the representational level, some formats are more easily and readily represented, possibly due to familiarity and to lower (combinatorial) complexity.

At the processing level, some types of information burden memory and processing mechanisms more than other types of information.

Cognitive Instabilities

FRAMING EFFECT

Statement with the **same content** but with a **different wording** have a **different impact** on judgments and decisions.

People behave differently when the same problem is described
underlying

positive aspects

vs.

negative aspects

of the options among which to choose

(Tversky & Kahneman, 1981)

Original Study: Tversky & Kahneman, 1981

Asian Disease Problem

Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people.

Two alternative programs to combat the disease have been proposed:

Program A: 200 will be saved

**Program B: 1/3 probability that all people will be saved &
2/3 that no people will be saved**

Original Study: Tversky & Kahneman, 1981

Asian Disease Problem

Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people.

Two alternative programs to combat the disease have been proposed:

Program C: 400 will die

**Program D: 1/3 probability that nobody will die &
2/3 probability that all people will die**

Framing Effect

Result

Program A

200 people will be saved

Program B

1/3 probability all people will be saved &
2/3 probability no people will be saved



A: 72%
B: 28%

Program C

400 people will die

Program D

1/3 probability nobody will die &
2/3 probability all people will die



C: 22%
D: 78%

Framing Effect

Program A differs from program C because

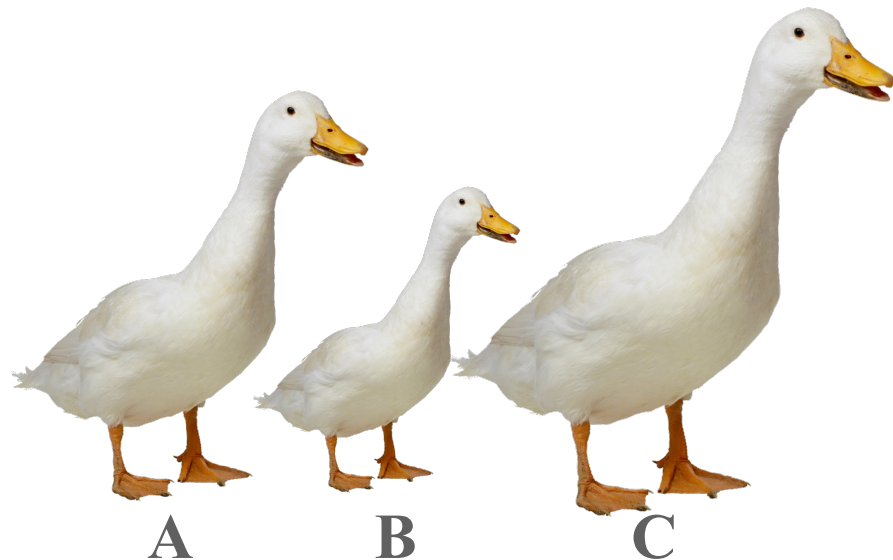
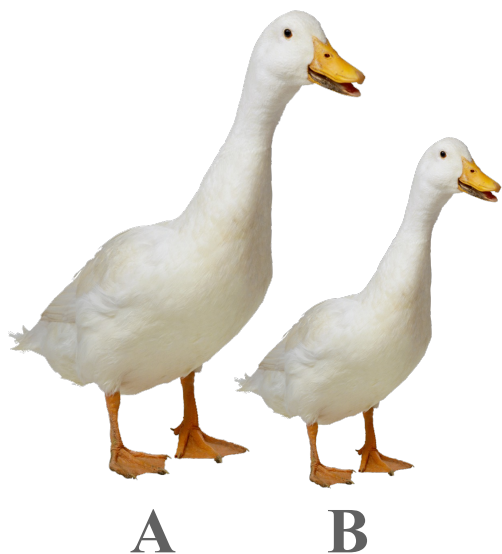
in A the words convey a positive meaning, i.e. the emphasis is *on saving lives*.

in C the words convey a negative meaning, i.e. the emphasis is *on people dying*.

(IN) CONSISTENT PREFERENCES

Regularity Principle

Is A bigger than B?



people's propensity to accept xenotransplant (transplant of other animals' organs in humans)

- **Condition with 2-choice alternative:**
 - Pork liver
 - Human liver

- **Condition with 3-choice alternative:**
 - Pork liver
 - Human liver
 - Dog Liver

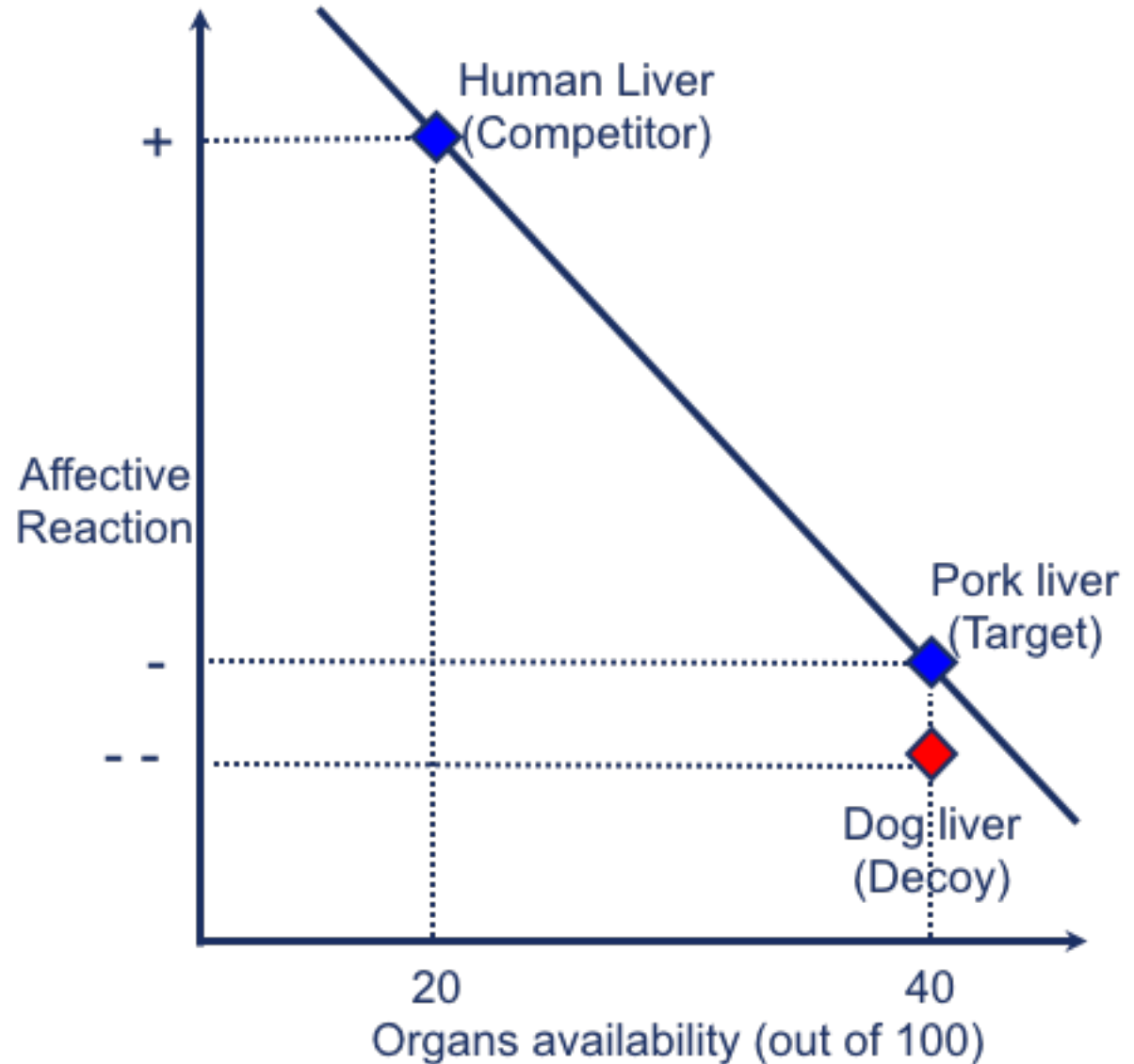
Rubaltelli E., Burra P., et al. (2008). Strengthening acceptance for xenotransplantation: The case of the attraction effect. *Xenotransplantation*, 15, 159-163.

ATTRACTION EFFECT

Two Factors:

Liver Availability

Liver Attractiveness



ATTRACTION EFFECT

2-set condition:

97.5 of choices for human liver in spite its availability is half of that of the pork liver

3-set condition:

choices of pork liver increase from 2.5% to 25.6%

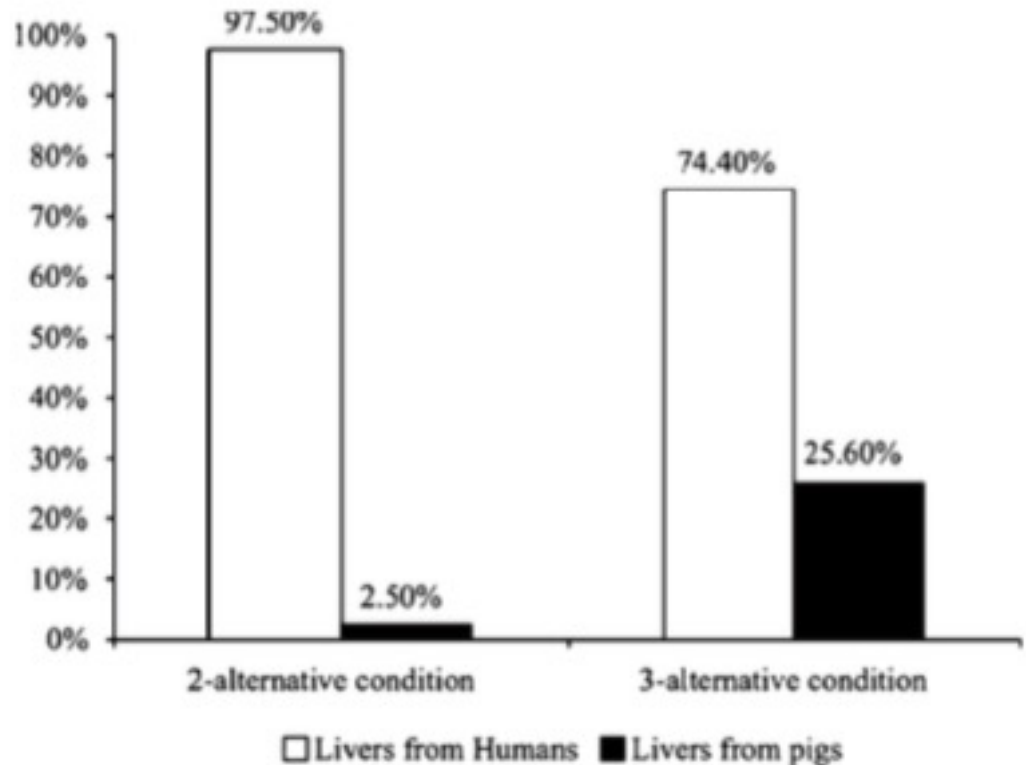


Fig. 2. Frequency of choice for livers from human and genetically modified pig donors in the two conditions.

ATTRACTION EFFECT

What differs between the 2-set choice and the 3-set choice?

The number of alternatives but, crucially, the relationship between the alternatives in terms of *affective reactions*.

Table 2. Ratings of how attractive participants felt each type of liver donor (n = 41)

Livers from	Mean rating	Standard deviation
Humans	5.76	0.92
Pigs	2.22	2.12
Monkeys	1.51	2.28
Dogs	1.17	1.86
Sheep	1.02	1.93

The table shows mean ratings for five liver donor types. A 'sig' marker is placed to the left of the mean ratings for Humans (5.76) and Pigs (2.22), with two blue arrows pointing from the 'sig' to each of these values. Another 'sig' marker is placed to the right of the mean ratings for Monkeys (1.51) and Dogs (1.17), with two blue arrows pointing from the 'sig' to each of these values.

ATTRACTION EFFECT

So, the difference between the 2-set and 3-set conditions is also in term of type of alternatives.

Pig liver is considered less attractive than human liver but more attractive than dog liver. Thus pig liver is “affectively” **dominated** by human liver but **dominates** dog liver.

In the 3-set condition, adding the **dominated** alternative (dog livers) increase the choice of the **dominating** alternative (pig liver).

Memory Distortions

Memory Distortions

Post-event, inducing information (*Loftus, 1970*)

Example

1. **Video of a car accident;**
2. **Questions** (different for different groups of participants);
3. **Memory test**



Memory Distortions

The questions are asked *after* viewing the video but they affect the memory test: participants respond in a way that is consistent with the **linguistic cues**.

About how fast were the cars going when they...?

Smashed	40.8 mph
Collided	39.3 mph
Bumped	38.1 mph
Hit	34.0 mph
Contacted	31.8 mph



Memory

The way questions are asked introduce new information which changes the memory of the video.

Consider these two types of question:

Did you see **the** broken streetlight?

Did you see **a** broken streetlight?



The question with «**the**» produces a higher number of «yes» responses (which are wrong!)

A Miniature Experiment Involving Language and Memory

I will present you a list of words. Please try to remember them. At the end of the presentation – NOT during presentation - please write down all the words you remember. We will then perform a simple recognition test.

Verbal Memory Experiment

~~XXXXXXXXXX~~

Immediate Free Recall



Recognition Test + Confidence

~~CREATION~~

Sure YES Maybe Sure NO

List of items

KẸO	Candy
CHUA	Sour
ĐƯỜNG	Sugar
VỊ ĐẮNG	Bitter
TỐT	Good
NẾM	Taste
RĂNG	Tooth
ĐẸP	Nice
MẬT ONG	Honey
RƯỢU VANG	Bubble wine
SÔ CÔ LA	Chocolate
TRÁI TIM	Heart
KEM	Ice Cream
ĂN	Eat
BÁNH	Cake

Creating False Memories: Remembering Words Not Presented in Lists

Henry L. Roediger III and Kathleen B. McDermott
Rice University

Two experiments (modeled after J. Deese's 1959 study) revealed remarkable levels of false recall and false recognition in a list learning paradigm. In Experiment 1, subjects studied lists of 12 words (e.g., *bed, rest, awake*); each list was composed of associates of 1 nonpresented word (e.g., *sleep*). On immediate free recall tests, the nonpresented associates were recalled 40% of the time and were later recognized with high confidence. In Experiment 2, a false recall rate of 55% was obtained with an expanded set of lists, and on a later recognition test, subjects produced false alarms to these items at a rate comparable to the hit rate. The act of recall enhanced later remembering of both studied and nonstudied material. The results reveal a powerful illusion of memory: People remember events that never happened.

Table 1
Recognition Results for Experiment 1: The Proportion of Items Classified As Sure Old (a Rating of 4), Probably Old (3), Probably New (2), or Sure New (1) and the Mean Ratings of Items As a Function of Study Status

Study status	Old		New		Mean rating
	4	3	2	1	
Studied	.75	.11	.09	.05	3.6
Nonstudied					
Unrelated lure	.00	.02	.18	.80	1.2
Weakly related lure	.04	.17	.35	.44	1.8
Critical lure	.58	.26	.08	.08	3.3

Several limiting factors

Evolution:

building on existing structures, not necessarily designed for the functions they presently support. *e.g. Reading and writing*

Processing:

- interplay between the organism and the environment
- projecting a 3-D world into 2-D retinal representations
- un-focused attention to aspects of the environment
- exploiting available, sub-optimal functions to adapt to the environment *e.g. Episodic memory (of the past) to predict the future*
- working memory limitations

Can limits be ... positive?

As many other functions of the human mind, memory is, to some extent, unreliable: Some information we have been exposed to is not available later on.

Forgetting is a very common experience, even more so in some pathological conditions.

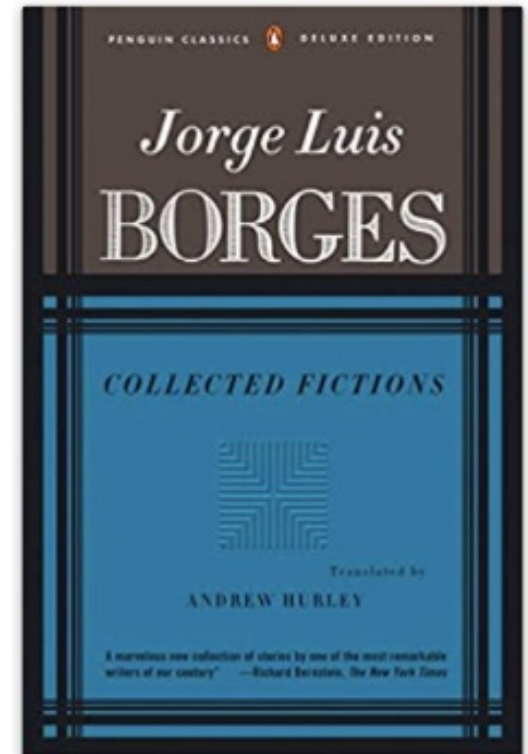
Forgetting may be seen as a limit of memory... or maybe not: It may actually be a *productive* feature memory

Let's consider this issue by looking at literature

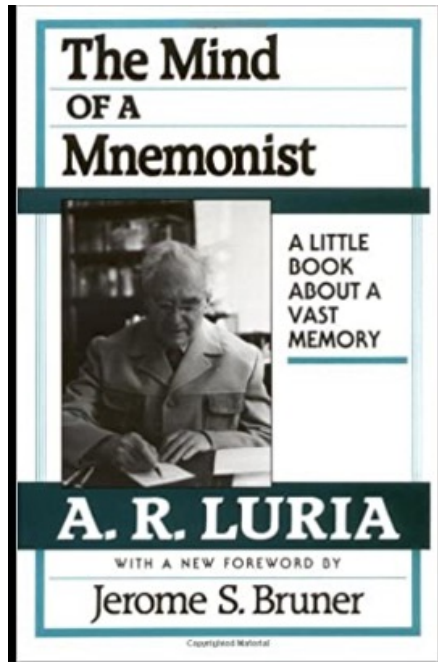
Jorge Luis Borges

Funes el memorioso (Funes the Memorious) *Ficciones*, 1944
(*English Translation*, 1962, Grove Press)

He remembered «the shape of clouds at all given moments, as well as the associated perceptions (muscular, thermal, etc.) of each moment. Funes has an immediate intuition of the mane of a horse or the form of a constantly changing flame».

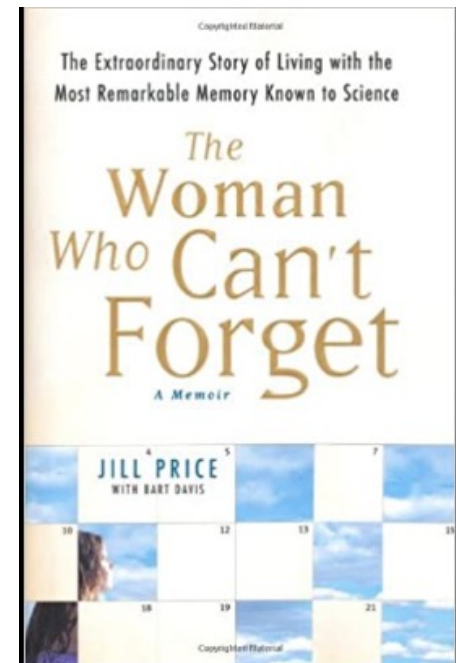


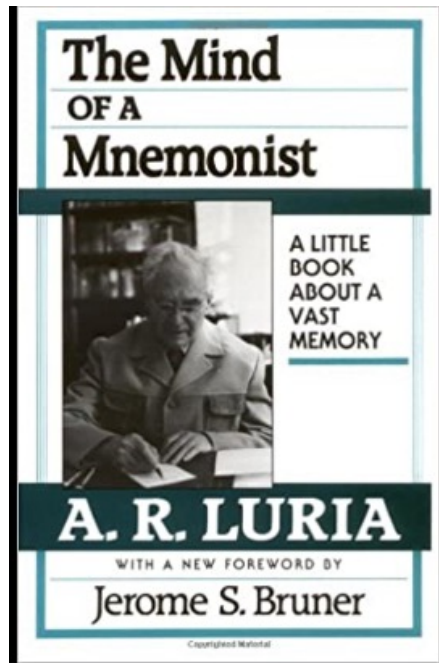
Let's consider this issue by looking at science.



A. R. Luria, 1968 *The mind of a mnemonist*.
Oxford: Basic Books.

J. Price & B. Davis, 2008 *The woman who can't forget: The extraordinary story of living with the most remarkable memory known to science - A memoir*.
New York: Free Press.





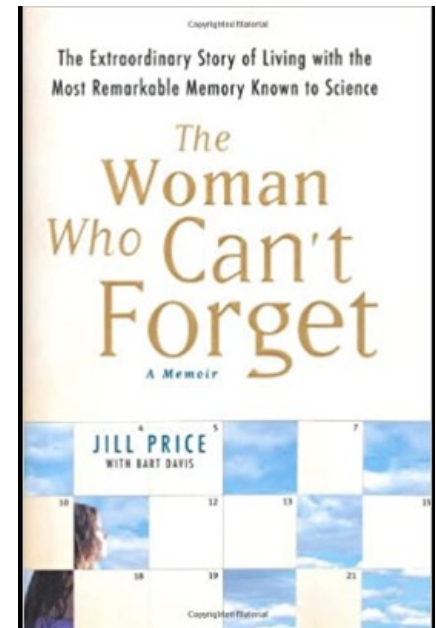
A. R. Luria, 1968 *The mind of a mnemonist*.
Oxford: Basic Books.

Once we were convinced that the capacity of S.'s memory was virtually unlimited, that he did not have to "memorize" the data presented but merely had to "register an impression," which he could "read" on a much later date (in this account we will cite instances of series he reproduced ten or even sixteen years after the original presentation), we naturally lost interest in trying to "measure" his memory capacity. Instead, we concentrated on precisely the reverse issue: Was it possible for him to forget? We tried to establish the instances in which S. had omitted a word from a series.

Mrs Price said: "Some memories are good and give me a warm, safe feeling. But I also recall every bad decision, insult and excruciating embarrassment. Over the years it has eaten me up. It has kind of paralysed me."

J. Price & B. Davis, 2008 *The woman who can't forget: The extraordinary story of living with the most remarkable memory known to science - A memoir.*

New York: Free Press.



Some *positive* features of the limits of the human mind

Journal of Applied Research in Memory and Cognition

journal homepage: www.elsevier.com/locate/jarmac

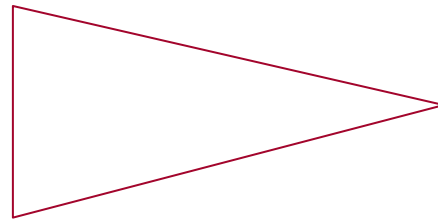
The Many Faces of Forgetting: Toward a Constructive View of
Forgetting in Everyday Life

Jonathan M. Fawcett*
Memorial University of Newfoundland, Canada

Justin C. Hulbert
Bard College, USA

What can forgetting do?

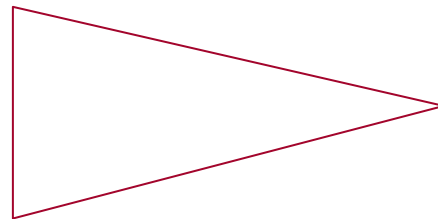
Serenity
Stability



Maintaining a
positive & coherent
self-image

Guardian

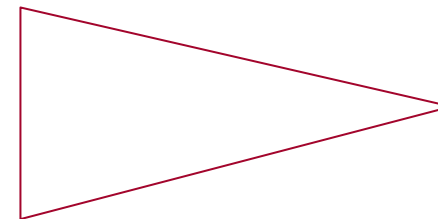
Clarity
Revision
Abstraction



Facilitating efficient
cognitive functions

Librarian

Inspiration
Rediscovery



developing a
creative and flexible
worldview

Inventor

What can forgetting do?

- allows to avoid certain emotional consequences of past events - either by making them relatively inaccessible or dulling their emotional properties; facilitates forgiveness, helping us to move past others' negative actions and motivate ourselves despite recent adversity.

Serenity

- allows us to find stability in our understanding of the world by removing details inconsistent with our self- and world-views; helps us navigate situations requiring shading past experience.

Stability

What can forgetting do?

- helps us get rid of mundane experiences, the details of which are unlikely to be important later, helping to reduce distracting clutter and maintain mental clarity.

Clarity

- allows us to update experiences and memories with new information to maximize relevance while minimizing competition.

Revision

- provides a mental digestion process through which details are lost, allowing commonalities across similar experiences to form a general knowledge base.

Abstraction

What can forgetting do?

- helps us cast off preconceptions and past fixations, allowing us to identify creative solutions to new problems.

Inspiration

- motivates us to reconnect with activities and people from our past. Nostalgia rekindles complex associations and gives them a new chance to flourish (creativity).

Rediscovery

A very last example:
Language can affect what/how we perceive things

Language effects

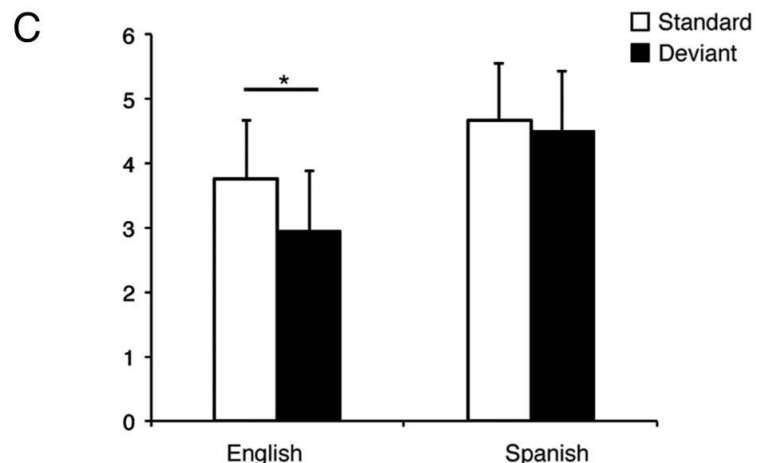
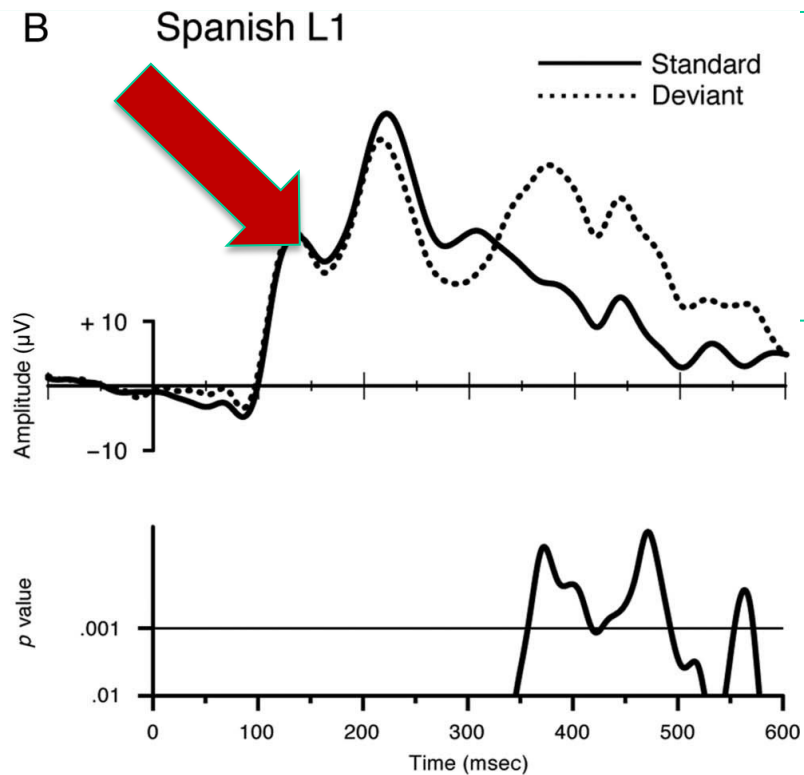
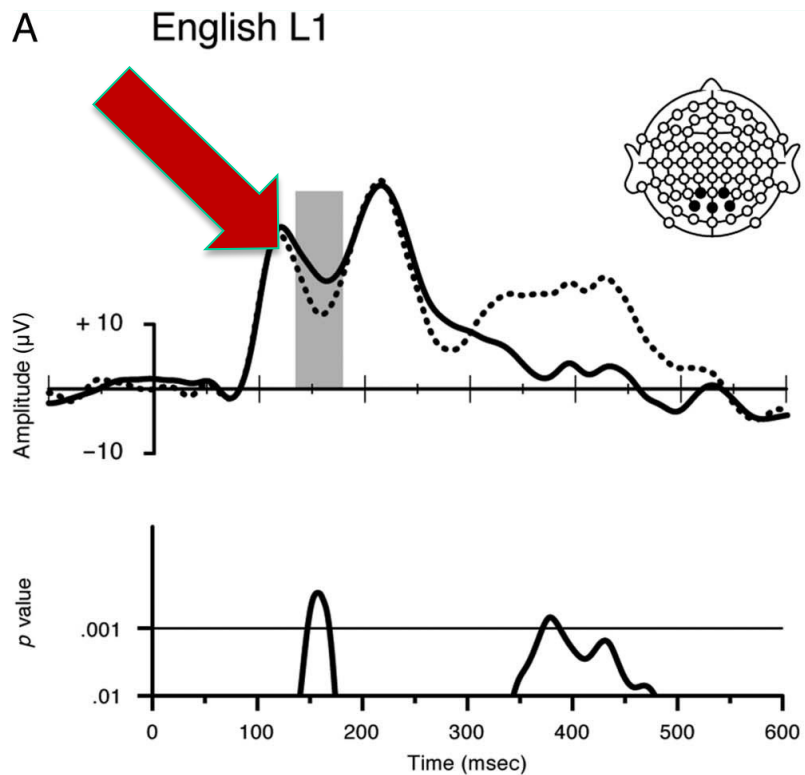
Boutonnet, Dering, Viñas-Guasch, & Thierry, 2013

Oddball: an odd element elicits a ERP wave called vMMN
(visual MisMatch Negativity)

English: **cup, mug**

Spanish: **taza**





English speakers show a vMMN, Spanish speakers do not.

Speakers of a language that does not linguistically distinguish between two elements will perceive them categorically «identical» while speakers of a language that distinguish them linguistically into two kinds of elements will perceive them as categorically different.

They will do so automatically, rapidly, and without awareness (as shown by the electrophysiological measures).

Thank you

Grazie

Cảm ơn



**UNIVERSITÀ
DI TRENTO**

**Dipartimento di
Psicologia e Scienze Cognitive**

remo.job@unitn.it