The Human Conductome:

Understanding why we make “bad” decisions

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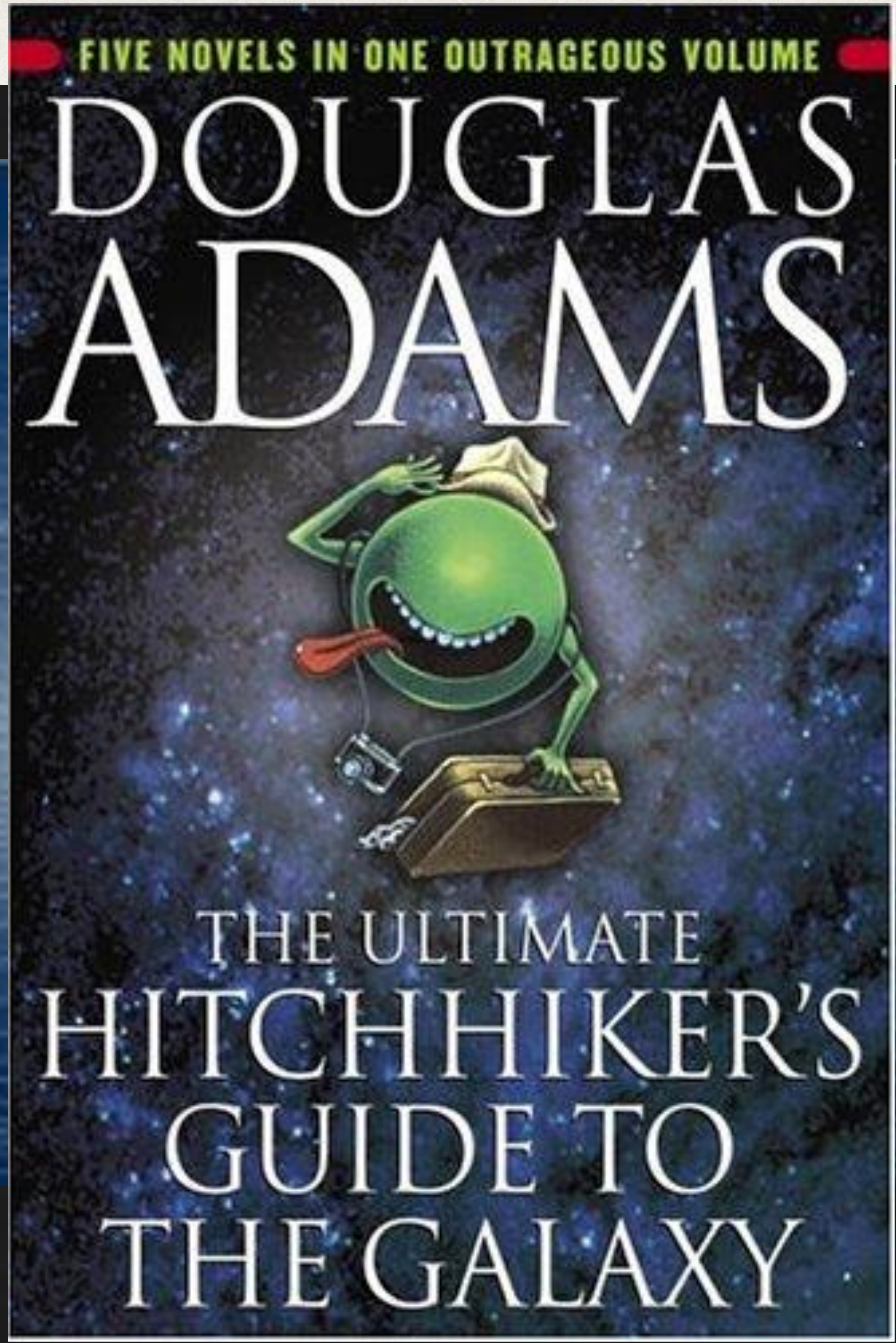
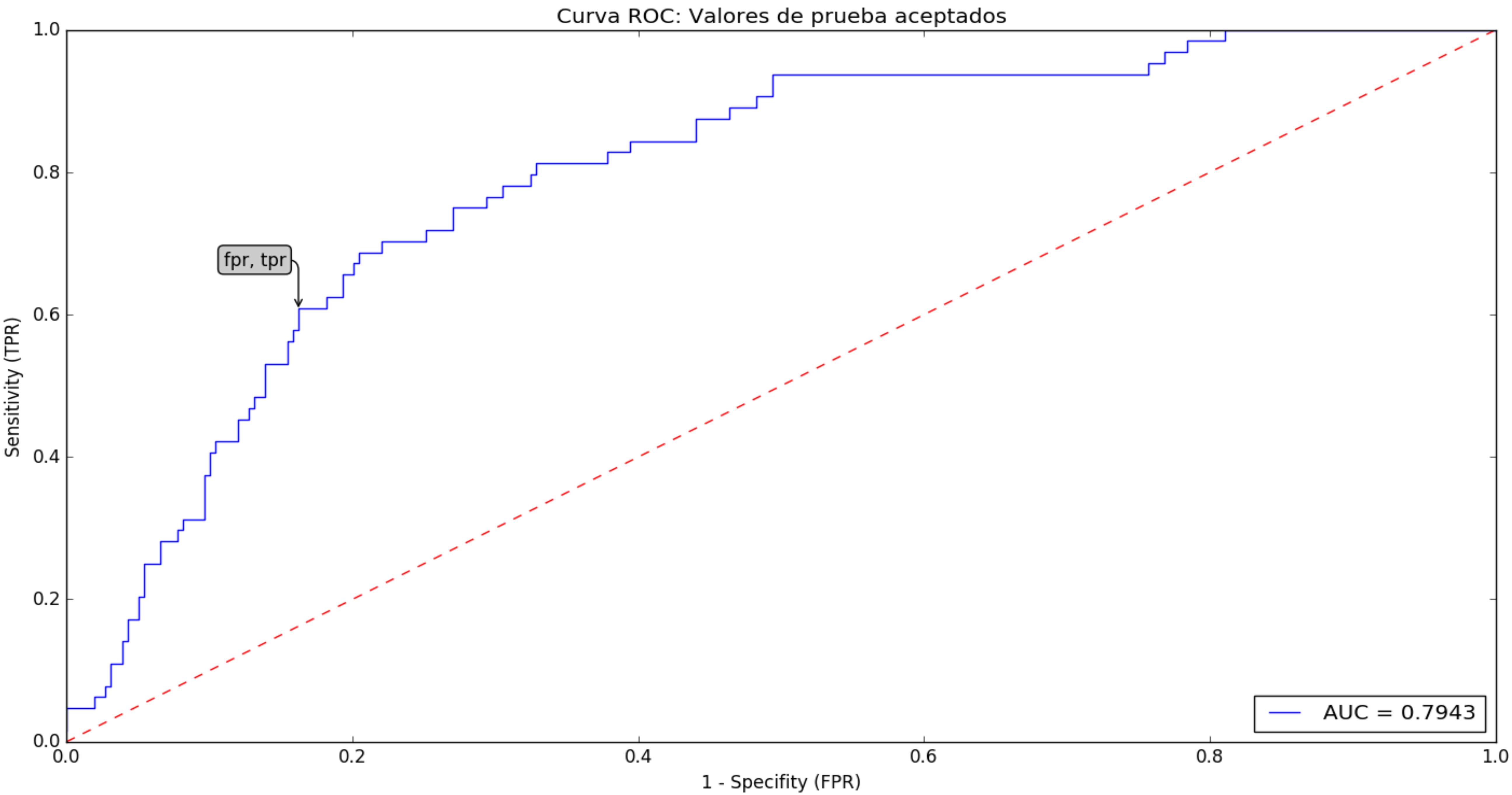
Simposio

15 de junio 2018


FIVE NOVELS IN ONE OUTRAGEOUS VOLUME
DOUGLAS ADAMS
THE ULTIMATE HITCHHIKER'S GUIDE TO THE GALAXY



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Predictive model for obesity…

Results from predictive models * based on data from a study of 1,076 non-academics and academics from the UNAM:

2,524 variables - Genetic, epidemiological, physiological,…

- **Epidemiological**: Personal (81), Personal history (130), Family History (548), Self-health evaluation (226), Nutrition (220), Lifestyle (390), Health knowledge (293)
- **Genetic** (772)
- **Anthropometric and physiological** (49)

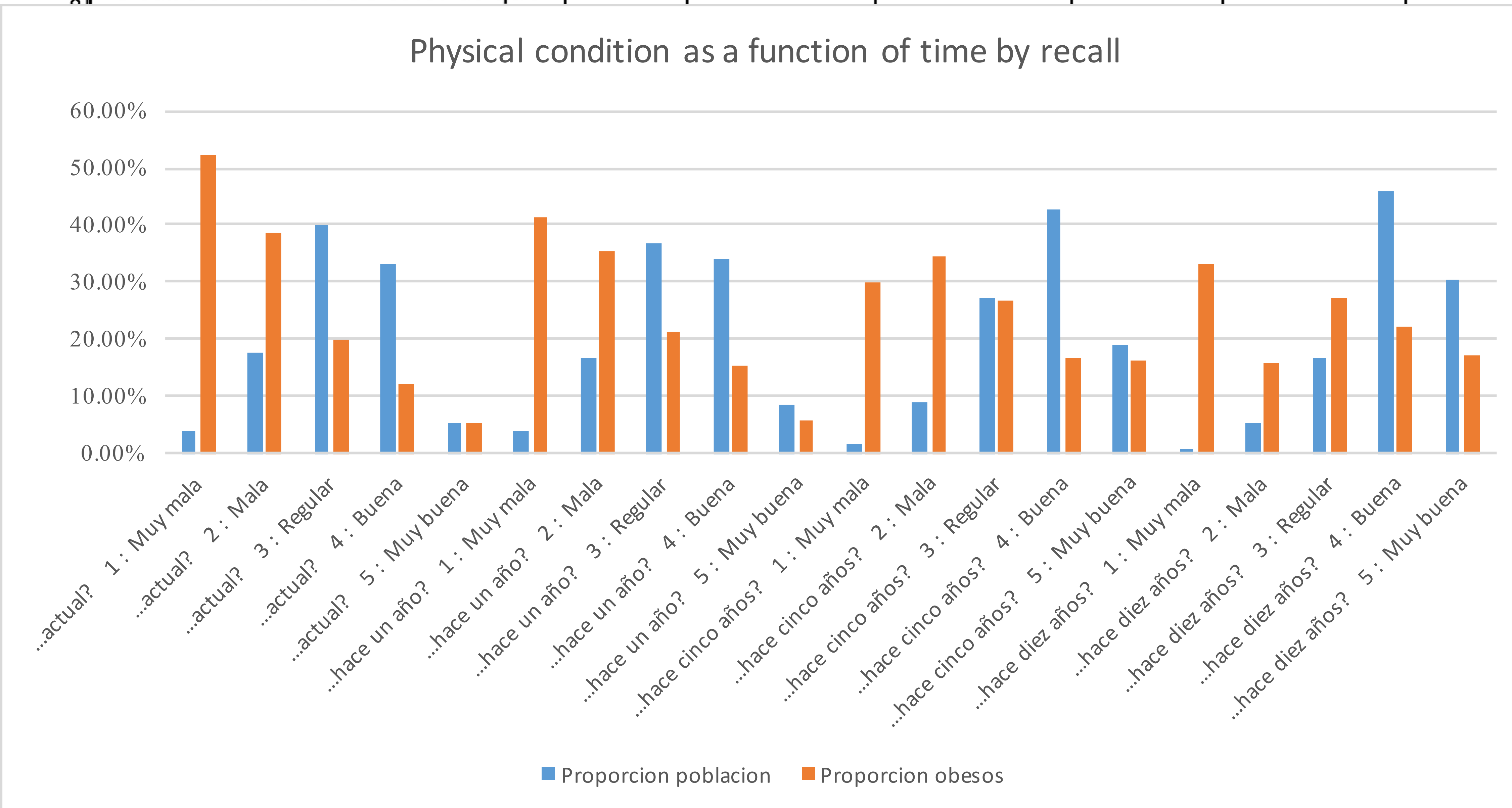
* Models are classification models of Naive Bayes type. Model performance is based on a 70/30 training/test split

Nutrition	
Specificity (TNR)	83.40%
1 – Specificity (SPC)	16.60%
Sensitivity (FPR)	29.69%
Accuracy (ACC)	72.76%
AUC ROC	0.63
Lifestyle	
Specificity (TNR)	84.17%
1 – Specificity (SPC)	15.83%
Sensitivity (FPR)	31.25%
Accuracy (ACC)	73.68%
AUC ROC	0.70
Lifestyle and Nutrition	
Specificity (TNR)	78.38%
1 – Specificity (SPC)	21.62%
Sensitivity (FPR)	46.88%
Accuracy (ACC)	72.14%
AUC ROC	0.71
Lifestyle and Nutrition and Personal and Family History	
Specificity (TNR)	81.08%
1 – Specificity (SPC)	18.92%
Sensitivity (FPR)	51.56%
Accuracy (ACC)	75.23%
AUC ROC	0.76

Variable	Valor	Epsilon	Nx	Nxc	N	Nc	Pc	Pxc	Descripción
Aestatura	1	4.801461	91	38	1076	228	0.2119	0.4176	Estatura que estima tener el encuestado < 1.5 : 1
Aestatura	2	-0.92449	399	77	1076	228	0.2119	0.193	Estatura que estima tener el encuestado [1.5, 1.6) : 2
Aestatura	3	-1.09413	366	69	1076	228	0.2119	0.1885	Estatura que estima tener el encuestado [1.6, 1.7) : 3
Aestatura	4	0.143796	185	40	1076	228	0.2119	0.2162	Estatura que estima tener el encuestado [1.7, 1.8) : 4
Aestatura	5	-1.63546	32	3	1076	228	0.2119	0.0938	Estatura que estima tener el encuestado [1.8, 1.9) : 5
Aestatura	6	-0.7333	2	0	1076	228	0.2119	0	Estatura que estima tener el encuestado [1.9, 2.0) : 6
Aestatura	7	1.928548	1	1	1076	228	0.2119	1	Estatura que estima tener el encuestado > 2.0) : 7
Apeso	1	-3.77209	62	1	1076	228	0.2119	0.0161	Peso que estima tener el encuestado <= 50 : 1
Apeso	2	-4.05811	79	2	1076	228	0.2119	0.0253	Peso que estima tener el encuestado (50, 55) : 2
Apeso	3	-5.74441	132	1	1076	228	0.2119	0.0076	Peso que estima tener el encuestado [55, 60) : 3
Apeso	4	-5.1211	172	9	1076	228	0.2119	0.0523	Peso que estima tener el encuestado [60, 65) : 4
Apeso	5	-1.86651	142	21	1076	228	0.2119	0.1479	Peso que estima tener el encuestado [65, 70) : 5
Apeso	6	-2.34173	138	18	1076	228	0.2119	0.1304	Peso que estima tener el encuestado [70, 75) : 6
Apeso	7	0.84116	106	26	1076	228	0.2119	0.2453	Peso que estima tener el encuestado [75, 80) : 7
Apeso	8	8.123762	143	70	1076	228	0.2119	0.4895	Peso que estima tener el encuestado [80, 90) : 8
Apeso	9	14.14686	102	80	1076	228	0.2119	0.7843	Peso que estima tener el encuestado >= 90 : 9
condi_act	1	5.045429	44	23	1076	228	0.2119	0.5227	¿Cómo consideras tu condición física actual? 1 : Muy mala
condi_act	2	5.865344	189	73	1076	228	0.2119	0.3862	¿Cómo consideras tu condición física actual? 2 : Mala
condi_act	3	-0.57931	429	86	1076	228	0.2119	0.2005	¿Cómo consideras tu condición física actual? 3 : Regular
condi_act	4	-4.18504	355	43	1076	228	0.2119	0.1211	¿Cómo consideras tu condición física actual? 4 : Buena
condi_act	5	-2.94241	57	3	1076	228	0.2119	0.0526	¿Cómo consideras tu condición física actual? 5 : Muy buena
condi_act	8	-0.7333	2	0	1076	228	0.2119	0	¿Cómo consideras tu condición física actual? 8 : No quiero re
condi1	1	3.176688	41	17	1076	228	0.2119	0.4146	¿Cómo consideras tu condición física hace un año? 1 : Muy n
condi1	2	4.71648	180	64	1076	228	0.2119	0.3556	¿Cómo consideras tu condición física hace un año? 2 : Mala
condi1	3	0.133941	396	85	1076	228	0.2119	0.2146	¿Cómo consideras tu condición física hace un año? 3 : Regula
condi1	4	-2.65254	367	57	1076	228	0.2119	0.1553	¿Cómo consideras tu condición física hace un año? 4 : Buena

Epsilon	# participantes	# obesos	Proporcion obesos	Puesto
-2.81	234			
1.23	74			
0.19	54			
-1.64	10			
-2.38	52			
-3.58	81			
-2.05				
2.03				
-0.53				
0.51				
2.41				
2.06				
3.53				
0.30				
2.85				

¿Cuántas calorías hay en un litro de agua?	Epsilon	# participantes	Proporcion poblacion	# obesos	Probabilidad obesidad	Proporcion obesos
No sabe el número de calorías que						



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Proporcion obesos
31.18%
31.08%
19.38%

		Proporcion obesos
		17.81%
		22.36%
190	45	23.68%

¿Cómo es tu s... actualmente?	Epsilon	# participantes	# obesos	obesos
1 : Muy mala	1.15	15	5	33.33%
2 : Mala				
3 : Regular				
4 : Buena				
5 : Muy buena				

¿Qué acciones le gustaría tomar resp	Epsilon	# participantes	Proporcion poblacion	# obesos	Probabilidad obesidad	Proporcion obesos
Bajar de peso	5.25	771	71.65%	223	28.92%	97.81%
Esta contento con su peso	-7.54	239	22.21%	3	1.26%	1.32%
Subir de peso	-3.50	63	5.86%	2	3.17%	0.88%
No sabe	-0.90	3	0.28%	0	0.00%	0.00%

Why is a prediction model important?

Because…

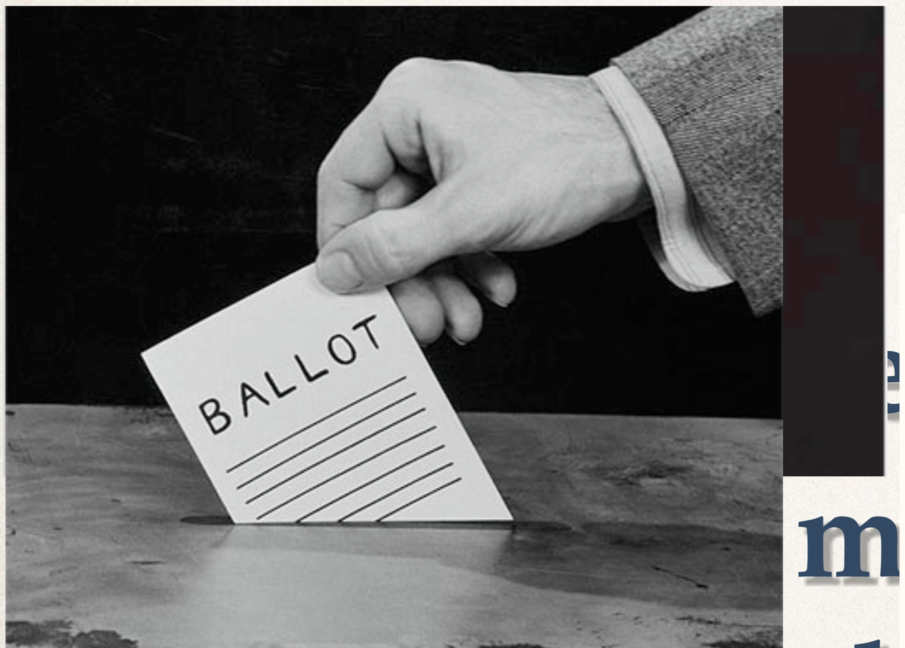
The principal purpose of living systems and the principal purpose of science - medicine, public health - is to…

Predict

for

Decision making

Some important decisions…



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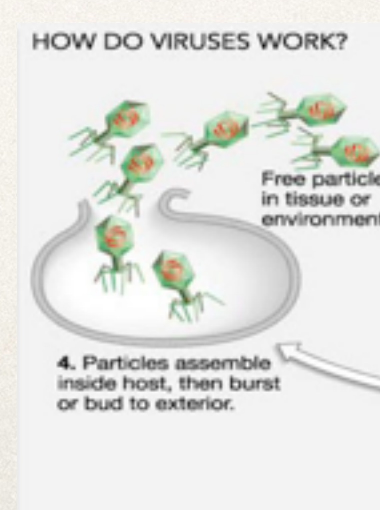
both dual

d collective level



There are "good" decisions and there are "bad" ones

Predictability and Decision Making

¿Qué es una decision?

Una selección entre alternativas implicando un cambio de estado

- Asociada con una acción no con cosas
- Asociada con una "estrategia"
- ¿Cómo enumerar las alternativas?
- ¿Cómo ponderar las alternativas?
    - ¿Qué factores se toma en cuenta?
    - Escalas de tiempo
- "Racional" versus "irracional"
- "Emocional" versus "lógico"
- Explicito versus implícito

Predictibilidad en los Sistemas Simples versus los Sistemas Complejos

1) Suelto un objeto de mi mano. ¿Qué pasará?

Cae al suelo 100% Se queda colgado en el aire 0%

2) Dejo dos objetos de distintas masas caen de mis manos.
¿Cuál tocará piso primero?

Lo mas pesado 0% Lo menos pesado 0% Ambos al mismo tiempo 100%

3) Empujo este objeto con mi mano. ¿Qué pasa?

Se mueve 100% Se queda sin mover 0%

Fenomenología: experiencia cotidiana Las leyes de Newton

¿Qué es predecible?
¿Los seres humanos?

1) No han tomado agua (ningún liquido) en tres días. Alguien te ofrece un litro de agua o una caja de hojuelas. ¿Qué seleccionas?

Agua	100%	Hojuelas	0%

2) Hay un incendio grave en el auditorio y suena la alarma. Yo les invito esperar hasta el final de mi platica o se huyen. ¿Qué haces?

Huyes	100%	Se queda	0%

3) Tienen mucho, mucho hambre. Alguien les ofrece una comida de 1500 calorias para satisfacerles. Pueden seleccionar entre carnitas, enchiladas suizas y frijoles negros; o puro apio (7.5kg). ¿Qué seleccionas?

Carnitas etc.	100%	Apio	0%

¿Qué es predecible?
¿Los seres humanos?

4) No han tomado agua (ningún liquido) en tres días. Alguien te ofrece un litro de Coca-cola o un litro de Pepsi. ¿Qué seleccionas?

Coca cola 70% Pepsi 30%

5) Hay un incendio grave en el auditorio y suena la alarma. Llegaste a la salida pero notas alguien quien no conoces atrapado. Regresas para tratar de ayudarles arriesgando tu propia vida o sigues corriendo?

Si regresas 50% No regresas 50%

6) Tienen mucho, mucho hambre. Alguien les ofrece una comida de 1500 calorias para satisfacerles. Pueden seleccionar entre carnitas, enchiladas suizas y frijoles negros; o barbacoa, chicharrón y arroz ¿Qué seleccionas?

Carnitas etc. 50% Barbacoa etc. 50%

¿Qué es predecible?

1) ¿Quién de ustedes será obeso en 20-30 años?

2) ¿Quién de ustedes padecerá de diabetes en 30-40 años?

3) ¿Quién de ustedes morirá antes de 70 por un mal estilo de vida?

4) ¿Cuánta biodiversidad perderá México en los próximos 50 años?

5) ¿Qué acciones (factibles) resultarán en una reducción del número de personas en situación de calle?

6) ¿Habrá computadoras inteligentes (estilo Hal2000 de la película 2001 A Space Odyssey) en 20 años?

y muchísimas otras

Predictabilidad y la toma de Decisiones

"Decisiones"

Normalmente pensamos en las decisiones como algo más humano asociado con la voluntad libre

¡Somos autómatas! En la mayoría…

- Una bola en un campo gravitacional
- Un gato en un campo gravitacional
- Un ser humano en un campo gravitacional

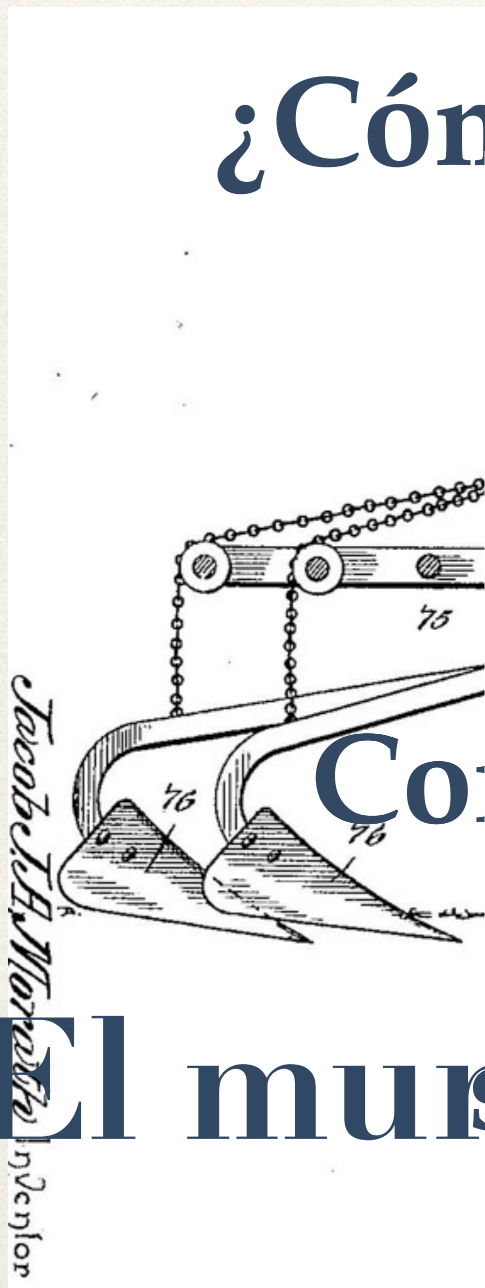
¿Porqué tomamos malas decisiones?

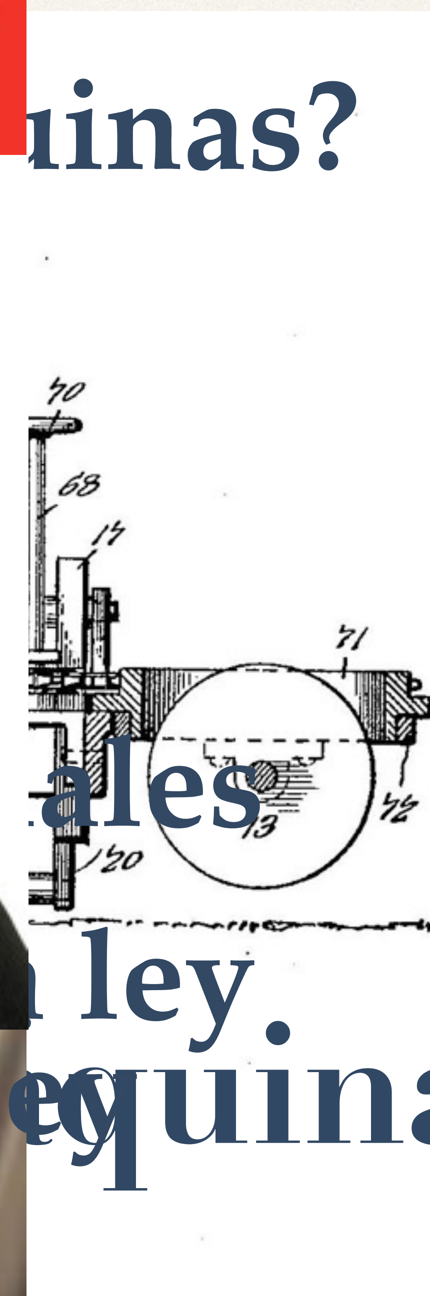
What Doesn't Make Decisions?

Prediction and science: the last 3 centuries

De hecho…

¿Cóm ... uinas?





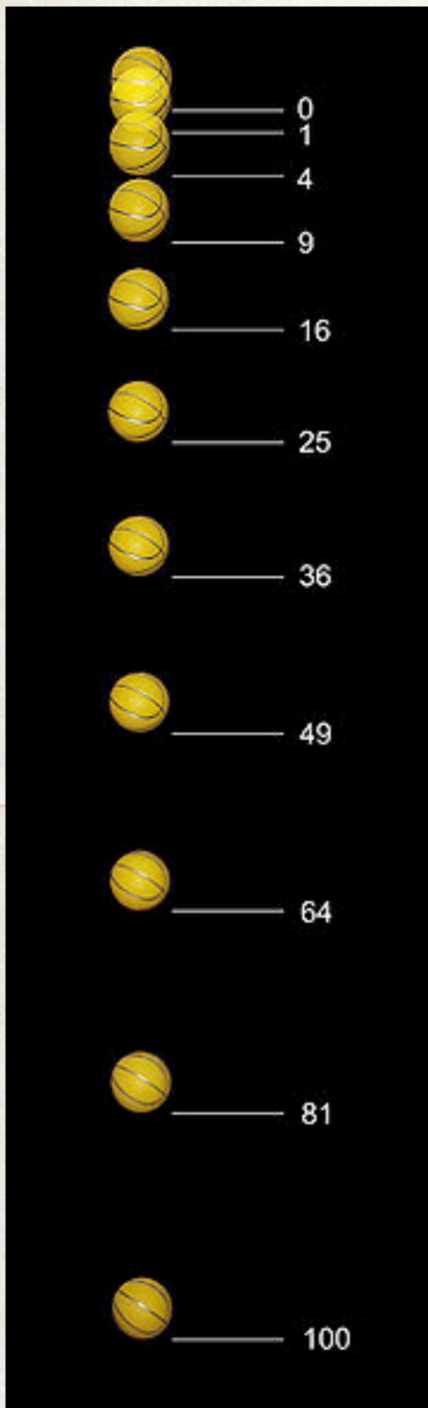
Co... ales

... ley.

El mu... quina

somos esclavos de la ley

Predictability in Simple Systems versus Complex Systems



Mechanistic

Adaptive

The *evolution* of function

is the revolution that allowed

systems to escape the tyranny

of physics.

e difference between complex an

ple systems is the difference betw

"being" and "doing"

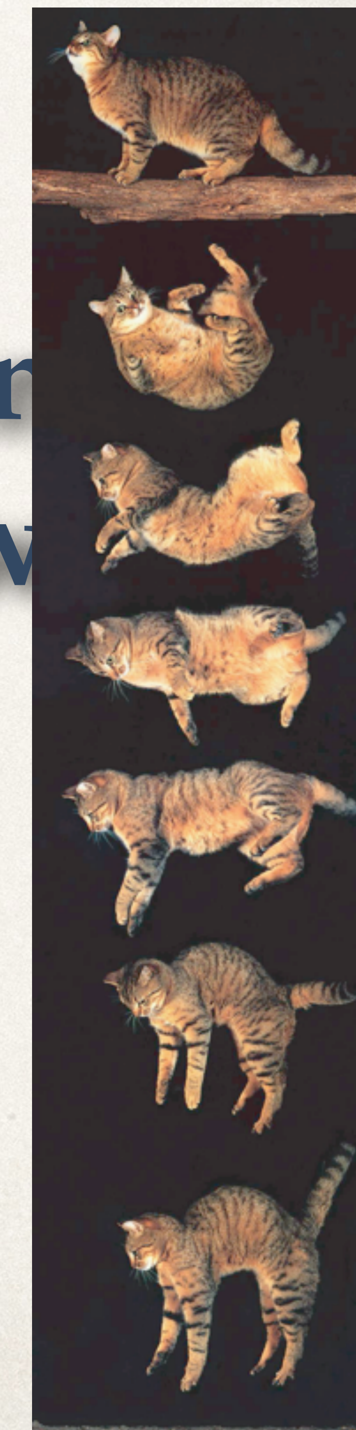
The cat obeys the same laws

of physics as the ball.

But it's not a "slave" to them

Complexity is a consequence

of that revolution.



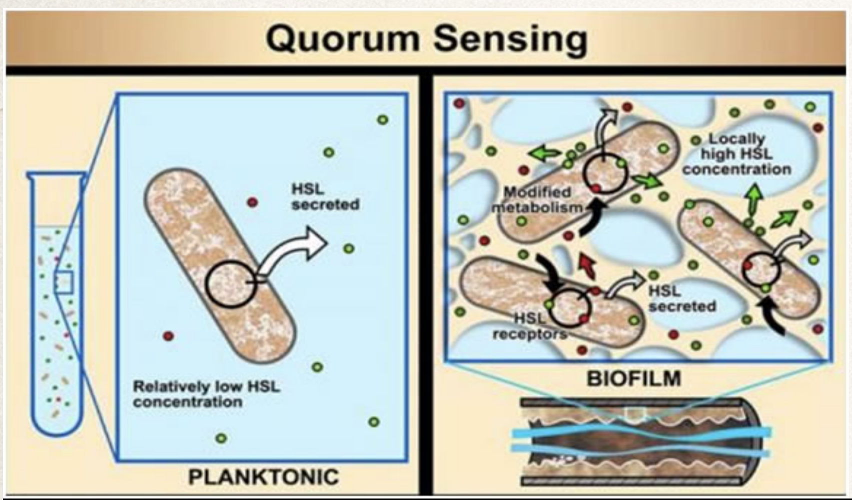
Every Living Thing Makes Decisions:

Every living thing is a “data miner”

What´s the difference/same between human decision making and that of a worm or even a bacterium?

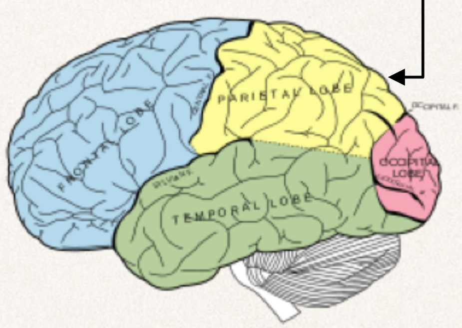
They all use prediction models for decision making.

However, the complexity and richness of the set of possible behaviours and the probability distribution on them - the decision “landscape”



What is the Difference Between them?

Different data, different data processors and different inference algorithms

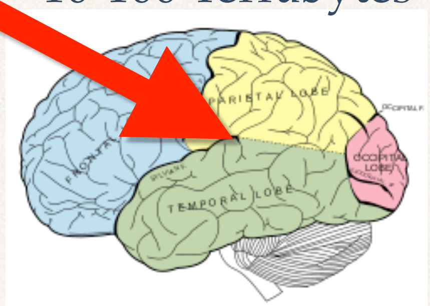


Same goal of modeling a ***complex*** world for ***decision making*** and "***optimization***"

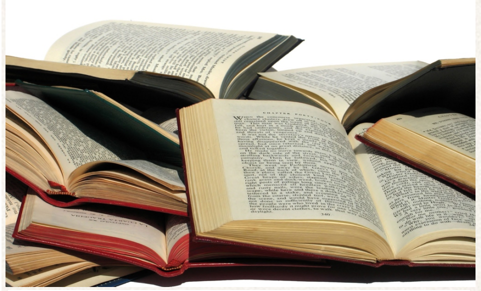
Deep Data, the Data Revolution and Decision Making

A revolution in the generation of data

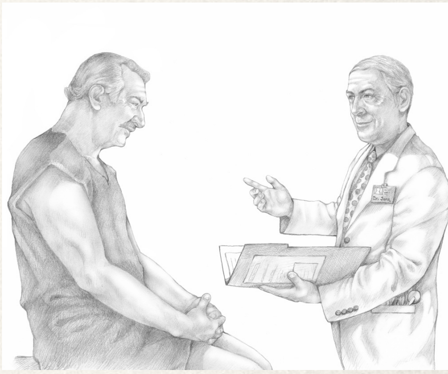
Human brain
10-100 Terrabytes



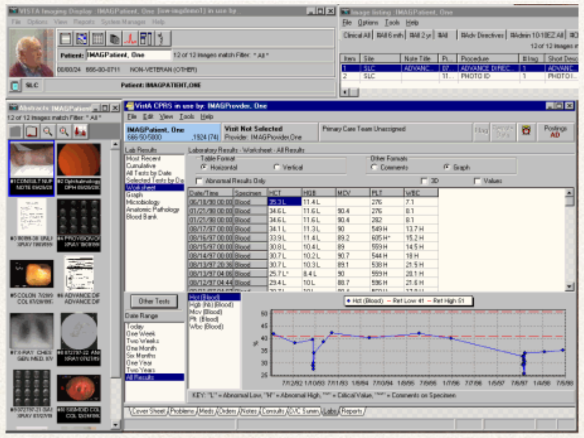
All the books in the world 30-50 Terrabytes



A revolution in data analysis

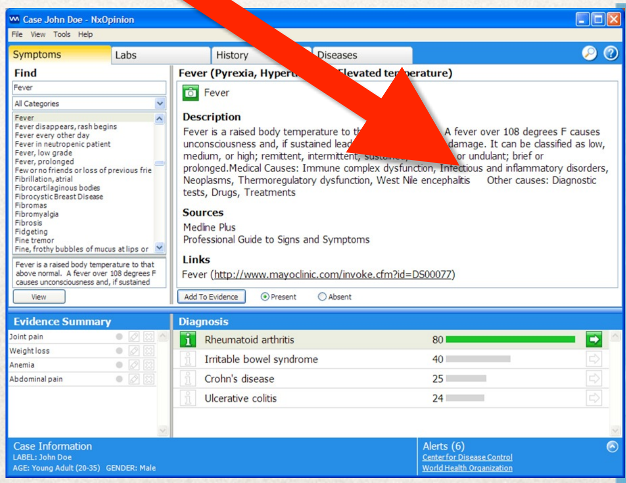


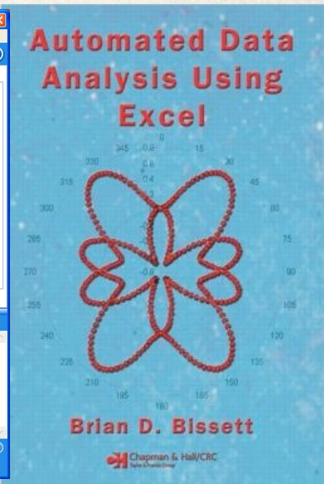
1 human genome
= 1GB (200)
CT image
= 10MB
MRI image
= 40MB



In electronic form
1 zettabyte

A revolution in data storage





How do we measure the "value" of a decision?

- **First, what is the goal or purpose of the decision?**
- **Second, can we determine a metric of success?**
  - Great experience? Movie, meal,…
  - Long and happy marriage?
  - Higher salary?
  - Vote?
  - Increased sales?
  - More children?
  - Longer life?
  - Other…
  - More than one?

Importance of "scale":

- time
  - a decision can have different values as a function of time
- population/statistical ensemble
  - a decision may be good/bad for you and bad/good for the group
- causal chain/attribution

Importance of feedback and learning

Importance of substrate

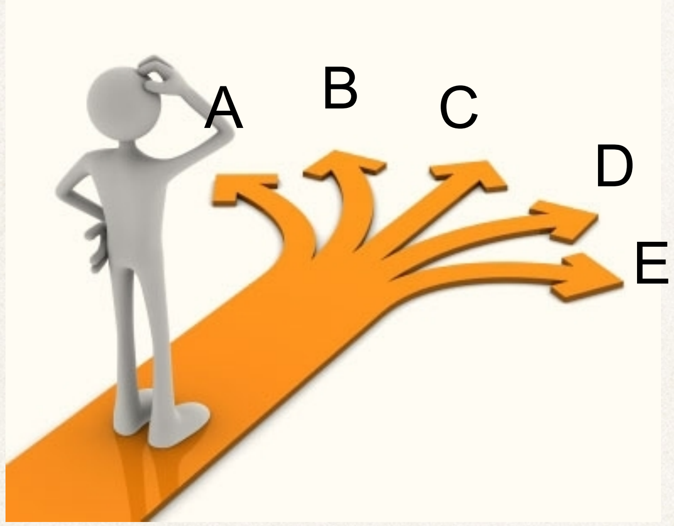
- Genetic
- Epigenetic
- Neuronal

In Evolution Natural Selection is the ultimate arbiter of the "value" of decisions

The Value of a Decision:
The Rational Theory of Decision Making

Alternativas: A, B, C, D, E

Preferencias: P(A), P(B), P(C), P(D), P(E)



Para tomar una decisión racional se ranquea las alternativas por sus preferencias y adopta la alternativa con mayor preferencia

Puede hacer la comparación P(i) > o < P(j) para todas las alternativas
Si P(i) > P(j) y P(j) > P(k) entonces P(i) > P(k)

¿Se aplica únicamente a los seres humanos?

Lo racional es siempre traicionar – ¡piensa sobre manejar en el DF!

Ejemplo de la racionalidad: El dilema del prisionero

	Prisionero B se mantiene silencioso	Prisionero B traiciona
Prisionero A se mantiene silencioso	Cada uno recibe sentencia de 6 meses	Prisionero A: 10 años Prisionero B: se libera
Prisionero A traiciona	Prisionero A: se libera Prisionero B: 10 años	Cada uno recibe sentencia de 5 años

Group Decisions versus Individual Decisions

- ¿Quién toma decisiones?
  - Individuos, familias, empresas, gobiernos, muchas otras unidades organizacionales

	P	*if P then Q*	*Q*
Individual 1	true	true	true
Individual 2	false	true	false
Individual 3	true	false	false
Society	true	true	false

Si votamos por mayoría entonces la sociedad no es lógico/racional

An Algorithmic Representation of a Decision Requires an Algorithmic Representation of the World: A Model

A “decision”

$$P(C \mid X(t))$$

Probability of C given X

Prediction

In the physical world, predictions tend to be **algoríthmic**

In the biological world, predictions tend to be **heurístic**

Physical world
Less complex,
less adaptative

Biological World
More complex,
more adaptative

$X(t)$ = the information used to make the decisión (predict)

How much information do you need or use to make a “good decision”?

What degree of multi-factoriality is there?

The biological world requires a lot more data.

Algorithmic Representation of a Decision

$P(C|\mathbf{X}(t))$ represents our model of reality and perception

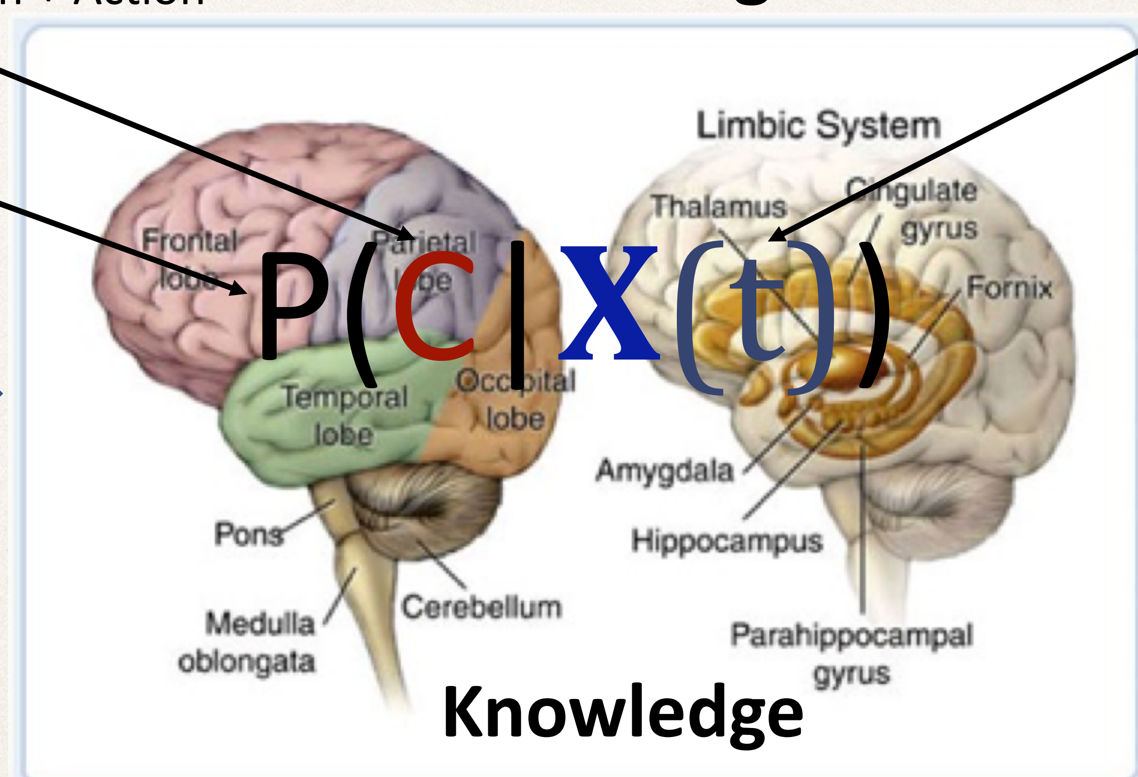
Data + Information + Knowledge

Prediction --> Decision + Action

Human Intelligence

Heuristic: we don't know what it is in humans. It's a model of the world.

Data + Information



$P(C|\mathbf{X}(t))$

Knowledge

Decision + Action

There are many Alternatives to be considered in Decisions And many possible actions

Did it work?

The decision+action is judged to be good or bad with respect to A performance indicator

Algorithmic Representation of a Decision

$P(C|X(t))$ represents the algorithm's model of reality and perception

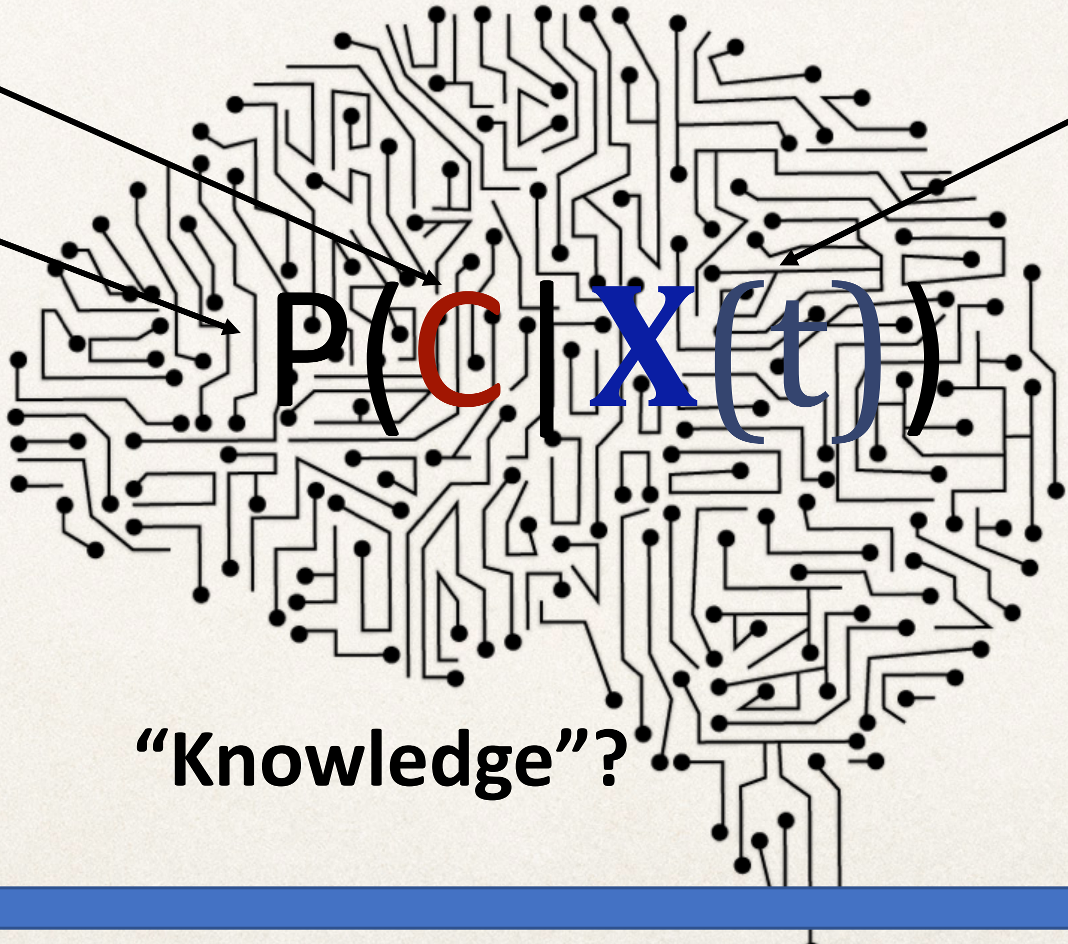
Data + Information + Knowledge

Prediction --> Decision + Action

Artificial Intelligence

Heuristic: we don't know what it is in humans. It's a model of the world.

Data + Information



$P(C|X(t))$

Decision + Action

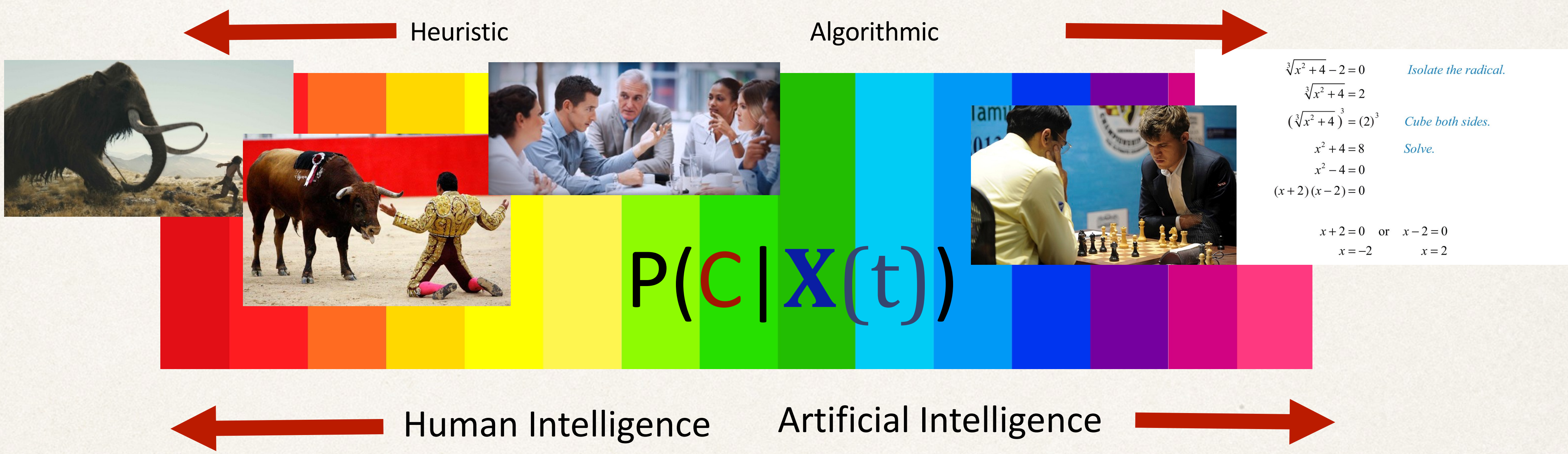
"Knowledge"?

Did it work?

The decision+action is judged to be good or bad with respect to A performance indicator

Algorithmic Representation of a Decision

Human Intelligence versus Artificial Intelligence



As examples of this function for humans we have: Roger Federer making a tennis shot; Sergio Perez deciding when to brake; Octavio Paz deciding which words to use; you reading a memo from the CEO; You deciding whether to invest in a new hardware set up; you deciding whether to hire a new Chief Data Architect;…

Every decision/action we take requires and uses a DIFFERENT P(C|X), whether we use HI or AI!

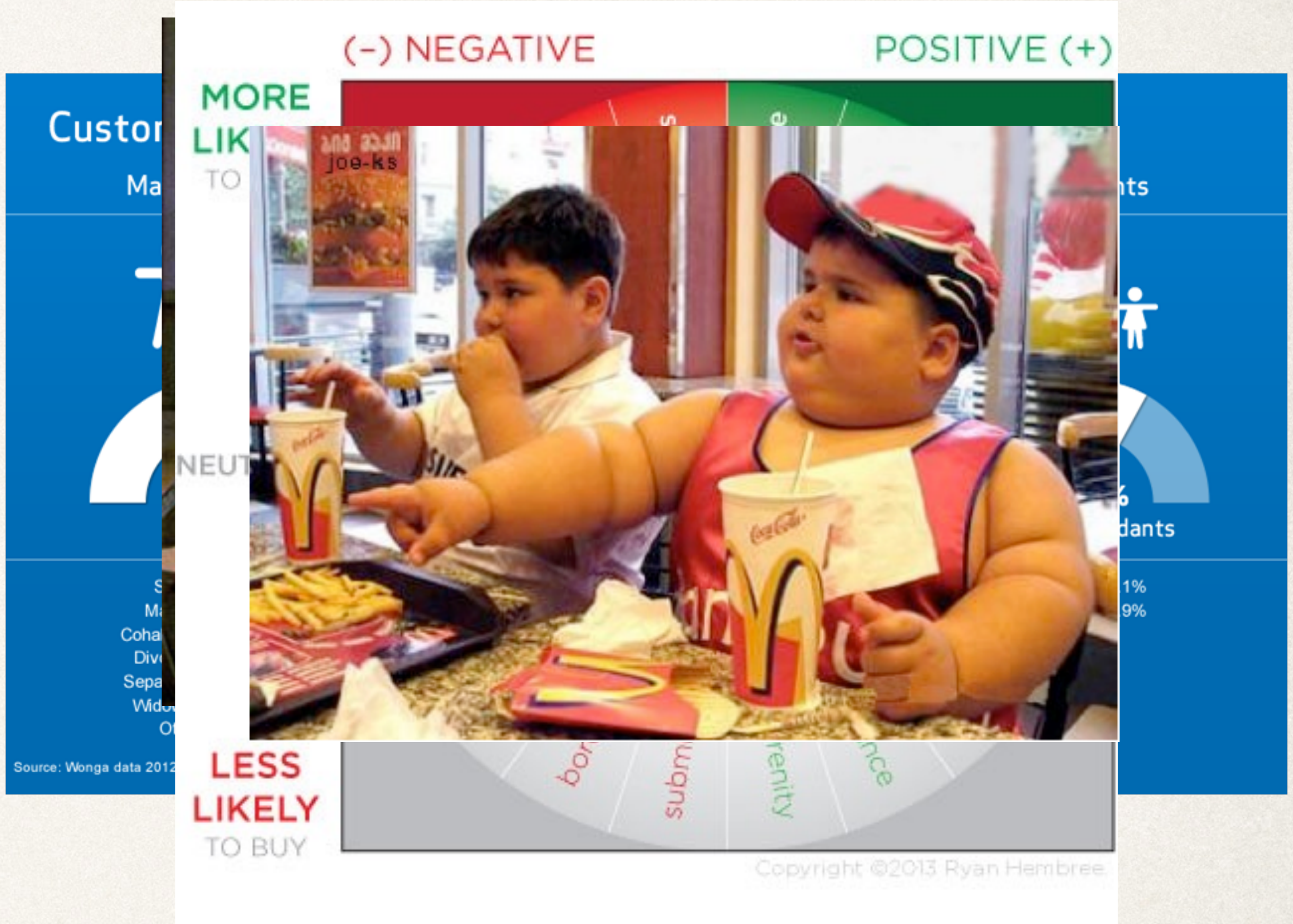
How we arrive at this function is a deep mystery. How we convince ourselves we arrive at a decision often doesn't have much to do with reality because there are many subjective elements to it.

Your Prediction/Decision Heuristic/Algorithm depends on…

"Who" you are

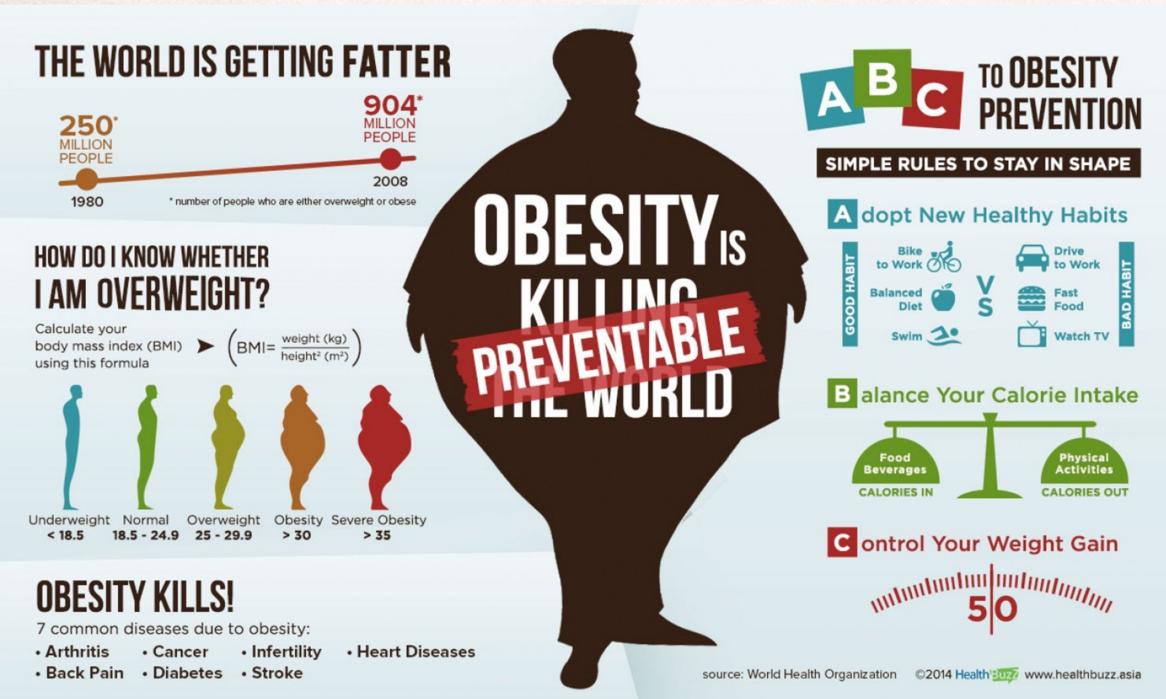
What and how you "think"

What and how you "feel"

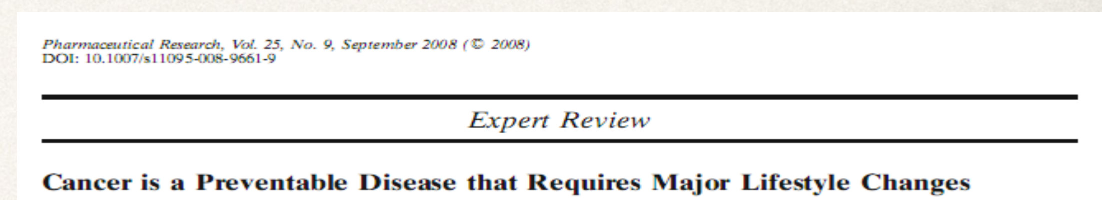


Your prediction/decision heuristic/algorithm then determines your behaviour - what you do

Decision Making and the Obesity Pandemic



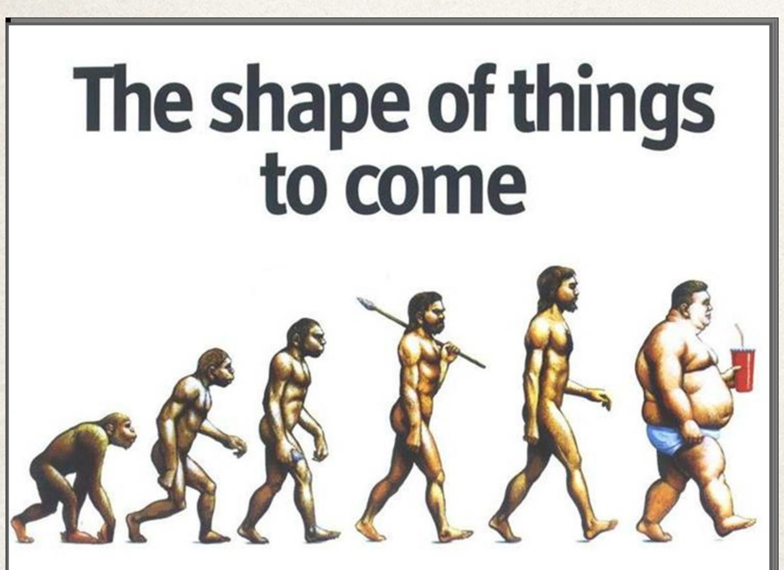
Obesity, type 2 diabetes, heart disease, strokes, cancer etc. are diseases associated with "lifestyle" and therefore are "preventible" (?)


Pharmaceutical Research, Vol. 25, No. 9, September 2008 (© 2008)
DOI: 10.1007/s11095-008-9661-9

Expert Review

Cancer is a Preventable Disease that Requires Major Lifestyle Changes

They are **behavioral** diseases,
i.e. diseases arising from **decision making**.



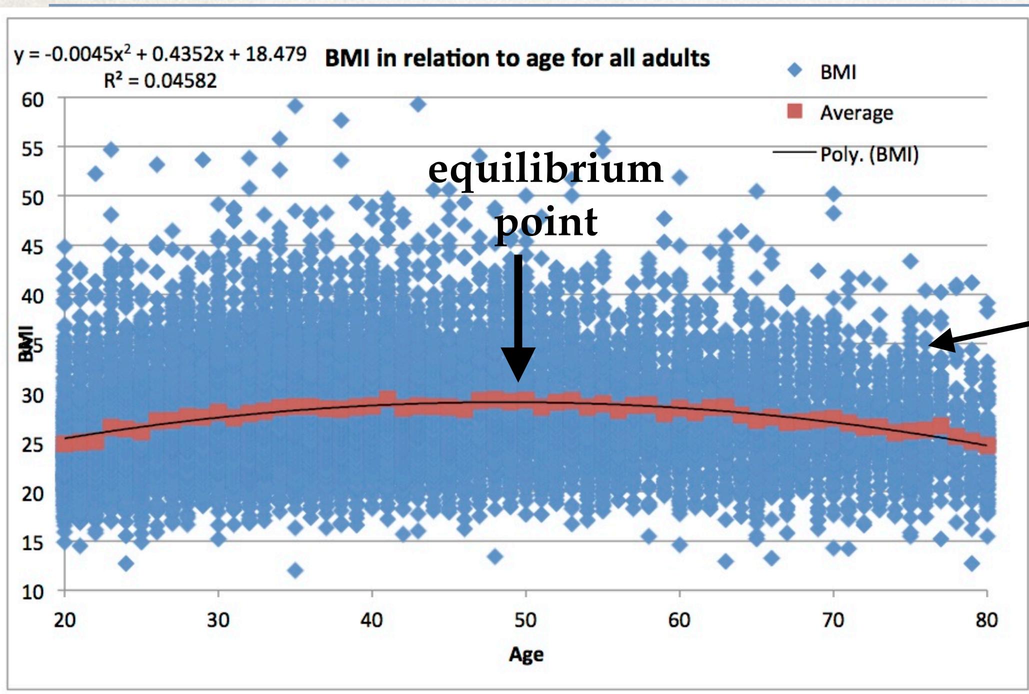
Human behavior is **complex**

and requires "**deep data**".

Obesity - risk factors: What you do

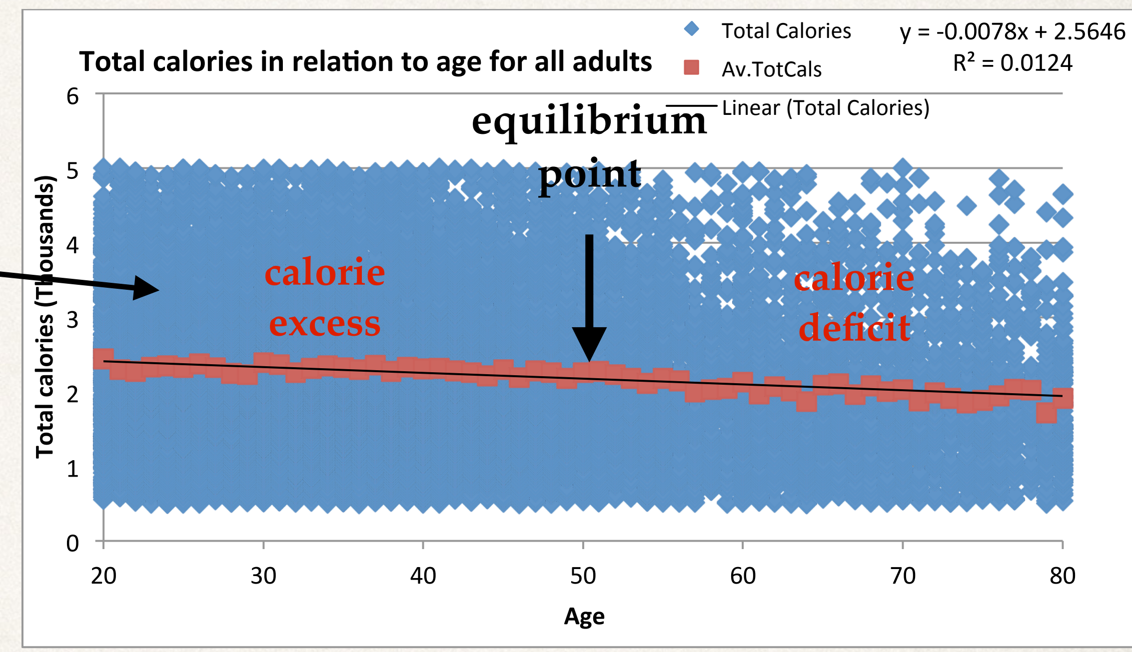
You aren't what you eat you become what you eat
We "decide" to eat too much

Epidemiological data from ENSANUT 2006

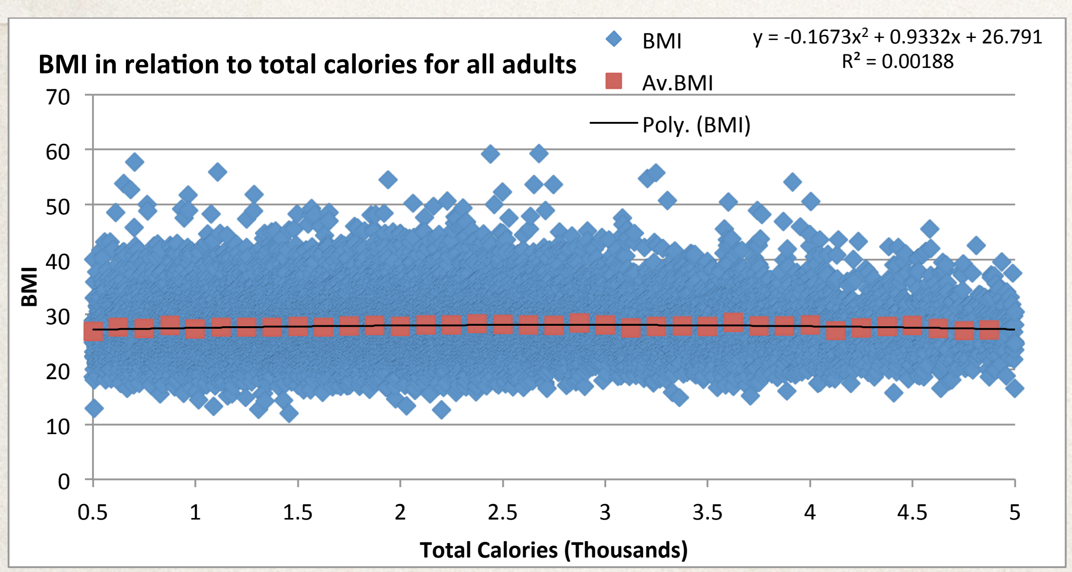


We get fatter then we get thinner

Its not "noise"its multifactoriality



We eat less the older we get



The obese eat as much as the thin

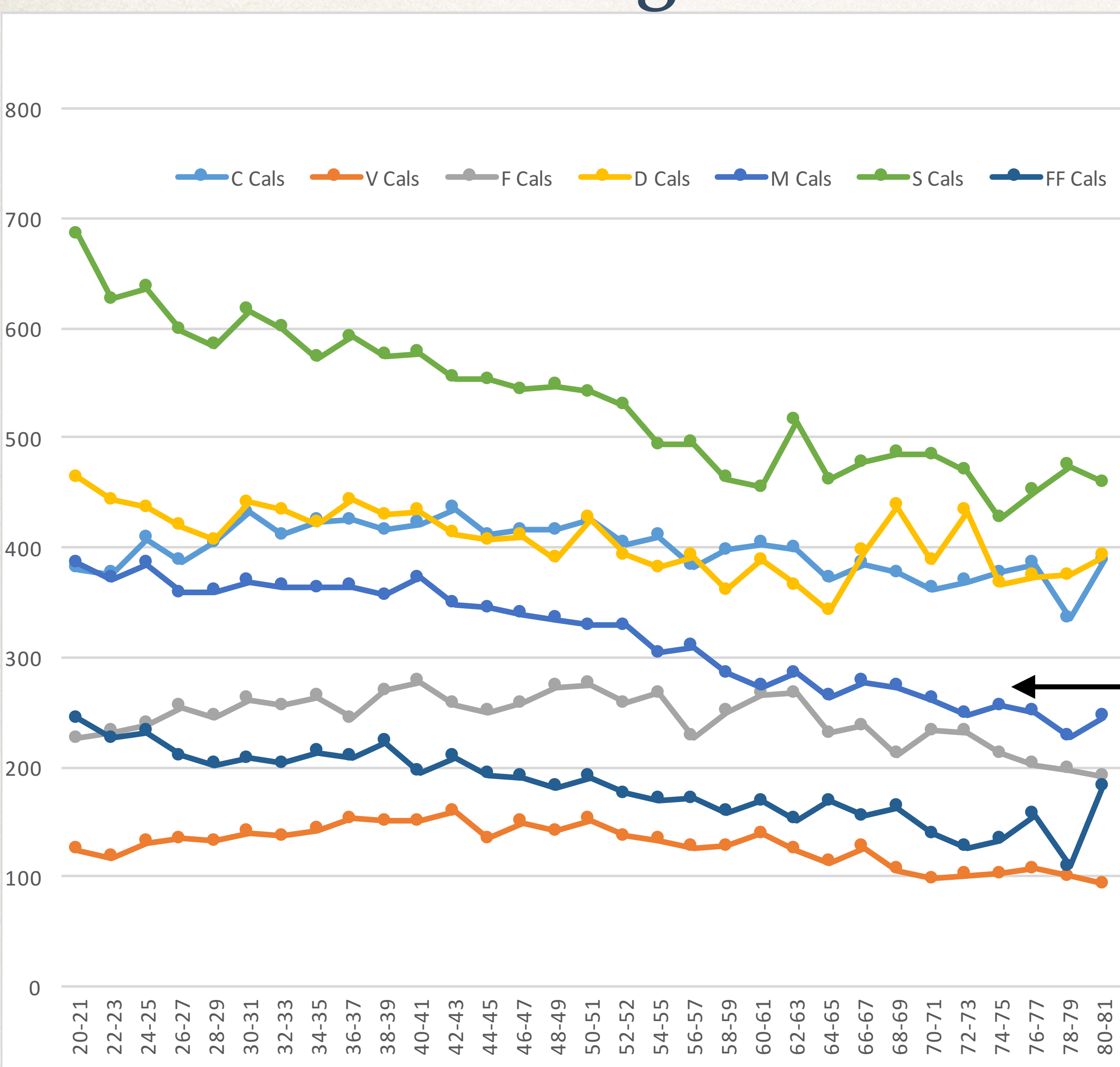
	Variable(s)	Unstd. B	Std. Error	t	f	R^2	Sig	Lower	Upper
Moving Av.					29.236	0.343	0		
BMI Change	Constant	-1.954	0.362	-5.392			0	-2.68	-1.228
ALL	Total_Cals	0.904	0.167	5.407			0	0.569	1.239
	Variable(s)	Unstd. B	Std. Error	t	f	R^2	Sig	Lower	Upper
Moving Av.					13.397	0.193	0.001		
BMI Change	Constant	-1.625	0.444	-3.656			0.001	-2.515	-0.734
Men	Total_Cals	0.724	0.198	3.66			0.001	0.328	1.121
	Variable(s)	Unstd. B	Std. Error	t	f	R^2	Sig	Lower	Upper
Moving Av.					22.429	0.286	0		
BMI Change	Constant	-1.754	0.372	-4.711			0	-2.5	-1.008
Women	Total_Cals	0.833	0.176	4.736			0	0.481	1.185

Its the excess of calories that is the motor for obesity. The motor is more active at 20 and stops at 50 and then goes in reverse.

Obesity - risk factors: What you do
We “Decide” to eat the “wrong” things

Epidemiological data from ENSANUT 2006

The motor changes its fuel…

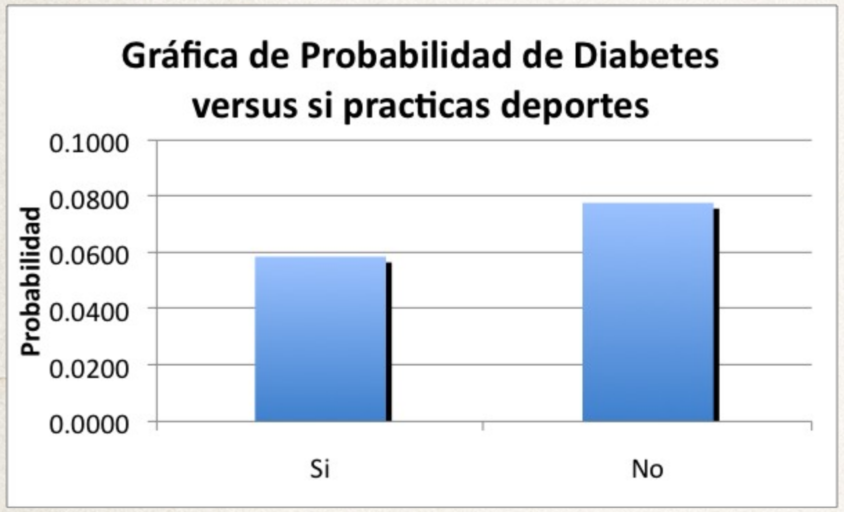


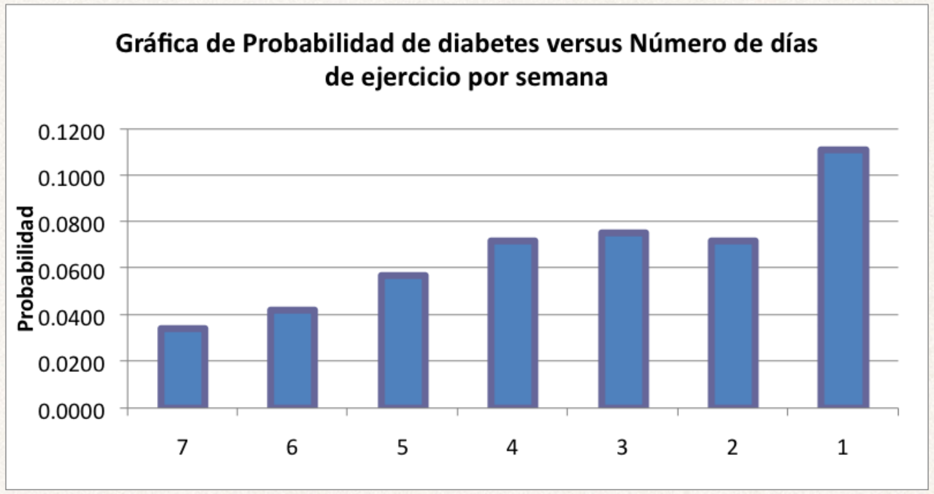
	Edad 20	Edad 50	Edad 80	Diff 50 20	Diff 80 20	Diff 80 50	Edad 20	Edad 50	Edad 80
S	650	540	460	16.92%	29.23%	14.81%	26.75%	23.38%	24.73%
FF	230	185	140	19.57%	39.13%	24.32%	9.47%	8.01%	7.53%
M	370	330	240	10.81%	35.14%	27.27%	15.23%	14.29%	12.90%
D	450	415	370	7.78%	17.78%	10.84%	18.52%	17.97%	19.89%
F	230	270	200	-17.39%	13.04%	25.93%	9.47%	11.69%	10.75%
V	120	150	90	-25.00%	25.00%	40.00%	4.94%	6.49%	4.84%
C	380	420	360	-10.53%	5.26%	14.29%	15.64%	18.18%	19.35%
	2430	2310	1860	4.94%	23.46%	19.48%			

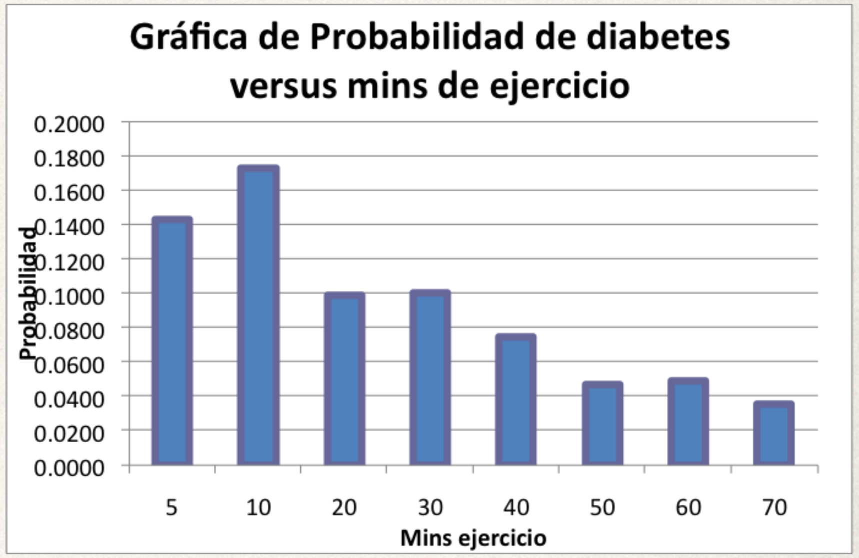
The fuel mix at age 20 consists of 51.5% sugars, junk food and meat and 30% fruit, vegetables and cereals. At age 50 its 45.5% and 36.5%.

Accelerated reduction in meat consumption in the aged

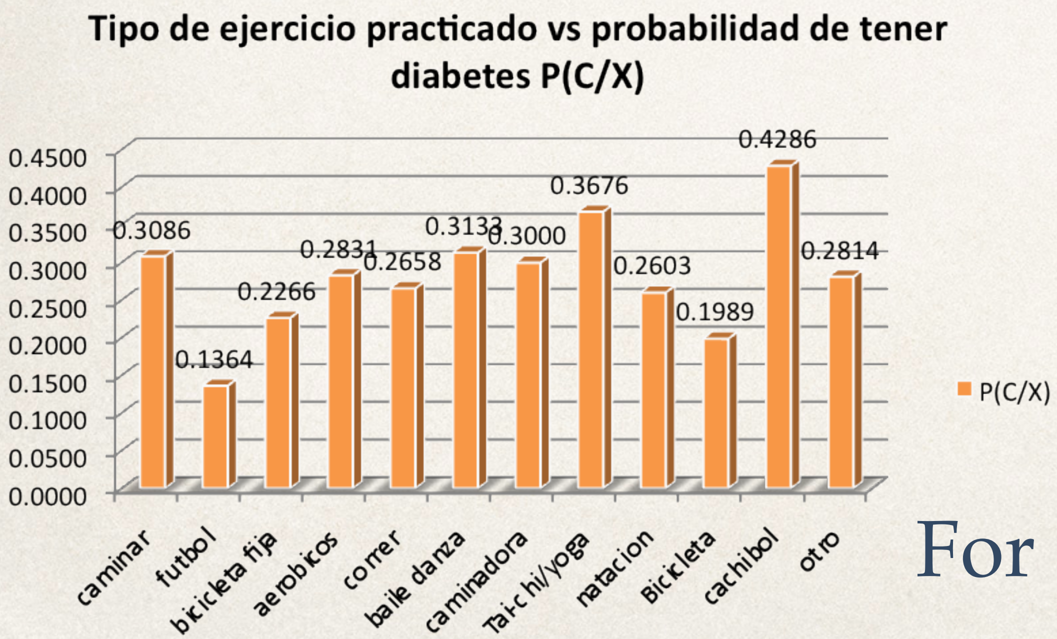
Chronic disease - Risk factors What you do We "Decide" when to exercise, what type, how often,...

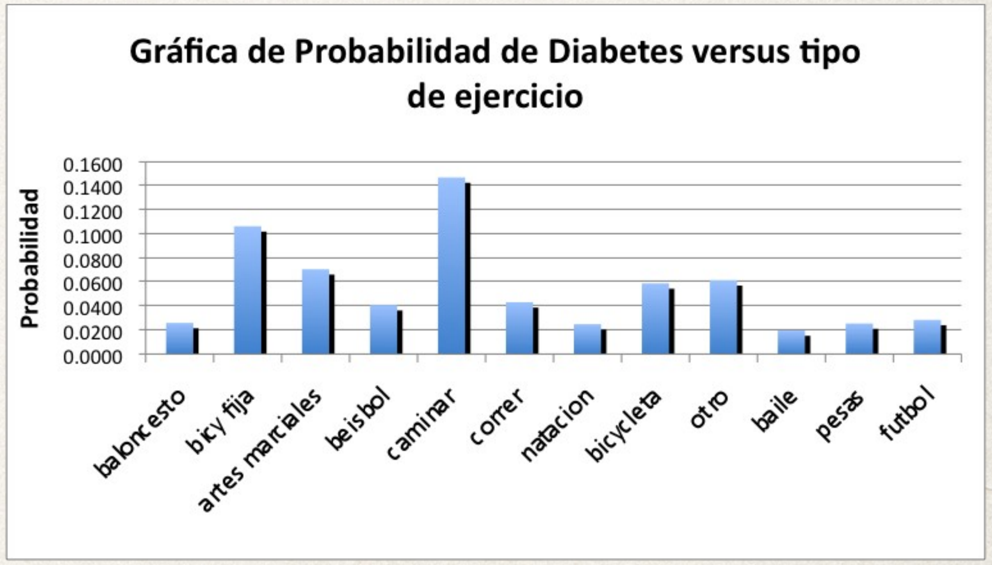






For men 20-59 de PREVENIMSS 2006





For seniors > 59

Is it riskier to walk than do nothing?

- So, there is ample evidence that we eat too much, too much of the wrong things and we don’t exercise enough. These are all associated with “bad” decisions?

- Why do we make these decisions?

- Are our decisions rational? Depends on:

    - What value function our decision making is based on

    - What processing model P(|) we use

    - What information **X**(t) we have available

Rational Decision Making: The Information X(t)

- Do we have the information available to make a “rational” decision?

Pregunta	Epsilon	# participantes	Proporcion poblacion	# obesos	Probabilidad obesidad	Proporcion obesos
Hacer ejercicio no tiene importancia	0.51	3	0.28%	1	33.33%	0.44%
Hacer ejercicio es poco importante	-0.90	3	0.28%	0	0.00%	0.00%
Hacer ejercicio es importante	-1.45	115	10.69%	18	15.65%	7.89%
Hacer ejercicio es muy importante	0.56	953	88.57%	209	21.93%	91.67%

Pregunta	Epsilon	# participantes	Proporcion poblacion	# obesos	Probabilidad obesidad	Proporcion obesos
Si sabe del nuevo impuesto en alimentos de alta densidad	-0.81	814	75.72%	163	20.02%	71.49%
No sabe del nuevo impuesto en alimentos de alta densidad	1.47	261	24.28%	65	24.90%	28.51%

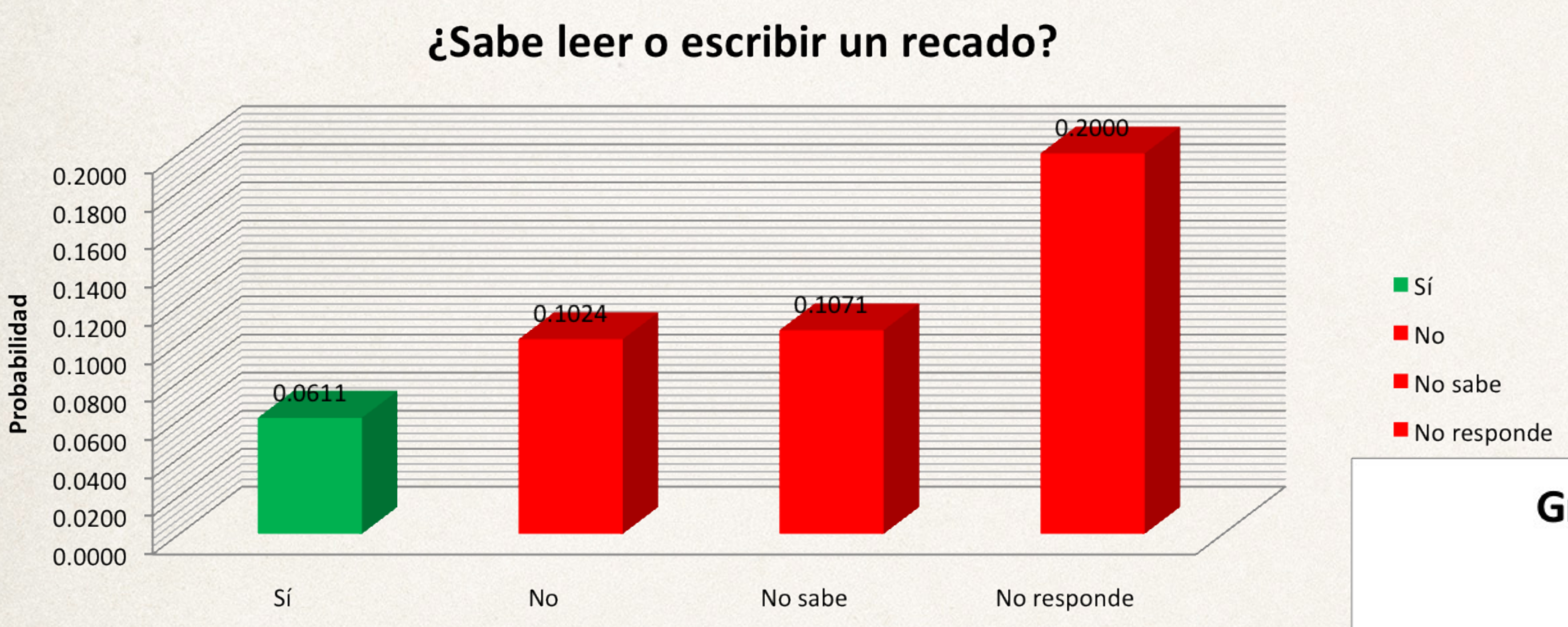
Pregunta	Epsilon	# participantes	Proporcion poblacion	# obesos	Probabilidad obesidad	Proporcion obesos
Si conoce el IMC para un peso normal	-3.07	141	13.12%	15	10.64%	6.58%
No conoce el IMC para un peso normal	1.21	934	86.88%	213	22.81%	93.42%

What information is necessary and what information, if any, is sufficient?

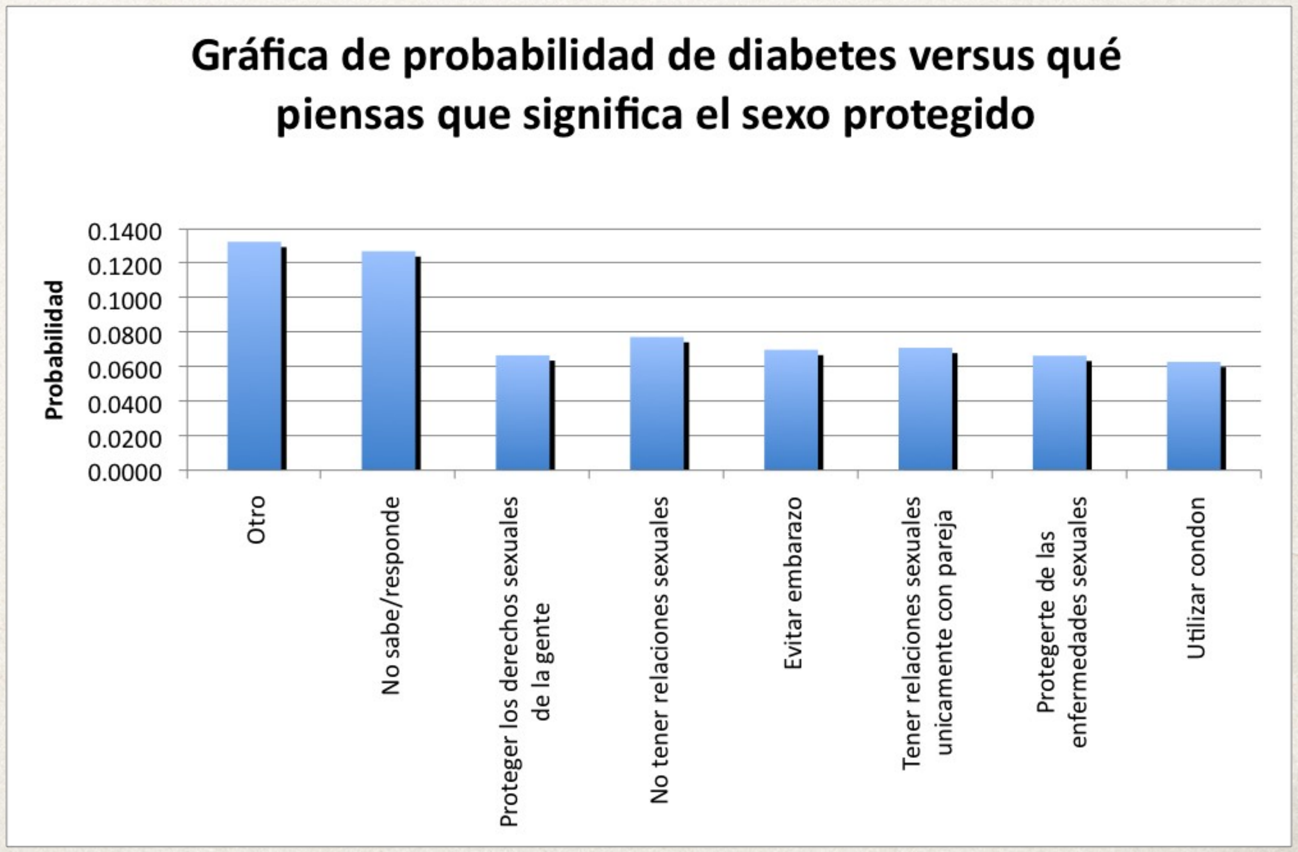
Chronic disease - risk factors

What you think (know): Ignorance can kill

Epidemiological data from ENCOPREVENIMSS 2006



For men 20-59 from PREVENIMSS 2006

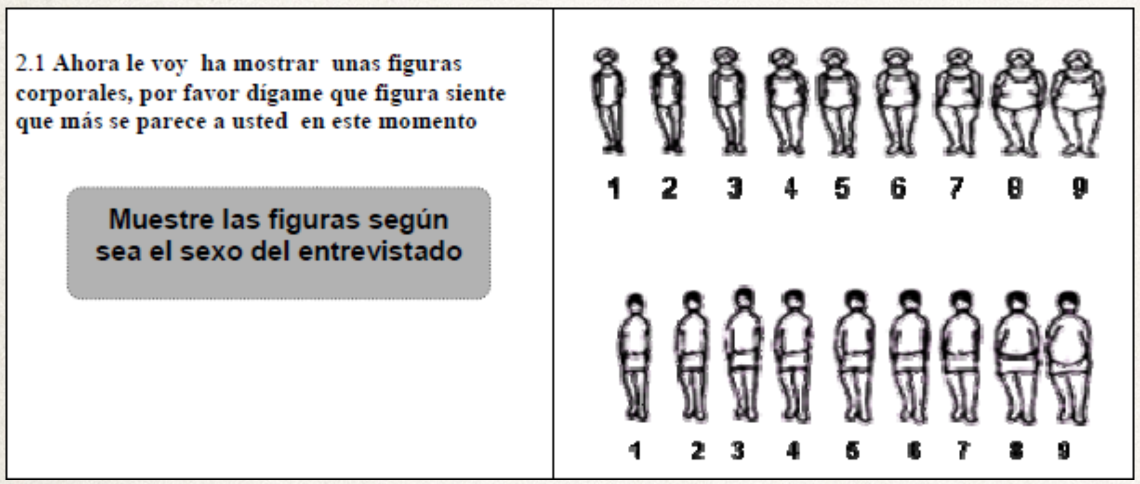


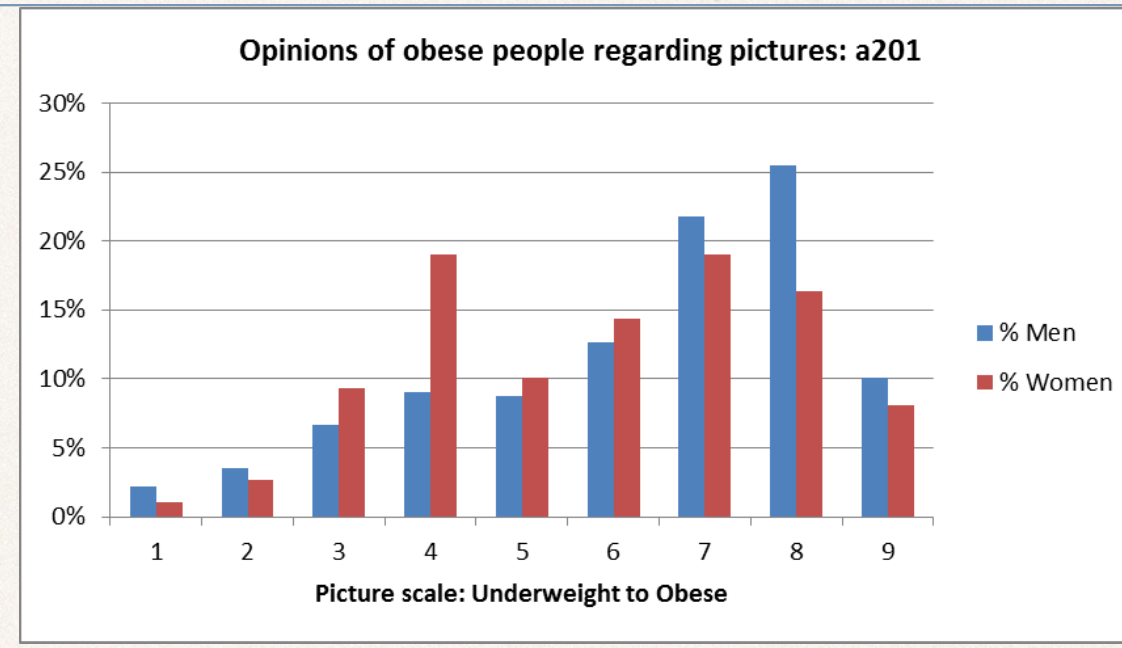
Ignorance and especially about health issues is as important a risk factor as obesity

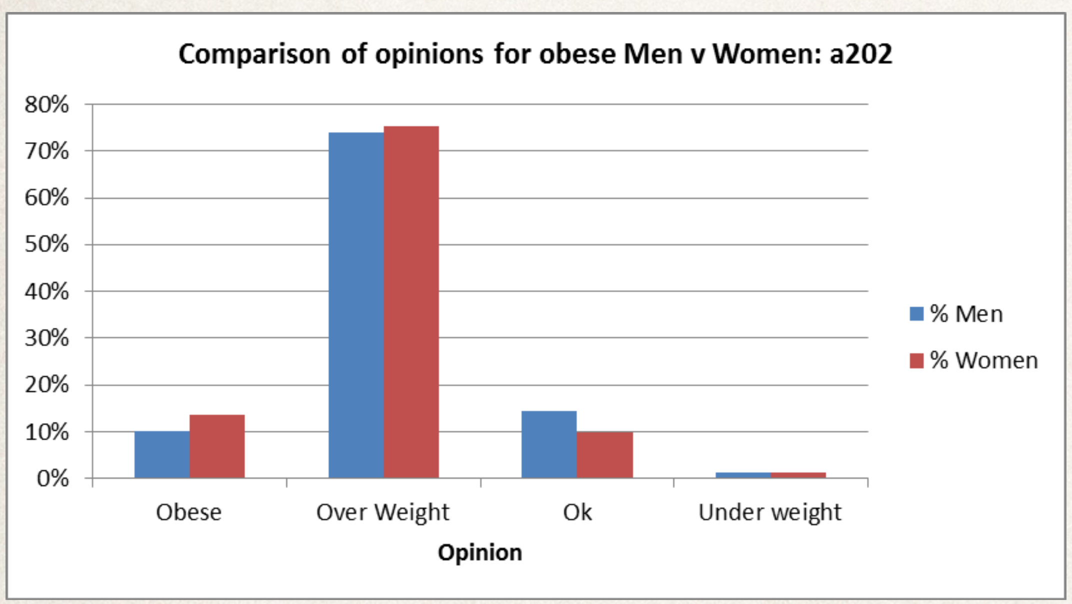
Rational Decision Making:

Our processing unit - misperception by image

Epidemiological data from ENSANUT 2006







People think they're less overweight/obese than they are. Symptom severity is under-estimated.

Fundamental question: Why do we "lie" to ourselves?

J. Easton, H. Sicilia - BMC, Frontiers in Public Health

Perception of weight and Cognitive Biases - What you think/feel

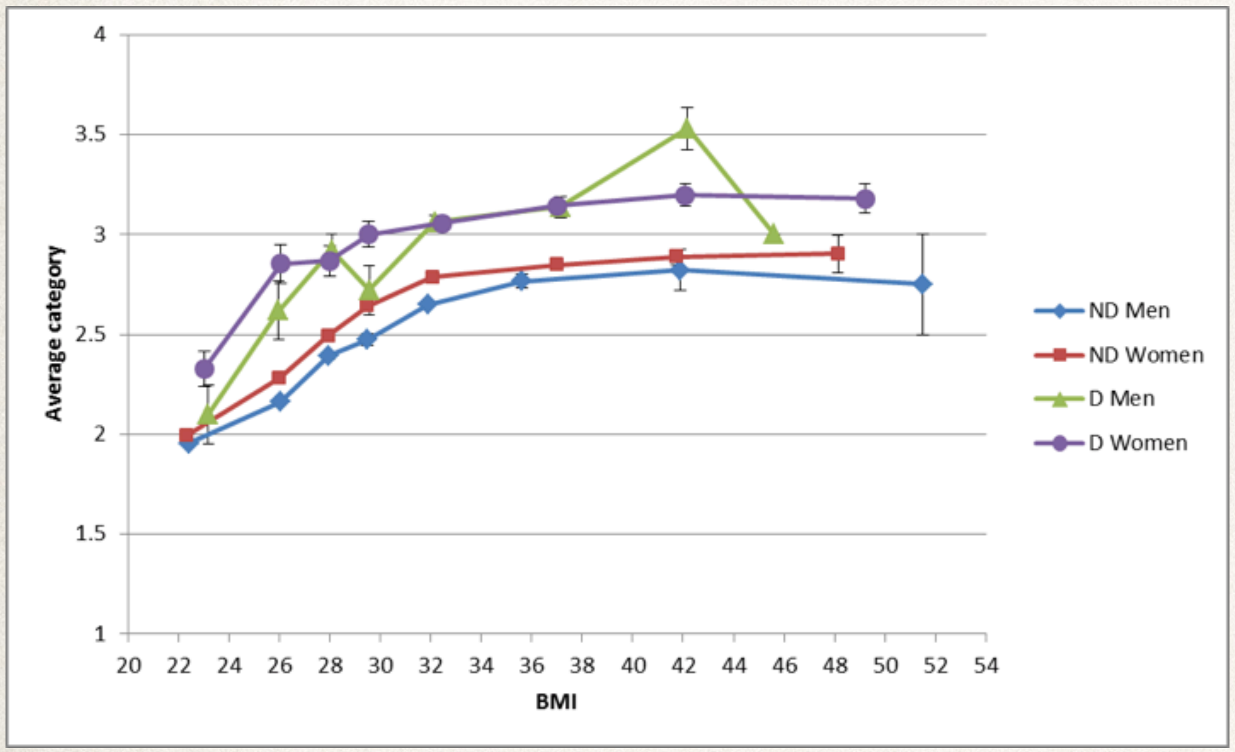


Figure 2. Comparison of non-diagnosed (ND) versus diagnosed (D) obese mean responses for the category self-perception question by gender.

Slopes in the linear range are 35-50% less than one would expect if people could gauge their weight accurately! The lobster in the pot syndrome

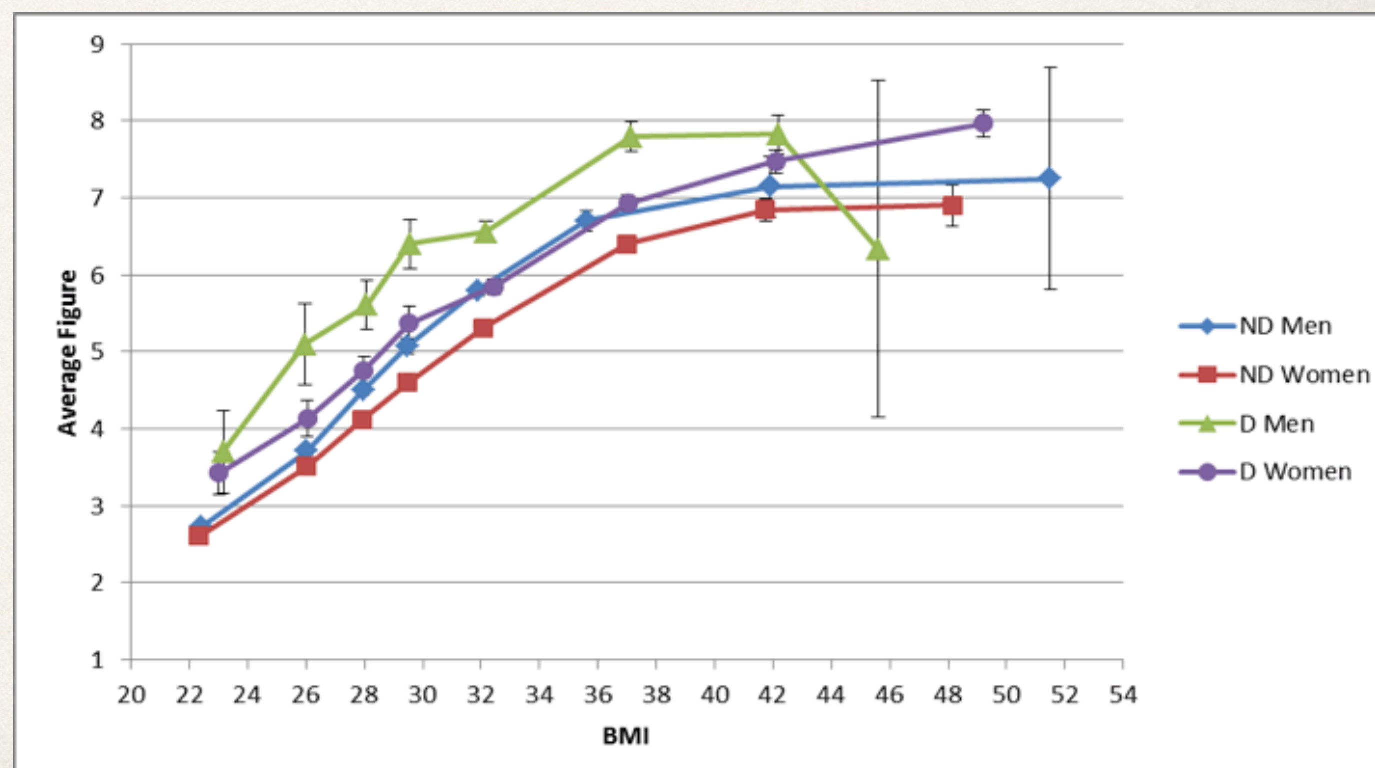
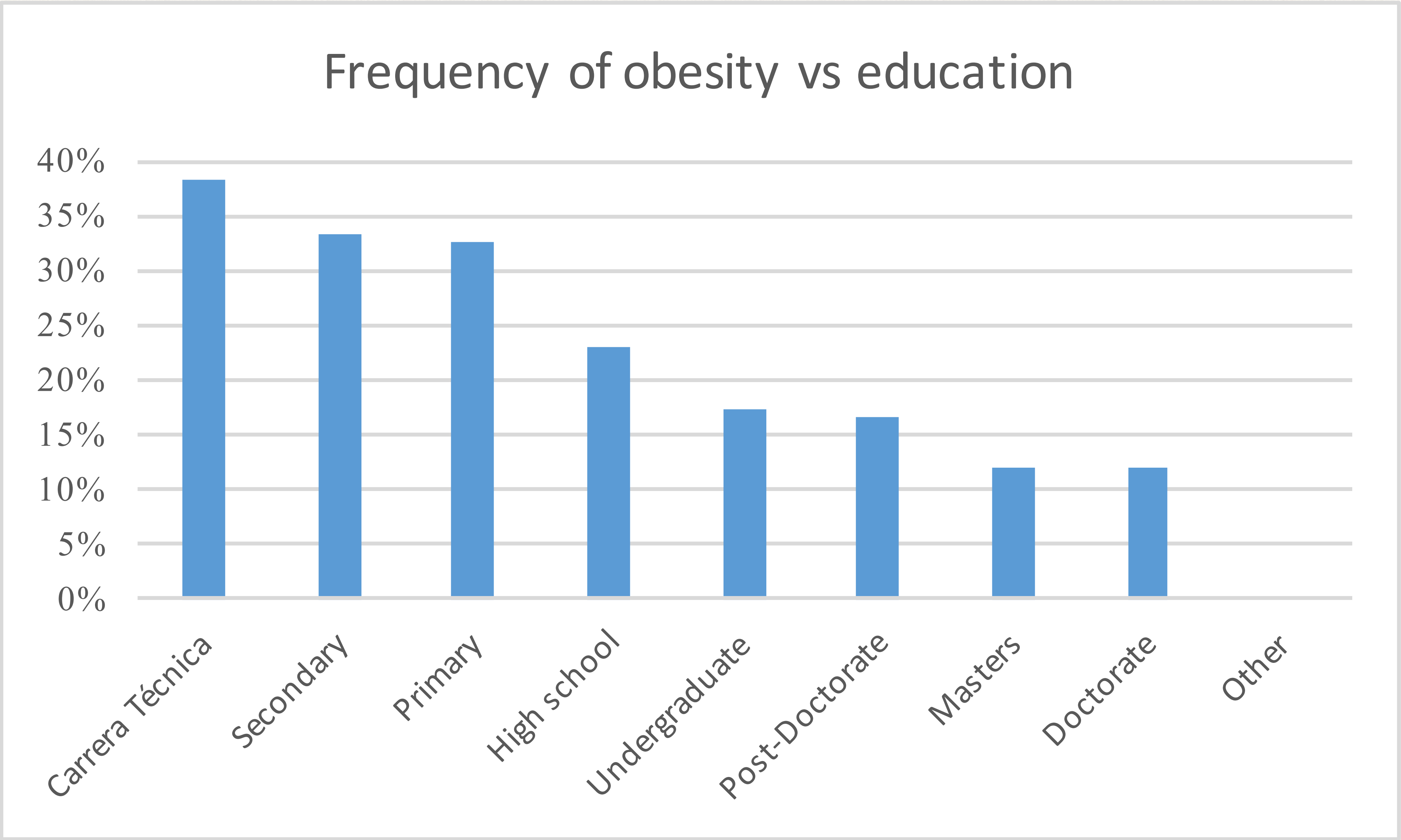


Figure 3. Comparison of non-diagnosed (ND) versus diagnosed (D) obese mean responses for the Stunkard figure rating scale question by gender.

Self-serving bias

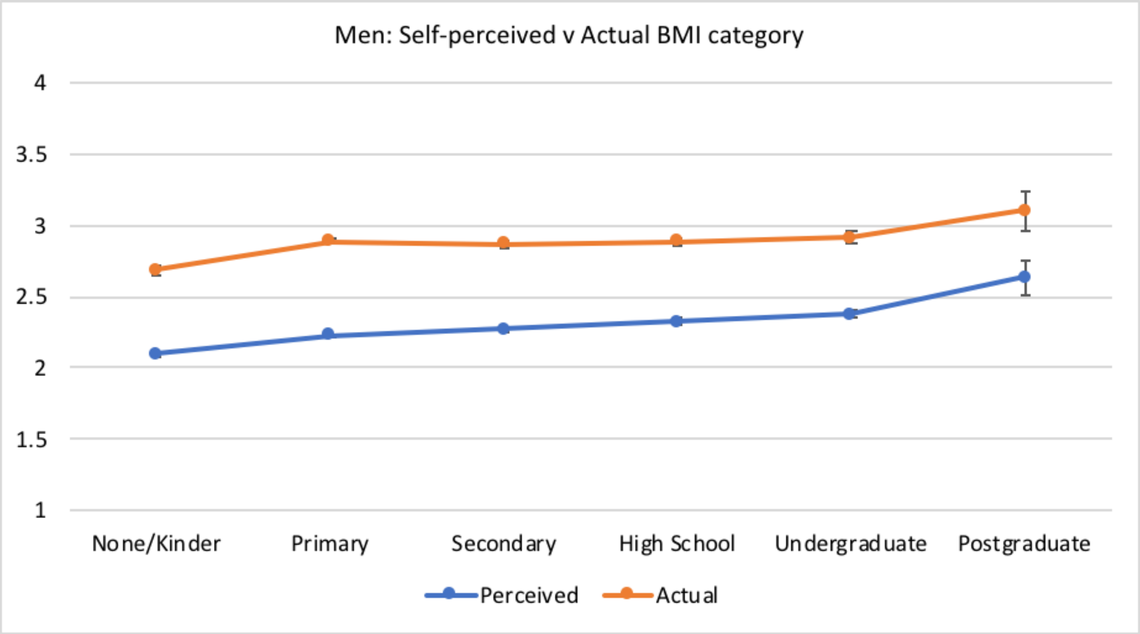
Anchoring bias

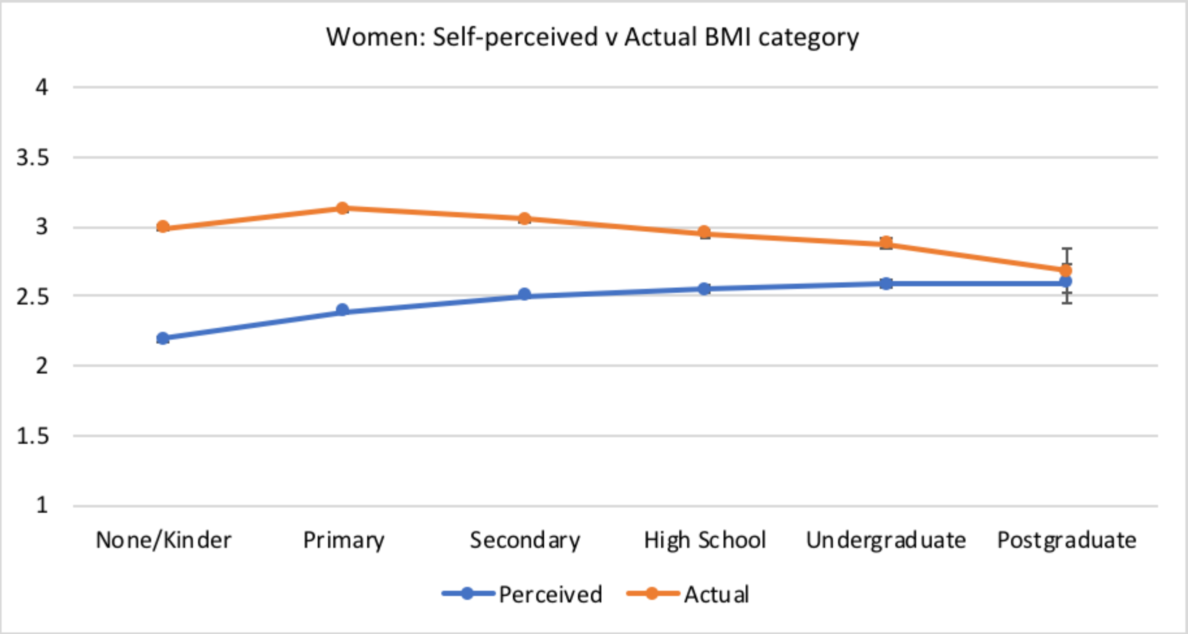
The Role of Education
What Decisions are Taken Differently?



UNAM 2014 Study: 1,076 participants

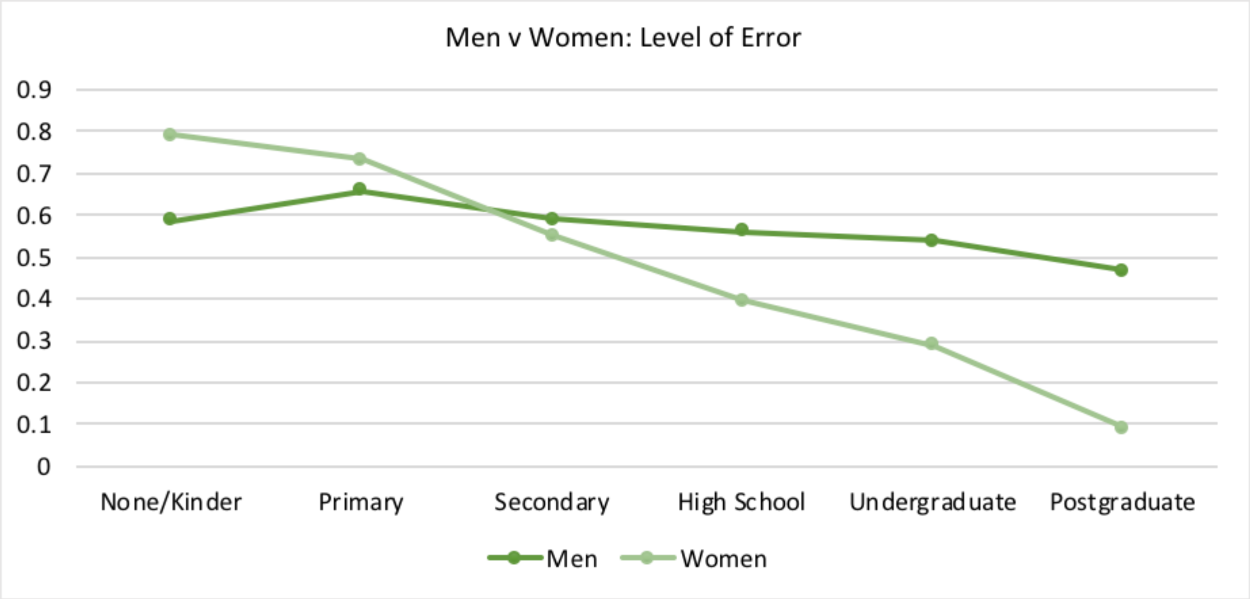
Perception, Educational Level and Gender





"Do you consider yourself to be…? 1) Overweight, 2) Obese, 3) Underweight, 4) Normal"

People of different educational levels have different models of themselves and their environment



Gender difference for BMI versus height

ENSANUT 2006

Perception, Educational Level and Gender

All BMI Obese	Education level (n; %)					
Self-Perception	None/Kinder	Primary	Secondary	High School	Undergraduate	Postgraduate
Obese	13; 2.3	87; 3.3	54; 5	29; 7.1	19; 7.4	1; 6.7
Overweight	338; 59.5	1845; 69.8	830; 77.4	326; 80.3	209; 81.3	13; 86.7
Normal	200; 35.2	672; 25.4	177; 16.5	50; 12.3	28; 10.9	1; 6.7
Underweight	17; 3	38; 1.4	12; 1.1	1; 0.2	1; 0.4	0; 0
BMI Obese Men	**Education level (n; %)**					
Self-Perception	None/Kinder	Primary	Secondary	High School	Undergraduate	Postgraduate
Obese	4; 3.7	14; 2.2	13; 4.6	10; 6.8	3; 2.5	1; 9.1
Overweight	65; 60.2	406; 62.8	196; 68.8	110; 75.3	98; 81.7	9; 81.8
Normal	38; 35.2	217; 33.5	69; 24.2	26; 17.8	18; 15	1; 9.1
Underweight	1; 0.9	10; 1.5	7; 2.5	0; 0	1; 0.8	0; 0
BMI Obese Women	**Education level (n; %)**					
Self-Perception	None/Kinder	Primary	Secondary	High School	Undergraduate	Postgraduate
Obese	9; 2	73; 3.7	41; 5.2	19; 7.3	16; 11.7	0; 0
Overweight	273; 59.3	1439; 72.1	634; 80.5	216; 83.1	111; 81	4; 100
Normal	162; 35.2	455; 22.8	108; 13.7	24; 9.2	10; 7.3	0; 0
Underweight	16; 3.5	28; 1.4	5; 0.6	1; 0.4	0; 0	0; 0

ENSANUT 2006

Number and percentage of actual BMI obese by self-perceived BMI category and educational level.

Perception, Educational Level and Gender

All	Education Level (n; %)					
Actual BMI	None/Kinder	Primary	Secondary	High School	Undergraduate	Postgraduate
Obese	13; 2.3	87; 3.3	54; 5	29; 7.1	19; 7.4	1; 6.7
Overweight	154; 19.5	1116; 34.7	652; 45.3	323; 50.1	213; 57	12; 66.7
Normal	543, 72.4	1621; 73.2	750; 70.1	315; 64.2	262; 77.5	14; 73.7
Underweight	11; 36.7	17; 34.7	20; 69	11; 64.7	5; 41.7	N/A
MEN	**Education Level (n; %)**					
Actual BMI	None/Kinder	Primary	Secondary	High School	Undergraduate	Postgraduate
Obese	4; 3.7	14; 2.2	13; 4.6	10; 6.8	3; 2.5	1; 9.1
Overweight	50; 18.1	364; 28.8	189; 34.1	104; 38.7	88; 45.8	7; 63.6
Normal	229; 74.8	753; 81	340; 77.3	132; 65	127; 84.1	7; 87.5
Underweight	4; 33.3	7; 38.9	3; 33.3	3; 42.9	3; 75	N/A
WOMEN	**Education Level (n; %)**					
Actual BMI	None/Kinder	Primary	Secondary	High School	Undergraduate	Postgraduate
Obese	9; 2	73; 3.7	41; 5.2	19; 7.3	16; 11.7	0; 0
Overweight	104; 20.3	752; 38.5	463; 52.4	219; 58.2	125; 68.7	5; 71.4
Normal	314; 70.7	868; 67.6	410; 65.1	183; 63.5	135; 72.2	7; 63.6
Underweight	7; 38.9	10; 32.3	17; 85	8; 80	2; 25	N/A

ENSANUT 2006

Number and percentage of participants correctly identifying their BMI category by educational level for all four standard BMI categories.

Perception and Action

1) "In the last year have you lost or gained weight?"

2) "Was this weight loss intentional?"

BMI Obese	**Education level (n; %)**					
Intention to lose	None/Kinder	Primary	Secondary	High School	Undergraduate	Postgraduate
All	17; 6.3	100; 7.1	61; 9.2	28; 10.9	24; 15.7	2; 25.0
Men	2; 3.9	23; 8.0	10; 6.4	10; 12.2	10; 16.1	1; 25.0
Women	15; 6.8	77; 6.8	51; 10.0	18; 10.3	14; 15.4	1; 25.0

ENSANUT 2006

Mis-perception has consequences

Do We Always Misperceive our Weight?

MHAS Study
Collaboration with INGER

	Self-Reported BMI				
Measured BMI (n; %)	Underweight	Normal	Overweight	Obese	Total
Underweight	4; 57.1	3; 42.9	0; 0.0	0; 0.0	7; 100.0
Normal	4; 1.8	178; 80.2	38; 17.1	2; 0.9	222; 100.0
Overweight	2; 0.5	81; 19.4	292; 69.9	43; 10.2	418; 100.0
Obese	0; 0.0	4; 1.4	71; 24.6	213; 73.9	288; 100.0

There are systematic misperceptions in terms of image and linguistic concept, but not numbers. Why?

Are “Bad” Decisions in our Genes?

Driver	Value	Epsilon	P(C/X)	P(C)	N(X/C)	N(X)	N(C)	NTotal
rs2943641_A	2	2.9391	0.6000	0.2169	6	10	123	567
rs2972146_C	2	2.9391	0.6000	0.2169	6	10	123	567
rs2943650_G	2	2.9391	0.6000	0.2169	6	10	123	567
rs12629908_A	2	2.6981	0.3116	0.2169	43	138	123	567
rs870347_C	2	2.2200	0.2914	0.2169	44	151	123	567
rs1407434_G	0	2.1617	0.2841	0.2169	50	176	123	567
rs972283_A	2	2.1543	0.3085	0.2169	29	94	123	567
rs10496971_C	2	1.9688	0.3011	0.2169	28	93	123	567
rs2241766_C	1	1.9472	0.2741	0.2169	54	197	123	567
rs10885122_A	2	1.9426	0.5000	0.2169	4	8	123	567
rs2986742_G	2	1.9121	0.4545	0.2169	5	11	123	567
rs1799884_A	2	-2.0385	0.0000	0.2169	0	15	123	567
rs3943253_A	2	-2.0502	0.1364	0.2169	15	110	123	567
rs4607517_A	2	-2.1053	0.0000	0.2169	0	16	123	567
rs4880436_A	2	-2.1388	0.0870	0.2169	4	46	123	567
rs174537_C	2	-2.1927	0.0851	0.2169	4	47	123	567
rs174546_G	2	-2.1927	0.0851	0.2169	4	47	123	567
rs174550_A	2	-2.1927	0.0851	0.2169	4	47	123	567
rs972283_A	0	-2.3181	0.1521	0.2169	33	217	123	567
rs2073821_A	2	-2.3502	0.1170	0.2169	11	94	123	567
rs1513181_G	2	-2.3605	0.1250	0.2169	14	112	123	567
rs2237895_A	2	-2.3836	0.1308	0.2169	17	130	123	567
rs7803075_G	2	-2.4635	0.0847	0.2169	5	59	123	567
rs896854_A	0	-2.5528	0.1398	0.2169	26	186	123	567
rs7809589_C	2	-2.5964	0.1231	0.2169	16	130	123	567
rs1111875_A	0	-3.2065	0.1211	0.2169	23	190	123	567

UNAM Study 2014: Genetic analysis

obesity (score = 0.904, predictive but scarce)
772 SNPs considered
Subsets with obesity,
DM2, lipids, hepatic

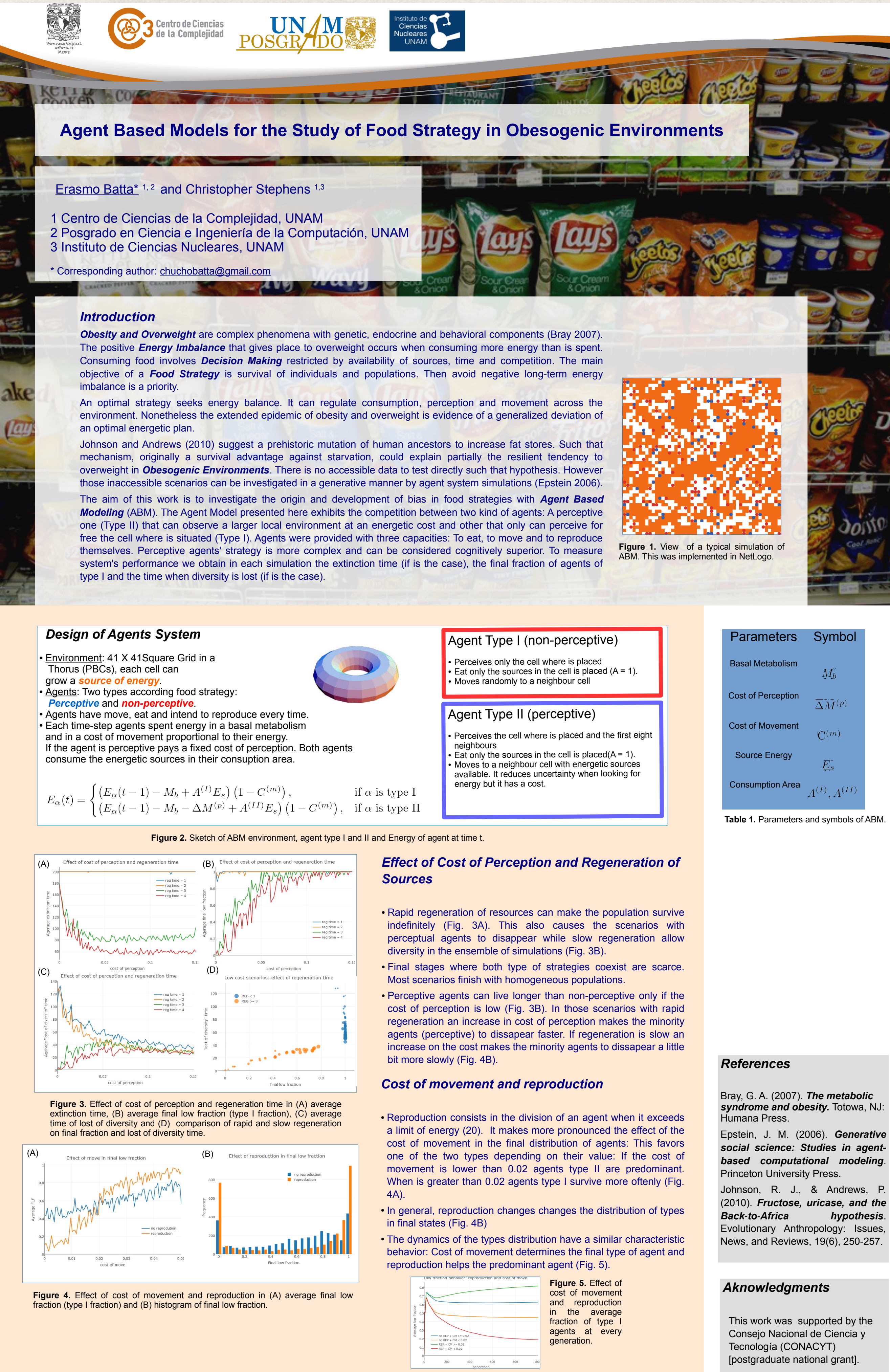
obesity (score = 0.105, not so predictive but common)

Thrifty Gene Hypothesis - Neel 1962

Adaptations that were useful in our evolutionary past are now harmful.

Physiological versus behavioural focus - what genes are associated with generic behaviours. Looking for a “haystack-in-a-needle”.

Evolutionary Psychology versus Evolutionary Just-so stories…



Let's try and recreate the world of 200,000 years ago and see what behaviours were useful in environments then versus environments now.

Recreate environments with scarcity / plenty and find which adaptations are favoured / disfavoured

Conclusions

- The Human Conductome is the entirety of factors which control human behavior: **Behaviour <— Strategies <— Decisions <— Predictions**
- It is extraordinarily multifactorial and adaptive. It requires big, deep data across multiple scales to understand it: genetics, epigenetics, physiology, psychology, neuroscience, epidemiology, sociology,… We don't have such data, but the Data Revolution is helping.
- A crucial ingredient of the Conductome is how we evaluate decisions, the different concepts of value and to understand why we make "bad" decisions.
- Another crucial ingredient is how we create a model of reality that may be substantially different from reality itself. Such deviations can have severe psychological, social and other health consequences.

The goal of Project 42 is to obtain and model data in order to better understand the Conductome and predict human behavior. We have a lot of interesting work to do over the coming months, years, decades,… We need a lot of help!

You're all invited!

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