Conductome

“CONDUCTOME”:

A New Paradigm for Predicting and Explaining Human Behaviour

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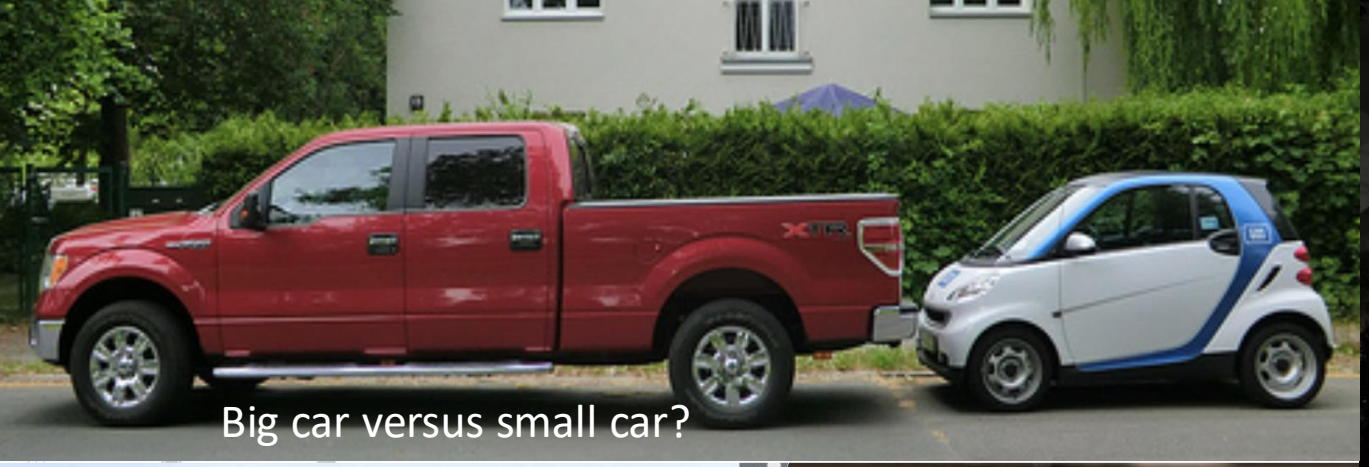
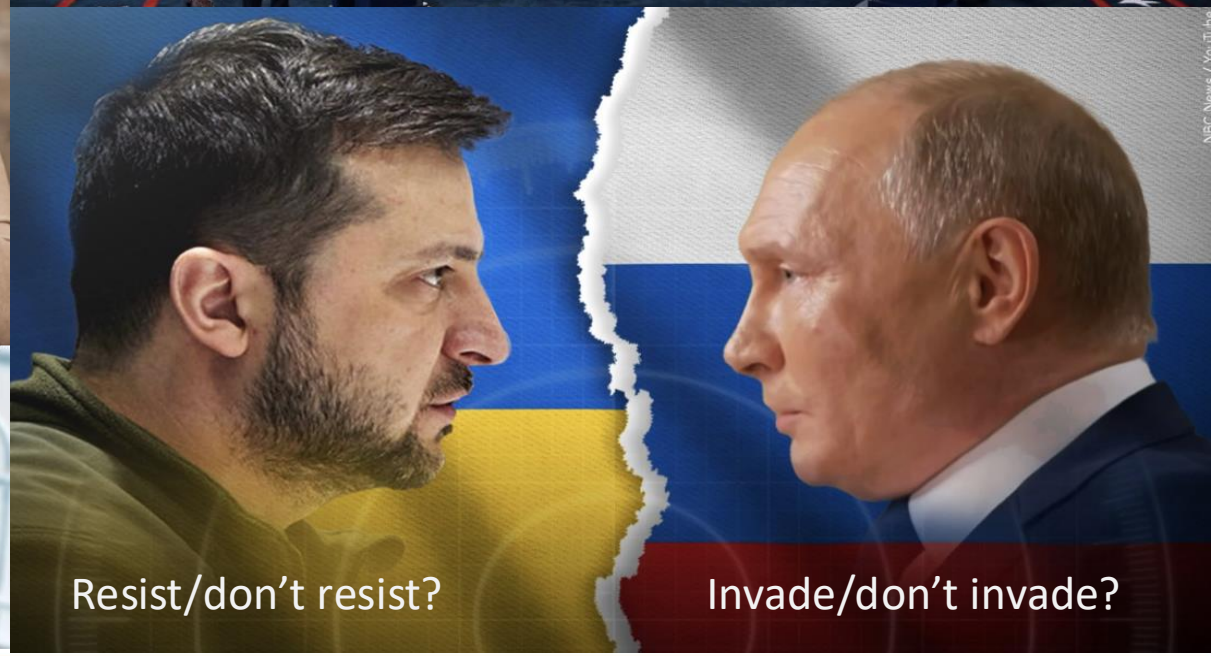

Big car versus small car?


No Mask
Masks


Stairs versus escalator?

Hamburger versus salad?

Netflix or gym?


Resist/don’t resist?
Invade/don’t invade?

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What is the CONDUCTOME?

Two visualizations and a mathematical representation

The **CONDUCTOME** Landscape

- dynamic and adaptive.

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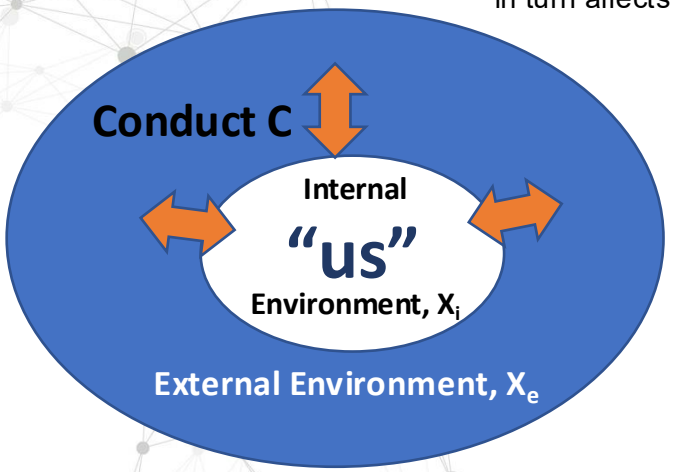
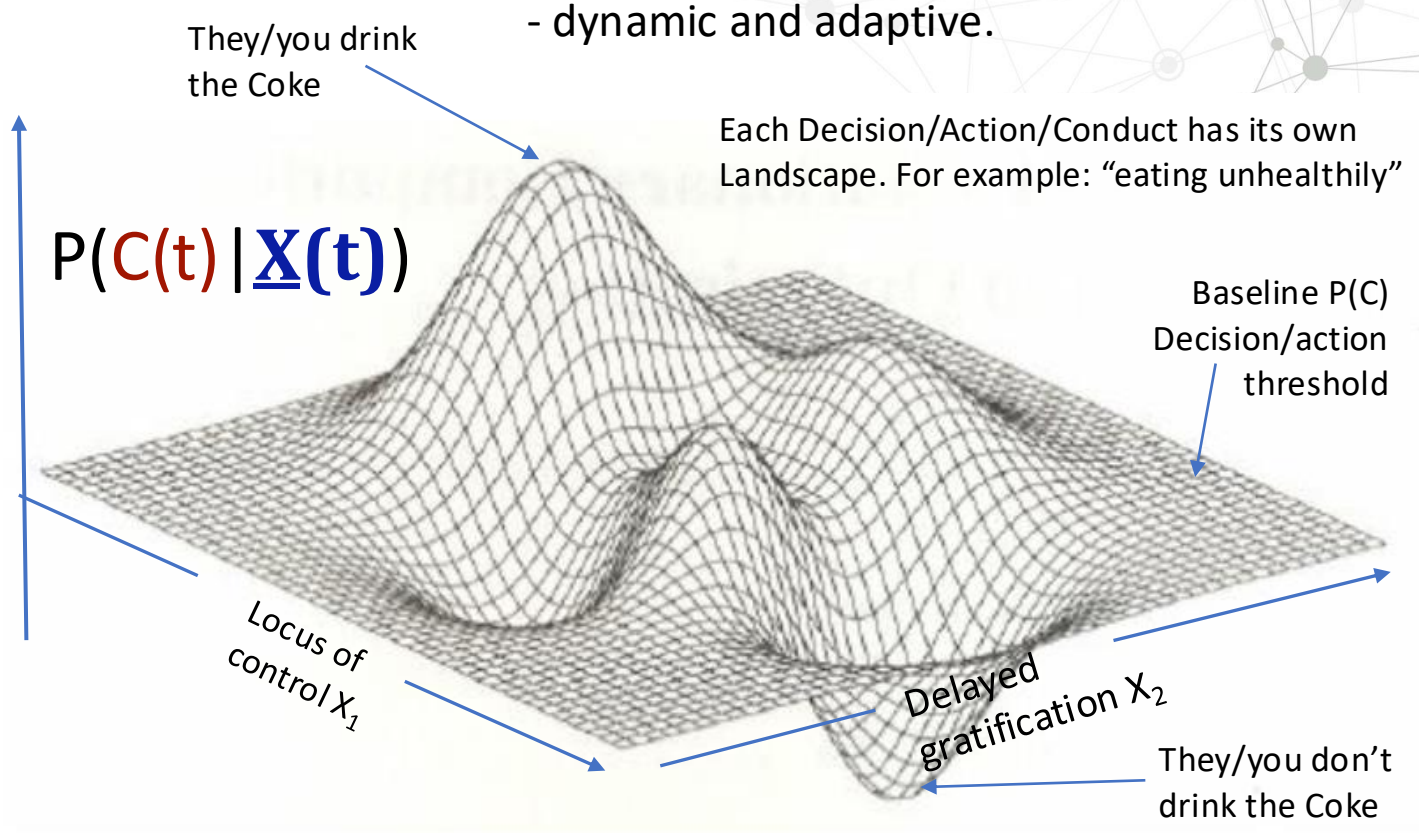
Conduct is the way in which we interact or change the world – "doing". This leads to changes in our physical and mental state which in turn affects our behaviour.





A conduct's "ecological" niche can be defined as **the range of resources, conditions (external) and adaptations (internal) allowing the conduct to maintain itself over time**

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How do we calculate P(C(t)|X(t))?

We need a ”statistical ensemble”?

There are two types: ”**external**” and “**internal**”

Let’s look at an example of an ”external” ensemble…

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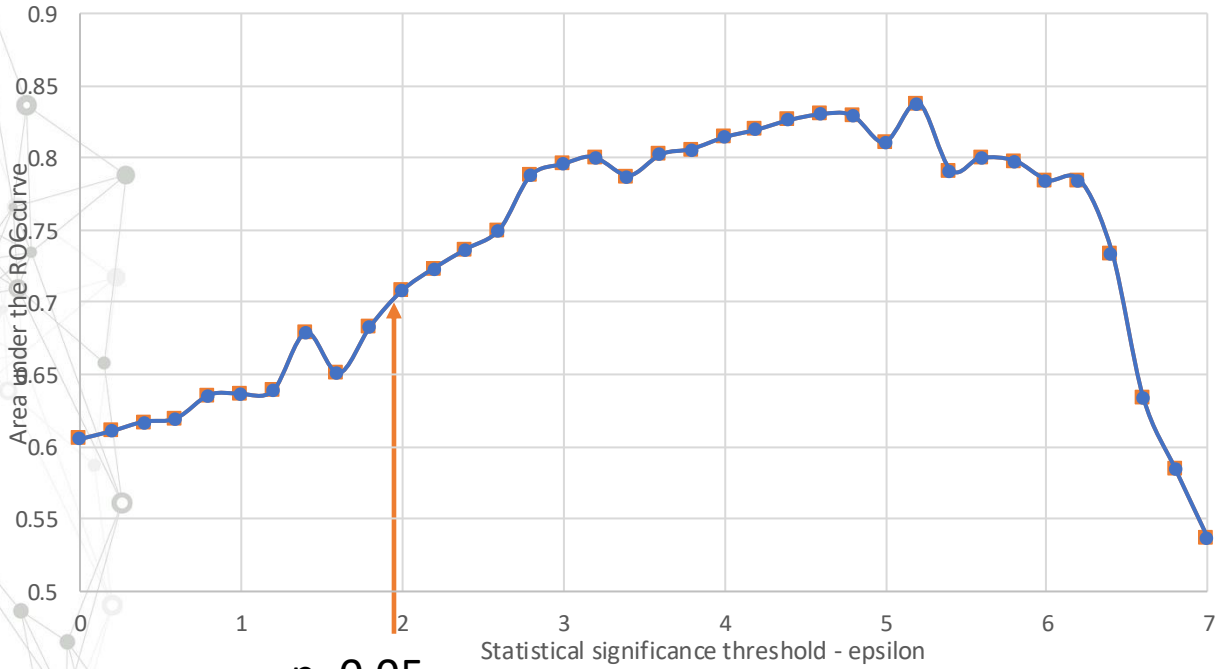
How many and what type of factors $X = (X_1, X_2, \ldots, X_N)$ are relevant for $P(C|X)$ for C = ”eating unhealthily during the pandemic?”

Genetic? Epigenetic? Physiological? Sociological? Economic? Political? Psychological?...

Locus of control? Delayed gratification? Self-efficacy? Stress? Anxiety? Depression? Beliefs?...

Predicting…

The Conduct: C = eating unhealthily (self-reported)
When: during the COVID19 pandemic
Who: 425 undergraduate students from Mexican private and public universities
Data: **X** = 3428 "buckets" from 414 items (119 personal/demographic/economic/health factors) 296 items from: anxiety, depression, stress, delayed gratification, three-factor eating, locus of control, beliefs and self-efficacy



p=0.05

Naïve Bayes approximation used to calculate P(C|**X**). P(C|**X**) → ln(P(C|**X**)/(1-P(C|**X**))) = $\sum_{i=1}^{N} s_i + \ln(\frac{P(c)}{1-P(C)})$ where $s_i = \ln(\frac{P(X_i|C)}{P(X_i|\bar{C})})$.

Variable "buckets" included in the model iff $\varepsilon = \frac{N_{X_i}(P(C|X_i)-P(C))}{\sqrt{N_{X_i}P(C)(1-P(C))}}$ > threshold (binomial test).

Data was divided into 80%/20% training-test split with 5-fold cross-validation for each value of the statistical significance threshold

Explaining…

These are the 28 most statistically significant predictors from 3428 in total from 10 psychological instruments, anthropometric measurements, self-health evaluation, lifestyle, demographics.

All of them explain… a bit

Variable definition	Value	P(C|X)	Epsilon	Score
How do you consider your health during your studies (with pandemic)?	Bad	0.82	7.12	2.35
Do you exercise/have you exercised regularly?	No	0.54	5.92	1.11
How do you consider your physical condition during your studies (with pandemic)?	Bad	0.55	5.44	1.18
How much do you think you ate during your studies (with pandemic)?	More than recommended	0.47	4.84	0.85
How much do you think you ate during your studies (with pandemic)?	Much more than reommended	0.77	4.50	2.01
Anxiety: current level of anxiety, compared to before the pandemic?	Much more	0.54	4.09	1.14
Obesity/overweight Have you consulted or received treatment from a health professional?	Yes	0.56	4.02	1.21
Stress: Current stress level compared to stress before the pandemic?	Much more	0.50	3.64	0.97
Regarding weight, how has it changed due to the pandemic?	Increased	0.40	3.61	0.55
How do you consider your weight to be during your studies (with pandemic)?	Overweight	0.44	3.60	0.75
Locus of control exercise: Select the degree to which this describes you: Rain prevents me from exercising	Describes me frequently	0.77	3.60	1.97
You or a member of this household has a: Car?	No	0.43	3.56	0.68
Height	(1.449, 1.57]	0.42	3.51	0.66
Delayed gratificacion frequency: Even when I'm hungry, I can wait until it's time to eat something	Almost never	0.55	3.50	1.15
Autoefficacy food: How confident are you to be able to adjust to the + 3 times x week routine despite?	If someone offers you unhealthy food.	0.67	3.34	1.57
Delayed gratification level: I have a hard time maintaining a healthy/special diet	Agreed	0.45	3.33	0.77
How do you consider your physical condition during the your studies (with pandemic)?	Very bad	0.68	3.30	1.63
Delayed gratification frequency: I've always tried to eat healthy because it's a good decision for the future.	Sometimes	0.44	3.29	0.74
Delayed gratification frequency: I've always tried to eat healthy because it's a good decision for the future.	Neither agree/disagree	0.46	3.27	0.81
Locus of control exercise: I[d like to exercise but don't know how to do it	Totally describes me	0.59	3.23	1.32
Locus 0f control food: I eat what I eat because it's the only thing there is.	Frequently describes me	0.49	3.23	0.93
How do you consider your health to be before entering the university?	Regular	0.41	3.20	0.63
How do you consider your health during the race (with pandemic)?	Regular	0.39	3.15	0.51
Delayed gratification frequency: I've always tried to eat healthy because it's a good decision for the future.	Almost never	0.57	3.15	1.23
Stunkard figure Which figure represents you when you entered the university?	6	0.50	3.14	0.96
Locus of control food: Even though I want to control what I eat, there are always situations that prevent it.	Frequently describes me	0.63	3.14	1.45
Stress: in the last month How often did you realize that you couldn't do everything you had to do?	Frequently describes me	0.42	3.12	0.66

Explaining…

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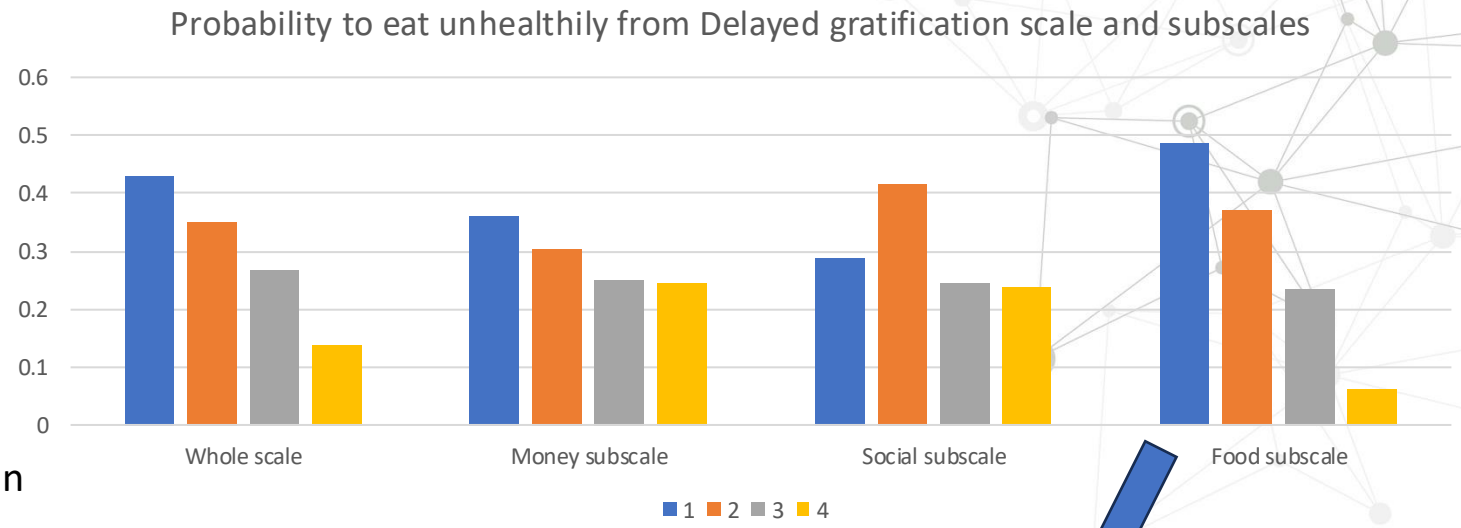
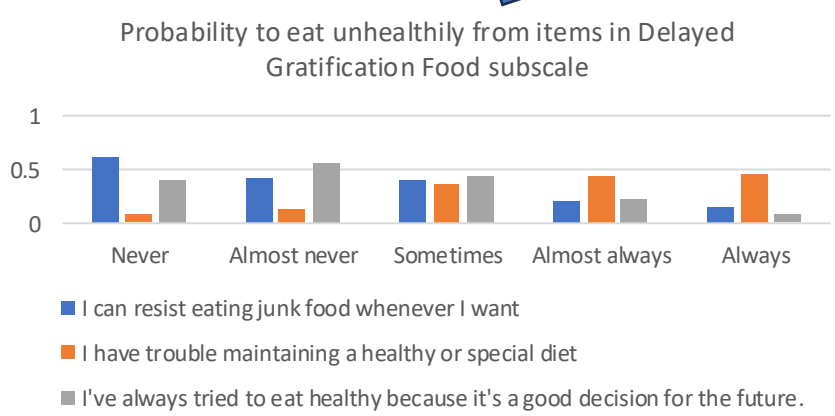
Behaviour: Eating unhealthily

Predictability from Delayed Gratification





Eating behaviour

What does it really mean to ”explain” here?

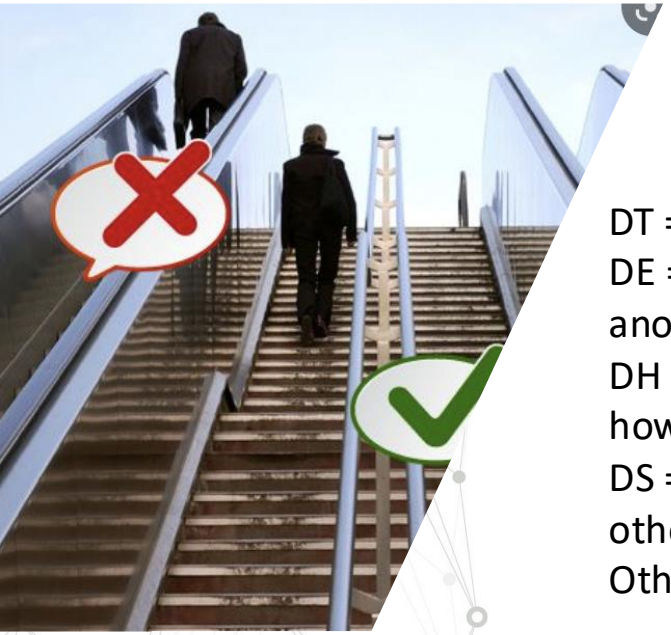
When is a decision “good” versus “bad”?

Why do we take the escalator instead of the stairs?

How does our ”internal” ensemble work?

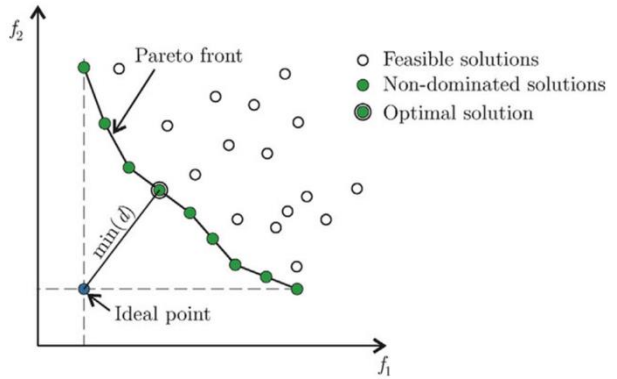
We need a metric to measure it.

Rational decision making implies that there is a unique utility function that we optimize



What is the utility function here?

DT = the time difference between taking the stairs and taking the elevator?
DE = the difference in physical energy expended in one route versus another?
DH = the relative perceived health benefit of one versus the other (think how this can change pre-COVID versus post-COVID!)?
DS = the socialization benefit in the case you would take one versus the other with coworkers?
Others?



How do we balance these tradeoffs and make our decision?

How do we make decisions?

For a potential utility we assign a value function v_i
For N_v value functions we have: $\mathbf{V} = (v_1, v_2, \ldots, v_{Nv})$
Every action A_k leads to a change: $D\mathbf{V}(A_k) = (Dv_1(A_k), Dv_2(A_k), \ldots, Dv_{Nv}(A_k))$

A decision is "good" versus "bad" with respect to a given value function v_i if $Dv_i(A_k) > 0$ ("good" decision) versus $Dv_i(A_k) < 0$ ("bad" decision).

It is not possible to have $Dv_i(A_k) > 0$ for all v_i. E.g., in the stairs-elevator situation if the elevator was slow where $DT(\textit{stairs versus elevator}) > 0$ but $DE(\textit{stairs versus elevator}) < 0$. "You can't have your cake and eat it".

$D\mathbf{V}(A_k)$ can take different values depending on where the measurement is made – pre-action versus post-action.

Post-action, $D\mathbf{V}(A_k)$ represents the real or perceived payoffs of the action, i.e., they are outcomes.

For a pre-action evaluation $\langle Dv_i(A_k) \rangle$ represents the predicted value change due to the action. Although $\langle \ldots \rangle$ could in some circumstances be calculated objectively, in general it comes from an ***internal*** prediction model for estimating what the change in value will be.

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