



 POLITECNICO DI MILANO

Department of Architecture and Urban Studies



Black swans and splendid Unicorns
Complex systems theory and urban resilience

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Eraclitus' revenge

Statement 1. We look at the world through epistemological glasses

Example 1

Descart

vs

Leibniz

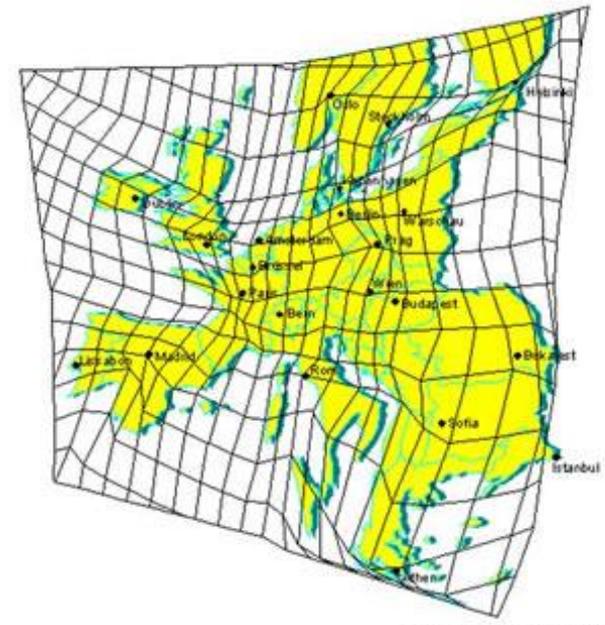
a) Coordinates define distances

b) Distances define coordinates

a)



b)



© Spiekermann & Wegener, IRFUD

Railway travel time 1993



Eraclitus' revenge

Statement 1. We look at the world through epistemological glasses

Other examples:

Biology:

*caterpillar → butterfly → caterpillar or
butterfly → caterpillar → butterfly ?*

Philosophy of science:

Local viewpoint: the whole is more than the sum of the parts

*Global viewpoint: the whole is approx. reduced to the sum
of the parts*



Eraclitus' revenge

Statement 2. The choice of the epistemological glasses depends on: easiness of use, aesthetic reasons, bias (limited knowledge, prejudice)

Statement 3. We are more and more aware that Eraclitus' approach is better than Parmenide's approach for understanding the world.

Parmenide: There are "beings" that evolve more or less quickly over the time

Eraclitus: There are only "processes" that produce more or less persistent shapes (structures) seen as "beings"



Eraclitus' revenge

The evolution of the viewpoint in 4 steps:

since Aristotele till of Newton/Galileo:

explanation of shapes (geometry) and beings (arithmetic, ...)

Newton/Galileo:

the laws of deterministic motion

Termodinamics, evolutionary biology:

probability, randomness,

New science of complexity (not yet largely known among people):

chaotic behaviours, irreversibility, ...

Final statement: Despite the many evidences of an uncertain world, in irreversible evolution, for most of people it's still difficult to accept the Eraclitus' viewpoint; and they go on with using the less suitable Parmenide's view.



Lions and gazelles

“Every day in Africa a gazelle wakes up. It knows it must run faster than the fastest lion or it will be killed. Every morning a lion wakes up. It knows that it must outrun the slowest gazelle or it will starve to death. It doesn’t matter whether you are a lion or a gazelle, when the sun comes up, you better be running”

Abe Gubegna (1934-1980) Ethiopian novelist

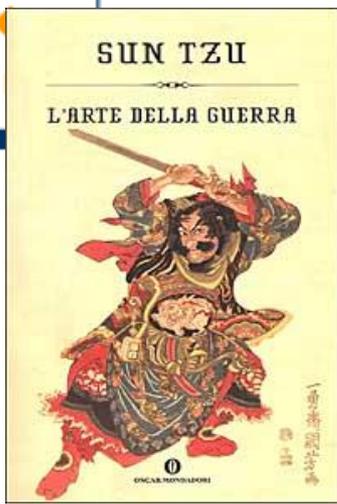
Statement 1. *To persist in an Heraclitus’ world every “being” (from inanimate things till over-human structures - e.g. society -) must be enduring.*

So: + A wall, to persist in a earth-quake, must be strong enough

+ A gazelle, to survive, must run fastest as possible, cluster with other gazelles, simulate death

+ An employ, to keep his job in a ICT society, must learn these ICT

+ A society, to face shortage of resources, must become sustainable



Lions and gazelles

1. *Sun Tzu said: The art of war is of vital importance to the State*
2. *It is a matter of life and death, a road either to safety or to ruin. Hence it is a subject of inquiry which can on no account be neglected.*

Sun Tzu (VI-V century b.C.) The "Art of War"

Statement 2. Endurance can be:

- + **passive:** e.g. **redundancy** (over-dimensioning a beam)
e.g. **multiplicity** (user + pass + security key)
- + **active:** e.g. **taming the uncertain** (warning systems)
e.g. **adaptation** (learning from disasters)

Final statement . Endurance measures are costly and often they seem to be unnecessary when the system looks far from risks. Right evaluation of the cost/benefit ratio of these measures is the big puzzle for living beings in a uncertain world

N. Taleb's Black Swans

Black Swan Theory

comes from the book

*"The Black Swan: The Impact of the Highly Improbable"
by Nassim Nicholas Taleb (2007)*



*The phrase is the poet Juvenal's characterization of something being "**rara avis in terris nigroque simillima cygno**" ("a rare bird in the lands: black and very much like a swan").*

*The black swan was **assumed not to exist**. Then black swans were discovered in Australia.*

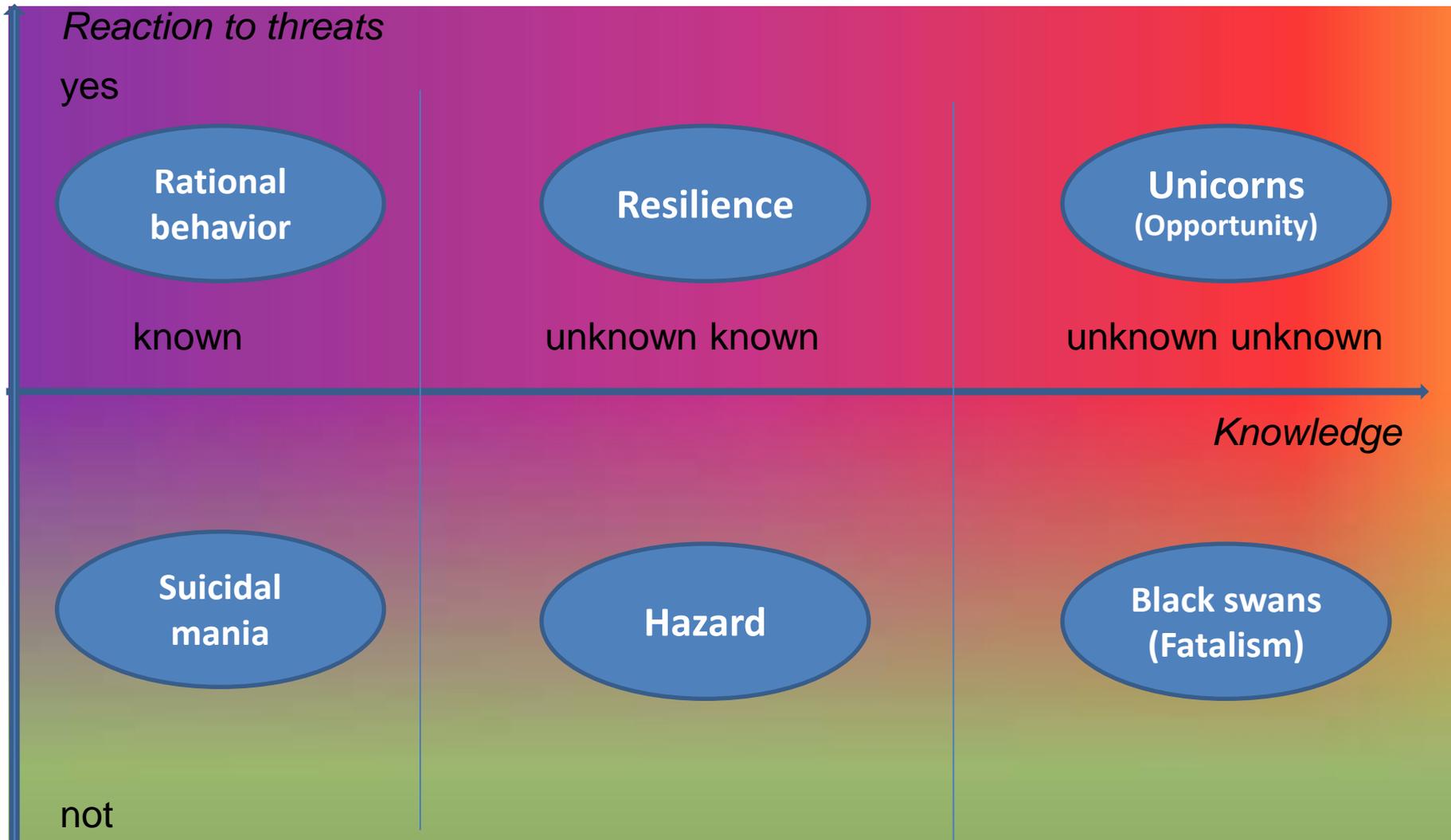
*So "**black swan**" is a metaphor for largely unexpected events.*

*The "black swan theory" refers to the impact to unexpected events of large magnitude and consequence and **their dominant role in history**. It's a theory of very rare events. Such events, considered extreme outliers, collectively play vastly larger roles than regular occurrences.*



N. Taleb's Black Swans

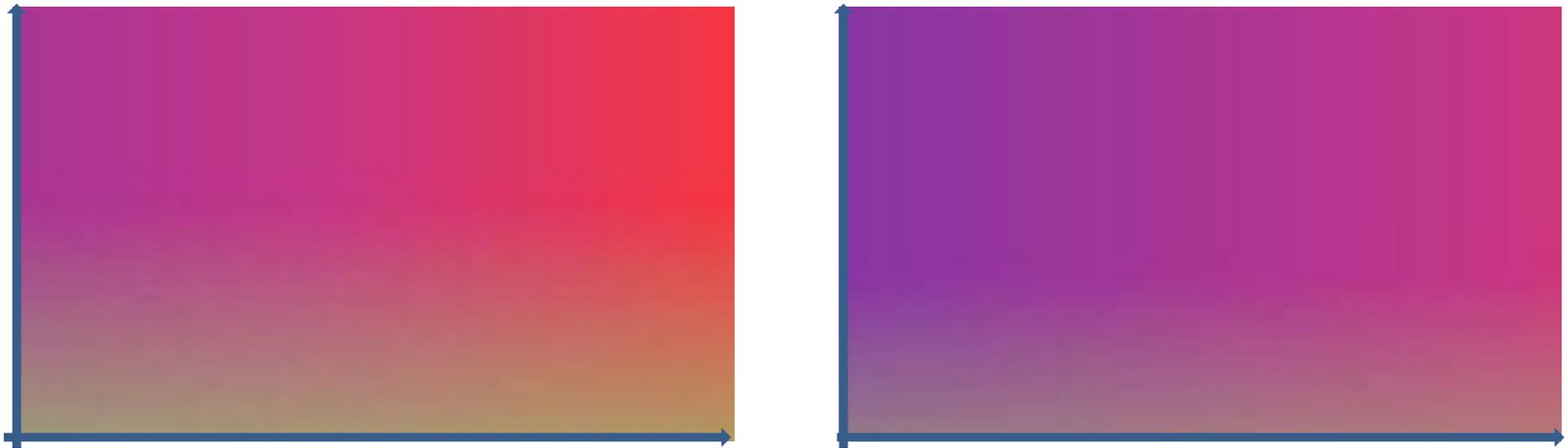
Living in a uncertain world: knowledge and behavior (a map)





“Unicorns” & Resilience in Knowledge Society

Opportunity: Knowledge and ICT reduce unknown and increase spaces for resilience and “splendid unicorns” actions.

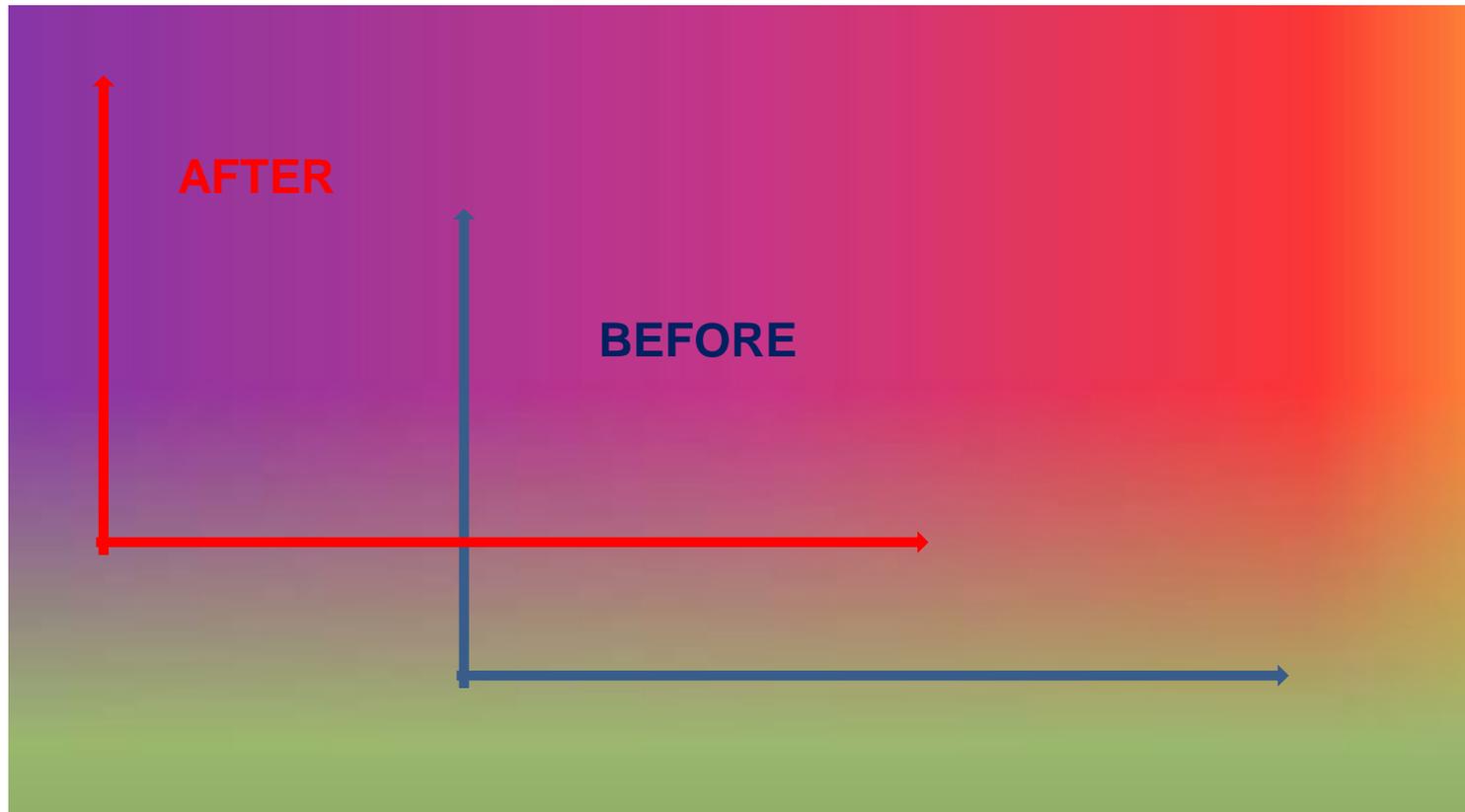


more knowledge, more reaction to threats



“Unicorns” & Resilience in Knowledge Society

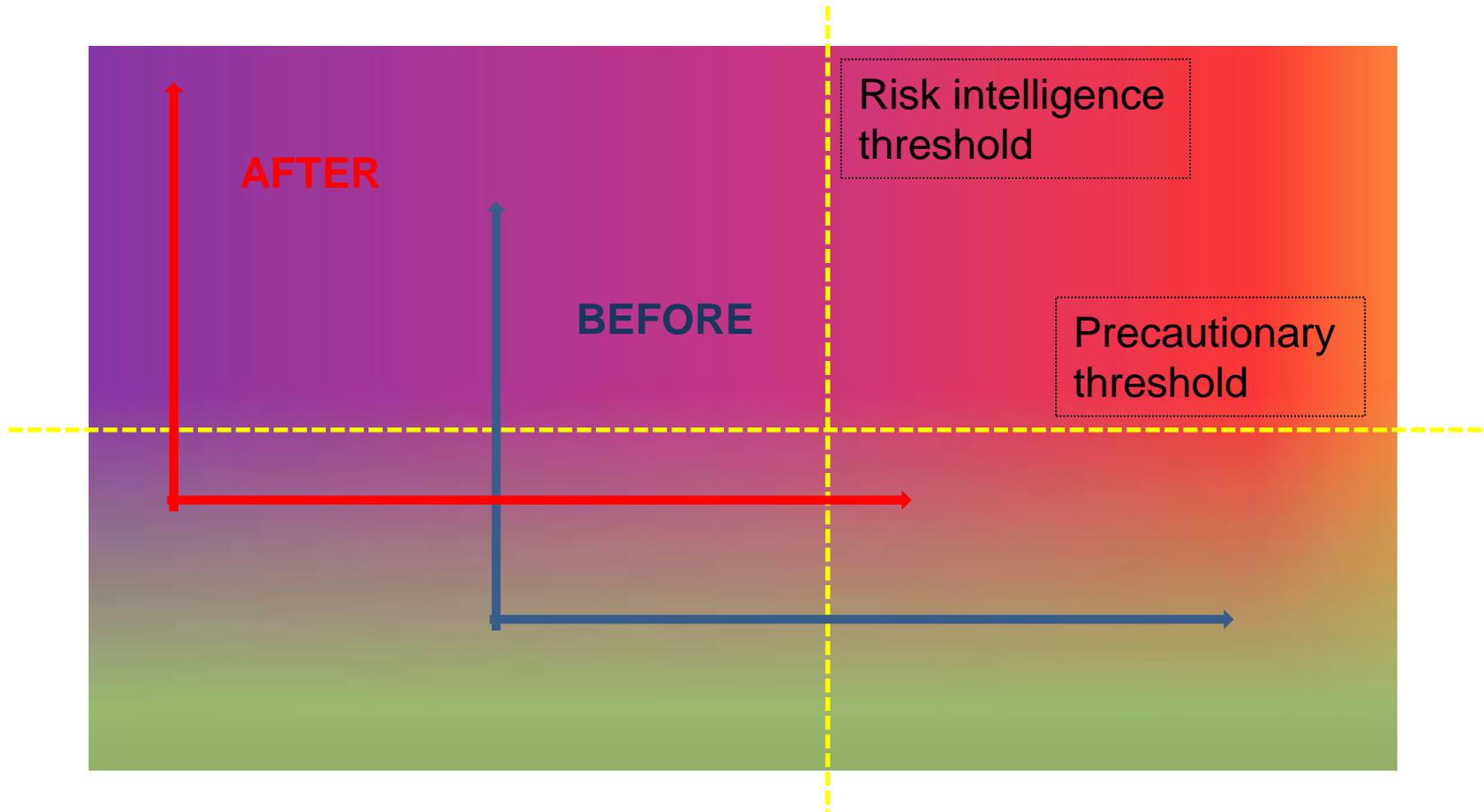
The shift of the “window” of knowledge and actions, within an “ideal” space of knowledge/action.





“Unicorns” & Resilience in Knowledge Society

- Threats: 1. *reduced risk intelligence (consciousness of the unknown)*
2. *reduced reaction to risk (loose precautionary principle)*





Thanks for your attention

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