Maurizio Indirli

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L'evoluzione del concetto di resilienza

LIFE FRANCA , Prima Conferenza Nazionale

Anticipare e comunicare i rischi naturali

Trento, 18-20 aprile 2018

dal latino:

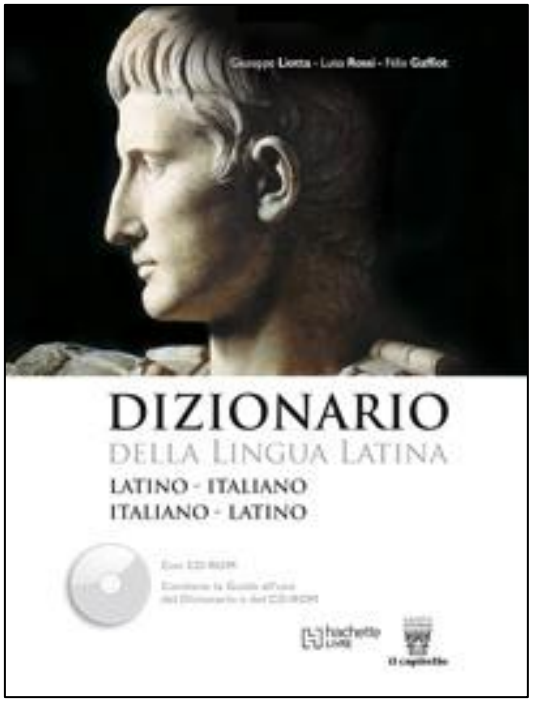
resilire (rĕsĭlĭo, rĕsĭlis, resilui, rĕsĭlīre; resilĭens -ĕntis)

1) **saltare indietro, ritornare saltando**
2) **indietreggiare velocemente, ritirarsi precipitosamente, retrocedere in fretta**
3) **rimbalzare, ripercuotersi**
4) **ripiegarsi su se stesso, restringersi, ridursi**
5) **rinunciare, disdire**

Alexander D.E., 2013.
Resilience and disaster risk reduction:
an etymological journey,
Nat. Hazards Earth Syst. Sci., 13, 2707-2716.

La voce è presa da:

G. Liotta, L. Rossi, F. Gaffiot
DIZIONARIO DELLA LINGUA LATINA
Latino Italiano
HACHETTE Livre
il capitello Torino 2010



stoicismo
Antica Grecia

resilienza
come atteggiamento
di distacco

cultura latina

- *Marcus Vitruvius Pollio* (ca. 80-70; ca. dopo 15 a.C.)
- *Titus Lucretius Carus* (94; 50 a.C.)
- *Gaius Plinius Secundus Maior* (23 o 24; 79 d.C.)
- *Lucius Annaeus Seneca Maior* (ca. 54; ca. 39 d.C.)
- *Lucius Annaeus Seneca Minor* (ca. 4 BC; 65 d.C.)
- *Publius Ovidius Naso* (43 BC; 17 d.C.)
- *Marcus Tullius Cicero* (106; 43 a.C.)
- *Titus Livius* (59 a.C.; 17 d.C.)
- *Marcus Fabius Quintilianus* (ca. 35-40; 96 d.C.)
- *Lucius Enneus Florus* (74; ca. 130 d.C.)
- *Gaius Petronius Arbiter* (ca. 27; 66 d.C.)

più tardi, tra gli altri:

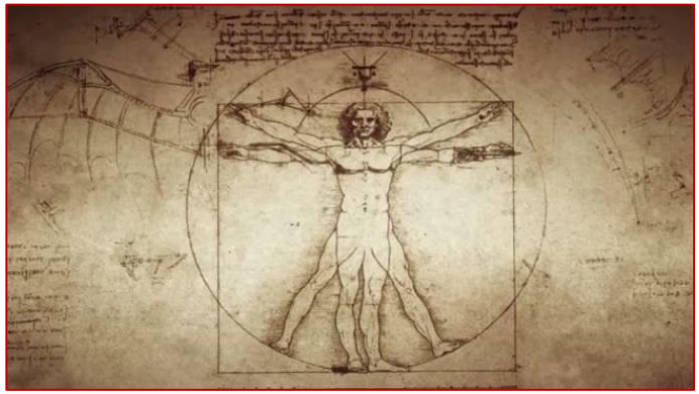
- *Ammianus Marcellinus* (ca. 325-330; dopo 391 d.C.)
- *Flavius Vegetius Renatus* (seconda metà IV-V secolo)

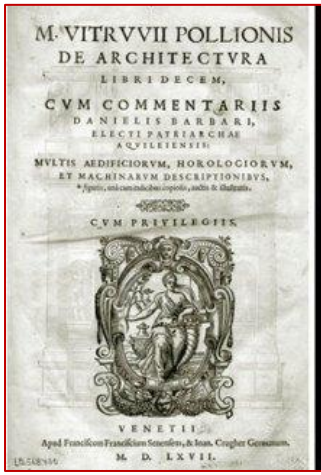
Plutarcus
(50; dopo 120 d.C.)
Greco romanizzato
nato a Cheronea)

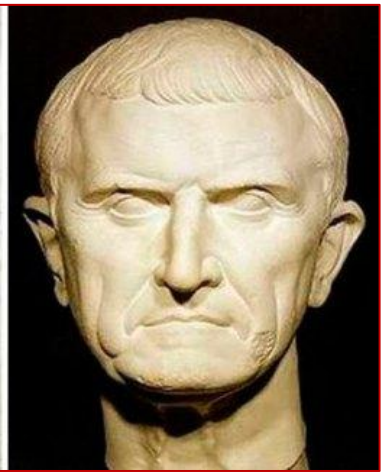
Vite Parallele (Licurgus e Numa Pompilius)
resilienza nei tratti dei leader,
incluse virtù morali e intellettuali

- architettura (Vitruvius)
- scienze naturali (Lucretius, Plinius Maior)
- legge e religione (Seneca Maior, Seneca Minor, Cicero, Quintilianus)
- descrizione del quotidiano in senso tangibile e metaforico (tutti)
- letteratura (Ovidius, Petronius)
- storia (Livius, Florus, Marcellinus, Renatus)

architettura







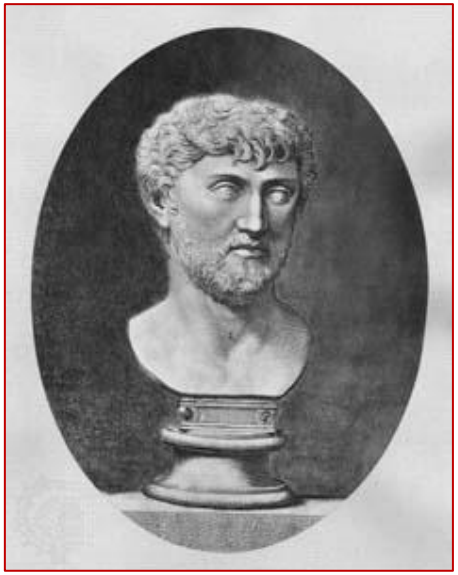
Marcus Vitruvius Pollio,
De Architectura

"L'Architettura è una scienza, che è adornata di molte cognizioni, e colla quale si regolano tutti i lavori, che si fanno in ogni arte."

l'acustica nei teatri

poesia e scienze naturali

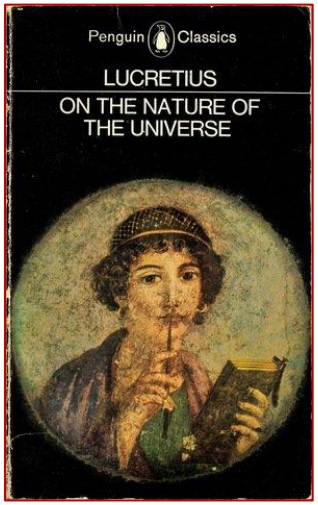
Titus Lucretius Carus,
De Rerum Natura



"L'uomo può «salvarsi» solo attraverso la conoscenza delle cose e non attribuendo ad interventi divini ciò che non riesce a capire."

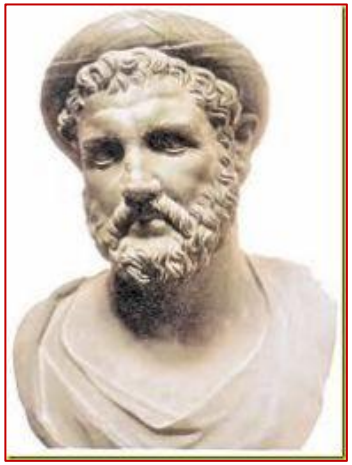
il vuoto e la resistenza dei corpi

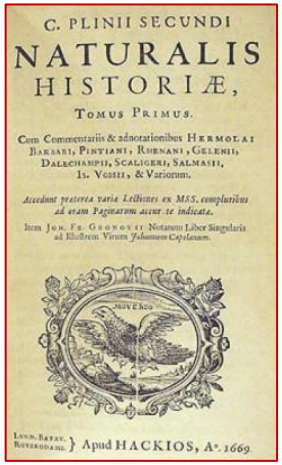
i simulacri, atomi sottilissimi che si distaccano dalle cose o dai corpi e colpiscono i nostri sensi (immagini)



scienze naturali

Gaius Plinius Secundus Maior,
Naturalis Historia



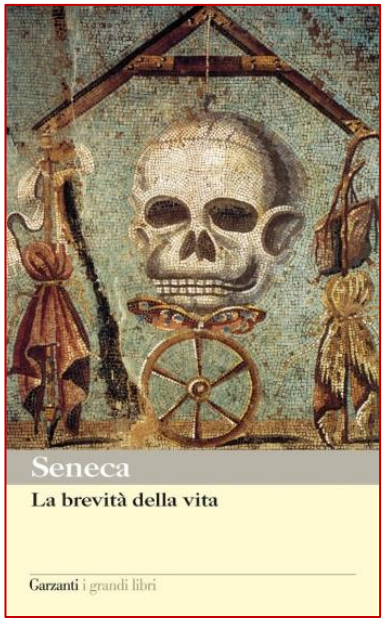

C. PLINII SECUNDI
NATURALIS
HISTORIÆ,
TOMUS PRIMUS.
Cum Commentariis & adnotationibus HERMOLAI BARBARI, PINTIANI, RHENANI, GELENII, DALECHAMPII, SCALIGERI, SALMASII, Is. VOSSII, & Variorum.
Accedunt praeterea varia Lectiones ex MSS. complurimis ad oram Paginarum accurate indicata.
Item JOH. FR. GRONOVII Notarum Liber Singularis ad Illustrem Virum Johannem Capelanum.
MOVERO.
LUGD. BATAV. ROTERODAMI. } Apud HACKIOS, Anno 1669.

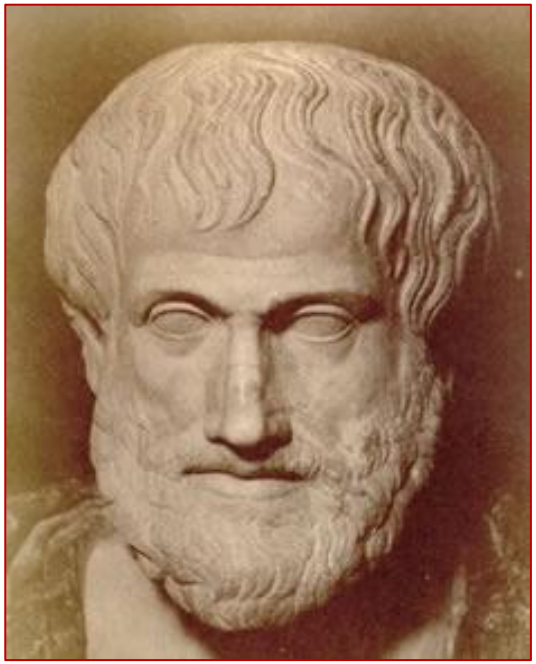
"Nel confrontare diversi autori l'uno con l'altro, ho scoperto che alcuni dei più seri e recenti scrittori hanno copiato, parola per parola, da lavori precedenti senza riconoscerne il merito."

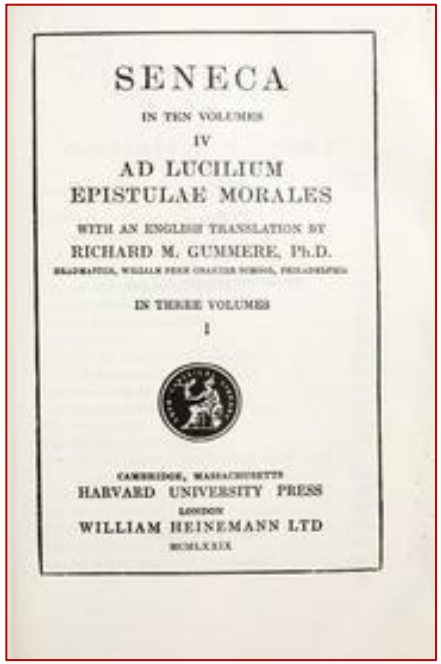
i pesci, il miele e l'ortica

storia e filosofia

Lucius Annaeus Seneca Maior,
Controversiae





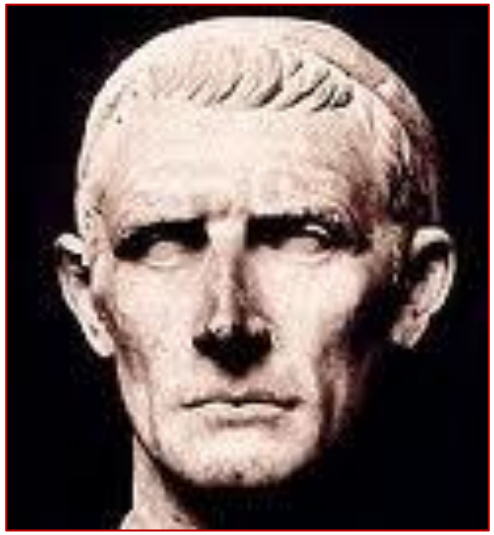

SENECA
IN TEN VOLUMES
IV
AD LUCILIUM
EPISTULAE MORALES
WITH AN ENGLISH TRANSLATION BY
RICHARD M. GUMMERE, Ph.D.
IN THREE VOLUMES
I
CAMBRIDGE, MASSACHUSETTS
HARVARD UNIVERSITY PRESS
LONDON
WILLIAM HEINEMANN LTD

"Il libro ti muta nell'essenza."

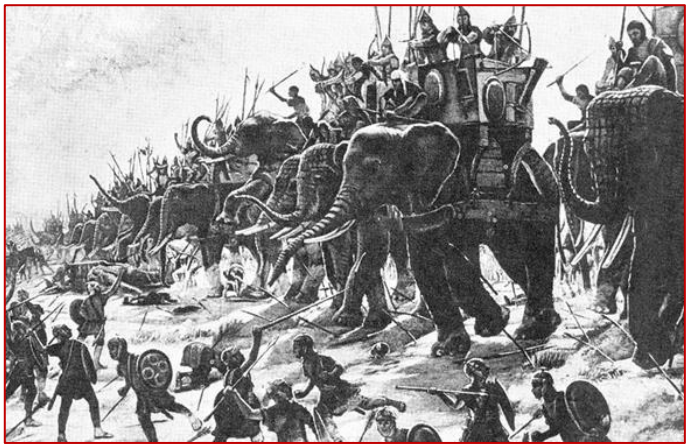
la condanna della sacerdotessa

storia

Titus Livius,
Ab Urbe Condita



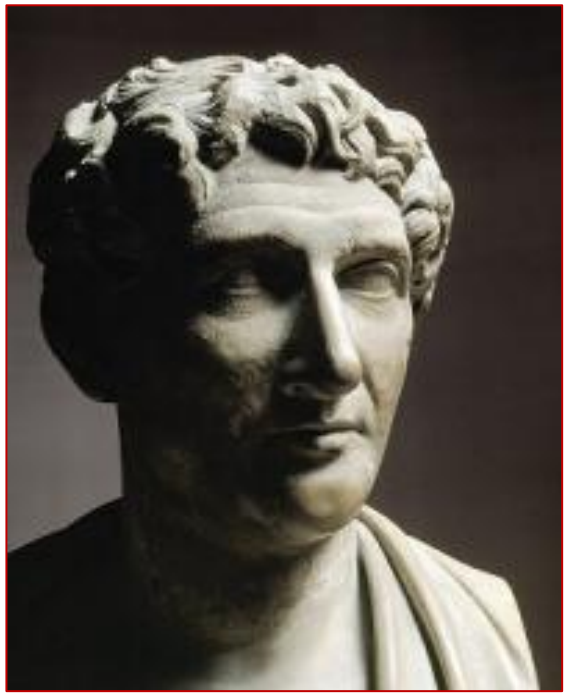
"Portare aiuto dopo la battaglia è tardi."

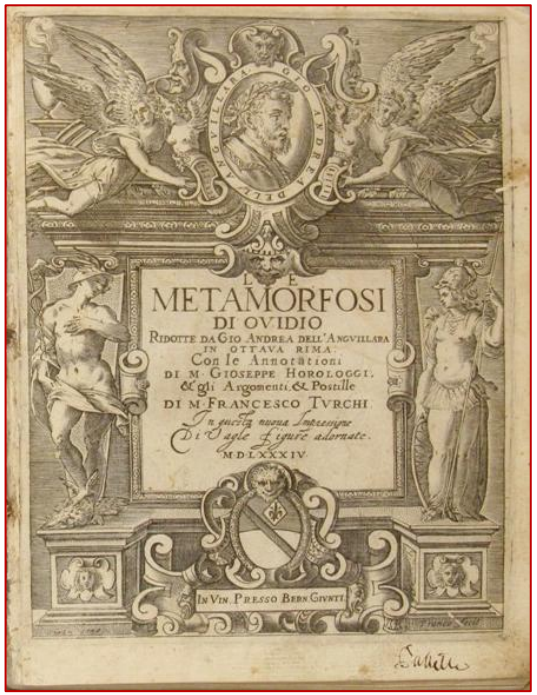


gli elefanti imbizzarriti nella battaglia di Zama

letteratura

Publius Ovidius Naso,
Metamorphoses



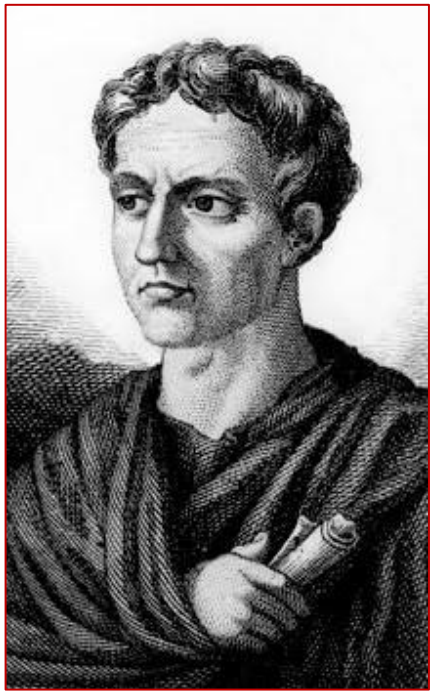


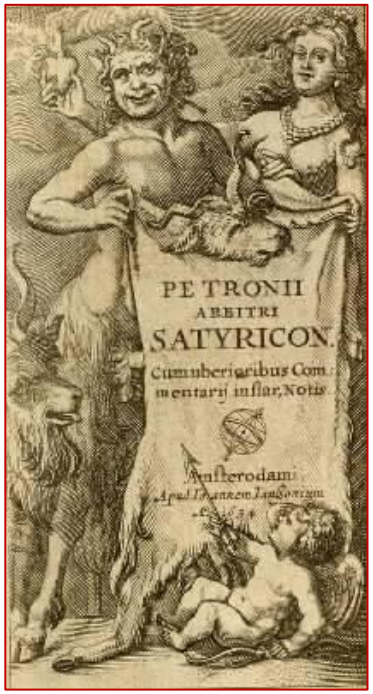
"L'amore è cosa piena di ansioso timore."

navigare, nuotare e combattere

letteratura

Gaius Petronius Arbiter,
Satiricon



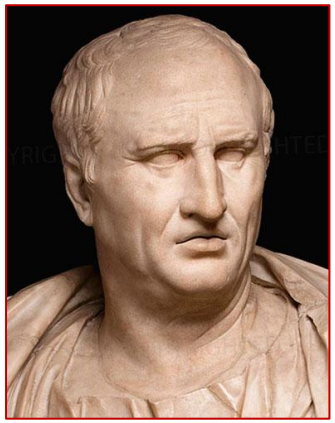


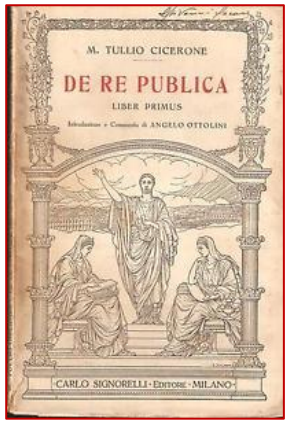
"Che possono le leggi, là dove solo il denaro ha potere,
o dove la povertà non ha mezzi per vincere?
Persino quei filosofi, che passano i giorni gravati dalla cinica bisaccia,
finiscono anch'essi col vendere a fior di quattrini i loro assiomi.
Pertanto anche un procedimento legale è merce da mettere a mercato,
e anche il cavaliere che siede in giudizio non sdegna di farsi comperare."

il giovane schiavo; la lotta di Laocoonte

legge

Marcus Tullius Cicero,
Pro Roscio Armerino





"Mala tempora currunt (Corrono cattivi tempi)."

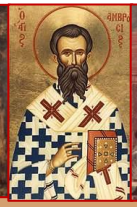
l'accusa rimbalza lontano dal proprio cliente

Marcus Fabius Quintilianus,
Istitutio Oratoria

"Quelli che vogliono apparire saggi tra gli sciocchi, appaiono sciocchi tra i saggi."

come portare il giudice dalla propria parte

cultura latina

cultura medievale

tra gli altri:

- *Sofronius Eusebius Hieronymus* (San Girolamo, ca. 347-420)
- *Ambrosius Mediolanensis* (Sant'Ambrogio, ca. 340-397)
- *Aurelius Augustinus Hipponensis* (Sant'Agostino, 354-430)
- *Paulus Diaconus Warnefred Barnefridus Cassinensis* (Paolo Diacono, ca. 720-799)

più tardi, tra gli altri:

- *Bonaventura Bagnoregis* (Bonaventura, 1221-1274)
- *Gaufridus Monemutensis* (Geoffrey of Monmouth; ca. 1100-1155)

più tardi, tra gli altri:

- *Pietro Alighieri* (1300-1364)
- *Guido da Pisa* (seconda metà XIII secolo; prima metà XIV secolo)



- *Epistolae*
- *Hexameron*
- *Breviculus collationis cum Donatistis*
- *Historia Langobardorum*
- *Legenda Major Sancti Francisci*
- *Historia Regum Britanniae*
- commentari *Divina Commedia*

Dal preciso nucleo concettuale della cultura Romana classica (impiegato non frequentemente ma propriamente), sembra che il termine "**resilire**" e i suoi derivati rimbalzi da un pensatore all'altro, attraverso le epoche: talvolta mantenendo il senso originale fino a Giacomo Leopardi, altrimenti assumendo un significato ambiguo oppure una connotazione negativa.

Giacomo Leopardi
1798-1837

Zibaldone di pensieri

Papa Leone X
1475-1521

"***PERCUSSA RESILIUNT***"
Stanza degli Elementi, Palazzo Pitti, Firenze

Trascurando i passaggi nascosti (difficili da identificare per non specialisti) di "**resilire**" nelle lingue neolatine e nell'inglese (Francese: "résiler"; inglese: "resile"), è bene concentrarci sul lavoro di eminenti intellettuali bilingui (Latino/Inglese; Latino/Volgare) che contribuirono fortemente alla nascita del metodo scientifico moderno.

nascita del moderno metodo scientifico

- *Franciscus Baconus de Verulamio* (Francis Bacon; 1561-1626)
- *Renatus Cartesius* (René Descartes, 1596-1650)
- *Galileo Galilei* (1564- 1642)

Novum Organum e *Sylva Sylvarum*
Latino/Inglese

Epistola CX ad R.P. Mersennum
Latino/Francese

Honoratus Fabrius-Honoré Fabri, 1608-1688, *Tractatus Physicus De Motu Locali*; Fortunio Liceti, 1577-1657, *Liteosphoros, seu de Lapide Bononiensi*)
Latino/Italiano

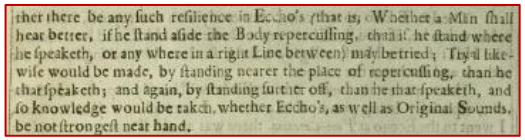
in **Bacone** e **Cartesio** il termine "**resilienza**" (e derivati) compare direttamente per descrivere proprietà fisiche e fenomeni naturali

sebbene sembri che **Galilei** ignori la parola, essa appare in scambi epistolari o dibattiti con colleghi a proposito di Astronomia e moto dei corpi

…"The Eccho cometh as the Original Sound doth in a round orb of Air: It were good to try the creating of the Eccho, where the Body repercussing maketh an Angle: As against the Return of a Wall, & c. Also we see that in Mirrors, there is the like Angle of Incidence, from the Object to the Glass, and from the Glass to the Eye. And if you strike a Ball side-long, not full upon the Surface, the rebound will be as much the contrary way; whether there be any such ***resilience*** *in Eccho's (that is, Whether a Man shall hear better, if he stand aside the Body repercussing, than is he stand where he speaketh, or any where in a right Line between) may betried; Tryal like-wise would be made, by standing nearer the place of repercussing, than he that speaketh; and again, by standing further off, than he that speaketh, and so knowledge would be taken, whether Eccho's, as well as Original Sounds, be not strongest near hand."…*

Francesco Bacone

E' innegabile che, grazie a **Francesco Bacone**, la spinta più robusta verso un approccio scientifico ai problemi si sviluppa in Inghilterra, Scozia e Irlanda.


ther there be any ſuch reſilience in Eccho's (that is, Whether a Man ſhall hear better, if he ſtand aſide the Body repercuſſing, than is he ſtand where he ſpeaketh, or any where in a right Line between) may betried; Tryal like-wise would be made, by ſtanding nearer the place of repercuſſing, than he that ſpeaketh; and again, by ſtanding further off, than he that ſpeaketh, and ſo knowledge would be taken, whether Eccho's, as well as Original Sounds, be not ſtrongeſt near hand.

Ralph Bohun
1639-1716
Discourse concerning the origine and properties of wind

James Keill
1673-1719
An Account of Animal Secretion

Thomas Campbell
1733-1795
A Philosophical Survey of the South of Ireland, in a series of letters to John Watkinson

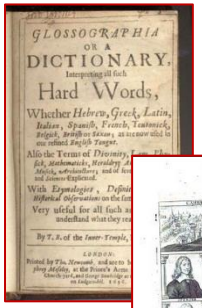
le prime enciclopedie

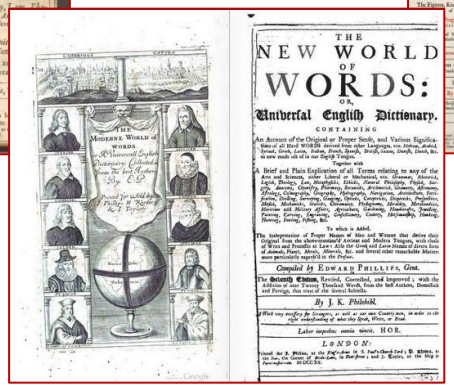
- *Thomas Blount* (1618-1679)
- *Edward Phillips* (1630-1696)
- *Ephraim Chambers* (1680-1740)

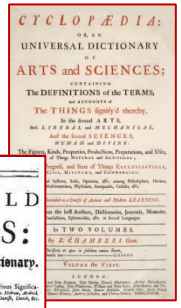
Glossographia

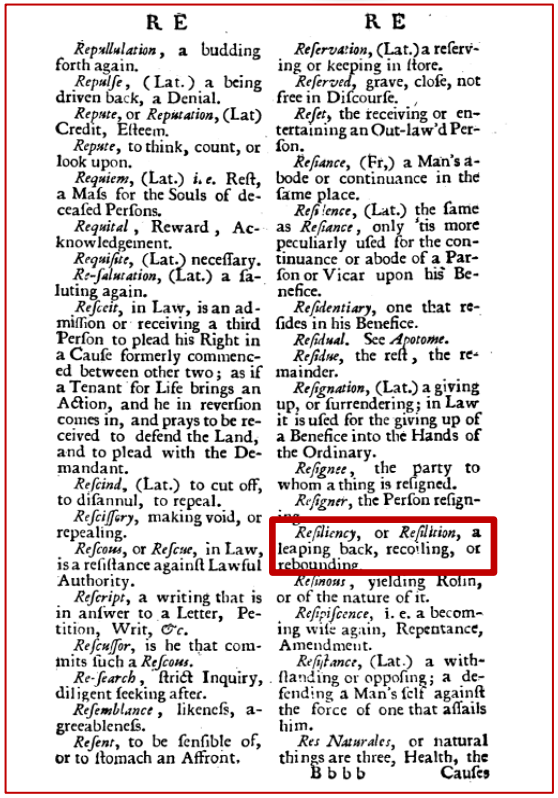
The New World of English Words, or, a General Dictionary

Cyclopaedia, or, an Universal Dictionary of Arts and Sciences





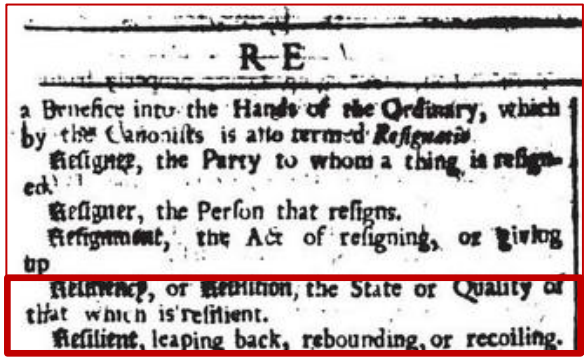




RE RE

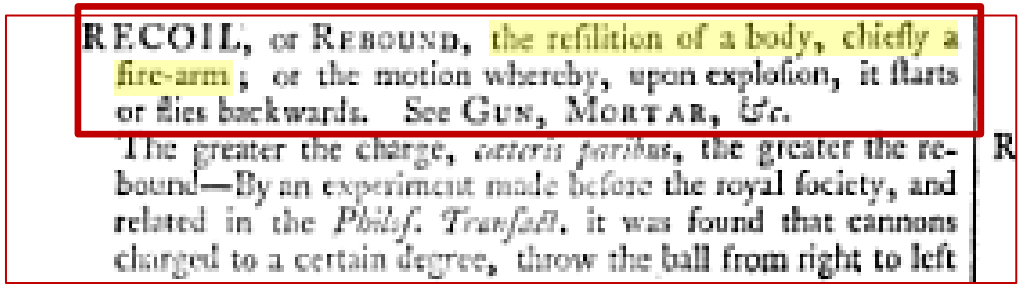
Repullulation, a budding forth again.
Repulse, (Lat.) a being driven back, a Denial.
Repute, or *Reputation*, (Lat) Credit, Esteem.
Repute, to think, count, or look upon.
Requiem, (Lat.) *i. e.* Rest, a Mass for the Souls of deceased Persons.
Requital, Reward, Acknowledgement.
Requisite, (Lat.) necessary.
Re-salutation, (Lat.) a saluting again.
Rescit, in Law, is an admission or receiving a third Person to plead his Right in a Cause formerly commenced between other two; as if a Tenant for Life brings an Action, and he in reversion comes in, and prays to be received to defend the Land, and to plead with the Demandant.
Rescind, (Lat.) to cut off, to disannul, to repeal.
Rescissory, making void, or repealing.
Rescous, or *Rescue*, in Law, is a resistance against Lawful Authority.
Rescript, a writing that is in answer to a Letter, Petition, Writ, *&c.*
Rescussor, is he that commits such a *Rescous*.
Re-search, strict Inquiry, diligent seeking after.
Resemblance, likeness, agreeableness.
Resent, to be sensible of, or to stomach an Affront.
Reservation, (Lat.) a reserving or keeping in store.
Reserved, grave, close, not free in Discourse.
Reset, the receiving or entertaining an Out-law'd Person.
Residence, (Fr,) a Man's abode or continuance in the same place.
Residence, (Lat.) the same as *Residance*, only 'tis more peculiarly used for the continuance or abode of a Parson or Vicar upon his Benefice.
Residentiary, one that resides in his Benefice.
Residual. See *Apotome*.
Residue, the rest, the remainder.
Resignation, (Lat.) a giving up, or surrendering; in Law it is used for the giving up of a Benefice into the Hands of the Ordinary.
Resignee, the party to whom a thing is resigned.
Resigner, the Person resigning.
Resiliency, or *Resilition*, a leaping back, recoiling, or rebounding.
Resinous, yielding Rosin, or of the nature of it.
Resipiscence, i. e. a becoming wise again, Repentance, Amendment.
Resistance, (Lat.) a withstanding or opposing; a defending a Man's self against the force of one that assails him.
Res Naturales, or natural things are three, Health, the

B b b b Causes



R E

a Benefice into the Hands of the Ordinary, which by the Canonists is also termed *Resignatio*.
Resignee, the Party to whom a thing is resigned.
Resigner, the Person that resigns.
Resignment, the Act of resigning, or giving up.
Resiliency, or Resilition, the State or Quality of that which is resilient.
Resilient, leaping back, rebounding, or recoiling.



RECOIL, or REBOUND, the resilition of a body, chiefly a fire-arm; or the motion whereby, upon explosion, it starts or flies backwards. See GUN, MORTAR, &c.
The greater the charge, *ceteris paribus*, the greater the rebound—By an experiment made before the royal society, and related in the *Philos. Transact.* it was found that cannons charged to a certain degree, throw the ball from right to left

Denis Diderot (1713-1784)
Jean Baptiste Le Rond d'Alambert (1717-1783)
co-editori della *Encyclopédie*:
i termini "**résiliation/résilier**" sono confinati nel campo della giurisprudenza.

con il progresso della cultura scientifica occidentale, "**resilience**" - e attributi - mette a fuoco le proprietà fisiche (rimbalzare di oggetti, elasticità dei corpi, assorbimento di energia dopo gli impatti, recupero della forma originale dopo la deformazione, ecc.).

la prima definizione quantitativa ("ingegneristica")

- *Thomas Tredgold* (1788-1829)
- *William John Macquorn Rankine* (1820 -1872)

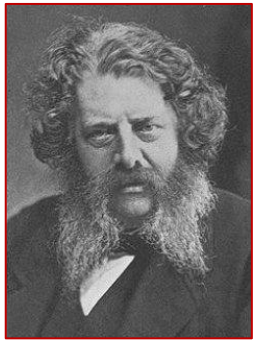
co-fondatore della termodinamica con Rudolf Clausius e William Thomson 'Lord Kelvin'

Practical essay on the strength of cast iron, and other metals

Elementary Principles of Carpentry

A Manual of Applied Mechanics

Formule quantitative che mettono in relazione forza, duttilità e resilienza delle travi.



Part II Theory of Structures, Chapter III Strength and Stiffness, Section 1 Summary of General Principles, 244 Strength-Toughness-Stiffness-**Resilience**

A MANUAL

OF

APPLIED MECHANICS.

BY

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AND PHILOSOPHICAL SOCIETY OF MANCHESTER, OF THE ROYAL
SOCIETY OF TASMANIA, ETC., ETC.

With Numerous Diagrams.

THIRD EDITION, REVISED.

LONDON:
CHARLES GRIFFIN AND COMPANY,
STATIONERS' HALL COURT,
1864.

[*The Author reserves the right of Translation.*]

solids more plastic and liquids less viscous.

244. The **Ultimate Strength** of a solid is the stress required to produce fracture in some specified way. The **Proof Strength** is the stress required to produce the greatest strain of a specific kind consistent with safety; that is, with the retention of the strength of the material unimpaired. A stress exceeding the proof strength of the material, although it may not produce instant fracture, produces fracture eventually by long-continued application and frequent repetition. Strength, whether ultimate or proof, is the product of two quantities, which may be called **Toughness** and **Stiffness**. *Toughness*, ultimate or proof, is here used to denote the greatest strain which the body will bear without fracture or without injury, as the case may be: *stiffness*, which might also be called *hardness*, is used to denote the ratio borne to that strain by the stress required to produce it,—being, in fact, a *modulus of elasticity* of some specified kind. *Malleable* and *ductile* solids have ultimate toughness greatly exceeding their proof toughness. *Brittle* solids have their ultimate and proof toughness equal or nearly equal.

Resilience or **Spring** is the quantity of *mechanical work* required to produce the proof strain, and is equal to the product of that strain, by the *mean stress* in its own direction which takes place during the production of that strain,—such stress being either exactly or nearly equal to one-half of the stress corresponding to the proof strain. Hence the resilience of a solid is exactly or nearly one-half of the product of its proof toughness by its proof strength; in other words, one-half of the product of the square of its proof toughness by its stiffness.

Each solid has as many different kinds of stiffness, toughness, strength, and resilience as there are different ways of straining it, as the following table shows. In that table *pliability* is used as a general term to denote the inverse of *stiffness*:—

266. The **Resilience, or spring** of the bar, or the work performed in stretching it to the limit of proof strain, is computed as follows:—x being the length, as before, the elongation of the bar under the proof load is

$$x = \frac{fx}{E};$$

305. The **Resilience or Spring of a Beam** is the *work performed* in bending it to the proof deflection. This, if the load is concentrated at or near one point, is the product of half the proof load into the proof deflection; that is to say,

$$\frac{W v_1}{2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1.)$$

(2.) A *Modulus of Resilience*, $\frac{f^2}{E}$, of the kind already mentioned in Article 266.

323. **The Resilience of a Cylindrical Axle** is the product of one-half of the greatest moment of torsion into the corresponding angle of torsion; and it is given by the following equation:—

$$\left.\begin{aligned} \frac{M\,i}{2} &= \frac{f^2 h_1^2 x}{5{\cdot}1\,C} \text{ for a solid shaft; or} \\ \frac{M\,i}{2} &= \frac{f^2 (h_1^4 - h_0^4)\,x}{5{\cdot}1\,C\,h_1^2} \text{ for a hollow shaft.} \end{aligned}\right\} \ldots\ldots (1.)$$

medicina e psichiatria

- *Robert Bentley Todd* (1809-1860)
- *David James Hamilton* (1849-1909)
- *Thomas Clifford Allbutt* (1836-1925)
- *Andrew Wynter* (1819-1876)

The Cyclopaedia of Anatomy and Physiology (autori vari)

A text-book of pathology systematic & practical

A System of Medicine by Many Writers (autori vari)

Subtle Brains and Lissom Fingers

processi industriali

- *Charles Frederick T. Young* (1819-1864)
- *R. M. Hoffman*

C. F. T. Young
The fouling and corrosion of iron ships: their causes and means of prevention, with the mode of application to the existing iron-clads

R.M. Hoffman
A generalised concept of resilience, Textile Research Journal 18(3): 141-148, 1948

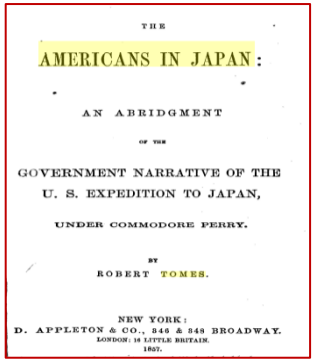
L.F. Beste - R.M. Hoffman
Quantitative study of Resilience, Textile Research Journal 20 (7): 441-453, 1950

capacità di ripresa dopo le avversità (psicologia, protezione civile)

- *Robert Bell* (1800-1867)
- *Robert Tomes* (1817-1882)

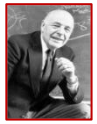
Eminent literary and scientific men. English poets,
nel volume 133 *Lardner's Cabinet Cyclopaedia*

The Americans in Japan


THE
AMERICANS IN JAPAN:
AN ABRIDGMENT
OF THE
GOVERNMENT NARRATIVE OF THE U. S. EXPEDITION TO JAPAN,
UNDER COMMODORE PERRY.
BY
ROBERT TOMES.
NEW YORK:
D. APPLETON & CO., 346 & 348 BROADWAY.
LONDON: 16 LITTLE BRITAIN.
1857.

Notwithstanding the calamities caused by the earthquake, there was shown a resiliency, in the Japanese character, which spoke well for their energy.

Precisa e vivida descrizione del terremoto/tsunami che colpì Shimoda, presso Tokio, il 23 Dicembre 1854,
che sottolinea la capacità adattativa del popolo giapponese come "**resiliency**" ed energia del carattere.


psichiatria/psicologia scienze sociali

- *Donald A. Bloch* → *effetti di esperienze calamitose sui bambini (tornado di Vicksburg, Mississippi, 1953)*
- *Norman Garmezy* → *competenza/adattamento in schizofrenia*
- *Michael Rutter* → *esperienze di vita e disordine psichiatrico*
- *Ann S. Masten* → *competenza/resilienza nella transizione all'età adulta*
- *W. Neil Adger* → *definizione di resilienza sociale: capacità delle comunità di affrontare shock/stress esterni*

antropologia

- *Melville Jean Herskovits* → *"**mental resilience**" e conservazione/adattamento delle popolazioni africane in caso di shocks*
- *Jerome Kagan* → *studi a cavallo tra antropologia/psicologia*
- *Gabriel Ward Lasker* → *studi a cavallo tra antropologia/ecologia*



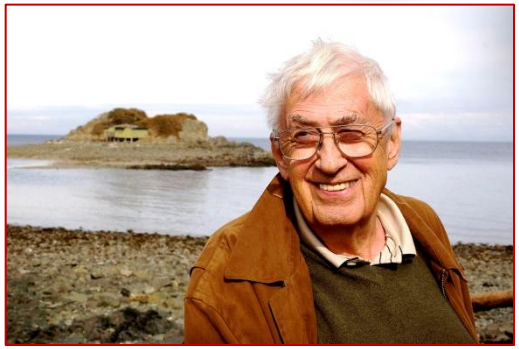
ecologia

- *Crawford Stanley (Buzz) Holling* (nato 1930)
fondatore di Resilience Alliance (http://www.resalliance.org/1.php)

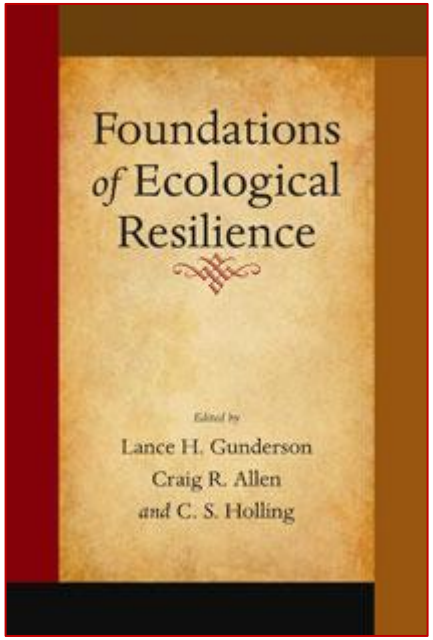
C. S. Holling, *Resilience and stability of ecological systems, Annual Review of Ecology and Systematics, Vol 4 :1-23, 1973*

But there is another property, termed resilience that is a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables. In this sense, the

L. H. Gunderson, C. R. Allen, C. S. Holling, *Foundations of Ecological Resilience, Island Press, 2009*



Il concetto di "**resilienza ecologica**" permette di comprendere come i sistemi ecologici complessi possano adattarsi e riprendersi in seguito sia a disturbi locali quali uragani, incendi, malattie da parassiti, alluvioni, sia perturbazioni di grande scala come i cambiamenti climatici.
Gli ecologisti hanno sviluppato questo concetto negli ultimi 30 anni per spiegare le sorprendenti e non lineari dinamiche di adattamento nei sistemi ecologici complessi.
Per gli scienziati ambientali, la teoria della "**resilienza ecologica**" è importante in quanto favorisce gli approcci di gestione adattativa delle risorse degli ecosistemi.



P. Sundt, *Conceptual pitfalls and rangeland resilience, Rangelands, 2010; 32: 30–33*

"**resilienza**" come abilità degli ecosistemi di continuare ad adattarsi, piuttosto che propensione a ritornare ad un dato equilibrio

T. Elmqvist, C. Folke, M. Nyström, G. Peterson, J. Bengtsson, B. Walker, J. Norberg. *Response diversity, ecosystem change, and resilience, Frontiers in Ecology and the Environment 2003; 1(9): 488–494*

C. Folke, S. Carpenter, B. Walker, M. Scheffer, T. Elmqvist, L. Gunderson, C. S. Holling, *Regime shifts, resilience, and biodiversity in ecosystem management, Annual Review of Ecology, Evolution, and Systematics, 2004, 35: 557–81*

G. Peterson, C.R. Allen, C.S. Holling. 1998, *Ecological Resilience, Biodiversity, and Scale. Ecosystems, 1998, 1: 6–18*

B. Walker, C. S. Holling, S. R. Carpenter, A. Kinzig, *Resilience, Adaptability and Transformability in Social-ecological Systems, 2004, Ecology and Society 9:5*

ecologia

- *Crawford Stanley (Buzz) Holling* (nato 1930)
fondatore di Resilience Alliance
(http://www.resalliance.org/1.php)

reazione omeostatica

equilibrio dinamico

stabilità

"represents the ability of a system to return to an equilibrium state after a temporary disturbance"

resilienza

"measure of the persistence of systems and their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables"

resilienza ingegneristica

"maintaining efficiency of function"

"stability near an equilibrium steady state"

resilienza ecologica

"maintaining existence of function"

"magnitude of disturbance that can be absorbed before the system changes its structure by changing the variables and processes that control behavior."

sostenibilità

- *Charles Perrings*
- *Peter Timmermann*

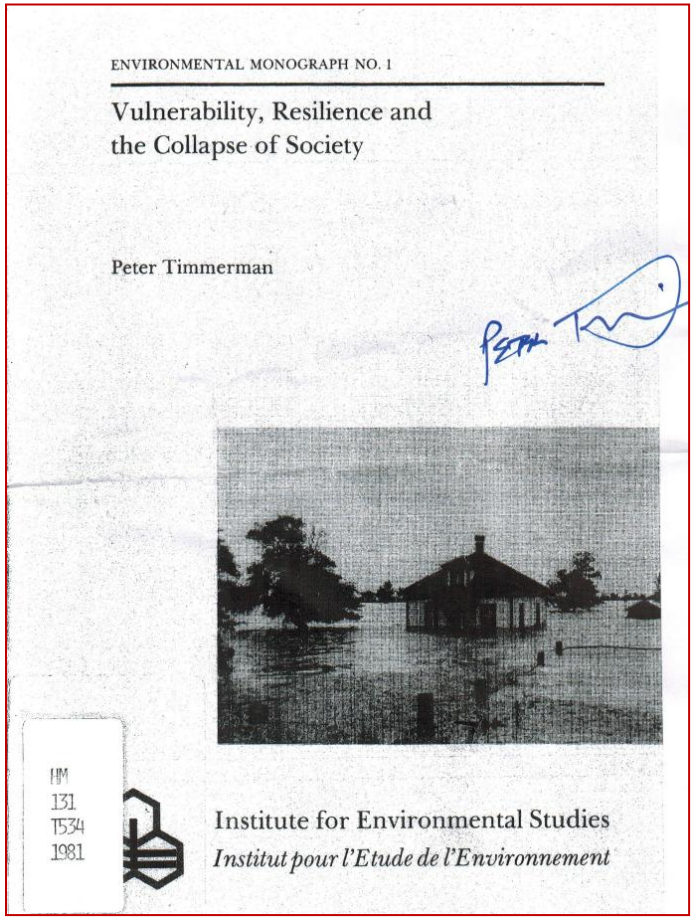
analisi del cambiamento nei sistemi economico-ambientali

MISURA E IMPLEMENTAZIONE DELLA SOSTENIBILITA'

ambienti naturali vulnerabili ai cambiamenti climatici

"*the key point is that* ***resilience*** *is a measure of stability in the face of shocks […] in joint economy-environment systems*"
and "[…] *offers a helpful way of thinking about the evolution of social systems partly because it provides a means of analyzing, measuring and implementing the sustainability of such systems*" (Perrings, 1998).

resilience "*[…] as a term describing the ability of a society to bounce back from severe stress […]*" and as "*[…] the measure of a system's, or part of a system's capacity to absorb and recover from the occurrence of a hazardous event*".(Timmermann, 1981).



ENVIRONMENTAL MONOGRAPH NO. 1

Vulnerability, Resilience and the Collapse of Society

Peter Timmerman

Institute for Environmental Studies
Institut pour l'Etude de l'Environnement

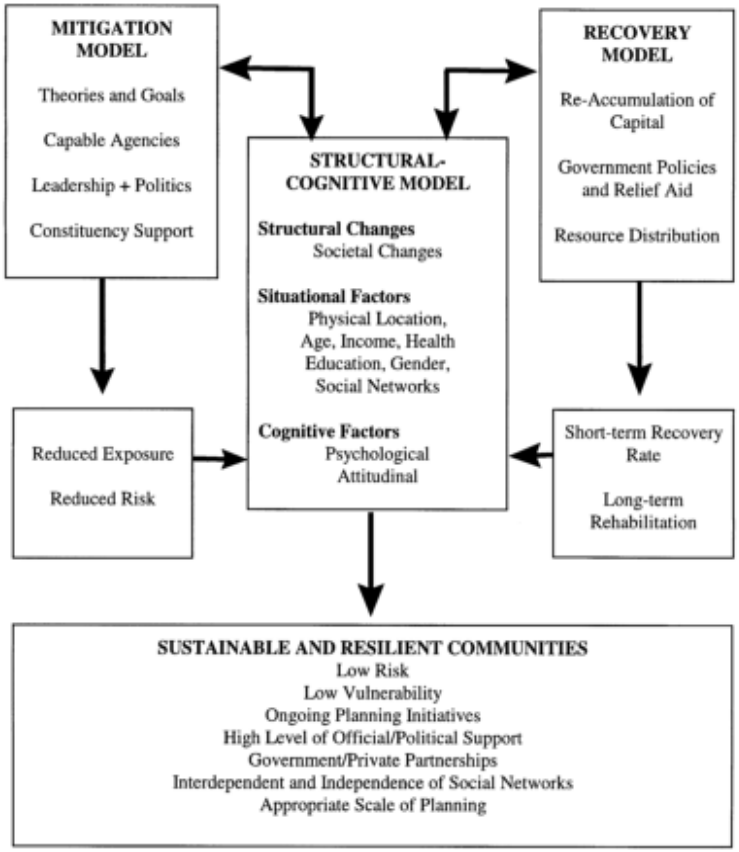
sustainable hazard mitigation

■ *Graham A. Tobin*

approccio ecologico/socio-politico
caso di studio: stato della Florida

MODELLO DI COMUNITA' RESILIENTI E SOSTENIBILI

His "*[…] ultimate goal is to achieve community sustainability and resilience in the face of prevailing natural and technological hazards*" and "*[…] facilitate recovery processes*"; moreover, "*[…] sustainable and resilient communities are defined as societies which are structurally organized to minimize the effects of disasters, and, at the same time, have the ability to recover quickly by restoring the socio-economic vitality of the community […]*" (Tobin, 1999).



disaster risk reduction

- *S. Bernard Manyena*
- *Amitrajeet A. Batabyal*
- *Mark Pelling*

relazione tra resilienza e vulnerabilità in un sistema socio-economico

resilienza e riduzione di rischio/povertà

disastri naturali e resilienza sociale nelle città vulnerabili

aspetto multidisciplinare del concetto di resilienza (Reghezza-Zitt et al., 2012)

INTERNATIONAL FEDERATION

ruolo delle Agenzie Internazionali

the International Federation of Red Cross and Red Crescent Societies (IFRC)

dedica il World Disaster Report del 2004 alla resilienza delle comunità

the United Nations-International Strategy for Disaster Reduction (UN-ISDR)

redazione del Hyogo Framework (2005)

the United Nations Office for Disaster Risk Reduction (UNISDR)

definizione di resilienza nel dizionario terminologico (2009)

UNISDR
The United Nations Office for Disaster Risk Reduction

"The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management".

campagna UNISDR "Making Cities Resilient" (2009): local governance/urban risk.

proliferazione del concetto di resilienza in ecologia e scienze sociali

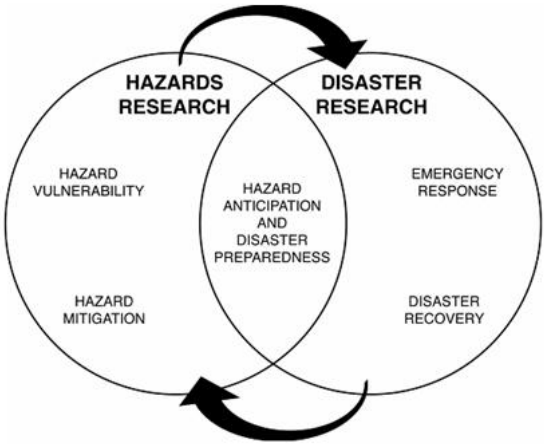
tipologie delle definizioni di resilienza in ecologia e sistemi socio-ecologici (Olsson et al., 2015)

Meanings	*Attributes*			
	Descriptive-neutral (N)	*References*	*Prescriptive-good (G)*	*References*
Bounce Back (BB)	**BB-N** resilience and stability of ecological systems	Holling, 1973	**BB-G** resilience and sustainable development	Perrings, 1998
Bounce Back and Transform (BB-T)	**BB-T-N** a handful of heuristic and some propositions for understanding resilience in social-ecological systems	Walker et al., 2006	**BB-T-G** resilience thinking: integrating resilience, adaptability and transformability	Folke et al., 2010

i vari approcci di varie discipline
portano a diverse definizioni di resilienza,
accrescendone sempre di più l'ambiguità concettuale

aspetto multidisciplinare del concetto di resilienza (Reghezza-Zitt et al., 2012)

Categories and classes	*Definitions*	*References*
(I) DESCRIPTIVE CONCEPT		
(Ia) ECOLOGICAL SCIENCE		
1) original-ecological	measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables	Holling, 1973
2) extended-ecological	magnitude of disturbance that can be absorbed before the system changes its structure by changing the variables and processes that control behavior	Gunderson and Holling, 2002
	and capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks, and therefore identity	Walker et al., 2006
	2a) three characteristics: *i)* to absorb disturbances; *ii)* for self-organization; *iii)* for learning and adaptation;	Walker et al., 2002
	2b) four aspects *1)* latitude (width of the domain); *2)* resistance (height of the domain); *3)* precariousness; *4)* cross-scale relations;	Folke et al., 2004
3) systemic-heuristic	quantitative property that changes throughout ecosystem dynamics and occurs on each level of an ecosystem's hierarchy	Holling, 2001
4) operational	resilience *of* what *to* what?	Carpenter et al., 2001
	and ability of the system to maintain its identity in the face of internal change and external shocks and disturbances	Cumming et al., 2005
(Ib) SOCIAL SCIENCES		
5) sociological	ability of groups or communities to cope with external stresses and disturbances as a result of social, political, and environmental change	Adger, 2000
6) ecological-economic	transition probability between states as a function of the consumption and production activities of decision makers	Brock et al., 2002
	and ability of the system to withstand either market or environmental shocks without losing the capacity to allocate resources efficiently	Perrings, 2006
(II) HYBRID CONCEPT		
7) ecosystem-services-related	underlying capacity of an ecosystem to maintain desired ecosystem services in the face of a fluctuating environment and human use	Folke et al., 2002
8) social-ecological system		
8a) social-ecological	capacity of a social-ecological systems to absorb recurrent disturbances so as to retain essential structures, processes, feedbacks	Adger et al., 2005
8b) resilience-approach	perspective or approach to analyze social-ecological systems	Folke, 2006
(III) NORMATIVE CONCEPT		
9) metaphoric	flexibility over the long term	Pickett et al., 2004
10) sustainability-related	maintenance of natural capital in the long run	Ott and Döring, 2004



NRC, National Research Council, 2006

(Bruneau et al., 2003; Tierney and Bruneau, 2007)

TOSE: raggruppamento di fattori tecnici, organizzativi, sociali ed economici che interessano le comunità soggette a disastri

TOSE	*Dimensions of resilience (in case of an earthquake event)*
Technical	*The technical dimension of resilience refers to the ability of physical systems (including components, their interconnections and interactions, and entire systems) to perform to acceptable/desired levels when subject to earthquake forces.*
Organizational	*The organizational dimension of resilience refers to the capacity of organizations that manage critical facilities and have the responsibility for carrying out critical disaster-related functions to make decisions and take actions that contribute to achieving the properties of resilience outlined above, that is, that help to achieve greater robustness, redundancy, resourcefulness, and rapidity.*
Social	*The social dimension of resilience consists of measures specifically designed to lessen the extent to which earthquake-stricken communities and governmental jurisdictions suffer negative consequences due to the loss of critical services as a result of earthquakes.*
Economic	*The economic dimension of resilience refers to the capacity to reduce both direct and indirect economic losses resulting from earthquakes.*

definizione quantitativa di resilienza basata sulla funzionalità

punto di partenza: resilienza sismica
basata sulle 4R
Robustness, Redundancy, Resourcefulness, Rapidity

$$R = \int_{t_0}^{t_1} [100 - Q(t)]dt$$

t_0: time istant when the hazardous event happens;
$Q(t)$: quality of infrastructure in function of time

R: community earthquake loss of resilience (100% pre-event; reduced, as an example, to 50% immediately after the event).

misura della resilienza sismica; definizione concettuale (adattata da Bruneau et al., 2003)

CARRI (Community and Regional Resilience Initiative) Reports (i.e. Cutter et al., 2008; Moser, 2008; Colten et al., 2008; Morrow, 2008; Gunderson, 2009; Tierney, 2009; Wilbanks, 2009; Rose, 2009; Colten and Sauer, 2010; Norris, 2010) fornisce una notevole quantità di materiale scientifico;

la resilienza è definita come "*a community or region's capability to prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to public safety and health, the economy, and national security*"

classificazione degli approcci quantitativi alla resilienza (adattato da Cerè et al., 2017)

modelli quantitativi di resilienza

QUANTITATIVE APPROACHES

- multi-hazard wide spectrum
  - Henry and Ramirez-Marquez, 2012
  - Zobel and Khansa 2013
  - Gama Dessavre et al., 2016.
  - Kircher, et al, 2006 — **HAZUS**
- single-hazard small scale approaches
  - *performance-based direct approaches*
    - Cimellaro et al., 2008
    - Cimellaro et al., 2009
    - Cimellaro et al., 2010b
    - Cimellaro and Piqué, 2016
    - Mavrouli et al., 2014
    - Barberis et al., 2015
    - Biondini et al., 2015
    - Haugen and Kaynia, 2008
  - *expert-based indirect approaches*
    - Uzielli et al., 2015
    - Kaynia et al., 2008
    - Karamouz and Zahmatkesh, 2017
    - Field et al., 2016

Hazus-MH, modello software a GIS-based, che fornisce stima delle perdite per terremoti, inondazioni, uragani e tsunami, sviluppato da Federal Emergency Management Agency, FEMA https://www.fema.gov/hazus)

è in posizione eccentrica perché

"*[…] resilience is taken into account in a non-explicit way […]*" and other "*[…] geo-environmental hazards […]*" are considered "*[…] as an indirect aftereffect of the primary seismic event*" (Cerè et al., 2017)

modelli quantitativi di resilienza

PEOPLES sviluppato al MCEER
(Multidisciplinary Center for Earthquake Engineering Research, University of Buffalo)

PEOPLES individua un indice di resilienza
e propone resilience performance levels (*RPLs*)
basati su un numero finito di parametri

LIMITI:

extreme earthquake scenarios: definiti con "probabilistic seismic hazard assessment" (PSHA)

solo alcuni indicatori di performance possono essere con approccio multi-hazard

Progetto MOVE
(Methods for the Improvement of Vulnerability Assessment in Europe)
EC FP7 Programme)

sforzo euristico; approccio né qualitativo né quantitativo;

quattro fattori chiave:

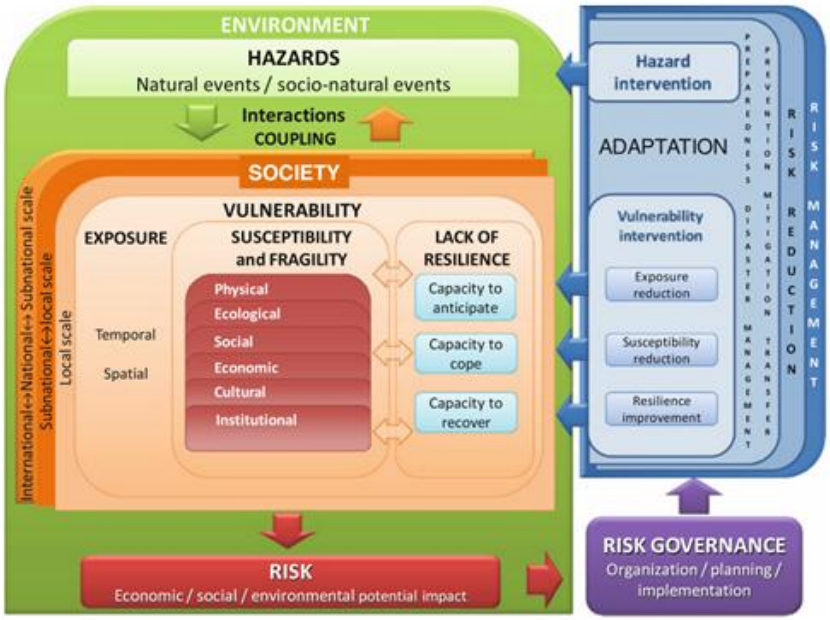
(a) exposure to a hazard or stressor;
(b) susceptibility (or fragility);
(c) societal response capacities or lack of resilience;
(d) adaptive capacities.

già applicato in diversi contesti (ambienti urbani, costieri e montani)

sviluppo di modelli per la quantificazione della resilienza delle infrastrutture
(ospedali, lifelines, strutture, città)

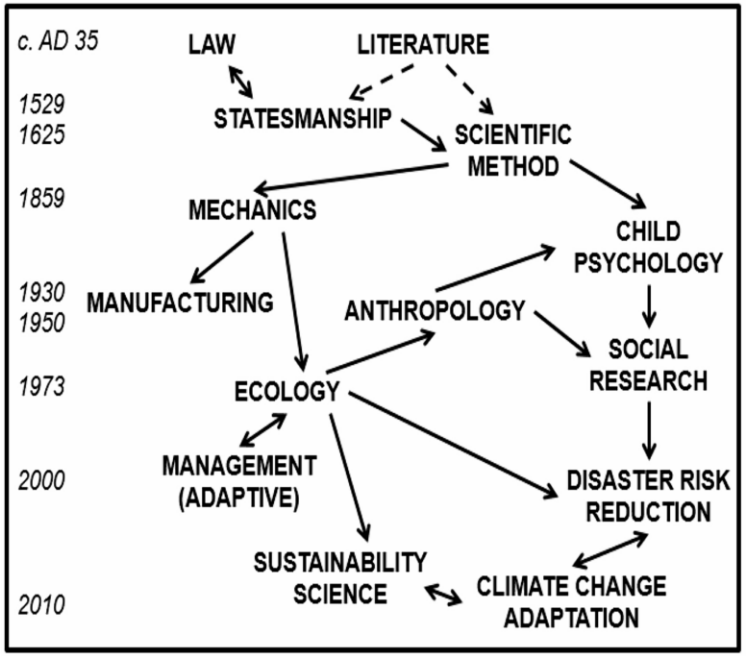
Acronym PEOPLES	*Framework groups*
P	Population and demographics
E	Environment and ecosystem
O	Organized government services
P	Physical infrastructure
L	Lifestyle and community competence
E	Economic development
S	Social-cultural capital

PEOPLES framework for resilience-based design (RBD)
(adapted from Renschler et al., 2010; Cimellaro et al., 2016)

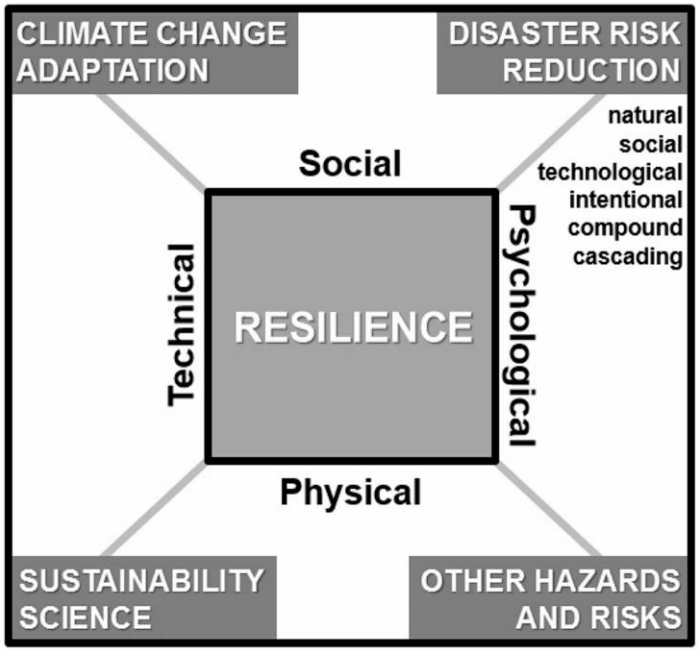


(Birkmann et al., 2013)

QUADRO RIASSUNTIVO



evoluzione del concetto di resilienza (da Alexander, 2013)



riassunto degli studi sulla resilienza nelle varie scienze (da Alexander, 2013).

QUESTIONI APERTE SUL CONCETTO DI RESILIENZA

ontologia, confini del sistema, meccanismi di feedback

- ontologia carente;
- mancanza di un solido background generale;
- confini di sistema non ben definiti;
- approcci divergenti tra studiosi di scienze naturali e scienze sociali.

"key components of a formal ontology are: classes (taxonomies), relationships, axioms, and instances" (Guarino, 1998)

"[…] the boundaries of the social system may be considerable harder to describe than those of the ecological systems […]" (Alexander, 2013)

feedback mechanisms in social-ecological systems "*[...] are primarily determined by […] structured agency [individual and collective], rather than by structural forces"* (Olsson et al., 2015)

critiche agli approcci funzionalisti

- sopravvalutazione dei meccanismi di consenso;
- approccio conservatore ai cambiamenti sociali;
- sottostima di meccanismi inerziali e di istituzioni malfunzionanti;
- scarsa considerazione per le teorie del conflitto;
- spazio insufficiente a tematiche quali diversità, diseguaglianza, potere.

a static concept of resilience can justify and endorse (consciously or not) "*[…] particular policies, projects, and practices […] increasily adopted by influential global organizations such as the United Nations Development Program and funding institutions such as the Rockfeller Foundation as a basis for policy-making and deployment of funds*" (Olsson et al., 2015)

sottostima di fattori chiave nelle strategie di riduzione del rischio

- diritto all'informazione sugli hazard;
- crescita esplosiva della popolazione;
- corruzione;
- rischi sulle popolazioni indotti da azioni governative;
- discriminazione nei confronti delle donne.

This effort is fundamental to fill the existing gap, highlighted by researchers belonging to social sciences/humanities, in the definition of resilience, and "[…] to challenge publicly any social, economic, political, religious or cultural obstacles to risk reduction […]" (Alexander and Davis (2012)

resilienza «duttile» o «eco-sociale»

spostamento irreversibile verso un nuovo equilibrio ⇦

autopoiesi vs omeostasi

⇨ oscillazioni attorno ad uno stato stazionario

resilienza «elastica» o «ingegneristica»

QUESTIONI APERTE SUL CONCETTO DI RESILIENZA

approccio single-hazard vs multi-hazard

- sviluppo di scenari multi-hazard (eventi passati, presenti e futuri);
- valutazione esaustiva di impatto, occorrenza, interrelazioni, gerarchie, combinazioni;
- studi da scale regionali a locali.

è necessario considerare il range completo degli hazard ed evitare omissioni, utilizzando linguaggi/strumenti comuni per ottenere rigorose mappe e affidabili "*global hazard factors*" (Indirli, 2007)

approccio NDSHA vs PSHA per il terremoto

- inadeguatezza PSHA (*Probabilistic Seismic Hazard Assessment*);
- utilizzo di modelli affidabili: NDSHA (*Neo-Deterministic Seismic Hazard Assessment*);
- sviluppo e adozione dell'"*intermediate-term middle-range earthquake prediction*".

a strategy for the mitigation of earthquake impact should be oriented to cost-effective preventive measures, aimed at creating knowledge-based, hazard-resilient public assets, rather than to highly expensive post-disaster rescue and relief operations, that currently prevail in many countries; time-dependent hazard scenarios (based on *NDSHA*) can be helpful in reorienting the current strategies toward increased earthquake preparedness (Panza et al., 2002)

in the integrated *NDSHA* method, intermediate-term middle-range earthquake prediction, performed by means of the algorithms *CN* or *M8*, is provided;
the results of the global real-time experimental testing of *CN* and *M8* algorithms indicate the possibility of practical earthquake forecasting, although with limited accuracy (i.e. with a characteristic alarm-time ranging from a few months to a few years and a space uncertainty of hundreds of kilometers;

a reduction of space uncertainty is feasible through the combined use of seismological, geological and morphostructural information;
among the possible developments towards a more accurate identification of the area of the impending earthquake, the analysis of real-time deformation patterns within alerted earthquake prone areas is expected to play a relevant role, where the newly available high quality positioning data (e.g., GPS and InSAR) would permit the compilation of real-time displacement/deformation maps within the alerted areas and combine them with routinely updated seismic information (Peresan et al., 2010; 2012).

compared to other areas of timely warning (e.g. tropical cyclones, some kinds of flood or drought emergencies), earthquake warning has just reached its 'adolescence' in science, due to the complex nature of the seismic phenomenon;
therefore, we cannot know in advance the location, magnitude, and time of occurrence of an earthquake; nevertheless, the accuracy of earthquake warnings is improving and the ability to spatially define and map the zones of highest risk is advancing rapidly;

TEMPORARY REMARKS (NOT FINAL!)

nuclei for a pluralistic but holistic view of resilience

attributes	***description***	***target***
safety	protection of life, heritage, assets from natural/human-made disasters across climate/social changes	*multi-hazard combinations/maps*
robustness	adequacy of structural/infrastructural systems to withstand actions related to their function/exposure	*multilevel networks*
adaptive capacity	ability to respond successfully to new changes and recovery with acceptable consequences after catastrophic events	*social-ecological models*
sustainability	maintaining the natural/anthropogenic capital and fostering mature self-balanced environments	*sustainability models*
governance	consensual and shared management of conflicts towards a new equilibrium before/throughout/after traumas/disasters	*risk management*
anamnesis	safe-guarding and transmitting collective memory and cultural identity intact to posterity as a drop anchor for democracy	*preservation of tangible/intangible heritage*

GRAZIE DELL'ATTENZIONE









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