VOCABULARY OF A DOCTORAL STUDENT
Edited by Aarne Mämmelä
Version 1.11, 30.10.2006
VOCABULARY OF A DOCTORAL STUDENT

Edited by Aarne Mämmelä, VTT, R&D, Telecommunications, P.O. Box 1100, FI-90571 Oulu, Finland, email Aarne.Mammela@vtt.fi

This vocabulary has been prepared in aid of a doctoral student in engineering, but it may be useful also for students in science. The selected terms are those that most students may face during the course of their work, including literature searches, research methods, and writing papers and a thesis. Since there seems to be not much literature available about philosophy of technology, I have used the terminology from both philosophy of science and systems engineering. Science is based on a reductive scientific approach, and systems engineering is based on the opposite holistic or systems approach. These two approaches are seen as complementary to each other. In addition, I have used the terminology in product design since in many research projects a prototype is developed. Some explanations are controversial and I have tried to give a neutral definition.

Each item includes a term in bold, translation into Finnish in parentheses, and a definition or explanation in English, unless the explanation is assumed to be trivial or too abstract without much practical use. Similar explanations are separated by a comma, and different explanations are separated by a semicolon. A division is marked with Arabic or Roman numbers. Cross-references to other terms in the vocabulary are marked in italics. Some of the most important terms are marked with an asterisk (*) to help to start conceptual analysis, whose importance is emphasized in modern analytic philosophy of science. Those terms include *concept, *development, *document, *model, *organization, *problem, *product, *reductionism, *research, *system, *theory, and *thing. By following the cross-references many other related terms are found. The number of terms is over 1200. At the end of the vocabulary some abbreviations are explained. Also the most important literature references are listed there. A companion document is "Bibliography of a doctoral student."
abbreviation (lyhenne) see **acronym**

**abduction** (abduktio) **inference** to the best **explanation** [Honderich05], opposite to **deduction**, facts are explained by a theory which best explains the facts, sometimes assumed to be a form of **induction**

**abrupt change** (äkillinen muutos, hyppy) jump, usually not amenable to **analysis**, opposite to **continuity** [Wolfram02], see **anomaly**, **catastrophe theory**

**absorption cost** (omakustannusarvo, OKA) **prime cost**

**abstract** (abstrakti) opposite to **concrete**

**abstract** (abstrakti, tiivistelmä) a one-paragraph **summary** of a **document** after the title and list of authors, an abstract can be **informative** (preferred) or descriptive [Young02], includes what the author has done, how it was done (if it is important), principal results (numerically, when possible), and significance of the results [Spectrum65], see **abstracts database**, **executive summary**, **extended abstract**, **introduction**, **conclusions**

**abstraction** (abstraktio) the procedure for going one description level to another towards less detail [Calvez93], opposite to **refinement**, see **bottom-up**

**abstracts database** (tiivistelmätietokanta) a collection of information on **publications**, usually **scientific journal** and **conference papers**, including **titles**, names of authors, **abstracts** and **keywords**, accessible by computer, see **citation database**, **electronic library**, **literature**, **document**, **literature search**, **information retrieval**, **browser**

**accept** (hyväksyä) opposite to **reject**, see **approve**

**acceptance** (hyväksyminen) opposite to **rejection**

**acceptance rate** (hyväksymissuhde) **acceptance ratio**

**acceptance ratio** (hyväksymissuhde) acceptance rate, the ratio of **accepted** and **submitted manuscripts**, especially in a **conference**

**accurate** (tarkka)

**accuracy** (tarkkuus) accuracy of measurement, the closeness of agreement between a **measurement** result and the accepted **reference value** [amc03], inversely related to both **systematic errors** and **random errors**, and thus includes the terms **frueness** and **precision**, cannot be expressed as a numerical value [ISO Guide 99:2004], the most appropriate means of expressing the accuracy is **uncertainty** [amc03], see **mean-square error**, **instrument**

**accuracy of measurement** (mittauksen tarkkuus) **accuracy**

**acknowledgment** (kiitokset) an author’s statement expressing thanks to those who have assisted in the preparation of a **document** [Random House99] or to those who have given funding, located in a **preface** or in a separate section before **appendices** and **references**

**acronym** (akronyymi, lyhenne, kirjainsana) an **abbreviation** that is pronounced as a word [Young02]

**active voice** (aktiivimuoto) preferred voice instead of **passive voice** [Day98], see **document**

**actuator** (toimielin) see **sensor**, **system**

**adjunct professor** (lähin vastine: dosentti) a **professor** attached or belonging to a **university** without full or permanent status [Random House99], see **docent**

**adviser** (ohjaaja) a person who gives advice to a student, especially somebody who is an expert in the same field [Hornby95], see **supervisor**

**advisor** (ohjaaja) **adviser** [Young02]

**aesthetics** (estetiikka) esthetics, a branch of **axiology**, see **humanities**
affine (affini) of or pertaining to a transformation that maps parallel lines to parallel lines and finite points to finite points [Random House99], see linear

agreement (sopimus) see contract, nondisclosure agreement

agenda (asialista) a list of things to be discussed in a meeting, considered a singular word [Young02]

algebra (algebra) a branch of mathematics, generalization and extension of arithmetic, deals with general statements of relations, usually functions, utilizing letters and other symbols to represent quantities in the description of such relations [Random House99], see analysis

algorithm (algoritmi) a set of rules for solving a problem in a finite number of steps [Random House99], see method, behavioral model, genetic algorithm, iteration, recursion, protocol

algorithmic complexity (algoritminen kompleksisuus) Kolmogorov complexity, descriptive complexity, the length of the shortest binary program that describes an object, the expected algorithmic complexity of a random variable is approximately equal to its entropy [Skyttner05], [Baeyer05], [Thomas06], see logical depth, statistical complexity, computational complexity

alliance (allianssi, liitto, liittouma) formal arrangement with a separate company for purposes of development, and involving exchange of information, hardware, intellectual property, or enabling technology [Belliveau02], see alliance, forum

alpha prototype (alfaprototyyppi) an early prototype, built with parts with the same geometry and material properties as intended for the production version of the product, tested to determine whether or not the product will work as designed and whether or not the product satisfies the key customer needs [Ulrich95], see beta prototype

alpha test (alfatestaus) in-house testing of the alpha prototype [Belliveau02]

ambiguity (epäselvyys, epävarmuus, monikäsitteisyys, moniselitteisyys) equivocation, the condition of admitting more than one meaning [Random House99], for example in a phase estimator, see term

analog model (analogiamalli) a model, for example electrical network, which uses a physical appearance different to the phenomenon or object to be characterized, see cybernetics

analogy (analogia, vastaavuus) a similarity between like features of two things, on which a comparison can be made [Random House99]; a form of reasoning in which one thing is inferred to be similar to another thing in a certain respect, on the basis of known similarities in other respects, see isomorphism, induction, creativity, correspondence, metaphor, cybernetics

analysis (analyysi, erittely) generalization and extension of algebra, study of the changes of a continuously varying function, differential and integral calculus and its higher developments, use of analysis excluding approximations corresponds to deduction; discussion of a problem by algebra, as opposed to geometry [Random House99]; ontological reduction, resolving or separating a whole into its elements or component parts, opposite to synthesis [Wilson99]; see systems analysis, reverse engineering, check list, catastrophe theory

analytical model (analyyttinen malli) mathematical model

analytic philosophy of science (analyyttinen tieteenfilosofia) a modern trend of philosophy of science in addition to hermeneutics [Niiniluoto02], subjects include logical analysis of scientific language and concepts, ideal model for scientific theory construction and scientific inference, and critical evaluation of presupposals of disciplines and their research methods

annex (lisäys, liite) something added to a document [Random House99], see appendix

annotation (huomautus) a critical or explanatory note added to a text [Random House99]

annotated bibliography (kirjallisuusluettelohuomautuksin) see annotation, bibliography
anomaly (anomalia, poikkeama, epänormaalisuus) discrepancy, for example abrupt change, trend, periodicity, or statistical correlation [Wilson90]

ansible instantaneous telecommunications between two points, regardless the distance between them [Clute95]

antirealism (antirealismi) instrumentalism, denial of realism, theories are treated as computational devices for describing predictions of phenomena

antonym (vastakohta) opposite to synonym, see thesaurus

apostrophe (heittonmerkkki) marks ‘ and ’, see punctuation

appendix (liitte) supplementary material at the end of a document [Random House99], see annex, enclosure, attachment

application (sovellus) the use to which something is put [Random House99]

application (hakemus) petition, request [Random House99]

application layer (sovelluskerros) the highest layer in the OSI model above the presentation layer, provides a means for application processes to access the OSI environment, examples of protocols at this layer are file transfer and electronic mail, communication services are using the application layer [Tanebaum96], [Stallings91], see source coding

applied science (sovellettu tiede) a misnomer for technology or engineering [Leppälä03]

applied research (soveltava tutkimus, tavoitetutkimus) targeted research directed primarily towards a specific practical or commercial aim or objective with respect to products, processes, or services, research where ideas are put into an operational form [Jain97], see development, oriented basic research

approach (lähestymistapa) the method used or steps taken in setting about a task [Random House99], see research method

approve (hyväksyä) see accept

approximation (likiarvo) see numerical solution, simulation

architecture (arkkitehtuuri) the scheme by which the functional parts are arranged into physical parts and by which the parts interact [Ulrich95], see modular architecture, integral architecture, product architecture, structure, system

archival journal (tieteellinen lehti) scientific journal, a journal that publishes original research results

area (alue) extent, range, scope [Random House99], see field

argument (argumentti, perustelu) a process of reasoning, series of reasons [Random House99]

argument (argumentti) independent variable of a function; the angle corresponding to a point representing a given complex number in a polar coordinate system [Random House99]

arithmetic (aritmetiikka) the most elementary branch of mathematics [Random House99], simple number theory

art (taide) in contrast with science [Wilson99], see engineering, humanities

artefact (artefakti, ihmiskäden työ) artifact

article (artikkeli, kirjoitus) a factual piece of writing, usually on a single topic [Random House99], see document

articulated knowledge (selvästi ilmaistu tieto) explicit knowledge, opposite to tacit knowledge [Leppälä03]

artifact (artefakti, ihmiskäden työ) any object made by humans, see product

artificial (keinotekoinen) man-made, opposite to natural
artificial intelligence (tekoäly) design of devices programmed to perform functions analogous to learning and decision making [Random House99], see systems analysis, smart

artificial life (tekoelämä) [Wolfram02]

assistant (asistentti) a faculty member in a university ranking below an assistant professor or senior assistant

assistant professor (lähin vastine: yliasistentti) a university teacher ranking above a lecturer and below an associate professor [Random House99]

associate editor (apulaisesditori) see editor

associate professor (apulaisprofessori) a university teacher ranking above an assistant professor and below a professor [Random House99]

assume (olettaa)

assumption (oletus) something taken for granted [Random House99], see definition, condition, axiom, idealization, implied assumption, default, fact

asterisk (asteriski, tähti, tähtimerkki) mark “∗”

attachment (liite, liitetiedosto) a file attached to an email, enclosure, a document added to a letter [Random House99], see appendix

attribute (attribuutti, ominaisuus, tunnusmerkki) a quality, character, characteristic, or property attributed as belonging to a thing [Honderich05], see substance

audience (yleisö) see readership, conference

audit (seuranta, tarkastus) an appraisal of the effectiveness of the processes by which the new product was developed and brought to the market [Belliveau02]

author (tekijä, kirjoittaja) the writer of a document, see coauthor

authority (auktoriteetti, viranomainen, asiantuntija) an expert on a subject; a person or body of persons in whom the power to determine is vested [Random House99], see certification, reference value, measurement standard

autonomy (autonomia, itsenäisyys) independence or freedom [Random House99]

auxiliary hypothesis (apuhypoteesi) additional hypothesis [Rosenberg00]

average (keskiarvo) see mean, median, mode, bias, estimation theory, mathematical statistics

award (palkinto) reward, a prize given to somebody in honor of their achievement [Hornby95]

axiology (arvoteoria) value theory, a part of philosophy, inc. (i) ethics, (ii) aesthetics, and (iii) religion [Random House99]

axiom (aksiooma) a proposition or premise assumed without proof in an axiomatic system, see assumption, hypothesis, postulate, intrinsic value

axiomatic system (aksioamaattinen järjestelmä) a deductive system that has axioms, a deductively organized system of (i) primitive symbols, (ii) rules of formation distinguishing well-formed from ill-formed expressions, (iii) definitions, (iv) axioms, and (v) rules of inference establishing how theorems are proved from the set of axioms [Honderich05], see proposition, corollary

bachelor of science (luonnontieteiden kandidaatti, tekniikan kandidaatti) an undergraduate degree ranking below master of science, see college, university

backslash (kenoviiva) mark “\”, see punctuation, slash

backup copy (varmuuskopio) see manuscript

backwards causality (kausaalisuus taaksepäin) teleological causality, causality based on a final cause [Honderich05], opposite to forwards causality
**bandwidth** (kaistanleveys) the range of frequencies required to transmit a particular signal, the range of frequencies that a system can pass; the rate at which information can be transmitted, see throughput

**baseline** (vertailukohta) reference value

**base quantity** (perussuure) see quantity, derived quantity [ISO Guide 99:2004]

**basic research** (perustutkimus) generic research with no specific application or immediate commercial objectives in mind although it may be in fields of present or potential commercial interest, results are usually published in scientific journals [Jain97], see oriented basic research, applied research

**behavior** (käyttäytyminen) see phenomenon

**behavioral model** (käyttäytymismalli) a description model which describes the behavior of internal functions of a system, thus expressing the contribution of each function to its environment, specification of algorithms for the functions, hierarchically between the functional model and executive model [Calvez93], see product specification, OSI model

**behavioral science** (käyttäytymistiede) a science, as psychology, sociology, or anthropology, that derives its concepts from observation of the behaviour of living organisms [Random House99], see social science

**bench** (penkki, työpöytä) see laboratory

**benchmark** (vertailutesti, mittapuu) see reference value

**benchmarking** (vertailuanalyysi) a study of the performance data of existing products with functionality similar to that of the product under development, see reference system

**benchmark problem** (testitehtävä)

**benchmark program** (testausohjelma, nopeustestiohjelma)

**benefit** (etu, hyöty) a performance metric that specifies an advantage [Bock01], see payoff

**beta prototype** (beettaprototyyppi) a late prototype built with parts supplied by the intended production processes, extensively evaluated internally and also typically tested by customers in their own use environment [Ulrich95], see alpha prototype

**beta test** (beettatesti) an external test of a beta prototype [Leppälä03]

**bias** (harha) average error, the systematic error in a measurement result, the difference between the average value of a measurement result and the accepted reference value [amc03], [Kay93], see trueness, average, biased, mean-square error

**bias** (ennakkoluullo) prejudice [Random House99]

**biased** (harhainen; ennakkoluuloinen) having a bias [Random House99]; subjective

**bibliographical data** (luettelointitiedot) see reference

**bibliography** (kirjallisuusluettelot) a complete or selected list of publications compiled upon some common principle [Random House99], see annotated bibliography, reference, literature search

**biology** (biologia) a branch of natural science, see evolution theory, artificial life, artificial intelligence, bionics, neural network, genetic algorithm

**biography** (biografía, henkilöhistoria) a written account of an author’s life [Random House99], see curriculum vitae

**bionics** (bioniikka) the study and means by which humans and animals perform tasks and solve problems, and of the application of the findings to the design of electronic and mechanical parts [Random House99], see biology, cybernetics, systems engineering

**black box** (musta laatikko) a system whose internal workings are unknown or irrelevant to current purposes
blind review (sokkotarkastus) a peer review where the referees are anonymous to the authors, see double blind review

block diagram (lohkokaavio) a diagram using labelled blocks connected by lines to represent the relationship of parts or phases [Random House99]

boldface (lihava kirjasin, lihava kirjasinlaji) see letter, italic, roman

bold-faced (lihavoitu)

boldfacing (lihavointi) see italicization, equation, document

book (kirja) a book is divided into parts, chapters and sections, books about science can be divided into (i) monographs, (ii) reference books, (iii) textbooks, and (iv) trade books [Day98], see literature, style book

bootstrap (vyörytys) self-generating or self-sustained process [Random House99], see initial condition

bottom-up (kokoava, alhaalta ylöspäin etenevä) opposite to top-down, see abstraction, synthesis, epistemological reduction

boundary (rajapinta) something that distinguishes a system from its environment [Checkland99]

boundary condition (reunaehto, rajaehento) a condition under which certain laws are believed to hold [Losee01], see initial condition, assumption

brace (aaltosulku) curly bracket, marks “{” and “}”, see equation, punctuation

bracket (hakasulku) square bracket, marks “[” and “]”, see equation, references

brainstorming (aivoriihi) a group technique for solving problems, generating ideas, stimulating creative thinking, etc., by unrestrained spontaneous participation in discussion without immediate criticism [Random House99], in contrast with groupthink, see creativity

breadboard (koekytkentälevy) a proof-of-concept modelling technique that represents how a product will work, but not how a product will look [Belliveau02]

breadboarding (koekytkentä)

breadboard model (koekytkentämalli) see prototype

browser (selain) see abstracts database, search engine, electronic journal

budget (budjetti, talousarvio) see organization

business idea (liikeidea, toiminta-ajatus) a summary of the strategy of an organization, the way the organization earns its income [Kamensky00]

calibration (kalibrointi) setting or checking the graduation of a quantitative measuring instrument, see trueness

camera-ready copy (kuvausvalmis kopio) the final, ready to be photographed version of a manuscript that will be published in a conference proceedings

capacity (kapasiteetti, suorituskyky) the capability to receive or contain [Random House99], see information theory

capital (pääoma) the wealth, as in money or property, owned or employed in business by an individual [Random House99], organization, etc., see cost, price, economy, investing, resource

capital letter (suuri kirjain) upper case letter

caption (kuvateksti, taulukkoteksti) a title or explanation for a figure or table [Random House99], see legend

Cartesian coordinate system (karteesinen koordinaatisto) rectangular coordinate system, see polar coordinate system

case study (tapaustutkimus) see research
catastrophe theory (katastrofiteoria) theory of discrete changes [Wolfram02], see abrupt change, systems engineering

category (kategoria, luokka) class, the most fundamental division of some subject-matter in philosophy [Honderich05]

causal (kausaalinen)

causality (kausaalisuus, syy-seuraussuhde) genuine relation between two events; it is necessary but not sufficient that causality has a temporal order, i.e., the effect happens after the cause [Honderich05], see final cause, determinism, free will, correlation, deduction, upwards causality, downwards causality

causal law (kauasallilaki) a scientific law that is based on causality, one form of sequential laws [Nagel79], see theory

causation (kausaalisuus) causality

cause (syy) efficient cause, explanation of some event by identifying an earlier event referred to as effect [Honderich05], opposite to final cause, see causality, factor

center of excellence (osaamiskeskus) a geographic or organizational group with an acknowledged technical, business, or competitive competency [Belliveau02], see organization

central limit theorem (keskeinen raja-arvolause) see statistics

certification (sertifiointi, varmentaminen) a process of formally acknowledging that someone has mastered a body of knowledge on a subject [Belliveau02]; an external validation given by an accredited authority [Calvez93], see verification, organization, trueness

chaos (kaaos) apparently random behaviour within a nonlinear deterministic system, whose outcome is sensitive to minute, unmeasurable variations in the initial conditions [Wolfram02], see chance

chaos theory (kaaosteoria) see chaos, systems engineering

chance (sattuma) the unpredictable and uncontrollable random element of an event [Random House99], see determinism, free will, probability

channel (kanava) a medium for transmitting signals in one direction between two points, see distortion, noise

channel coding (kanavakoodaus) coding that adds redundancy for efficient error detection and control, see data link layer, modulation, information theory

chapter (luku) a main division of a book, technical report, or the like [Random House99], see document, section

checklist (muistilista, tarkistuslista) see analysis

chemical engineering (kemiantekniikka)

chemistry (kemia) a branch of natural science

chunk (fyysinen rakennusosa) physical building block of a product architecture [Ulrich95], [Belliveau02]

circuit (piiri, virtapiiri, kytkenentä) the complete path of an electric current, including generating apparatus and intervening components [Random House99], see system

circular reasoning (kehäpäättely) reasoning in which an alleged proof of a given conjecture involves at some point the assumption of the conjecture to be proved

citation (sitaatti, lainaus, ote, lähdeviite) quotation, see reference

citation database (viitetietotokanta) an abstracts database that includes also references of publications, see electronic library

cite (viitata) quote, refer
cited half-life (viitausten mediaani-ikä) the number of journal publication years going back from the current year which account for 50% of the total citations received by the cited journal in the current year, the median age of citations, see impact factor, immediacy index

class (luokka) category, a collection of things, a set whose members may be specified by means of a list or by reference to a property which all and only the members of the class possess [Honderich05]

classification (luokiteltu) the assignment of things to groups within a system of categories distinguished by some property [Random House99], see taxonomy

classified (luokiteltu, luottamuksellinen, salainen) assigned to classification, as restricted, confidential, or secret, that limits its use to authorized persons [Random House99], see nondisclosure agreement

clause (lause) main or subordinate clause

client (asiakas, tilaaja) customer, user, see server

coauthor (tekijäkumppani) one of two or more joint authors [Random House99]

code (koodi, säännöt) see coding, code of ethics

code of ethics (tapasäännöstö) code of ethics of a scientific society and its members

coding (koodaus) see formatting, source coding, encryption, channel coding, modulation

cognitive (kognitiivinen, tiedollinen) of or pertaining to the mental processes of perception, memory, judgment, and reasoning, as contrasted with emotional and volitional processes [Random House99], see free will

coherence (koherenssi, yhtenäisyys, johdonmukaisuus) consistence, consilience, the quality of being logically integrated, consistent, and intelligible [Webster's New World01], a quality in theory

college (college, opisto, korkeakoulu) an institution of higher learning that provides a general education in the liberal arts and sciences and grants a bachelor's degree [Random House99], see bachelor of science, university

colon (kaksoispiste) mark “:”, see punctuation

combined standard uncertainty (yhdistetty normaaliepävarmuus) estimated standard uncertainty of a combination of measurement results, see uncertainty

comma (pilkku) mark “,”, see punctuation

commercial publisher (kaupallinen julkaisija, kustantamo) a company whose business is the publishing of books, periodicals, computer software, etc. [Random House99], see publisher, scientific society

communication (viestintä) transfer of information, transference of meaning between systems by the conveying of information [Skyttner05], a matter of encoding a thought in a form that one’s audience can decipher, putting one’s thoughts into words and one’s audience will reverse the process [Honderich05], see language, transaction

communications (tietoliikenne) telecommunications

commutation (vaihtaminen, kääntäminen) a property of scalar multiplication, but not matrix multiplication

compatible (yhteensopiva, vaihtokelpoinen) able to run on a specified computer, able to work with a specified device, functionally equivalent to another, usually widely used system [Random House99], opposite to incompatible

competence (pätevyys) see profession, referee

competing hypothesis (kilpailleva hypoteesi) see hypothesis, null hypothesis, strong inference
**competitive strategy** (kilpailustrategia) answers to the question how an organization will acquire, maintain and strengthen its competitive advantages [Kamensky00], see strategy

**complete** (täydellinen)

**complete induction** (täydellinen induktio) mathematical induction, induction used in mathematical proofs, actually a form of deduction

**complex** (kompleksinen, monimutkainen) composed of many interconnected parts [Random House99]

**complexity** (kompleksisuus, monimutkaisuus) number of parts and their relations in a system, system property measured for example by size, energy consumption, and delay of implementation, see complex, algorithmic complexity, logical depth, statistical complexity, computational complexity, information, price-quality ratio

**complexity science** (kompleksisuustiede) science of complexity [Skyttner06]

**complexity theory** (kompleksisuusteoria) a theory of complexity in biology, based for example on the idea that nature is a cellular automaton [Wolfram02]

**complex number** (kompleksiluku) an ordered pair of two real numbers, see vector, matrix

**complex sentence** (virke) a sentence containing one or more dependent clauses or subordinate clauses in addition to the main clause [Random House99], represents a thought, see word, punctuation, tense, voice, first person

**component** (komponentti) a discrete packaged electronic element that performs one electrical function [Young79], see device, circuit, system

**compound** (yhdyssana) see hyphen, word

**comprehensive prototype** (täydellinen prototyyppi) a full-scale, fully operational version of a product, for example beta prototype [Ulrich95], see focused prototype, prototype

**computational complexity** (laskennan kompleksisuus) see computational complexity theory, algorithmic complexity

**computational complexity theory** (laskennan kompleksisuusteoria) a branch of computer science that deals with resources (time, memory, energy) required to solve problems [Wolfram02], see complexity

**computer** (tietokone) see information engineering

**computer science** (tietojenkäsittelyoppi, tietojenkäsittelytiede) information science, a branch of formal sciences, see computational complexity theory

**concept** (käsite) an abstract idea of an object formed by mentally combining all its characteristics or properties in a definition [Random House99], see universal, semiotic triangle, term, product concept

**concept formation** (käsitteenmuodostus) formation of new concepts, see theory construction, scientific method

**conceptual analysis** (käsiteanalyysi) see concept, analytic philosophy of science, mind map

**conceptualism** (konceptualismi) any of the several doctrines existing as a compromise between realism and nominalism and regarding universals as concepts

**conceptual model** (käsitteellinen malli) a model based on the use of symbols to represent qualitative aspects, for example functional or behavioral model [Calvez93], used as a basis for an mathematical model

**conceptual system** (käsitejärjestelmä) see concept

**conclusions** (johtopäätökset) a brief summary and discussion in a document, especially in a scientific paper, includes what is shown by the work and its significance, limitations and advantages, applications of the results, and recommendations for further work [Spectrum65], see abstract, introduction
conclusion validity (johtopäätöksen valideetti) statistical conclusion validity, validity concerned with the relationship between the treatment and the outcome of the experiment, we want to make sure that there is a statistical relationship with a given significance [Wohlin99]

concrete (konkreettinen) opposite to abstract

concurrency (samaaikaisuus) carrying out separate activities of the product development process at the same time rather than sequentially [Belliveau02]

concurrent (samaaikainen) see parallel, modular

concurrent engineering (samaaikainen tuote- ja valmistussuunnittelu) simultaneous engineering, product design and manufacturing process development occur concurrently in an integrated fashion, using a cross-functional team, rather than sequentially by separate functions [Belliveau02], all product related information is visible to all participants [Leppälä03], see transparent, generative order

condition (ehto, varaus) a restricting, limiting, or modifying circumstance [Random House99], see initial and boundary condition, assumption, optimum

conference (konferenssi) a formal scientific meeting of a number of people for discussion and consultation [Random House99], usually larger than a symposium, see acceptance ratio, deadline, keynote speaker, invited paper, session, track, exhibition, selection committee, peer review, audience, registration, treasurer

conference paper (konferenssijulkaisu) see journal paper

conference proceedings (konferenssijulkaisu) a record of the papers presented at a conference, see literature, camera-ready copy, page charge

confidence (luottamus, luotettavuus) belief in the reliability of a thing [Random House99]

confidence interval (luottamusväli) [Kreyszig83], coverage interval [ISO Guide 99:2004], see confidence limit

confidence level (luottamustaso) level of confidence [Kreyszig83], [Taylor94], coverage probability [ISO Guide 99:2004]

confidence limit (luottamusraja) lower or upper limit of the confidence interval [Kreyszig83], see coverage interval

confirmation (vahvistus, vahvistaminen, varmennus, varmistus, vahvistus) justification, verification

conjecture (konjektuuri) hypothesis in formal sciences, a hunch proposed as a possible theorem to be proved [Honderich05]

consensus (yksimielisyys) common opinion in a scientific community, see truth theory

consistence (konsistentssi, yhtenäisyys, johdonmukaisuus) coherence, freedom from contradiction

consistent (konsistentti, tarkentuva) see estimator

consilience (konsilienssi, yhtenäisyys) unity of knowledge [Wilson99], coherence

constant (vakio) see variable, parameter

constraint (rajoite) limitation or restriction [Random House99], see estimation theory, optimum, product requirement

construction engineering (rakennustekniikka)

construct validity (teoreettisen rakennelman valideetti) validity concerned with the relation between theory and observation [Wohlin99], see isomorphism

consumer (kuluttaja) user, a person who is using products
**consumer need** (kuluttajatarve) a problem the consumer would like to have solved [Belliveau02], see **customer need**

**content** (sisältö)

**context** (yhteys, asiayhteys)

**continuity** (jatkuvuus) opposite to **abrupt change**, see **analysis**, **regularity**

**contribution** (osuus) a course of action that helps to solve an **engineering problem**, see **credit**

**contract** (kontrahti, sopimus) see **agreement**

**contradiction** (ristiriitita, ristiriitaisuus) see **consistency**

**control** (säätö, ohjaus) regulation, see **system**

**control theory** (säätöteoria) see **systems analysis**

**control unit** (säätöyksikkö) controller, regulating mechanism [Random House99], see **state machine**, **system**

**convention** (konventio, tapa) a rule, method or practice established by usage, custom [Random House99]

**copy** (kopio, jäljennös, moniste, kappale (yksittäinen kirja), (lehden) numero) see **issue**, **volume**, **hard copy**

**copy editor** (kustannustoimittaja, tekstitoimittaja) an employee of a **publisher** whose responsibility is to prepare **manuscripts** for publication by providing markup for the printer as well as any needed improvements in **spelling**, **grammar**, and **style** [Day98]

**copyright** (tekijänoikeus) the exclusive ownership of and the right to make use of a literary or artistic work, protected by law for a specified period of time, the copyright protects the form of expression rather than the subject matter of the writing, the copyright continues to be valid even after the death of the author for a specified number of years, usually for 70 years, see **permission**, **intellectual property**, **trademark**, **patent**

**core competence** (ydinosaaminen) that capability at which an **organization** does better than other organizations [Belliveau02]

**corollary** (korollaari, seurauslause) a **proposition** that is incidentally proved in proving another proposition [Random House99]

**correct** (virheetön, oikea) representing the **truth**, see **plausible**

**correctness** (virheettömyys, oikeellisuus) see **truthfulness**, **original paper**

**correlation** (korrelaatio, riippuvuussuhde) the degree to which two or more **attributes** or **measurements** on the same group of elements show a tendency to vary together [Random House99], correlation does not warrant or reflect **causal** connection [Rosenberg00], see **causality**, **internal validity**

**correspondence** letter; agreement with something else or with one another, conformity, similarity, **analogy** [Webster’s New World01]

**cosmogony** (kosmogonia) a **theory** of the origin and development of the universe [Random House99], see **cosmology**

**cosmology** (kosmologia) a part of **metaphysics**, origin and general structure of the universe, especially with such of its characteristics as **space**, **time**, **causality**, and freedom [Random House99], see **cosmogony**, **free will**

**cost** (hinta, kustannus, kulu) the **price** paid to acquire, produce, accomplish, or maintain anything [Random House99]; a **performance metric** that specifies an immediate or long-term disadvantage of an associated **benefit** [Bock01], see **payoff**, **capital**, **labor costs**, **direct costs**, **indirect costs**, **overhead costs**, **prime cost**

**counterexample** (vastaesimerkki) see **falsification**
coverage factor (kattavuuskerroin) the number by which the standard deviation is multiplied to obtain the expanded standard uncertainty [Taylor94]

coverage interval (kattavuusväli) confidence interval [Kreyszig83], an estimate of the range of values within which the true value is assumed to be with a certain coverage probability, a means of expressing uncertainty, including systematic and random errors [amc03], [ISO Guide 99:2004], see bias, standard deviation, mathematical statistics

coverage probability (kattavuustodenäköisyys) confidence level [Kreyszig83], level of confidence [Taylor94], probability that the true value is within the coverage interval [ISO Guide 99:2004], for example 95%, 99%, or 99.9% [Buckner97b], [Kreyszig83], see uncertainty, trueness, precision

creativity (luovuus) originality of thought [Random House99], see brainstorming, analogue, metaphor, mind map, extreme, opposite, research, development, lateral thinking, serendipity, invention

credit (opintopiste) 60 credits is equivalent to one academic year or 1600 hours of full-time work of a student

credit (kunnia, ansio) see contribution

criterion (kriteeri) a standard of judgement, a rule or principle for evaluating or testing something [Random House99], plural form is criteria, see metric, optimum, performance criterion

critical path (kriittinen polku) a single sequence of tasks whose combined required times define the minimum possible completion time for the entire set of tasks in a project [Ulrich95], see PERT chart

criticism (kritiikki) the act of analyzing and evaluating of a work [Random House99] with the aim to improve it, see groupthink, values

crucial experiment (ratkaiseva koe) see experiment

cumulative index (hakemistojen yhdistelmä) an author and subject index that covers several recent volumes of a certain journal

curly bracket (aaltosulku) brace

curriculum vitae (curriculum vitae, ansio-luettelo) track record, a summary of one’s personal history and professional qualifications, as that submitted by a job applicant [Webster's New World01], see biography

curve fitting (käyrän sovitus) see estimation theory

customer (asiakas, tilaaja) client, user, see funding, marketing, industry

customer need (asiakastarve) any attribute of a potential product that is desired by the customer, expressed in the language of the customer, see product requirement, consumer need, feature

cybernetics (kybernetiikka) the comparative study of organic control and communication systems and mechanical or electronic systems analogous to them [Random House99], see analogy, bionics, biology, systems engineering

cycle time (kierrosaika) the length of time for any operation, from start to completion [Belliveau02]

dash (ajatusviiva) usually the same as em dash, see en dash, punctuation

data (data, tiedot) information prepared for or stored by a computer, a plural noun

database (tietokanta) see abstracts database, citation database, electronic library, data mining

data book (datakirja) a book containing information about components of some manufacturer
data link layer (siirtoyhteyskerros) the layer above the physical layer and below the network layer in the OSI model, the principal service provided by the data link layer to the higher layers is that of error detection and control, the layer attempts to make the physical link error-free and provides the means to activate, maintain, and deactivate the link, the bottom part of the data link layer is medium access control sublayer [Tanenbaum96], [Stallings91], see error rate, channel coding

data mining (analysoiva tiedonhaku, tiedonrikastus) knowledge discovery in databases, the nontrivial extraction of implicit, previously unknown, and potentially useful information from data [Frawley92], see literature search

deadline (takaraja, aikaraja, määräaika, määräpäivä) the time by which the manuscript must be submitted to a conference or a special issue of a journal

debugging (debuggaus, virheiden etsintä ja poisto) detecting and removing errors from a computer program [Random House99], see verification, testing, patching

decision theory (päättösteoria) a mathematical theory of decision-making, see game theory, detection theory

deduce (dedusoida) see deduction

deduction (deduktiio) a form of inference, if the premises are true the conclusion must be true, i.e., deduction preserves the truth [Honderich05], if the conclusion is false, at least one of the premises must be false, often inaccurately defined as drawing of a particular truth from a general truth, which is opposite to induction, deduction corresponds to analysis, see reduction, complete induction, causality, abduction, measurement

deductive (deduktiivinen) see deduction

deductive system (deduktiivinen järjestelmä) a system that has at least one rule of inference but need not have any axioms [Honderich05], see axiomatic system, natural deductive system

deductive explanation (deduktiivinen selitys) a form of scientific explanation that is based on a deductive system [Nagel79], see axiomatic system

default (oletusarvo) a preset value that a computer system assumes or an action that it takes unless otherwise instructed [Random House99], see assumption


definition (määritelmä) explanation of the meaning of a word or expression, naming wider class to which something belongs and distinguishing properties [Honderich05], probably using primitive symbols or terms [Rosenberg00], see assumption, semantics, well-defined problem, ill-defined problem

degree (tutkinto) an academic title conferred by universities and colleges upon the completion of studies [Random House99], see bachelor of science, master of science, doctor of philosophy, doctor of science

degree of freedom (vapausaste) see mathematical statistics

delay (viive) the period of time for which something is delayed, see performance, latency

deliverable (tulos) the output such as technical reports, regulatory approvals, working prototypes, or marketing research reports that shows a project has achieved a result [Belliveau02]

demand (kysyntä) the desire for a commodity or products together with ability to pay for it [Webster's New World01], see supply, price-quality ratio, law of supply and demand, industry

demonstration (demonstratio, havaintoesitys, todistaminen, näyteluento) see prototype

derived quantity (johdannaisuure) see base quantity, quantity [ISO Guide 99:2004]

description model (esitysmalli, kuvausmalli) functional, behavioral, or executive model [Calvez93], see OSI model

descriptive (deskriptiivinen, kuvaileva) see abstract
design (suunnittelu) product design

detection (ilmaisu) demodulation, the process of recovering at the receiver a signal that has been modulated on a carrier wave [Sklar01], see modulation, channel coding

detection theory (ilmaisuteoria) a part of estimation theory, see detection, decision theory

determinism (determinismi) thesis that all events without exception are effects, or events necessitated by earlier events which are causes, future events are fixed and unalterable as the past is fixed and unalterable [Honderich05], contrasted with chance, free will and final cause, see causality, chaos

deterministic (deterministinen) see determinism

*development (kehitystyö) systematic use of the existing knowledge for production of useful materials, devices, systems, or methods, including design and development of prototypes and processes [Jain97], see product development

developmental law (kehityslaki) incomplete scientific law based on historical or genetic descriptions, one form of sequential laws [Nagel79], see genetic explanation

deviation (poikkeama) see standard deviation, error

device (laite, yksikkö, elektroninen komponentti, algoritmi) a thing made for a particular purpose [Random House99], see equipment, development; an electronic part that contains one of more active elements, see component

dictionary (sanakirja) a book containing a selection of words, with information about their meaning, pronunciations, etymologies, inflected forms, etc. [Random House99], usually college and unabridged versions, see language, thesaurus

digital library (digitaalinen kirjasto) electronic library

direct costs (suorat kustannukset) see indirect costs

discipline (tieteenala, tiedonhaara) a branch of knowledge, learning or science [Webster’s New World01], see interdisciplinary reduction, multidisciplinary

discovery (löytö) see scientific method, empirical-inductive method, knowledge, verification, creativity

discrete (diskreetti, epäjatkuva, erillinen) distinct, made of distinct parts [Random House99]

discuss (keskustella) to consider or examine by argument, comment, etc. [Random House99]

discussion (pohdinta) a part of results or conclusions, or a separate part of a scientific paper, see document

displayed equation (numeroitu yhtälö) an equation for which a number in parentheses is given for future reference, see in-text equation

dissertation (opinnäyte) a thesis, especially one written by a candidate for a doctorate [Random House99]

distortion (vääristymä, särö) a wave, sound or signal modified so as to produce an unfaithful reproduction [Webster’s New World01], see channel, noise, linear, nonlinear

distribution (jakelu) delivery, see industry

diversity (diversiteetti, monimuotoisuus)

diversity of science (tieteen monimuotoisuus) science is a network of theories that mutually support and partially explain each other and do not have a privileged foundational level, say physics, opposite to foundationalism or unity of science [Honderich05]

docent (dosenatti) a university lecturer who has a doctor’s degree, ability to teach, and significant research results after his or her doctor’s degree, roughly equivalent to a second doctoral thesis
doctor (tohtori) a person who has passed the required graduate courses and published and successfully defended a doctoral thesis in a public defence, required to independently discover new scientific knowledge, a graduate degree ranking above master of science

doctoral candidate (väittelijä) see doctor

doctoral thesis (väitöskirja) a thesis published by a doctoral candidate after the two referees selected by the university have written a positive review about the thesis manuscript, see dissertation, pre-examination

doctorate (tohtorinarvo) doctor's degree

doctor of philosophy (teknikan tai filosofian tohtori) a graduate degree ranking above a master of science and below doctor of science

doctor of science (tekniikan tai filosofian tohtori) a graduate degree ranking above a master of science and below doctor of philosophy

doctor of technology (teknikan tohtori) see doctor of philosophy, doctor of science

doctrine (oppi, oppijärjestelmä, oppinkappale, oppisuunta) *document (dokumentti, asiakirja, asiapaperi) see book, article, paper, publication, standard, patent, thesis or other technical report, in general includes a title, authors, abstract, table of contents, preface, glossary, list of abbreviations, list of symbols, introduction, materials and methods, system model, results, discussion, conclusions, summary, appendix, and index, and the text consists of parts (in books), chapters, sections, paragraphs, complex sentences, tables, figures, equations, and footnotes, see readership, literature search, transparent, voice, tense, italicization, bold-facing, punctuation

dogma (dogma, oppinkappale) doctrine that is accepted irrespective of reason or evidence [Honderich05], see paradigm

dogmatic (dogmaattinen, ahdasmielinen, suvaitsematon)
domain (arvojoukko) the set of values for which a function is defined [Weisstein05], see range

double blind review (kaksoissokkotarkastus) a blind review where also the authors are anonymous to the referees

doubt (epäilys) see ambiguity

downwards causality (alaspäin suuntautuva kausaalisuus) causal influence of higher-level phenomena on lower-level processes [Honderich05], opposite to upwards causality, downwards causality is in suspect in natural science, see final cause, emergence

draft (luonnos) see outline, sketch, revision, document

drift (ajautuma, ryömintä)
dual (duali, kahtalainen, kaksitahoinen, kaksinainen) having a twofold, or double, character or nature [Random House99]
dual hierarchy (kaksijakoinen hierarkia) a hierarchy in a research organization which includes a management hierarchy and a professional hierarchy [Jain97], see triple hierarchy

dualism (dualismi, kahtiajako) duality, the view that substances are either material or mental [Random House99], opposite to materialism

duality (duaalisuus, kahtalaisuus, kahtiajako) see symmetry

duration (kestoaika) length of time something continues or exists [Random House99]
dynamic (dynaaminen, muuttuva, kehittyvä; muistillinen) opposite to static, characterized by or producing change or progression [Random House99]; (a system) with memory
**dynamical law** (dynaaminen laki) a form of *functional laws* which show the manner a magnitude of some quantity varies with time or more generally how a change in magnitude per unit of time is related to other magnitudes [Nagel79], see *statical law*

**dynamical systems theory** (dynaaminen systeemiteoria) study of systems that evolve in time according to mathematical equations [Wolfram02], see *dynamic, nonlinear dynamics, systems engineering*

**dynamic range** (dynamikka-alue) an *linear signal* range whose upper bound is defined by saturation and lower bound by noise, see *system*

**dynamic structure** (dynaaminen rakenne) a *structure* that is changing with time, opposite to static structure [Bohm92], see *order, dynamic order*

**dynamics** (dynamikka) the branch of *mechanics* that deals with the motion and equilibrium of systems under the action of forces [Random House99]

**economics** (taloustiede) a branch of *social science*, see *cost, price, capital*

**edition** (laitos, painos) one of a series of printings of a *book*, each differing from another by alterations, additions, etc. [Random House99], see *print, book*

**editor** (editori, toimittaja) a person in a *journal* who organizes the *peer review* process and decides whether a submitted *manuscript* is published or not in the journal, a person who decides what will be published in a multiauthor book, see *copy editor*

**editorial board** (toimituskunta) the board of editors in a *journal*

**editor in chief** (päätoimittaja) principal editor of a journal to whom the *manuscripts* are submitted and who selects the editor to organize the *peer review*

**effect** (syy) see *cause*

**efficacy** (tehokkuus, voima, teho, vaikutuskyky) a *measure* of the extent to which a *system* contributes to the purposes of a higher level system of which it may be a *subsystem*

**effectiveness** (tehokkuus, teho) a *measure* of the extent to which a *system* achieves its intended *transformation* [Skyttner05]

**efficiency** (tehokkuus, suorituskyky, hyötysuhde) a *measure* of the extent to which a *system* achieves its intended *transformation* with the minimum use of *resources* [Skyttner05], see *performance*

**efficient** (tehokas) see *efficiency, estimator*

**efficient cause** (vaikuttava syy) *cause*

**electrical engineering** (sähkötekniikka) practical application of the theory of electricity to the construction of machinery, power supplies, etc. [Random House99], see *electronics, information engineering, and telecommunications*

**electromagnetics** (sähkömagnetismioppi) a branch of *physics*

**electronic library** (elektroninen kirjasto) *digital library*, *abstracts database* that includes also full texts of *publications*, see *citation database*

**electronic journal** (sähköinen lehti) a *journal* published on the Internet, see *browser*

**electronics** (elektroniikka) *development and application of devices and systems* involving the flow of electrons in a vacuum, in gaseous media, and in semiconductors [Random House99], see *microelectronics, nanotechnology, information engineering*

**element** (elementti, osa, alkio) *part*

**ellipsis** (sananpoisto) mark “...” or “…” used in a quotation for leaving out of a word or phrase that is not necessary for meaning [Young02], [Skillin74], see *punctuation*

**embedded** (sulautettu)
em dash (ajatusviiva) mark “—” whose length is equal to the width of letter M, used to replace some missing words or to show a sudden breaks or abrupt changes in a quotation [Chicago93], see en dash, dash, ellipsis

emergence (emergenssi, ilmaantuminen) occurrence of properties at higher hierarchy levels of organization which are not predictable from properties found at lower levels [Nagel79], neglected in reductionism, see holism, free will, downwards causality, system, synergy

emergent property (emergentti ominaisuus)

empirical (empiirinen, kokemusperäinen) based on fact or observation [Young02], see experimental, trial and error

empirical-inductive method (empiris-induktiiivinen menetelmä) scientific method in empirical sciences [Kragh02], see discovery

empirical science (kokeellinen tiede) science based on observations and experiments, opposite to formal science

empiricism (empirismi) a view which bases our knowledge on experience through the traditional five senses [Honderich05], contrasted with rationalism

emulator (emulaattori) real-time simulator, see simulation

enabling (mahdollistava) see technology

enclosure (liite) attachment, something enclosed or included within a letter [Random House99], see appendix

encryption (salaus) enciphering, adding a code to data being sent over a public network to prevent its unauthorized detection [Sklar05], see presentation layer, coding

encyclopedia (ensyklopedia, tietosanakirja) a book or set of books giving information on all or many branches of knowledge, generally in articles alphabetically arranged [Random House99], see language, literature

en dash (väliiviiva) mark “—” whose length is equal to the width of letter N, half of the length of em dash, used to connect continuing or inclusive numbers [Chicago93]

en dash (väliiviiva) mark “—” whose length is equal to the width of letter N, half of the length of em dash, used to connect continuing or inclusive numbers [Chicago93]

energy (energia) capacity to do work [Random House99], see power, complexity

engineer (insinööri) an expert in engineering, see scientist

engineering (teknilkka) practical application of science and mathematics, as in the design and construction of new products and services [Random House99], not existing in the nature, inc. chemical, civil, electrical, industrial, and mechanical engineering, see art, science, artefact, reverse engineering, technology

engineering design (tekninen suunnittelu) mechanical, electrical, software, etc. design of a product, in contrast to industrial design [Ulrich95]

enlightenment (valistus) an ambition to develop society with scientific knowledge and rationality

entropy (entropia, epäjärjestys) a measure of unavailable energy in a physical system [Random House99], a quantitative measure of the degree of disorder or randomness in thermodynamics [Checkland99]

entropy (entropia, keskimääräinen informaatio) average information content per source symbol [Checkland99]

environment (ympäristö) what lies outside the system boundary [Checkland99], see system, product requirement, telepresence, virtual reality

epistemological reduction (epistemologinen reduktio) intertheoretical and interdisciplinary reduction, opposite to deduction, see ontological reduction
**epistemology** (epistemologia, tietoteoria) theory of knowledge [Rosenberg00], part of *philosophy*, study of the origin, nature, methods and limits of human *knowledge*, inc. (i) *logic* and (ii) *philosophy of science* [Random House99]

**equation** (yhtälö) see displayed equation, in-text equation, variable, bold-facing, italicization, parenthesis, bracket, curly bracket, subscript, superscript, index, formula

**equipment** (laitteisto) see *device*

**equivocation** (epämääräisyys, moniselitteisyys) *ambiguity*, especially in a frequency estimator

**error** (virhe) the difference between a *measurement* result and the accepted *reference value* [amc03], see systematic error, random error, bias, standard deviation, mean-square error, curve fitting, mistake

**error rate** (virhesuhde) the ratio of erroneously received *symbols* and all received *symbols*, see *performance*, *data link layer*

**esthetics** (estetikkä) *aesthetics*

**estimation** (estimaattori) see consistent, efficient, sufficient

**ethical** (eettinen) see ethics

**ethics** (etiikka) a branch of *axiology*, see *code of ethics*

**ethos** (henki, periaate, asenne) see *research culture*

**event** (tapahtuma) an event is constituted by changes [Honderich05], see phenomenon, scenario, process, thing

**evidence** (näyttö, todiste, todistus) *proof*, see experiment, verification, indirect evidence

**evolution theory** (evoluutioteoria) see *biology*, *genetic algorithm*

**exclamation point** (huutomerkki) explanation mark, mark “!” , see *punctuation*

**executive summary** (johtajille tehty yhteenveto) an abstract prepared for executives

**executive model** (toteutusmalli) implementation model, a *description model* that specifies the physical parts of the *system*, consisting of processors for information transformation and decision making, memories for storing data, and communication nodes as intermediate elements for information transit points, hierarchically below the *functional model* and *behavioral model* [Calvez93], see OSI model, product specification

**exhibition** (näyttely, messut) see *conference*

**expanded uncertainty** (laajennettu epävarmuus, kokonaisepävarmuus) *uncertainty* expressed with *standard deviation* multiplied by a given coverage factor

**experience** (kokemus) new *knowledge* gained by *observation* or *experiment* [Rosenberg00]

**experiment** (koe) a *scientific* test or a set of tests done carefully to study what happens, to gain new *knowledge*, and to test a *theory* or *hypothesis* [Wohlin99], see crucial experiment, observation, evidence, empiricism, rationalism, laboratory experiment, field trial, pilot

**experimental** (kokkeillinen) see empirical, trial and error

**expert** (asiantuntija) specialist

**explanation** (selitys) that which produces understanding how or why something is as it is [Honderich05], see *theory*, *scientific explanation*

**explanation mark** (huutomerkki) explanation point
explanatory power (selitysvoima)

explicit (eksploitittimen, selvä) fully and clearly expressed or demonstrated [Random House99], opposite to implicit, see original paper

expression (lauseke, ilmaisu) a mathematical symbol or combination of symbols representing a value, relation, or the like [Random House99], see equation

extended abstract (pitkä tiivistelmä) a long abstract based on which some conferences make their decisions about acceptance before the camera-ready copy is submitted

external validity (ulkoinen valideetti) question of how general the findings are, can the result of the study be generalized outside the scope of the study [Wohlin99], see validity, internal validity, induction

extreme (ääripää) see creativity, opposite

fact (fakta, tosiasia) something that has been verified, see assumption, verification

factor (faktori, tekiä, osatekijä, syy, kerroin) see cause

false (virheellinen, epävaltava) opposite to true

falsifiability (falsifioitavuus) see falsification

falsification (falsifiointi) refutation, demonstration that the hypothesis is false by the discovery of a counterexample, opposite to verification [Rosenberg00]

fault (vika, virhe, häiriö) see robust, operational

feasibility study (esitutkimus) major technical or market unknowns are examined to produce knowledge about how to resolve or overcome them or to clarify the nature of any limitations [Belliveau02], see research

feature (piirre) the solution to a customer need or problem [Belliveau02]

feedback (takaisinkytkentä, palaute) return of part of the output of a circuit, system, or device to the input [Random House99], closed loop, see stability, feedforward

feedforward (myötäkytkentä) open loop, see feedback

fellow (fellow-arvo) a member of a scientific society ranking above a senior member and below a life fellow, for sustained long-term contributions in a specific field

fellowship (apuraha, fellow-jäsenyyys) see scholarship, grant, fellow

field (kenttä) an area where practical work is done, away from the laboratory; the realm of knowledge or a special work or opportunity [Webster’s New World01]

field test (kentttätesti) see field trial

field trial (kentttätesti) a trial of a new product or procedure to determine its usefulness or efficiency in actual performance [Random House99], see validation

figure (kuva; numeromerkki, lukumäärä) a pictorial representation, figures may be graphs, photographs, or line drawings [Day98], see document, legend, caption, histogram; a numerical symbol, an amount or value expressed in numbers [Random House99]

final cause (finaalisyy) teleological cause, explanation of some event by identifying the purpose, goal or end which it serves to attain [Honderich05], contrasted with efficient cause, final causes are in suspect in natural science, see emergence, backwards causality, downwards causality

finite state machine (äärellinen tilakone) a state machine with a finite number of states [Fletcher80]

first person (ensimmäinen persoono) preferably use the first person in a document [Day98], see complex sentence

focus (fokus, keskittyminen) central point of attention [Random House99], see object, research
focused prototype (kohdistettu prototyyppi) implement one or a few of the attributes of a product [Ulrich95], see prototype, comprehensive prototype

footnote (alahuomautus) see document

form (muoto) organization, structure, shape, or pattern given to some material, complementary to matter

formal (muodollinen) opposite to informal

formalism (formalismi, kaavamaisuus) strict adherence to or observance of prescribed or traditional forms [Random House99]

formal science (muodollinen tiede) a branch of science, inc. (i) logic, (ii) set theory, (iii) mathematics, and (iv) computer science, see empirical science

format (formaatti, ulkoasu, muoto) a specific arrangement in accordance with which computer data is processed, stored, printed, etc. [Sklar02], see presentation layer

formatting (formatointi, muotoilu) see format

formula (kaava) an expression of the constituents of a compound by symbols and figures [Random House99], see equation

forum (foorumi, areena, keskusteluaarena) see alliance, standard

forwards causality (kusaalisuus eteenpäin) causality based on efficient cause [Honderich05]

foundation (säätiö) see funding, grant, scholarship

foundationalism (käsitys tieteiden yhtenäisyydestä) see unity of science

fractal (fraktaali) a nested shape whose dimension is not an integer, whose length is infinite but whose area is finite

fractal geometry (fraktaaligeometria) theory of nested shapes [Wolfram02], see systems engineering

free will (vapaat tautot) will that is not completely governed by deterministic causal laws [Honderich05], see determinism, chance, emergence, cognitive

full paper (täysimittainen julkaisu) a full-length original journal paper, a well-rounded treatment of a problem area

full-stop (piste) period

function (funktio, toiminto) map, mapping, transformation, correspondence, operation [Random House99], a relation that uniquely associates members of one set with members of another set, more formally, a function from to is an object such that every is uniquely associated with an object, a function is therefore a many-to-one or sometimes one-to-one relation, the set of values at which a function is defined is called its domain, while the set of values that the function can produce is called its range, the term “map” is synonymous with function [Wesstein05], see analysis, system, variable, domain, range

functional (funktionalinen) see function

functional design (toiminnallinen suunnittelu) a complete functional solution in accordance with the product specifications and with qualities which will benefit the entire product life

functional law (funktionalilain laki) a form of scientific laws, including statical laws and dynamical laws [Nagel79]

functional model (toiminnallinen malli, rakennemalli) a structural model, a description model where a structure built using functions and relations between them, decomposition into functions corresponds to a topological rather than a temporal point of view of application activities, hierarchically above the behavioral model and executive model [Calvez93], see structure, product specification, abstraction, refinement, OSI model
**functional organization** (toiminnallinen organisointi) an organization where organizational links are primarily among those who perform similar functions [Ulrich95], see **project organization**, **matrix organization**

**functional parts** (toiminnalliset osat) functional elements, individual operations and transformations that contribute to the overall **performance** of the **product** [Ulrich95], see **physical parts**

**functional testing** (toiminnallinen testaus) financial support, see **marketing**, **customer**, **proposal**, **foundation**, **sponsor**

**funding** (rahoitus) a mathematical theory that deals with strategies for maximizing gains and minimizing losses within prescribed constraints [Random House99], see **systems engineering**, **decision theory**

**gamma test** (gammatestaus) a product use test in which the developers measure the extent to which the product meets the needs of target customers, solves the problems targeted during development, and leaves the customer satisfied [Belliveau02]

**Gantt chart** (Gantt-kaavio) time line, **timing plan**, a chart that depicts progress in relation to time, often used in planning and tracking a **project**, does not explicitly display the dependencies among tasks [Ulrich95], see **PERT chart**

**gatekeeper** (portinvartija, porttivahti) persons who have a good social network and act as information sources in a group [Jain97], see **research culture**

**generality** (yleisyys) a quality in **theory** [Wilson99]

**generalization** (yleistys) see **induction**

**general systems theory** (yleinen ystemeiteoria) study of large networks of elements [Wolfram02], see **systems engineering**

**generative order** (generatiivinen järjestys, luova järjestys) an overall order, a creative order between **timeless order** and **sequential order**, a deep and inward order out of which the manifest form of things can emerge creatively, an order where **time** does not have priority in contrast to **sequential order**, and internal interrelations are included, especially **iterations** [Bohm92], see **spiral model**, **iterative model**, **outline**, **refinement**, **concurrent engineering**, **PERT chart**

**genetic algorithm** (geneettinen algoritmi) an **algorithm** inspired by the **evolution theory**, solutions are improved among several alternatives by combining solutions (hybridization), by generating random variation (mutation), and by selecting the most fitted (natural selection), see **neural network**, **biology**

**genetic explanation** (geneettinen selitys) one form of **scientific explanations** based on genes [Nagel79], see **developmental law**

**glossary** (sanasto, luettelo) a part of a **document**, see **list of abbreviations**, **list of symbols**

**Gödel’s theorem** (Gödelin teoreema) a theorem which states that for any consistent formal system containing a certain part of arithmetic, a sentence in the language of this system can be constructed which is neither provable nor refutable in the system [Honderic05]

**graduate** (akateemisen välitutkinnon jälkeinen) studies after the **bachelor of science degree**, see **master of science**, **doctor of philosophy**, **doctor of science**

**grammar** (kielioppi) see **language**, **syntax**, **complex sentence**, **copy editor**
grammar book (kielioppi) a reference book on the way complex sentences of a language are constructed, especially the study of morphology and syntax

grant (apuraha) scholarship, fellowship, see award, reward, foundation

granularity (rakeisuus) the smallest measurement increment specified for a device or quantity [Bock01], see precision, resolution

graph (graafi, käyrädiagrammi) lines, bars, or other pictorial presentation of data [Day98], see figure, see Gantt graph, result

groupthink (ajatella ryhmänä) a mentality of group agreement without the individual minds sorting out the best decision or solution to a problem leading to poor performance [Jain97], in contrast with criticism, brainstorming

handout (luentomoniste) see lecture, slide presentation

hang-up (roikkuminen) a problem or difficulty [Webster’s New World01], especially in a nonlinear system

haptic interaction (haptinen vuorovaikutus) interaction with the sense of touch, see multisense interaction

hard copy (paperikopio, kalvokopio) a copy on film or paper as opposed to magnetic disk or tape

heading (otsikko) a title of a chapter or section

hermeneutics (hermeneuttiikka) the art or science of interpretation [Random House99], a modern trend in philosophy of science [Niiniluoto02], see analytic philosophy of science

hermeneutic circle (hermeneuttinen kehä) inherent circularity of all understanding [Honderich05], a circle in interpretation, which comes from the fact that details must be understood in the light of the whole, but the whole can be understood only from the details

heuristic (heuristinen) encouraging a person to solve problems for example by experimenting, evaluating possible answers or solutions, or by trial and error [Random House99]

heuristics (heuristiikka)

hierarchical control (hierarkkinen säätö) control in a hierarchical system [Checkland99], see hierarchy

hierarchy (hierarkia, arvojärjestys) any system of persons or things ranked above another [Random House99], see hierarchy level, OSI model

hierarchy level (hierarkiataso) in a system hierarchy, each hierarchy level is more complex than the one below, a level being characterized by emergent properties which do not exist at the lower level [Checkland99], see layer

histogram (histogrammi, pylväsdiagrammi) see mathematical statistics, figure

history (historia) study of past events; acts, ideas, or events that will or can shape the course of the future [Random House99], see developmental law, trend

holism (holismi) opposite to reductionism, theory that whole entities, as fundamental components of reality, have an existence other than as a mere sum of their parts [Random House99], see emergence, hierarchy level, vitalism

holistic (holistinen, kokonaisvaltainen)

holistic approach (holistinen lähestymistapa, kokonaisvaltainen lähestymistapa) systems approach [Checkland99]

holodeck (holodekki) telepresence and virtual reality combined: all involved are in a virtual environment
**hologram** (hologrammi) a three-dimensional image of an object produced by recording a photographic plate or film patterns of interference formed by a split laser beam and then illuminating the pattern with usually coherent light [Random House99], see telepresence

**holograph** (hologrammi) hologram

**hot spot** (hottspotti, kuuma piste)

**humanities** (humanistiset tieteet) inc. (i) history, (ii) philosophy, (iii) linguistics or study of languages, (iv) study of literature, visual arts, music, etc., (v) jurisprudence or science of law, and (vi) science of religion

**hypermedia** (hypermedia) a system where various forms of information, as data, text, graphics, video, and audio, are linked together by a hypertext program [Random House99]

**hypertext** (hyperteksti) a method of storing data through a computer program that allows a user to create and link fields of information at will and to retrieve the data nonsequentially [Random House99], see sequential

**hyphen** (tavuviiva) mark “-”, see compound, punctuation

**hypothesis** (hypoteesi) a hunch proposed as a possible solution to a problem [Honderich05], an idea of a causal relationship [Wohlin99], see competing hypothesis, null hypothesis, auxiliary hypothesis, objective, conjecture

**hypothetico-deductive method** (hypoteettis-deduktiivinen menetelmä) method based on the thesis that science proceeds by hypothesizing general statements or hypotheses from which observational consequences may be deduced to indirectly verify the hypotheses [Honderich05], see axiomatic system, theory, scientific method, empirical-inductive method

**hypothetico-deductive system** (hypoteettis-deduktiivinen järjestelmä) axiomatic system or other theory that is empirically verified by using the hypothetico-deductive method [Niiniluoto02]

**idea** (idea, ajatus, käsite) any conception existing in the mind as a result of mental understanding, awareness, or activity, a thought, a plan of action, a concept developed by the mind [Random House99], ideas are generated through a unique communication network of a research organization and facilitated by the ethos of a scientific community [Jain97], see research

**idealization** (idealisointi) something considered or represented in a perfect form, to approximate a thing in the real world, see assumption, reductionism

**idealism** (idealismi) any philosophical system or theory that maintains that the real is of the nature of thought or that the object of external perception consists of ideas [Random House99]

**ill-defined problem** (huonosti määritelty ongelm) badly defined problem, opposite to well-defined problem, see definition, customer needs

**illustration** (kuva, kuvitus) see figure

**image** (arvojoukko; kuva) range

**immediacy index** (välittöm vaikutusluku) the average number of times recent articles in a specific journal were cited in the present year, see impact factor, cited half-life

**impact** (vaikutus) influence, effect, see significance

**impact factor** (vaikutusluokka) the average number of times recent articles in a specific journal were cited in one year, usually averaged over two preceding years, see immediacy index, cited half-life

**imperfect tense** (imperfekti) past tense

**impersonal** (persoonaton, puolueeton) objective, see research culture
implementation (toteutus) development of the required operational material object described by the implementation specification using hardware or software, satisfying the product requirement, see product specification, development, complexity

implementation model (toteutusmalli) executive model

implication (implikaatio, johtopäätös, seuraamus) see imply

implicit (implisiittinen, epäsuora) opposite to explicit, see imply, tacit knowledge

implied assumption (hiljainen oletus) an assumption not explicitly stated

imply (sisältää, käsittää) to indicate or suggest without being explicitly stated; derivable by deduction [Rosenberg00]

imprecision (epätäsmällisyys) numerical value expressing precision, for example with standard deviation [amc03], [ISO Guide 99:2004], but not recommended in [Taylor94], see precision, accuracy, uncertainty

impulse response (impulssivaste) response of a linear system to an impulse, see transfer function

incommensurability (yhteismitattomuus) the supposed untranslatability of one theory or paradigm into another [Rosenberg00], see interdisciplinary reduction, intertheoretical reduction

incompatible (yhteensopimaton) opposite to compatible

indentation (sisennys) see paragraph

indeterminism (indeterminismi) a view incompatible with determinism [Honderich05], see free will, trend

index (indeksi, hakemisto, luettelo) see subscript, superscript, glossary, cumulative index, immediacy index, document

indirect costs (epäsuorat kustannukset) see direct costs, overhead costs

indirect evidence (epäsuora todiste) see evidence

induce (indusoida) see induction

induction (induktiivinen) see induction

induction (induktion) scientific induction, a form of inference in which the conclusion, though supported by the premises, does not follow from them necessarily [Honderich05], often inaccurately defined as reasoning from particular cases to general conclusions, scientific induction is incomplete and does not necessarily preserve the truth, induction is based on regularity of the world and usually analogies are used, a form of inductive reasoning is probabilistic reasoning, induction is opposite to deduction, see complete induction, abduction, probability, underdetermination, external validity

inductive (induktivinen) see induction

industrial design (teollinen muotoilu) design of aesthetics, ergonomics, and user interfaces of a product, in contrast to engineering design [Ulrich95]

industrial engineering (tuotantotekniikka) engineering applied to the planning, design, and control of industrial operations [Random House99]

industry (teollisuus) manufacturing productive enterprises collectively, see organization, invention, product, investing, capital, people, energy, material, research, development, design, manufacturing, marketing, distribution, mass product, customer, supply, demand, law of supply and demand, instrumentation

infer (päättellä, tehdä johtopäätös) see inference

inference (päättely) upgrading or adjustment of belief in the light of the play of new information upon current beliefs, inc. deduction, induction, abduction [Honderich05], see reasoning, analogy, strong inference

informal (epämuodollinen) opposite to formal
information (informaatio, tieto) communications about relations in forms [Baeyer05], a distinction which reduces uncertainty or increases order [Checkland99], referring to semantics [Skyttner06], see data, knowledge, message, entropy, pattern, random, complexity, syntactics, pragmatics

information (informaatio) a measure of randomness without any reference to meaning in information theory, referring to syntactics [Skyttner06], see data, knowledge, message, entropy, pattern, random, complexity, semantics, pragmatics

information engineering (tietotekniikka) the study or use of electronic equipment, especially computers, for storing, analyzing, and distributing information of all kinds, including words, numbers, and pictures, see electronics

information retrieval (tiedonhaku) see literature search, abstracts database

information science (tietojenkäsittelyoppi, tietojenkäsittelytiede) computer science

information theory (informaatioteoria) statistical information theory [Checkland99], mathematical theory of information concerned with the content, transmission, storage, and retrieval of information, usually in the form of messages or data [Random House99], see telecommunications, capacity, systems engineering, source coding, channel coding, modulation, network information theory

information transparency (tiedon läpinäkyvyys) visibility of information [Leppälä03]

informative (informatiivinen, valaiseva) see abstract, title

infrastructure (infrastrukturi, perusrakenne) see research culture

initial condition (alkuehdo, alkutila) a condition that is realized prior to, or at the same time as, the phenomenon to be explained [Losee01], see boundary condition, assumption, bootstrapping

innovation (innovaatio) the act or process of introducing new methods, devices, etc., widespread social, cultural or commercial adoption and application of a new idea, usually based on an invention [Leppälä03]

input (tulo) anything that crosses the boundary of a system and comes into the system [Checkland99], for example information, energy, or material, see output

insight (näkemys) see intuition

instrument (instrumentti, mittari, mittauslaite) a device for measuring the present value of a quantity under observation [Random House99], see calibration, trueness, precision, accuracy, uncertainty, scale, nominal value

instrumentalism (instrumentalismi) antirealism

instrumental value (välinearvo) a value that can be explained to others, opposite to intrinsic value, see values

instrumentation (instrumentointi, mittauslaitteet, laitteisto, niiden käyttö ja hoito) the use of or work done by instruments; the process of developing, manufacturing, and using instruments, especially in science and industry

integral architecture (yhteenrakennettu arkkitehtuuri) an architecture where functional elements of the product are implemented using more than one physical building block, a single physical building block implements many functional elements, or the interactions between physical building blocks are ill-defined and may be incidental to the primary functions of the product [Ulrich95], opposite to modular architecture

integration (integrointi) see modular architecture

integrity (rehellisyys, yhtenäisyys, eheys) honesty, see ethics, values; the state of being whole or entire
intellectual property (aineeton omaisuus) information, including proprietary knowledge, technical competences, and design information, that provides commercially exploitable competitive benefit to an organization [Belliveau02], see copyright, patent, trademark

interaction (vuorovaikutus) reciprocal action, effect, or influence [Random House99], see haptic interaction, multisense interaction, virtual reality, telepresence

interdisciplinary reduction (tieteiden välinen reduktio) reductionist hierarchy of sciences from bottom up is physics, chemistry, biology, psychology, sociology, economics, and history [Checkland99], see unity of science, diversity of science, intertheoretical reduction, reduction, incommensurability

interface (liitintä, rajapinta) a common boundary or interconnection between systems, equipment, concepts, or people; boundary between hierarchy levels [Checkland99]

interfere (interferoida) see superposition

interference (interferenssi, häiriö) interfering signal, see noise

internal validity (sisäinen valideetti) validity within the given environment and the reliability of the results, we must make sure that it is a causal relationship, and that it is not a result of a factor of which we have no control or have not measured [Wohlin99], see external validity, correlation

interpretation (tulkinta) the meaning assigned to another’s creative work, action, behaviour, etc.

interrelation (keskinäinen suhde, vuorovaikutus) interrelationship, see relation

interrelationship (keskinäinen suhde, vuorovaikutus) interrelation

intertheoretical reduction (teorioiden välinen reduktio) opposite to deduction, the relation between a less general and a more general theory that enables the more general theory to explain the truth of the less general theory, the laws of the reduced theory can be derived by deduction from that of the reducing theory [Rosenberg00], [Honderich05], see reduction, incommensurability

in-text equation (tekstin sisäinen yhtälö) an equation within a text without a number, see displayed equation

intractable problem (vaikkeasti käsiteltävä ongelm) not manageable problem, see mathematics, ill-defined problem

intrinsic value (itseisarvo) a value that need not and cannot be explained to others, opposite to instrumental value, see values, axiom

introduction (johdanto) a preliminary part of a document leading up to the main part [Random House99], includes nature of the problem, background of previous work, purpose and significance of the paper, method by which the problem is approached, and organization of the paper [Spectrum65], see motivation, orientation, scope, literature review, abstract, conclusions

intuition (intuitio, välitön tajuaminen, ennakoavistus) direct perception of truth, independent of any reasoning process [Random House99], ability to make right conclusions from fragmentary information

investing (investointi, sijoittaminen) putting money into business for the purpose of obtaining an income or profit, see industry, research, capital

invention (keksintö) something thought out, produced, or devised for the first time, a sudden and abrupt emergence of a new idea, see patent, intellectual property, innovation, knowledge, creativity

invisible hand (näkymätön käsii) an instance of the invisible hand is any order which arises spontaneously without intention or design, especially in economics [Honderich05], see evolution theory

invited paper (kutsuttu esitelmä tai julkaisu) see conference, journal, keynote speaker
irreducible (redusoinaton, pelkistymätön, jaoton, supistumaton) see reduction

isomorphic (isomorfinen) having the same form or appearance [Random House99]

isomorphism (isomorfismi) see isomorphic, isomorphism is assumed to be valid between a model and reality, see analogy, construct validity

issue (lehden numero) see copy, volume, journal

italic (kursivoitu) see letter, boldface, roman

italicization (kursivointi) see bold-facing, equation, document

italics (kursiivi)

iteration (iteraatio, toisto) a problem-solving or computational method in which a succession of approximations, each building on the one preceding, is used to achieve a desired degree of accuracy [Random House99], see recursion

iterative (iteratiivinen, toistuva) see iteration, recursive

iterative model (iteratiivinen malli) a timing plan of a project where the product is designed through a series of small design steps and modifications [Leppälä03], see waterfall model, spiral model, generative order

jargon (ammattikieli, ammattislangi, kapulakieli) language, especially the vocabulary peculiar to a particular trade, profession, or group [Random House99], see terminology

jitter (värinä) variability of carrier phase or latency

journal (lehti, tieteellinen lehti) a periodical dealing with scientific or professional matters [Webster’s New World01], see literature, archival journal, impact factor, immediacy index, cited half-life, editor, peer review, issue, special issue, electronic journal, invited paper

journal paper (lehtijulkaisu) see conference paper

justification (oikeuttaminen, oikeutus, peruste, perustelu) confirmation, verification

keynote speaker (pääpuhuja) see conference, invited paper

keyword (avainsana, tunnussana) a word that serves as a key, as to the meaning of another word, sentence, or a passage [Random House99], a word or phrase based on which a literature search is made

knowledge (tieto, tietämyst, tietous) an organized body of information accumulated by mankind or shared by people in a particular field, sources of knowledge include observation and experiment, reasoning (deduction and induction), memory, and other alleged sources (especially intuition) [Honderich05], see discovery, verification, invention, literature

laboratory (laboratorio) a room, building, etc. for scientific experimentation or research [Webster’s New World01], see field, bench

laboratory experiment (laboratoriokoe) see experiment, field trial

labor costs (työkustannukset) see cost

lag (hitaus) extended or unexpected delay, see latency

landmark book (uraauurtava kirja) see landmark paper

landmark paper (uraauurtava julkaisu) milestone paper, seminal paper, visionary, pioneering, or groundbreaking scientific paper

language (kieli) human speech or the written symbols for speech; any set or system of formalized symbols, signs, sounds, or gestures used or conceived as a means of communication [Random House99], see encyclopedia, vocabulary, grammar, thesaurus, stylebook, metalanguage

latency (latanssi, alkuvuute) initial delay, the delay between the transmission of the first bit of a packet and the reception of the first bit of the packet [Sheldon01], see delay, transmission delay, transfer delay, jitter, lag
lateral thinking (lateraalinen ajattelu, uudenlainen ajattelu) considering a problem statement from a fresh viewpoint [Leppälä03], see creativity

law (laki) natural law, see trend, regularity, rule

law of supply and demand (kysynnän ja tarjonnan laki) the law that determines the prices of products and services, see supply, demand

layer (kerros) see hierarchy level, OSI model

learning (oppiminen, oppi, koulusivistys, kirjasivistys) information; acquired knowledge or skill, especially much knowledge in a special field [Webster’s New World01]

least squares method (pienimmän neliösumman menetelmä) see estimation theory, mean-square error

leading scientist (johtava tutkija) a researcher ranking above a senior research scientist and below a research professor, see docent, associate professor

lecture (luento) see handout

lecturer (lehtori) a university teacher ranking below assistant professor [Random House99]

legend (merkintä) explanatory information about a figure, see caption

lemma (lemma, apuväittämä) help theorem [Honderich05]

letter (letteri; kirjain) correspondence, a short original journal paper that is published fast and includes comments on published papers, corrections, open problems, or enhancements of a previous paper; a part of word, a symbol or character that is part of an alphabet, corresponding to a speech sound or sounds [Webster’s New World01], see upper case letter, lower case letter, roman, italic, boldface

level (taso) hierarchy level

level of confidence (luottamustaso) coverage probability [ISO Guide 99:2004]

liberal arts (humanistiset tieteet) humanities

library (kirjasto) see literature, electronic library

license (lisenssi, lupa) see patent

licentiate in technology (teknikan lisensiaatti) a degree between master of science and doctor of philosophy, a junior doctor

life fellow (life fellow -arvo) a member of a scientific society ranking above a fellow

likelihood (uskottavuus) different from probability in estimation theory, see likely

likely (uskottava) seeming to justify belief or expectation, apparently fit or adapted for something expressed or implied [Webster’s New World02], see likelihood

limitation (rajoitus) restriction in application, see conclusions

linear (lineaarinen) consisting of, involving, or describable by terms of the first degree [Random House99], following the superposition principle, see affine

list of abbreviations (lyhenneluettelo) see document

list of symbols (symboliluettelo) see document

literature (kirjallisuus) the writings dealing with a particular subject, usually collected in libraries, see book, journal, magazine, conference proceedings, standard, patent, thesis, technical report, language, abstracts database

literature review (kirjallisuuskatsaus) review, overview, or survey of literature, such as in a doctoral thesis or technical report, or in the introduction of a scientific paper, see review paper

literature search (kirjallisuuselvytys) search of literature for a literature review, see abstracts database, information retrieval, bibliography, document, data mining
logic (logiikka) the study of correct or reliable reasoning, based on deduction, a branch of formal sciences, see rationalism

logical depth (looginen syvyys) a complexity measure by Murray Gell-Mann, the computing time or the number of instruction cycles needed to generate a data sequence [Baeyer05], see algorithmic complexity, statistical complexity

logical empirism (looginen empirismi) logical positivism, a new form of positivism, aiming to combine empiricism and advances in logic [Rosenberg00], see rationalism

logical positivism (looginen positivismi) logical empirism

lower case letter (pieni kirjain) see letter

machine (kone) a system of fixed and moving parts, for doing some kind of work [Webster's New World01], inc. (i) ordinary machine, which is a clock-like mechanism, deterministic and preprogrammed, (ii) statistical machine, and (iii) self-regulated machine [Checkland99], see state machine

macropscopic model (makromalli) a large-scale physical model [Honderich05]

magazine a periodical, see literature, journal, newspaper

magnitude (itseisarvo; suuruus, koko) absolute value; a number characterizing a quantity and forming a basis for comparison with similar quantities [Random House99]

main clause (päälause) a sentence that is a part of a complex sentence, consists of words

man-made (keinotekoinen, ihmisen tekemä) artificial

manual of style (tyyliopas) stylebook

manufacture (valmistaa, tuottaa) to make or produce by hand or machinery, especially on a large scale [Random House99], see research, development, product

manufacturing (valmistaminen, tuottaminen) designing and operating the production system in order to produce the product; broadly defined, manufacturing also often includes purchasing, distribution, and installation [Ulrich95], see development, industry

manufacturer (valmistaja, tuottaja) see manufacture

manuscript (käsikirjoitus) see page proof, proofreading, camera-ready copy, backup copy, peer review

mark (merkki)

marketing (markkinointi) mediates the interactions between the organization and its customers, facilitates the identification of product opportunities, the definition of market segments, and the identification of customer needs, and arranges for communication between the organization and its customers, sets prices, and oversees the launch and promotion of the product [Ulrich95], see industry, funding

market vision (markkinavisio) status of business areas in the future, see vision

master of science (diplomi-insinööri, filosofian maisteri) a graduate degree ranking above a bachelor of science and below a doctor of philosophy

mass (massa) quantity of matter [Checkland99]

mass product (massatuote) see industry

material (materiaali, aine, aines, raaka-aine, aineisto) matter, the substance of which something is made or composed [Random House99]

materialism (materialismi) opposite to dualism

materials and methods (materiaalit ja menetelmät) a part of a scientific paper, see document

mathematical induction (matemaattinen induktio) complete induction
mathematical model (matemaattinen malli) an analytical model, a theoretical model given in terms of mathematics and logic [Niiniluoto02], see simulation

mathematical statistics (tilastotiede) statistics, a branch of mathematics, collecting, classifying and analyzing information shown in numbers, often using probability theory [Random House99], see estimation theory, information theory, central limit theorem, sample, average, mean, median, mode, bias, standard deviation, coverage interval, coverage probability, histogram, degree of freedom

mathematics (matematiikka) a branch of logic of sets [Honderich05], formal science dealing with quantities and forms and their relationships by the use of numbers and symbols [Webster’s New World01], inc. arithmetic and number theory, algebra, mathematical statistics, trigonometry, analysis, and geometry, see intractable problem

matrix (matriisi; muotti) an ordered set of scalars, symbols, or functions in a form of a rectangular array [Random House99]; a die or mold for casting and shaping [Webster's New World01] see complex number, vector, equation; a mold

matrix organization (matriisiorganisaatio) a hybrid of functional and project organizations, each individual is linked to others according to both project they work on and their function [Ulrich95]

matter (materia, aine, aines, asia) material, complementary to form

mean (tilastollinen keskiarvo) see average, median, mode, bias, standard deviation, estimation theory

mean-square error (keskineliövirhe) a quadratic error metric that includes the effects of bias and standard deviation [Kay93], see accuracy, uncertainty, estimation theory, least squares method

measurand (mittaussuure) quantity intended to be measured [ISO Guide 99:2004], measured quantity, see reference value

measure (mitta, mittayksikkö, mitata) see measurement, unit, metric, performance metric

measurement (mittaus) an empirical procedure for ascertaining the magnitude of a given quantitative property possessed by an object, any measurement has three values associated with it including the estimate of quantity value, coverage interval, and coverage probability [Buckner97b], [amc03]. [ISO Guide 99:2004], see measurand, measurement result, measurement standard, unit, numerical quantity value, instrument, accuracy, uncertainty, trueness, precision, simulation, deduction


measurement result (mittaustulos) result of a measurement [ISO Guide 99:2004]

measurement standard (mittanormaali)


measurement unit (mittayksikkö) unit [ISO Guide 99:2004]

mechanical engineering (konetekniikka) a branch of engineering dealing with the design and production of machinery [Random House99]

mechanics (mekaniikka) a branch of physics, see dynamics, quantum mechanics, relativity theory

media access control sublayer (MAC-kerros) see medium access control sublayer

median (mediaani) see average, mean, mode, estimation theory, cited half-life

medium access control sublayer (MAC-kerros, siirtotien varauskerros) the bottom part of the data link layer above the physical layer in the OSI model, the sublayer that controls access to the transmission medium using multiple access protocols [Tanenbaum96], [Stallings91], see multiplexing, network information theory

member (jäsen) a member of a scientific society ranking below a senior member
mereology (mereologia) the formal theory of part-whole relations [Honderich05]
message (sanoma) see information
metalanguage (metakieli) a language or symbolic system used to discuss, describe, or analyze another language or symbolic system [Random House99]
metaphor (metaora, kielikuva, vertaus) the application of a word or phrase to an object or concept it does not literally denote, suggesting comparison, to that object or concept [Random House99], see analogy, creativity
metaphysics (metafysiikka) the study of first principles, a branch of philosophy, inc. (i) ontology and (ii) cosmology [Random House99]
method (metodi, menetelmä) a set of well-defined rules which lead to a correct solution to a problem, see scientific method, algorithm
methods (menetelmät) see materials and methods, scientific method
methodological reduction (metodinen reduktio) explanation in terms of ever more minute entities, see Ocham’s razor, reduction
methodology (metodologia, metodikka) the philosophical study of scientific methods [Honderich05], a set or system of methods, principles, and rules used for determining the way in which a problem can be solved in a given discipline [Random House99]
metric (metriikka, mitta) a geometric function having properties analogous to those of the distance between points on a real line [Random House99], a measure that reflects the degree to which the product satisfies customer needs, see criterion, performance metric, optimum
metrology (metrologia) see measurement [ISO Guide 99:2004]
microscopic model (pienoismalli) a small-scale physical model [Honderich05]
microelectronics (mikroelektroniiikka) see electronics, microtechnology
microtechnology (mikroteknologia) technology of machines of the order of a micrometer across
middleware (väliohjelmisto) software layer between the application software and the operating system, to hide technical complexity and unnecessary details from application developers [Leppälä03]
milestone (välitavoite) see timing plan
milestone paper (uraauurtava julkaisu) landmark paper
mind map (muistikartta) see creativity, outline, conceptual analysis
miniaturization (miniatyrisointi, pienoiskoossa rakentaminen) making in greatly reduced size [Random House99]
miniature model (pienoismalli) microscopic model
misnomer (harhaanjohtava nimitys)
mission (missio, elämämäärävä) the special task or purpose for which an organization is destined for life [Kamensky00], see values, business idea, vision, strategy
mistake (erehdys) blunder, see error
mode (moodi, toimintatila; tyyppiarvo, keskiverto) see average, mean, median, estimation theory
*model (malli) an intentionally simplified description of regularities governing a process or a definition of such a system, usually mathematical [Rosenberg00], a representation that involves some kind of analogy between the model and either reality or some other scientific claim, inc. physical and theoretical model, see analog model, functional model, behavioral
model, executive model, OSI model, isomorphism, causality, probabilistic model, regression model

modelling (mallintaminen) creation of a model

moderator (puheenjohtaja) chairman

modular (modulaarinen) a system composed of standardized units or sections for easy construction or flexible arrangement [Random House99], see module, parallel, concurrent

modular architecture (modulaarinen arkkitehtuuri) an architecture where physical building blocks implement one or a few functional elements in their entirety, and the interactions between the physical building blocks are well defined and are generally fundamental to the primary functions of the product [Ulrich95], see integral architecture

modularity (modulaarisuus) see modular, hierarchy, system

modulation (modulaatio, modulointi) varying of amplitude, frequency, or phase of a carrier wave in accordance with some signal [Sklar02], see physical layer, detection

module (moduuli, laiteyksikkö) a separable component, frequently one that is interchangeable with others, for assembly into units of differing size, complexity, or function [Random House99]

monograph (monografia, erikoistutkielma) a detailed written study of a single subject, often equivalent to a long review paper [Day98], and usually includes original results, see thesis, book

motivation (motivointi, innostaminen, kannustus) an introductory text that causes the reader to continue reading after the introduction of a document, see orientation

multidisciplinary (monitieteellinen) see discipline

multiple access (moniilittymä) remote sharing of the channel, users’ requirements may be dynamically changing [Sklar02], see medium access layer, multiplexing

multiplexing (multiplekointi, kanavointi) local sharing of the channel, user requirements are fixed or at most slowly changing, the resource allocation is assigned a priori, and the sharing is usually a process that takes place within the confines of a local site, for example a circuit board [Sklar02], see physical layer, multiple access

multisense interaction (monen aistin vuorovaikutus) interaction with all the five senses, see haptic interaction, virtual reality

nanotechnology (nanoteknologia) technology of very small size, working components are atoms, envisages machines perhaps of molecular size [Clute95], see microtechnology, electronics

natural deductive system (luonnollinen deduktiivinen järjestelmä) a deductive system that does not have axioms [Honderich05]

naturalism (naturalismi) the thesis that the natural sciences are the best guides to inquiry in philosophy [Rosenberg00], transcendental phenomena are denied

natural law (luonnonlaki) a regularity that actually governs processes in nature and which science sets out to discover [Rosenberg00], see scientific law

natural science (luonnontiede) science, a branch of science, systematized knowledge of nature and the physical world [Webster's New World01], inc. physics, chemistry and biology

necessary (vältämätön) see sufficient

network information theory (verkon informatioteoria) see information theory, medium access control sublayer

network layer (verkokerros) the layer above the data link layer and below transport layer in the OSI model, the layer is concerned with controlling the operation of the subnet, a key design issue is determining how packets are routed from source to the destination, relieves
higher layers of the need to know anything about the underlying data transmission and switching technologies used to connect systems [Tanenbaum96], [Stallings91]

**neural network** (neuroverkko) neural net, a computer model designed to simulate the behaviour of biological neural networks as pattern recognition, language processing, and problem solving with the goal of self-directed information processing [Random House99], see **genetic algorithm**, **biology**

**newspaper** (sanomalehti) see **periodical**, **subscribe**

**noise** (kohina, suhina, melu, hälínä) any unwanted **signal** that **interferes** with the signal being communicated, see **signal**, **interference**, **waste**, **distortion**

**nomadic** (kiertelevä, liikkuva)

**nominalism** (nominalismi) the philosophical doctrine that general or abstract words do not stand for objectively existing entities and that **universals** are no more than names assigned to them, see **realism**

**nominal value** (nimellisarvo) see **instrument**

**nondisclosure agreement** (salassapitosopimus) see **classified**

**nonlinear** (epälineaarinen) not **linear**, see **hang-up**

**nonlinear dynamics** (epälineaarinen dynamiikka) study of **systems** that evolve in time according to **nonlinear** mathematical equations such as soliton equations [Wolfram02], see **dynamical systems theory**, **systems engineering**

**nonparametric** (parametriton) opposite to **parametric**

**norm** (normi, käyttäytymissääntö) a rule or standard of behavior expected to be followed by each member of a social group [Random House99], norms are defined to protect the **values**

**normal science** (normaalitiede) a period of **science** during which the existing **paradigm** is not challenged [Honderich05], see **scientific revolution**

**notebook** (vihko) see **research**

**novel** (uusi, uudenlainen) **original**

**novelty** (uutuus) **originality**

**null hypothesis** (nollahypoteesi) a hypothesis deliberately raised to threaten the hypothesis, an opposite to a positive **hypothesis**, if the null hypothesis cannot be proved, the positive hypothesis would be true, a null hypothesis is sometimes used to guarantee **objectivity**, see **competing hypothesis**

**number** (numero, luku, lukumäärä, mittaluku) see **quantity**, **numerical quantity value** [ISO Guide 99:2004]

**number theory** (lukuteoria) generalization and extension of **arithmetic**, a branch of **mathematics**

**numerical quantity value** (suureen lukuarvo, mittaluku) numerical **value** of a **quantity**, numerical value, number in the representation of a **quantity value** [ISO Guide 99:2004]

**numerical solution** (numeerinen ratkaisu) see **simulation**, **algorithm**, **approximation**

**numerical value of a quantity** (suureen lukuarvo, mittaluku) **numerical quantity value** [ISO Guide 99:2004]

**object** (objekti, kohde) a **thing** to which attention is directed [Random House99], see **semiotic triangle**, **concept**, **term**, **subject**, **focus**

**objective** (objektivinen, puolueeton: tavoite) impersonal, without **bias**, opposite to **subjective**; specific goal, aims of research, more concrete than a **hypothesis**, see **object**

**observable** (havaittavissa oleva, havaittava ominaisuus) a **property** that can be observed

**observe** (havaita) see **observation**
observation (havainto) an act or instance of watching or noting something for a scientific purpose, see experiment, experience

occupation (ammatti) in contrast with profession

Occam’s razor (Okkamin partaveitsi) law of parsimony, the simplest explanation is best [Thomas06]

offprint (eripainos) reprint

ontology (ontologia) branch of metaphysics, science of being, embracing such issues as the nature of existence and the categorial structure of reality, see category

ontological reduction (ontologinen reduktio) division of a whole into a minimal number of entities or substances, opposite to synthesis, see reduction, epistemological reduction

open access journal (vapaasti luettava lehti) an electronic journal that is free for readers, but the authors must pay a publication fee for their paper (the papers have a referee process)

Open Systems Interconnection model (OSI-malli) OSI model

operation (operaatio, toiminta) a mathematical process, as addition, multiplication, or differentiation; the action of applying a mathematical process to a quantity or quantities [Random House99]; exploitation phase of a product development including maintenance, see cycle time, function

operational (operativinen, toiminnallinen, kunnossaoleva) see fault, robust

operator (operaattori) a symbol for expressing a mathematical or logical operation; a function, especially one transforming a function, set, etc. into another [Random House99]

opponent (vastaväättäjä) a person who makes critical questions to the doctoral candidate in a public defence and writes his or her opinion about the defence and the thesis

opposite (vastakohta) see creativity, extreme

optimal (optimaalinen) see optimum

optimum (optimi) the best result obtainable under specific conditions [Random House99], see constraint, metric, criterion

oral presentation (suullinen esitelmä) a conference talk given in front of an audience in a given session, see poster presentation, regular session

order (järjestys) a condition in which each thing is properly disposed with reference to other things and to its purpose [Random House99]; methodical or harmonious arrangement, inc. timeless order, sequential order, generative order [Bohm92], see structure, static structure, dynamic structure

organization (organisaatio, rakenne) a body of persons organized for some specific purpose, see research organization, functional organization, project organization, matrix organization, process, team, mission, values, business idea, vision, roadmap, strategy, norm, ethos, budget, center of excellence, core competence, certification, recruiting; the structure of a publication, see outline

orientation (orientointi, perehdyttäminen) an introductory text to guide the reader in adjusting to the topic of the document [Random House99], included in the introduction, see motivation

oriented basic research (kohdistettu perustutkimus) basic research to produce a broad base of knowledge likely to form the background to the solution of recognized or expected current or future problems of possibilities [Jain97]

original (alkuperäinen) novel, see originality

originality (alkuperäisyys) novelty, having original results, methods, observations, or concepts, synthesis of or new insights into previously reported research, see original paper
**original paper** (alkuperäisjulkaisu) a *scientific paper* presenting new scientific *knowledge*, an original paper is made to find out, through a blind *peer review* process, on whether the conclusions drawn by the *author* were (i) *original*, (ii) *significant*, (iii) *correct*, and (iv) *explicit*, the “judge” is the *editor* who is using two or more *referees* to support the decision

**orthogonal** (ortogonaalinen, kohtisuora, erillinen, eroteltavissa oleva) separate, resolvable; pertaining to or involving right angles or perpendiculars (in *mathematics*) [Random House99]

**orthogonality** (ortogonaalisuus) separability

**OSI model** (OSI-malli) Open Systems Interconnection model, OSI reference model, an *architecture model* for a *telecommunications* system, open for communication with other systems, inc. (i) *physical layer*, (ii) *data link layer*, (iii) *network layer*, (iv) *transport layer*, (v) *session layer*, (vi) *presentation layer*, and (vii) *application layer* [Tanenbaum96], [Stallings91], see hierarchy, description model, functional model, behavioral model, executive model

**outlier** (vieras havainto) see *estimation theory*

**outline** (jäsennys, hahmotelma, luonnos) a general account or report, indicating only the main features of a subject [Random House99], used to define the *organization* of a *document* or *presentation*, see draft, sketch, refinement, mind map, template, generative order

**output** (lähtö) anything that crosses the *boundary* of a *system* and comes out from the system [Checkland99], for example *information*, *energy*, or *material*, see input

**outsourcing** (alihankinta) the *process* of procuring a good or *service* from someone else, rather than the *organization* producing it themselves [Belliveau02]

**overhead costs** (yleiskustannukset) general fixed costs of running a business, as rent, lighting, and heating expenses, charges that are added to *direct costs*, see *indirect costs*, *project*

**page charge** (sivumaksu) usually a page charge is requested for extra pages in *conference proceedings*

**page proof** (sivuvedos, taittovedos) proof, a trial impression, sent to the *authors* for marking corrections, see *proofreading*, *copy editor*

**panel** (paneeli, keskusteluryhmä) a group of persons selected for a specific purpose, as discussing an issue publicly [Webster’s New World01] for example in a *conference*

**paper** (julkaisu, tutkielma) see *scientific paper*

**paper evaluation sheet** (julkaisun arviointilomake) *paper review form*

**paper review form** (julkaisun arviointilomake) a *template* with which a *referee* evaluates a *manuscript*

**paradigm** (paradigma, maailmankuva, ajatusmalli) unquestioned theory or set of beliefs [Honderich05], existing world-view, used during *normal science*, see *scientific revolution*, *dogma*

**paradox** (paradoksi) a seemingly contradictory or absurd statement that expresses a possible *truth* [Random House99]

**paragraph** (kappale) a distinct portion of written or printed matter dealing with a particular idea [Random House99], beginning on a new line that is usually intended, and beginning with a topic sentence or some other indication of the subject [Young02], consisting of complex sentences, a part of *section*

**parallel** (rinnakkainen) see *concurrent*, *modular*

**parameter** (parametri) a quantity or *constant* whose value varies with the circumstance of its application [Webster’s New World01], see *variable*, *system*, *setting*, *estimation*

**parametric** (parametrinen) opposite to *nonparametric*

**parenthesis** (sulku, sulkumerkki) marks “(” and “)”, see *equation*, *punctuation*
parsimony (parsimonia, kitsaus) economy, measures a quality in theory [Wilson99], see Ockham’s razor

part (osa) element, a portion or division of a whole that is separate or distinct [Random House99], see mereology, system, thing

partitioning (partitointi, osittaminen, jakaminen)

passive voice (passiivimuoto) see active voice

past perfect tense (pluskvamperfekti) pluperfect tense, see past tense, perfect tense

past tense (imperfekti) imperfect tense, a verb tense indicating a habitual, repeated, or continuing action or state in the past or an action or state in progress at a point of reference in the past, see past perfect tense

patching (paikkaus, täydennys) see debugging

patent (patenti) the exclusive right granted to an inventor to manufacture or sell an invention for a specified number of years [Random House99], usually for 20 years from the date on which the application for the patent was filed, published as a technical report, see literature, intellectual property, trademark, copyright, royalty, licence

pattern (hahmo) see information

payoff (voitto, tuotto) arithmetic combination of several benefits and costs that summarizes the impact of their interaction by increasing in value with increasing benefit and decreasing in value with increasing cost [Bock01], see quality

peer (vertaiken) a person who is the equal of the author in abilities, qualifications, or background [Random House99]

peer review (vertaistarkastus) an evaluation of a manuscript usually made anonymously by some peers of the author, or referees, organized by an editor or review organizer, see blind review, pre-examination

people (ihmiset) see organization, researcher

perfect tense (perfekti) present perfect tense, a verb tense indicating an action or state extending up to, or having results continuing up to the present, see present tense

performance (suorituskyky) the manner in which or the efficiency in using the available resources with which something reacts or fulfils its intended purpose [Random House99], see quality of service, performance value

performance metric (suorituskykymitta) performance measure, performance criterion, index of performance, cost function, figure of merit, a function which is used to measure performance and whose output is performance value [Haykin01], [Kay93], [Blomqvist79], [Bock01], see metric, performance requirement, benchmark

performance requirement (suorituskykyvaatimus) desired performance value [Bock01], see performance, performance metric, product requirement, constraint

performance value (suorituskyky, suoritusarvo) performance, numerical value of the performance metric, to be compared with the performance requirement [Bock01]

period (piste) full stop, mark “.”, see punctuation

periodical (alkakauslehti) a periodical publication, inc. journal and magazine, see newspaper, subscribe

permission (lupa) licence, see copyright

PERT chart (PERT-kaavio) program evaluation and review technique [Belliveau02], presents dependencies and timing of tasks in a project. tasks are represented by blocks with the name of the task and its expected duration, does not allow for loops or feedback and so cannot show coupling explicitly [Ulrich95], see Gantt chart, critical path, block diagram

phenomenon (ilmiö) a fact, event, or circumstance observed or observable, see behavior
**philosophy** (filosofia) general principles of a field of knowledge [Webster's News World01], divided into (i) metaphysics, (ii) epistemology and (iii) axiology

**philosophy of science** (tieteenfilosofia) theory of science, study of general principles of science, a branch of epistemology, see analytic philosophy of science, hermeneutics

**physical layer** (fyysinen kerros) the lowest layer of the OSI model below the data link layer, concerned with transmitting raw bits over a communication channel, the layer has four important characteristics, inc. mechanical, electrical, functional and procedural [Tanenbaum96], [Stallings91], see modulation, multiplexing, synchronization, scrambler, detection

**physical model** (fysikaalinen malli) a model based on a material construction, inc. (i) macroscopic model, (ii) microscopic or miniature model, opposite to theoretical model [Honderich05], see analog model, prototype, executive model, model

**physical parts** (fysikaaliset osat) physical elements, parts, components, and subassemblies that ultimately implement the product's functions [Ulrich95], see functional parts, architecture

**physics** (fysiikka) a branch of natural science that deals with matter, energy, motion and force [Random House99], classical continuous physics includes (i) mechanics, (ii) acoustics, (iii) thermodynamics, (iv) optics, and (v) electromagnetism, in addition, modern quantum physics includes (vi) molecular, (vii) atomic, (viii) nuclear, (ix) particle, and (x) solid-state physics, and statistical mechanics, relativity theory, and quantum mechanics are added to mechanics

**pilot** (pilotti, kokeilu) a preliminary of experimental trial or test [Random House99], see experiment

**plagiarism** (plagiointi, luvaton lainaus) an unauthorized use of the language and thoughts of another author and representation of them as one's own [Random House99], see ethics, code of ethics, self-plagiarism

**platform** (alusta) a technological subsystem around which a platform product is built [Ulrich95]

**platform product** (alustatuote) a derivative product that is designed from a platform [Belliveau02]

**plausibility** (uskottavuus, vakuuttavuus) a weaker counterpart of truthfulness [Honderich05], see plausible

**plausible** (uskottava, vakuuttava) having an appearance of truth or reason, credible, believable [Random House99], see correctness

**plenary session** (yleisistunto, täysistunto) a common session to where all conference attendees are invited, without any other parallel sessions

**pluperfect tense** (pluskvamperfekti) past perfect tense

**polar coordinate system** (napakoordinaaristo) see Cartesian coordinate system

**portfolio** (valikoima) a set of items [Belliveau02], for example project portfolio, product portfolio

**positivism** (positivismi) referring to “positive science,” a movement in philosophy of science akin to empiricism and naturalism [Honderich05], knowledge about reality can only be based on sensory observation, see logical empiricism

**postdoc** (tohtorin tutkinnon suorittanut henkilö) postdoctoral researcher

**poster** (posteri, juliste) a placard presented in a poster presentation [Random House99]

**poster presentation** (posteriesitelmä) a conference presentation given in front of a poster in a given poster session, see oral presentation
postgraduate (akateemisen loppututkinnon jälkeisiä jatko-opintoja koskeva) studies after the master of science degree, see graduate

postmodern (postmoderni) emphasizing the incoherence, obscurity, and contradiction of reality, see truth

postmodernism (postmodernismi) see postmodern, scepticism, relativism

postulate (postulaatti, oletus) a proposition that requires no proof [Random House99], see assumption, axiom, premise

power (teho, potenssi)

pragmatic (pragmaattinen, käytännöllinen) practical, emphasizing practical utility, see theoretical

pragmatic level (pragmaattinen taso) the highest conceptual level related to information above the semantic level, refers to the value and the practical utility of signs [Skyttner06], see values, syntactic level, economics, philosophy, axiology

pragmatics (pragmatiikka) the study of the relation of signs to their users [Honderich05]

pragmatism (pragmatismi) the quality or condition of being pragmatic

precedence (etusija) relative priority, see quality of service

precise (täsmällinen) see precision

precision (täsmällisyys) measurement precision, the closeness of agreement between independent measurement results obtained under stipulated conditions [amc03], describes the care and refinement of a measurement process, repeatability of the readings, and the number of significant decimal digits expressed in a measured quantity [Buckner97a], [Weisstein05], includes random errors only [amc03], usually expressed numerically by measures of imprecision such as standard deviation [ISO Guide 99:2004], but the term imprecision is not recommended in [Taylor94], see granularity, resolution, trueness, accuracy, uncertainty, coverage interval, coverage probability, tolerance, instrument

predictor (ennustin)

prediction (ennustus, ennustaminen) rational prediction is a form of induction [Honderich05], see determinism, chance, trend, likelihood

predictive power (ennustavuus) a quality in theory [Wilson99]

pre-examination (esitarkastus) an evaluation of a manuscript made by experts in the field, also called referees, organized by the university department

preface (alkulause) a part of a document, see acknowledgment

premise (premissi, lähtökohta) a proposition supporting or helping to support conclusions [Random House99], see axiom, assumption, postulate

present (esittää)

present perfect tense (perfekti) perfect tense

present tense (preesens) see perfect tense, tense

presentation (esitelmä) see present, slide presentation, oral presentation, poster presentation

presentation layer (esityskerros) the layer above the session layer and below the application layer in the OSI model, the layer is concerned with the syntax of the data exchanged between application entities, the purpose is to resolve differences in format and data presentation, an example of presentation protocols is encryption [Tanenbaum96], [Stallings91]

presenter (esiintyjä) speaker, see present

price (hinta, arvo) the sum or amount of money or its equivalent for which anything is bought [Random House99], see cost, capital, law of supply and demand, price-quality ratio
price-quality ratio (hinta-laatusuhde) see price, quality, demand

prime cost (omakustannusarvo, OKA) absorption cost, see cost

primitive symbol (perussymboli, alkeissymboli) a symbol than cannot be defined to avoid infinite loops of definitions [Honderich05], see primitive term, axiomatic system

primitive term (perustermi, alkeistermi) undefined term [Rosenberg00], meaning explained only by characterizing or pointing out examples, see definition, primitive symbol

print (painos) one of the number of impressions made from the same set of type, see edition, book, reprint

priority (prioriteetti, etuoikeus) the state or quality of being earlier in time or occurrence [Random House99], see precedence

private knowledge (yksityinen tieto) knowledge based on one's opinions, speculation, in contrast with scientific knowledge

probabilistic (satunnainen, todennäköisyys-) stochastic, random, see probability

probabilistic explanation (todennäköisyysyllisyys) a form of scientific explanation based on a probabilistic model

probabilistic law (todennäköisyyslaki) a form of scientific laws based on probabilistic explanation [Nagel79], see statical law

probabilistic model (todennäköisyysmalli) see probability, chance

probability (todennäköisyys) the relative possibility that a random event will occur, as expressed by the ratio of the number of actual occurrences to the total number of possible occurrences [Random House99], see chance, likelihood

*problem (ongelma) a question proposed for solution or discussion [Random House99], see product requirement, hypothesis, well-defined problem, ill-defined problem

problem statement (ongelmanasettelu) see problem

procedure (proseduuri, menetelytapa) the act or manner of proceeding in any action or process, conduct [Random House99]

process (prosessi, tapahtumasarja) a sequence of events with some sort of unity or unifying principle [Honderich05], see applied research, development, organization

produce (tuottaa) to make or manufacture

*product (tuote) a thing produced by labor [Random House99], all goods, services, and knowledge sold by an enterprise to its customer [Belliveau02], final result of engineering, see service, process, applied research, artefact, consumer need, customer need, product requirement, product concept, product specification, platform product, architecture, design, partitioning, upgrade, reuse, benchmarking, alpha prototype, beta prototype, gamma test

product architecture (tuotearkkitehtuuri) the way in which the functional parts are assigned to the physical chunks of a product and the way in which those physical chunks interact to perform the overall function of the product, see architecture

product concept (tuotekonsepti) a clearly written and possibly visual description of the technology, primary features, and form of a new product, description on how the product will satisfy the customer needs [Belliveau02], see proof of concept

product definition (tuotemäärittely) defines the product, including the target market, benefits to be delivered, positioning strategy, price point, product requirement, product concept, and product specifications [Belliveau02]

product design (tuotesuunnittelu) a part of product development, the definition of the physical form of a product to best meet customer needs [Ulrich95], definition of product specifications from product requirement, includes engineering design and industrial design, see industry
**product development** (tuotekehitys) the overall process of strategy, organization, concept generation, product and marketing plan creation, execution, and evaluation, and commercialization of a new product [Belliveau02]; converting product requirements into a working product, the phases of product development include (i) product requirements, (ii) product concept, (iii) product specifications, (iv) implementation, (v) manufacturing, (vi) marketing, and (vii) operation, see virtual product development, product design, research, creativity, industry

**product family** (tuoteperhe) the set of products that have been derived from a common product platform [Belliveau02]

**product requirement** (tuotevaatimus) translation of customer needs into technical terms, statement of the problem to be solved, a precise description of the necessary or desirable attributes of the product to be developed, as well as information about how achievement of the attributes will be verified through testing, without defining a product concept, describing (i) environment, (ii) functions to be satisfied, (iii) constraints to be respected, (iv) interfaces to be used, (v) system size, execution speed, performance, etc., each requirement consists of a metric and a target value for that metric, see performance metric, performance requirement, performance value, product specification, verification, validation, certification

**product specification** (tuotespesifikaatio, tuotemääritys) a complete description of a product to be designed which operates in the environment specified in the product requirements using functional, behavioral, and executive models, phases included are (i) environment analysis and modelling, (ii) delimitation of system inputs and outputs, describing system’s functional relations with the environment, (iii) functional specifications, (iv) operational (behavioral) specifications, and (v) technological (implementation) specifications, product specifications are based on a product concept and give quantitative target values for its parameters

**profession** (professio, akateeminen ammatti) in contrast with occupation, see competence

**professor** (professori) a university teacher of the highest rank in a particular branch of learning, ranking above an associate professor, see adjunct professor, docent, research professor, tenure

**progress report** (väliraportti, tilanneraportti) see project, research report

**project** (projekti, hanke) something that is planned or devised, a specific task or investigation [Random House99], see progress report, final report, technical report, deliverable, timing plan, Gantt chart, PERT chart, critical path, risk

**project manager** (projektipäällikkö) person who is responsible for project estimating, planning and management

**project organization** (projektiorganisaatio) an organization where organizational links are primarily among those who work on the same project [Ulrich95], see matrix organization, functional organization

**project plan** (projekitusunnitelma) a formal approved document used to guide both project execution and control [Belliveau02], see research plan, proposal

**project team** (projektiyli) a multifunctional group of individuals chartered to plan and execute a new project [Belliveau02]

**proof** (sivuvedos, taittovedos) page proof

**proof** (todistus) deductive derivation of a conjecture from a set of definitions and axioms; evidence, see axiomatic system, prove, circular reasoning, Gödel’s theorem

**proof of concept** (tuotekonseptin oikeellisuuden osoitus) see product concept, prototype

**proofreader** (oikolukija) see page proof

**proofreading** (oikoluku) see page proof

**property** (ominaisuus) an attribute that things are acknowledged to have [Honderich05], see quality, class, part, measurement, thing
**proposal** (rahoitushakemus) research proposal, funding application submitted to a customer; a proposal for a thesis, see timing plan

**proposition** (väite) a formal statement of either truth to be demonstrated or an operation to be performed [Random House99], see corollary, axiomatic system

**protocol** (protokolla, yhteyskäytäntö) a set of rules governing the format of messages that are exchanged between computers [Random House99], see telecommunications, algorithm

**prototype** (prototyyppi) approximation of a product, (i) the first physical model of a new product concept from which other forms are copied or developed, (ii) a theoretical or analytical model, (iii) a comprehensive prototype, or (iv) a focused prototype [Ulrich95], see alpha prototype, beta prototype, demonstration, breadboard, development, proof of concept

**prototyping** (prototypointi) process of developing a prototype, see rapid prototyping

**prove** (todistaa) to derive deductively from a set of axioms, see proof

**pseudo-science** (pseudotiede, näennäistiede) nonscience that is distinguished from science by falsifiability

**publication** (julkaisu) a document that is published, usually after a peer review, especially a book, periodical, conference proceedings, or scientific paper

**public defence** (väitöstilaisuus) a public meeting where a published manuscript submitted as a doctoral thesis is evaluated by opponents

**publicity** (julkisuus) see transparent, values

**publisher** (julkaisija) commercial publisher or scientific society

**punctuation** (välimerkkien käyttö) see complex sentence, period, ellipsis, comma, colon, semicolon, dash, em dash, en dash, hyphen, slash, exclamation point, question mark, quotation mark, apostrophe, parentesis, bracket, brace

**qualitative** (kvalitatiivinen, laadullinen) see quality

**quality** (kvaliteetti, laatu, hyvyys) a performance metric that is an arithmetic combination of several benefits [Bock01], see payoff, quantity, price-quality ratio

**quality of service** (palvelun laatu) see service, quality, throughput, error rate, delay, reliability, precedence

**quantitative** (kvantitatiivinen, määärällinen) see quantity

**quantity** (määrä, suure) amount; the property of magnitude involving comparability with other magnitudes [Random House99], see base quantity, derived quantity, quality, variable

**quantity value** (suureen arvo) value of quantity, value, magnitude of a quantity represented as a product of a numerical quantity value (or more briefly a number) and a unit [ISO Guide 99:2004]

**quantum communications** (kvanttitietoliikenne) teleportation of quantum states

**quantum mechanics** (kvanttimekaniikka) a part of mechanics in modern physics

**question mark** (kysymysmerkki) mark “?” , see punctuation

**quotation mark** (lainausmerkki) marks “ and ” , see punctuation

**random** (satunnainen) stochastic, probabilistic, formless, shapeless, unpredictable [Baeyer05], not deterministic, see chance, information

**random error** (satunnaisvirhe) see precision, error, systematic error

**randomness** (satunnaisisuus) opposite to determinism

**range** (arvojoukko) image, the set of all values that a function can take as its argument varies over the domain [Weisstein05]
rapid prototyping (nopea prototypointi) prototypes used to test quickly the product's technical feasibility or consumer interest

rational (rationalinen, järjen mukainen, järkevä)

rationalism (rationalismi) a view emphasizing the role or importance of reason, usually including intuition, in contrast to sensory experience, the feelings, or authority [Honderich05], contrasted with empiricism, see enlightenment

readership (lukijakunta) see document, audience

real (realinen, todellinen)

realism (realismi) scientific realism, the thesis that the claims of theoretical science must be treated as literally true or false [Rosenberg00], see antirealism, nominalism, conceptualism, scepticism

reason (syy)

reasoning (päättely, perustelu) searching for reasons and giving them when somebody has found them [Honderich05], see inference, intuition, circular reasoning, argument

recording device (tallennin)

recruiting (rekrytointi, työhönotto) see organization

recursion (rekursio) see algorithm, recursive, iteration

recursive (rekursiivinen, palautuva) pertaining to or using a rule or procedure that can be applied repeatedly [Random House99], can be either time recursive or order recursive, see iterative

reduce (alentaa, pienentää, vähentää, pelkistää, sieventää) to bring down to a smaller size, amount, price, etc. [Random House99]

reduced theory (erityisempi teoria) less universal theory [Rosenberg00], see intertheoretical reduction

reducing theory (yleisempi teoria) more universal theory [Rosenberg00], see intertheoretical reduction

reduction (reduktio, luokitelu, erittely; pelkistäminen, sieventäminen) inc. (i) methodological reduction, (ii) ontological reduction (iii) epistemological reduction [Honderich05], see reduce, reductionism, systems analysis, irreducible, V-model

reductionism (reduktionismi) theory that every complex phenomenon can be explained by analyzing separately the simplest, most basic physical mechanisms that are in operation during the phenomenon [Random House99], opposite to holism, see scientific approach, reduction, systems analysis, top-down, bottom-up, idealization

reductionist (reduktionisti, reduktionistinen) see reductionism

redundancy (redundanssi, ylimäärä) the output of a source is said to possess redundancy if its output symbols are not equally likely or if they are not statistically independent [Sklar01], see source coding, channel coding

refer (viitata) cite, see reference

referee (esitarkastaja) an expert in a field [Young02], a peer to the author who, usually anonymously to the authors, gives a referee report to the editor, or selection committee as requested by a review organizer, in a peer review process, see competence

refereeing (tarkastaminen)

referee practice (esitarkastus) peer review process

referee process (esitarkastus) peer review process

referee report (tarkastajan lausunto, katselmointiraportti) review report, opinion of a referee given to the selection committee of a conference or to the editor of a journal by using a
Paper review form, including his or her opinion about the manuscript and a recommendation about the acceptance or rejection of the manuscript for possible publication

documentation (lähde, viite) citation, a publication which the author is using during the preparation of the manuscript, see bibliographical data, literature search, citation database

references (lähteet, viitteet) a numbered list of references in a document, numbers given in brackets, see bibliography

reference book (hakuteos) compilation of data, much broader subject than in a monograph [Day98], for example, encyclopedia, handbook, bibliography, see language, book

reference quantity value (vertailuarvo) reference value

reference system (vertailujärjestelmä) a benchmark against which all other systems are rated, either an industry standard or an obvious solution to the problem [Ulrich95], see benchmarking, reference value

reference value (vertailuvaaraa) reference quantity value, baseline [Bock01], the accepted true value of the measurand [amc03], the reference value is defined by an adopted physical or other standard, geometric laws, or a system or data decided as correct by some recognized authority [Buckner97a], see trueness, accuracy, uncertainty, error, bias, measurement standard, benchmark

refinement (jalostus) the procedure for going one description level to another towards more detail, opposite to abstraction [Calvez93], see ontological reduction, top-down, outline

refutation falsification

registration (rekisteröinti, ilmoittautuminen) see conference

regression model (regressionmalli) a model that includes a deterministic and random part, see probabilistic model

regular (säännöllinen) lawful, not capricious [Checkland99], see natural law, scientific law

regularity (säännöllisyys) see regular, continuity

regular session (normaalisessio, normaali­istunto) see conference, oral presentation

regulation (säätö, sääntely, sääntö, määräys, asetus) control, a rule, ordinance, or law by which conduct, etc. is regulated [Random House99]

reject (hylätä) opposite to accept

rejection (hylkääminen) opposite to acceptance

relation (relaatio, suhde, yhteys) ways in which things can stand with regard to one another or to themselves [Honderich05], see interrelationship, thing

relationship (suhde, yhteys) relation

relativism (relativismi) a view that there are no general truths, see postmodernism, scepticism

relativity theory (suhteellisuusteoria) relativistic mechanics for very great speeds, a part of modern physics

reliability (luotettavuus) trustworthiness, dependability, probability that the system operates correctly during a certain period defined by the mean time between failures (MTBF), see quality of service, verification, validation, confidence

relevance (relevanssi, merkitys) significance

repeatability (toistettavuus) the same results are obtained in the same laboratory [amc03], see repeatable, precision

repeatable (toistettava) something that can be done again

repair (korjata)
report (raportti)  see technical report
reprint (eripainos) offprint, separately printed journal paper supplied to authors, usually for a fee [Day98], see print
reproducibility (uusittavuus) the same results are obtained in different laboratories [amc03]
reputation (maine)  see code of ethics
requirement (vaatimus)  see product requirement, performance requirement
*research (tutkimus) careful study or investigation to discover new scientific knowledge or concepts, inc. basic research and applied research [Jain97], see creativity, idea, focus, development, investing, industry, feasibility study, case study, notebook
research center (tutkimuskeskus)  see industry, research institute
research culture (tutkimuskulttuuri)  a special culture in a research organization that covers objective elements as research laboratory facilities and equipment and subjective elements as ethos, values and norms, scientific discoveries are subjected to impersonal judgments and scientists critically evaluate scientific ideas and discoveries [Jain97], see research method, literature, scientific paper, seminar, gatekeeper, infrastructure
researcher (tutkija) a person with graduate training, high aptitude, socialized to work autonomously, tolerant to ambiguity, and show considerable initiative [Jain97], see research
research institute (tutkimuslaitos)  see research organization, research professor, technology transfer
research method (tutkimusmenetelmä)  method used in research, inc. (i) scientific approach, see scientific method and (ii) systems approach [Checkland99]
research organisation (tutkimusorganisaatio) an organization whose basic elements are ideas, researchers, funds, and research culture [Jain97], see organization, university, research institute, research center, dual hierarchy, triple hierarchy, matrix organization, information transparency
research plan (tutkimussuunnitelma)  see research proposal, project plan
research professor (tutkimusprofessori)  a professor especially in a research institute without teaching duties, ranking above a leading scientist
research program (tutkimusohjelma)
research proposal (rahoitushakemus)  see proposal
research report (tutkimusraportti)  a final report given to a foundation after the scholarship period, see progress report
research scientist (tutkija) a researcher ranking below a senior research scientist
resolution (resoluutio, erottelu, erotuskyky) the capability of distinguishing between two separate but adjacent parts or objects, reciprocal of granularity [Bock01], see precision, tolerance
resource (resurssi, voimavara) wealth to compute, build, or produce something, for example people, energy, material, or capital, see efficiency, performance, time
restriction (rajoitus)  see limitation
result (tulos) outcome
results (tulokset)  a part of an original scientific paper usually describing the performance of the system model, see document, graph
reuse (uudelleenkäyttö)  see product
reverse engineering (käänteistekniikka) a study or analysis of a device to learn details of design, construction, and operation, as to produce a copy or an improved version [Random House99], opposite to engineering

review (arviointi, tarkastus, katselmointi) see referee report

reviewer (esitarkastaja) referee [Smith90]

review organizer (esitarkastuksen organisoija) in a conference an expert who selects the referees for a given set of manuscripts, see selection committee, peer review

review paper (katsausjulkaisu) a paper including a literature review, written for experts in the field [Smith90], see tutorial paper, original paper, monograph

review report (tarkastajanlausunto, katselmointiraportti) referee report

revise (tarkistaa, korjata, parannella) revision (korjattu versio) new, corrected version of a manuscript

revolutionary science (vallankumouksellinen tiede) see normal science, paradigm

reward (palkinto) award

risk (riski) an event or condition that may or may not occur, but if it does occur will impact the ability to achieve a project's objectives [Belliveau02]

roadmap (kehityspolku) a science and technology roadmap, an extended look at the future of a chosen field of inquiry composed from the collective knowledge and imagination of the brightest drivers of change in that field, roadmaps communicate visions, attract resources from business and government, stimulate investigations, and monitor progress [Kostoff01], see futurology, trend

roadmapping (kehityspolun ennustaminen) [Belliveau02]

robust (robusti, häiriönsietoinen, varmatoiminen) the system remains operational, either completely or in degraded mode, even in the presence of unforeseen faults or events coming from the environment [Calvez93], see tolerance

robustness (robustisuus, häiriönsietokyky, varmatoimisuus) ruggedness

roman an upright type style that is not italic or boldface, see letter

royalty (rojalti) licence fee, a compensation or portion of the proceeds paid to the owner of a right, as a patent, for the use of it [Random House99]

rule (sääntö) see law, algorithm, protocol

sample (näyte, otos) see mathematical statistics

scalar (skalaari) a real or complex number

scale (skaala, asteikko) see instrument

scale division (askel, asteikon askel)

scale interval (askelarvo)

scale spacing (askelpituus)

scenario (skenaario, tulevaisuuden näkymä) an imagined sequence of events, especially any of several detailed plans or possibilities [Random House99], see vision

scepticism (skeptisismi, skeptisyys, epäilevyys) a view that a human being cannot acquire any knowledge, see postmodernism, relativism, realism

scholarship (apuraha) grant, fellowship, a specific gift of money or other aid, as by a foundation, to help a student to pay for instruction [Random House99] or to improve standard of living, see award

science (luonnontiede, tiede) (1) natural science, (2) knowledge ascertained by observation and experiment, critically tested, systematized, and brought under general principles
features of science include (i) reproducibility, (ii) parsimony, (iii) measurement, (iv) heuristics, and (v) coherence [Wilson99], see values, (3) a branch of such knowledge, inc. formal, natural, behavioural, and social science, and humanities, in contrast with art [Wilson99], see normal science, scientific revolution

science of complexity (kompleksisuustiete) complexity science, science of combining knowledge on complexity from different fields [Skyttner06]

science politics (tiedepolitiikka)

scientific approach (tieteilinen lähestymistapa) an approach based on reductionism, in contrast with systems approach [Checkland99]

scientific computing (tieteilinen laskenta) a numerical approximation method where mathematical models are used on computers [Wolfram02], see systems engineering

scientific explanation (tieteilinen selitys) explanation used in science, including deductive, probabilistic, teleological, and genetic explanations [Nagel79], see scientific law, theory

scientific induction (tieteilinen inductio) induction

scientific journal (tieteellinen lehti) archival journal

scientific knowledge (tieteilinen tieto) knowledge that has been empirically tested, public knowledge, in contrast with private knowledge, see enlightenment

scientific law (tieteilinen laki) our best estimate as to a natural law [Rosenberg00], scientific laws are sequential, functional, or probabilistic laws [Nagel79], see scientific explanation, theory

scientific method (tieteilinen menetelmä) includes the problems of discovery and verification [Honderich05], a research method, in which a problem is identified and broken down by reduction, relevant data are gathered by experiment and observation, competing hypotheses are formulated by induction, and the hypotheses are empirically tested for verification [Random House99], [Rosenberg00], [Wilson99], scientific method includes concept formation and theory construction [Niiniluoto02] with strong inference [Wilson99], see empirical-inductive method, hypothetico-deductive method, criticism

scientific paper (tieteilinen julkaisu) an original or review paper printed and made available to the public, especially to other scientists, see journal paper, conference paper

scientific realism (tieteilinen realismi) realism

scientific revolution (tieteilinen vallankumous) a period in science when the old paradigm is in a crisis and will be replaced by a new one [Honderich05], see normal science

scientific society (tieteilinen seura) a nonprofit organization, having a certain code of ethics, publishing scientific books, journals, and conference proceedings, and supporting the organizers of scientific conferences, see publisher, commercial publisher

scientist (tiedemies) an expert in science, see engineer, researcher

scope (rajaus, alue, kattavuus) area, extent or range of view [Random House99], defined in the introduction of a publication

s-curve (s-käyrä) technology performance improvements tend to progress over time in the form of an s-curve [Belliveau02]

scrambler (muokkain) see synchronization

screening (seulonta) the process of evaluating and selecting new ideas or concepts to put into the project portfolio

search engine (hakukone) see browser

section (kohta, kappale) a distinct part of a paper or a subdivision of a chapter, consists of subsection and paragraphs
selection committee (valintakomitea) a part of the technical programme committee in a conference that selects the papers to be accepted to the conference proceedings on the basis of referee reports, which are asked by review organizers

self-organization (itseorganisoituminen) [Wolfram02]

self-plagiarism (oman työn plagiointi) plagiarism where the author uses his own earlier text without a reference as if it were new, see code of ethics

self-regulated machine (itseohjautuva kone) a machine which has autonomous control over its own behaviour [Checkland99]

seminal paper (uraauurtava julkaisu) landmark paper

semantic information theory (semanttinen informaatioteoria) opposite to statistical information theory [Checkland99], see semantics, information theory

semantic level (semanttinen taso) the second conceptual level related to information above the syntactic level and below the pragmatic level, refers to the meaning of signs [Skyttner06], see semantics

semiotics (semiotiikka, merkitysoppi) the general study of signs, divided into syntactics, semantics, and pragmatics [Honderich05]

semiotic triangle (semioottinen kolmio) inc. (i) object, (ii) term, and (iii) concept [Niiniluoto02]

senior assistant (yliassistentti) roughly corresponds to an assistant professor

senior member (vahempi jäsen) a member of a scientific society ranking above a member and below a fellow, given by the society for significant performance in research in a specific field for at least five years

senior research scientist (eriikoistutkija) a researcher ranking above a research scientist and below a leading scientist

sensitivity (herkkyys) see tolerance, robustness

sensor (sensori, anturi) a mechanical device sensitive to light, temperature, radiation level, or the like, that transmits a signal to a measuring or control instrument [Random House99], see actuator

sentence (lause) a grammatical unit of one or more words, typically including a subject and a predicate or verb [Random House], a part of a complex sentence

sequence (sekventtis, sarja, jono)

sequential (sekeventiaalinen, peräkkäinen, asteittainen) characterized by regular sequence of parts [Random House99]

sequential order (peräkkäisjärjestys) temporal order where time is included to describe successive changes, a sequential order can be reduced to a timeless order, but a generative order cannot due to inherent dynamism [Bohm92], see waterfall model

sequential machine (sekvenssikone, tilakone) state machine

sequential law (sekeventiaalinen laki) a scientific law that shows the relation between a sequence of events, including causal laws and developmental laws [Nagel79], see theory
serendipity (onnekas sattuma) an aptitude for making desirable discoveries by accident, good fortune, luck [Random House99], see creativity

server (palvelin) see client

service (palvelu) an act of helpful activity [Random House99], see application layer, quality of service, applied research, development, product

session (sessio, istunto) a single continuous meeting within a conference, including plenary, poster, and regular session

session layer (yhteysjaksokerros) the layer above the transport layer and below the presentation layer in the OSI model, the layer provides the mechanism for controlling the dialogue between applications in end systems, a session might be used to allow a user to log into a remote timesharing system or to transfer a file between two machines [Tanenbaum96], [Stallings91]

set (joukko) a collection of objects or elements classed together, see class

set theory (joukko-oppi) a branch of formal sciences

setting (asetus) see parameter

sign (merkki) natural indication of a thing [Honderich05], see signal, semiotics, symbol, equation

signal (signaali) a function of time that is varied in such a way as to convey information [Random House99], see sign, bandwidth, noise

signal-to-noise ratio (signaali-kohinasuhde) the ratio of signal power and noise power, see dynamic range

significance (merkittävyys) importance, meaning [Random House99], see original paper, impact

simulation (simulointi) the imitation or representation of the behaviour or characteristics of a system through the use of a computer [Random House99], usually using a mathematical model, see measurement, deduction, systems engineering, virtual reality

sketch (luonnos) see draft, outline

slash (vinoviiva, jakoviiva) solidus, mark “/”, see punctuation

slide (kalvo) transparency, viewgraph, see slide presentation

slide presentation (kalvoesitys) see presentation, handout

smart (älykäs) see artificial intelligence

social science (sosiaalitiede, yhteiskuntatiede) a branch of science, inc. (i) anthropology, (ii) sociology, (iii) economics, and (iv) political science [Wilson99], see behavioural science

solidus (vinoviiva, jakoviiva) slash

solution (ratkaisu) an answer to a problem, how to do it, see hypothesis, product specification

source coding (lähdekoodaus) coding for reducing redundancy in the message symbols for efficient use of the channel capacity, a part of application layer, see information theory, channel coding

space (avaruus, tila, paikka, välilyönti) the unlimited three-dimensional realm or expanse in which all material objects are and all events occur; an interval or blank area in text [Random House99], see complex sentence

speaker (puhuja) see presenter, keynote speaker, talk

special issue (erikoisnumero) an issue of a journal devoted to a special topic, see deadline

specialist (spesialisti, asiantuntija) expert
**specification** (määrittely) see *product specification*

**spelling** (oikeinkirjoitus) see *word, copy editor*

**spiral model** (spiraalimalli) a *timing plan* of a *project* where the whole *process* is repeated and each time the result improves [Leppälä03], [Calvez93], see *waterfall model, iterative model, generative order*

**sponsor** (tukija, rahoittaja) *funding* source of a *project*

**square bracket** (hakasulku) *bracket*

**stability** (stabiilitus, stabilisuuks) resistance to sudden change or deterioration [Random House99], see *system, feedback*

**standard** (standardi, normi) *norm*, officially approved document for defining rules, instructions or *definitions for properties* of industrial *products, manufacturing* and testing methods, scientific *quantities* and *units, terminology*, etc., published as a *technical report*, see *literature, alliance, forum*

**standard deviation** (keskihajonta) see *precision, coverage interval, standard uncertainty, mean-square error*

**standard uncertainty** (normaaliepävarmuus) *uncertainty* represented with an estimated *standard deviation*

**state** (tila) *property* of a *state machine* which relates the inputs to the output in such a way that knowledge of the inputs after and including a certain time and the state at the same time completely determines the output for all later time instants, the state characterizes the memory of the machine, and the machine may include *feedback* [Fletcher80]

**state machine** (tilakone) a sequential *machine* whose output is dependent on a sequence of inputs, in contrast with a combinational system without any memory [Fletcher80], see also *state, system*

**state of the art** (tekniikan nykyinen taso) current *technology* [IEEE Computer Society], the latest and the most sophisticated or advanced stage of technology, *art*, or *science* [Random House99]

**static** (staattinen, muuttumaton; muistitonen) showing little or no *change* [Random House99]; memoryless (system); opposite to *dynamic*

**statistical law** (staattinen laki) a form of *functional laws* which show an interdependence between *magnitudes of quantities* so that a variation in any of them is concurrent with variations in the others [Nagel79], see *dynamical law*

**static structure** (staattinen rakenne) a *structure* that does not *change* with *time*, opposite to *dynamic structure* [Bohm92], see *order, timeless order, taxonomy*

**statistic** (tunnusluku) a numerical datum computed from a *sample* [Random House99], for example *average, standard deviation*, see *estimation theory, sufficient statistic*

**statistical** (statistinen, tilastollinen)

**statistical conclusion validity** (tilastollisen johtopäätöksen valideetti) *conclusion validity*

**statistical complexity** (tilastollinen kompleksisuus) a *complexity* measure by Jim Crutchfield, the size of the memory needed to predict the next state of a system [Baeyer05], see *algorithmic complexity, logical depth*

**statistical information theory** (tilastollinen informaatioteoria) Shannon’s *information theory*, opposite to *semantic information theory* [Checkland99], see *information theory*

**statistical machine** (tilastollinen kone) a *machine* the fine detail of whose *behaviour* is not *deterministic*, for example in quantum mechanics [Checkland99]

**statistical mechanics** (tilastollinen mekanikka) a branch of *mechanics*, usually approaches systems from a microscopic, or atomic-scale, point of view, see *thermodynamics, systems engineering*
statistics (tilastotiede) mathematical statistics

stochastic (stokastinen, satunnainen) probabilistic, random, see chance

strategy (strategia) the definition of the main goals and operating principles in order to satisfy the mission of an organization [Ramensky00], see technology strategy, competitive strategy, business idea

strong inference (valhva päättely) inference based on competing hypotheses [Wilson99]

structural model (rakenteellinen malli) functional model

structure (rakenne) the manner in which the elements of anything are organized or interrelated [Random House99]; order, arrangement, connection, and organization of simpler elements, see static structure, dynamic structure, form, architecture, organization, system

student member (opiskelijajäsen) a university student who is a member of a scientific society, see member

style (tyyli) see copy editor, stylebook

stylebook (tyyliopas) style guide, style manual, book containing the rules of use in punctuation, typography, and the like [Random House99]

subject (subjekti, aihe, tutkimuskohde) topic; that which thinks, feels, perceives, intends, etc. as contrasted with the objects of thought, feeling, etc.

subjective (subjektiiivinen, puolueellinen) biased, opposite to objective

submit (lähettää hyväksyttäväksi) send to the editor in chief or selection committee for a peer review process

submission (hyväksyttäväksi lähettäminen) see submit

subordinate clause (sivulause) a sentence that is a part of a complex sentence, consists of words

subscribe (tilata) see newspaper, periodical

subscript (alaindeksi) see equation

subsection (alakohta) see section

substance (substanssi, aine, materiaali) that of which a thing consists [Random House99], physical matter or material, see attribute

subsystem (alijärjestelmä) a system contained within a larger system [Checkland99]

summary (yhteenveto) a comprehensive recapitulation of things previously stated in a document [Random House99], see abstract

sufficient (riittävä, tyhjentävä) see necessary, estimator

sufficient statistic (tyhjentävä tunnusluuku) statistic that includes all available information for making a decision or estimate, see sufficient

superposition (superpositio) having the same effect on a sum as on each part of a sum, see linear, interfere

superscript (yläindeksi) see equation

supervisor (ohjaaja, valvoja) an official responsible professor or docent who watches a student or checks what he or she has done to make sure that work is done properly, see adviser

supply (tarjonta) the amount of commodity or products available for purchase at a given price [Random House99], see demand, industry, law of supply and demand

surplus value (lisäarvo) added value, additional value, see value chain
symbol (symboli) a manufactured sign, a mark used in place of something that is not present, or to identify it as a topic [Honderich05], see sign, word, variable, value, equation

symbolic system (symbolijärjestelmä) a system of symbols

symmetry (symmetria) see duality, analogy

symposium (symposiumi) a small conference organized for the discussion of some particular subject

synchronization (synkronointi) causing to agree in time or rate of speed, see physical layer, scrambler

synergy (synergia) the interaction of elements that when combined produce a total effect that is greater than the sum of individual elements, contributions, etc. [Random House99], see emergence

synonym (synonyymi) identical in meaning, opposite to antonym, see thesaurus

synonymous (synonyyminen, samanmerkityksen) see synonym

syntax (syntaksi, muutosäännöt) the relation of signs to other signs [Honderich05], see grammar, presentation layer

syntactic level (syntaktinen taso) the lowest conceptual level related to information below the pragmatic level, refers to relations of signs [Skyttner06], see complexity

syntactics (syntaktiikka) the study of syntax, a branch of semiotics, see grammar

synthesis (synteeli) opposite to analysis, the process of making a whole by putting together its separate component parts [Webster’s News World01], see systems engineering, induction

*system (systeemi, järjestelmä) a set or arrangement of things so related or connected as to form a unity or organic whole, a system is characterized in terms of hierarchical structure, emergent properties, communication, and control [Checkland99], see systems engineering, environment, boundary, interface, input, output, energy, material, information, waste, bootstrapping, sensor, actuator, state, function, architecture, block diagram, modular, parallel, concurrent, circuit, component, quality of service, measurement, performance, complexity, cost, price, linear, nonlinear, impulse response, transfer function, dynamic range, stability, bandwidth, channel, distortion, noise

systematic (systemaattinen, järjestelmällinen) see system, order

systematic error (systemaattinen virhe) see trueness, error, random error

system model (systeemimalli, järjestelmämalli) a part of a document, see materials and methods, model, system

systems analysis (systeemianalyysi, järjestelmäanalyysi) an engineering technique that breaks down complex technical, social, etc. problems into basic elements whose interrelations are evaluated and programmed, with the aid of mathematics, into a complete and integrated system [Webster’s New World02], see analysis, synthesis, reduction, systems engineering

systems approach (systeemilähDESTYTIMStapa, järjestelmälahDESTYTIMStapa) holistic approach, an approach based on holism, in contrast to scientific approach [Checkland99]

systems engineering (systeemitekniikka, järjestelmäteknikiikka) a branch of engineering using especially information theory, computer science, and facts from systems-analysis studies to design integrated operational systems for specific complexes [Webster’s New World02], see system, information theory, control theory, artificial intelligence, catastrophe theory, chaos theory, complexity theory, computational complexity theory, cybernetics, bionics, dynamical systems theory, fractal geometry, game theory, general systems theory, nonlinear dynamics, scientific computing, simulation, statistical mechanics, nanotechnology

table (taulukko) see document, caption

table of contents (sisällysluettelo) see document
**tacit knowledge** (hiljainen tieto) unconscious, implied or silent knowledge, for example in a working prototype, not in any document, opposite to articulated or explicit knowledge [Leppälä03]

**talk** (puhe) see **speaker**

**taxonomy** (taksonomia, luokitus) hierarchical classification, systematic classification of things into hierarchical groups [Random House99], see **class, timeless order, static structure**

**team** (tiimi) see **project team, organization**

**technical programme committee** (ohjelmakomitea) the committee that creates the program of a conference, see **selection committee**

**technical report** (raportti) see **patent, standard, thesis, dissertation**

**technical term** (ammattisana) see **term**

**technology** (teknologia) application of knowledge for practical ends using the results of mathematics and natural sciences, the sum of the ways in which the society provides itself with the products and services [Random House99], for example agriculture, medicine, and engineering, see s-curve, nanotechnology

**technology strategy** (teknologiastrategia) the focus of research and development and the ways to do them well [Kamensky00], see **strategy**

**technology transfer** (teknologiansiirto) the process of converting scientific findings from research laboratories into useful products [Belliveau02]

**technology vision** (teknologiavisio) assumption of technologies needed in the future [Kamensky00], see **vision**

**telecommunications** (tietoliikenne) science of transmitting information, as words, sounds, or images, over great distances, in the form of electromagnetic signals [Random House99], see **information theory, estimation theory, protocol, channel, transmission, ansible, teleportation, telepresence, virtual reality**

**teleological cause** (teleologinen syy) final cause

**teleological explanation** (teleologinen selitys) one form of scientific explanations based on final causes, but in suspect in natural sciences

**teleology** (teleologia) see **final cause**

**teleportation** (teleportaatio) ability to move people or objects from one place to another by matter transmission, i.e., using scientific equipment to transmit items in the form of information-carrying waves, which at the destination are reconstructed into matter [Clute95], see telecommunications, quantum communications, telepresence, virtual reality

**telepresence** (etäläsnäolo) a form of virtual reality [Skyttner05], presence in an existing environment for example as a hologram; no glasses are needed, but it needs a material (for example water vapor) to which the hologram is projected, see teleportation, holodeck

**template** (pohja, malli) see **outline**

**temporal** (ajallinen) of or pertaining to **time** [Random House99]

**temporal order** (aikajärjestys) sequential order

**tense** (aikamuoto) tempus, tenses include present tense, past tense or imperfect tense, perfect tense or present perfect tense, past perfect tense or pluperfect tense, future tense, and future perfect tense, see **document**

**tenure** (virassapysymisoikeus) status granted to an employee indicating that the position is permanent [Random House99], see **professor**

**tenure track** (virkaportaat, joissa odotetaan pysyvää virkaa) see assistant professor, associate professor, professor
term (termi, oppisana) a word or phrase used as the name of an object, especially one used in a particular type of language [Random House99], see universal, semiotic triangle, concept, primitive term, technical term, terminology, language, ambiguity

terminology (terminologia, termistö, erikoissanasto) see term, jargon

test (testi, koe) trial, see experiment

testability (testattavuus) suitability of a design to be efficiently tested, includes understandability, controllability, and measurability [Calvez93], see test

testing (testaaminen)

textbook (oppikirja) a book used for teaching of students [Day98], see tutorial paper

theorem (teoreema, väittämä) a proposition that is derived deductively from a set of axioms in an axiomatic system [Honderich05], see lemma, conjecture

theoretical (teoreettinen) see theory, pragmatic

theoretical model (teoreettinen malli) a theoretical description of the regularities in reality, introducing simplifying assumptions, which are adjusted or removed in the light of model’s predictive successes [Honderich05], usually a conceptual or mathematical model, opposite to physical model, see model

*theory (teoria) a coherent group of general propositions used as principles of explanation for a class of phenomena [Random House99], theories are either (i) axiomatic systems or (ii) sets of theoretical models [Honderich05], [Rosenberg00]; the four qualities in theory are (i) generality, (ii) parsimony, (iii) coherence, and (iv) predictive power [Wilson99], theories are ideally presented as deductive and causal structures [Nagel79], but many theories such as evolution theory are not tightly integrated deductively [Honderich05], see model, antirealism, realism, truth theory, scientific method, scientific explanation, scientific law

theory construction (teorianmuodostus) see concept formation, theory, scientific method

theory of knowledge (tietoteoria) epistemology

theory of science (tieenentietoa) philosophy of science

thermodynamics (termodynamiikka) a branch of physics, approaches statistical systems from a macroscopic, or large-scale, point of view, see statistical mechanics

thesaurus (synonymyisanakirja) a dictionary of synonyms and antonyms [Random House99]

thesis (opinnäyte) a formal technical report incorporating original research on a subject, especially one presented by a candidate for a degree, as a master’s degree [Random House99], see dissertation, literature, proposal, monograph

*thing (olio) entity, being, item whose existence is acknowledged by a system of ontology, often interchangeable with an object and stands in opposition to such terms as property, relation and event [Honderich05], see substance

thought experiment (ajatuskoe) controlled exercises of the imagination, employed to examine the implications of theories and to explore the boundaries of concepts [Honderich05]

threshold criteria (kynnyskriteerit) the minimum acceptable performance targets for any project being proposed or considered [Belliveau02]

throughput (läpäisykyky) the amount of material, data, etc. put through a process in a given period [Random House99], see performance

time (aika) dimension of change [Honderich05], see event, synchronization

timeless (ajaton, ikuinen) see time

timeless order (ajaton järjestys) an order that does not change with time, in contrast to sequential order, and generative order [Bohm92], see taxonomy, static structure

timing plan (ajoitusaavio) see Gantt chart, PERT chart, waterfall model, V-model, spiral model, iterative model, proposal, milestone
title (otsikko) the distinguishing name of a work, as a book, paper or technical report [Random House99], see heading, informative, abstract
tolerance (toleranssi, sietokyky) see precision, resolution, sensitivity, robust
top-down (analyttinen, jäsentävä, osittava, ylhääältä alaspäin etenevä) organized or proceeding from the larger structure to smaller, more detailed units [Random House99], opposite to bottom-up, see analysis, refinement, ontological reduction, deduction
topic (aihe) subject of research
topology (topologia) topography of an entity, a schema of a structural entity reflecting a division into distinct areas having a specific relation to one another, see functional model
total quality management (laatujohtaminen) TQM, a business improvement philosophy that comprehensively and continuously involves all of an organization’s functions in improvement activities [Belliveau02]
traceability (jäljitettävyys)
track (reitti, väylä, seurata) a course or route followed, a series or sequence of events or ideas [Random House99], see conference; to follow a track, course, etc.
track record (ansioluettelo) curriculum vitae
trade book (yleistajuinen kirja) scientific trade book, a book about science written for general public, sold primarily by book trade [Day98]
trademark (tavaramerkki, tuotemerkki) a word, name, symbol, or device which is used in trade with goods to indicate the source of the goods and to distinguish them from goods of others, trademark cannot be used to prevent others from making the same goods or from selling the same goods or services under a clearly different mark, see intellectual property, patent, copyright
trade-off (vaihtokauppa, kompromissi) exchange of one thing for another of more or less equal value, especially to effect a compromise [Random House99]
trade off (vaihtaa)
transaction (transaktio, toimitus) transference of valued phenomena, most often matter or energy, see communication
transcendental (transkendenttinen, ylluonnollinen) supernatural, see naturalism
transfer delay (siirtoviive) delay between the transmission of the first bit of a packet and the reception of the last bit of the packet, includes latency and transmission delay
transfer function (siirtofunktiot) the Fourier transform of the impulse response of a linear system
transformation (transfoormaatio, muunnos)
transmission (siirto) see telecommunications, channel
transmission delay (lähetysviive) time needed for the transmission of a packet from the first bit to the last bit, see latency, transfer delay, throughput
transparent (läpinäkyvä, avoin, peittelemätön) all information is visible to all participants [Leppälä93], see publicity
transparency (kalvo) viewgraph, slide
transport layer (kuljetuskerros) the layer above the network layer and below the session layer in the OSI model, the layer ensures that data units are delivered error-free, in sequence, with no losses or duplications [Tanenbaum96], [Stallings91], see reliability
treasurer (rahastonhoitaja) see conference
treatment (kohtelu, käsittely) one particular value of an independent variable in an experiment where the independent variable or factor is changed and other independent
variables are controlled at a fixed level during the experiment [Wohlin99], see conclusion validity

trend (trendi, kehityssuunta) the general course or prevailing tendency [Random House99], see anomaly, law, developmental law, history

trial (koe) test

trial and error (yritys ja erehdys) see heuristic, empirical, experimental

trigonometry (trigonometria) a branch of mathematics

triple hierarchy (kollmijakoinen hierarkia) a hierarchy in a research organization providing three different advancement opportunities, inc. (i) management hierarchy, (ii) professional hierarchy, and (iii) a third hierarchy occupied by professionals who have key administrative jobs and well as regular professional duties [Jain97], see dual hierarchy, matrix organization

true (tosi) opposite to false, see truth theory

trueness (oikeellisuus) the closeness of agreement between the average value obtained from a large series of measurement results and the accepted reference value [amc03], equivalent to absence of bias, inversely related to systematic errors only, cannot be expressed as a numerical value [ISO Guide 99:2004], see precision, accuracy, uncertainty, coverage interval, coverage probability, calibration, instrument, certification

true value (suureen tosiarvo) see reference value

truth (totuus) see verification, truth theory, deduction, induction, paradox, postmodern, relativism

truthfulness (totuudenmukaisuus) see correctness, plausibility, truth theory

truth theory (totuusteoria) truth theories include consensus, pragmatism, coherence, and correspondence [Honderich05]

tutorial paper (tutoriaali, opetuskäyttöön tehty katsaus) a review paper written for students [Smith90], see textbook

unbiased (biasoimaton, harhaton, puolueeton) objective; without a bias

uncertainty (epävarmuus) measurement uncertainty, uncertainty of measurement, parameter that characterizes the dispersion of the quantity values that are being attributed to a measurement, based on the information used, includes systematic and random errors [ISO Guide 99:2004], uncertainty is the most appropriate means of expressing the accuracy [amc03], expressed for example with standard uncertainty, combined standard uncertainty, expanded uncertainty, or coverage interval and coverage probability, uncertainty is usually expressed after the systematic errors are removed, see bias, standard deviation, mathematical statistics


underdetermination (alideterminaatio) the view that no one theory's truth can be determined by empirical data [Rosenberg00], see induction

undergraduate (akateemista välitutkintoa edeltävä) studies before the bachelor of science degree

unit (yksikkö, mittayksikkö) measurement unit, unit of measurement, scalar quantity with which other quantities of the same kind are compared in order to express their magnitudes [ISO Guide 99:2004], see measure, quantity

unit of measurement (mittayksikkö) unit [ISO Guide 99:2004]

unity (yhtenäisyys) see consilience

unity of science (tieteiden yhtenäisyys) foundationalism, arrange science hierarchically, with theories at the highest levels dependent on and to be explained by those below, all sciences are claimed to be reducible to physics, opposite to diversity of science [Honderich05], see interdisciplinary reduction
universal (universaali) a general term or concept or the generic nature that such a term signifies [Random House99], see nominalism

university (yliopisto, korkeakoulu) see professor, research institute, college, bachelor of science, master of science, doctor of philosophy

university of technology (teknillinen korkeakoulu tai yliopisto)

upgrade (parannus tuotteeseen) see product

upper case letter (iso kirjain) capital letter, see letter

upwards causality (ylöspäin suuntautuva kausaalisuus) [Honderich05], see downwards causality, efficient cause

user (käyttäjä) customer, any person who uses a product or service to solve a problem or obtain a benefit [Belliveau02]

validation (validointi, kelpuutus, hyväksyminen, hyväksyntä) confirmation through examination of a given item and provision of objective evidence that it fulfils the requirements for a stated intended use [ISO Guide 99:2004], see verification, certification, V-model, reliability, user

validity (valideetti, kelpoisuus, oikeellisuus, pätevyyys, palkkansapitävyys) see validation, conclusion validity, internal validity, construct validity, external validity

value (arvo) thing or quality having intrinsic worth, see axiology, values: quantity value [ISO Guide 99:2004]; a point in the range of a function [Random House99]

value chain (arvoketju) as a product moves from raw material to finished good delivered to the customer, value is added at each step in the manufacturing and delivery process, value chain indicates the relative amount of value added at each of these steps, see surplus value [Belliveau02]

value of quantity (suureen arvo) quantity value [ISO Guide 99:2004]

values (arvot) conceptions of desirable, the abstract concepts of what is right, worthwhile, or desirable, principles or standards [Random House99], a set of general principles that are not questioned, guiding all activities in an organisation, and whose characteristics include strength, stability, and independence of time and location [Kamensky00], examples include criticism, integrity, publicity, freedom, equality, see norm, mission, strategy, intrinsic value, instrumental value

value theory (arvoteoria) axiology

variable (muuttuja) a quantity that may assume any given value or set of values [Random House99], see equation, symbol, parameter

V-cycle (V-jakso) see V-model

V-model (V-malli) a timing plan of a project where the specification and design procedure is globally top-down and the implementation and test phase is globally bottom-up [Calvez93], see waterfall model, iterative model, verification, validation, certification, sequential order, generative order, reduction

vector (vektori) a quantity possessing both magnitude and direction [Random House99], see matrix, equation

vendor (toimittaja, myyjä) a person or agency that sells [Random House99]

verification (verifointi, varmennus, varmistus, varmistaminen, todentaminen, vahvistus, koestus) confirmation, justification, confirmation through examination of a given item and provision of objective evidence that it fulfils specified requirements [ISO Guide 99:2004]; establishing the truth of a hypothesis, usually by observation or experiment [Rosenberg00], verification is in practice unattainable since it implies inductive reasoning; see scientific method, experiment, validation, certification, discovery, reliability, fact

viewgraph (kalvo) transparency, slide
**virtual product development** (virtuaalinen tuotekehitys) paperless *product development* where all *design* and *analysis* is *computer*-based [Leppälä03]

**virtual reality** (virtuaalitodellisuus) a realistic *simulation* of an *environment* or sequence of events, including three-dimensional graphics, by a *computer* system using interactive software and hardware [Random House99], someone using special equipment (glasses, dress) may view them and interact with a seemingly physical way, see *telepresence*, *holodeck*, *multisense interaction*, *haptic interaction*

**virtual team** (virtualittimi) geographically dispersed *teams* that communicate and work primarily electronically [Belliveau02]

**vision** (visio, tulevaisuudenkuva) the most desirable, ultimate state of a *product* or *organization* [Kamensky00], see *technology vision*, *market vision*, *scenario*, *roadmap*, *futurology*

**vitalism** (vitalismi) a doctrine that attributes the viability of a living organism to a vital principle distinct from the physical and chemical processes of life [Random House99], see *holism*

**vocabulary** (sanasto) a list or collection of words and phrases, usually arranged in an alphabetical order and defined [Random House99]

**voice** (verbin pääluokka) voices include *active voice* and *passive voice*, see *first person*, *document*

**volume** (vuosikerta, nide) a set of issues of a *periodical*, often covering one year; a book, especially as one of a series of works [Random House99]

**waste** (jäte) any useless *output* of a system to the *environment* in any form, such as *material* or *energy*, for example sewage, heat, acoustic or electromagnetic *noise*, or *interference*

**waterfall model** (vesiputousmalli) *timing plan* of a *project* where the project is described as a series of steps, starting from *definition* and ending with operation and maintenance, if corrections are needed, the previous step may be revised [Leppälä03], [Calvez93], see *spiral model*, *iterative model*, *sequential order*, *generative order*

**well-defined problem** (hyvin määritelty ongelm) opposite to *ill-defined problem* [Honderich05], see *problem*, *definition*, *product requirement*

**whole** (kokonaisuus) a *thing* complete in itself or comprising all its *parts* or elements [Random House99], see *mereology*, *system*, *organization*

**wider system** (laajempi järjestelmä) a *system* containing the object system [Checkland99], see *subsystem*

**word** (sana) a unit of *language*, a *symbol* [Honderich05] corresponding to a speech sound, or series of them, consisting of one or more *letters*, see *compound*, *complex sentence*, *spelling*

**working range** (toiminta-alue, mittausalue) see *instrument*

**workshop** (workshop, työpaja, käytännön kurssi) a *seminar* or series of meetings for intensive study, work, discussions, etc. in some field [Webster’s New World01], usually smaller and not so formal as a *symposium*

---

**ABBREVIATIONS**

*ACM* Association for Computing Machinery, www.acm.org

*Arpanet* Advanced Research Project Agency Network

*ASIC* application-specific integrated circuit

*BibTeX* TeX format for bibliographies, www.iui.se/staff/jonasb/bibedit

*CDMA* code division multiple access

*CD-ROM* compact disk - read only memory

*CMOS* complementary metal-oxide semiconductor

*COMPENDEX* Computerized Engineering Index, see EI and www.engineeringvillage2.org
DAB digital audio broadcasting
DSP digital signal processor
DVB digital video broadcasting
DVD digital versatile disc
EI Engineering Index, www.ei.org
ENIAC Electronic Numerator, Integrator, and Computer
ETSI European Telecommunication Standards Institute, www.etsi.org
FM frequency modulation
GPS Global Positioning System
GSM Global System for Mobile Communications
IEEE Institute of Electrical Engineers (UK), now IET
IEEE Institute of Electrical and Electronics Engineers (USA), www.ieee.org
IEL IEEE/IET Electronic Library, ieeexplore.ieee.org,
www.ieee.org/products/onlinelibrary/prod/iel_overview.html
IET Institution of Engineering and Technology, includes former IEE and IIE, www.theiet.org
IIE Institute of Industrial Engineering, now IET
IMRAD introduction, methods, results, and discussion [Day98]
INSPEC Information Services in Physics, Electrotechnology, Computers and Control, see IET and www.engineeringvillage2.org
ISI Institute for Scientific Information, now Thomson Scientific, www.isinet.com
ITU International Telecommunication Union, www.itu.int
JCR ISI Journal Citation Reports, see ISI and isi01.isiknowledge.com/portal.cg
J-STAGE Japan Science and Technology Information Aggregator, Electronic, www.jstage.jst.go.jp
LaTeX typesetting system developed by R. Lamport, based on TeX, www.latex-project.org
LCD liquid crystal display
LED light emitting diode
LSI large scale integration
MAC media access control, medium access control
MIT Massachusetts Institute of Technology
MS-DOS Microsoft Disk Operating System
MTBF mean time between failures
NMT Nordic Mobile Telephone
OA open access, see DOAJ
OKA omakustannusarvo, prime cost
OSI Open Systems Interconnection [Tanenbaum96], [Stallings91]
PC personal computer
PCM pulse-code modulation
PDF portable document format
PERT program evaluation and review technique
SCI-Expanded Science Citation Index Expanded, see ISI and isi01.isiknowledge.com/portal.cg
SPIE International Society for Optical Engineering, www.spie.org
TeX typesetting system invented by D. Knuth, see LaTeX
TQM total quality management
TTL transistor-transistor logic
VHDL VHSIC hardware description language
VHSIC very high speed integrated circuit
VHS Video Home System
VLSI very large scale integration
WLAN wireless local area network
WWW World Wide Web

ACKNOWLEDGMENT
I have used extensively definitions from many references. The encyclopedia of philosophy [Honderich05] covers also philosophy of science, and a short vocabulary is included in [Rosenberg00]. A short vocabulary of systems engineering is included in [Checkland99]. A vocabulary of product development is in [Belliveau02], and a vocabulary of scientific writing is in [Young02]. Extensive discussions with Dr. Kari Leppälä from Provisec are acknowledged.

REFERENCES


