

# VOCABULARY OF A DOCTORAL STUDENT

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## VOCABULARY OF A DOCTORAL STUDENT

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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 *trueness* 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 (affiini) 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 (analyttinen malli) *mathematical model*

analytic philosophy of science (analyttinen 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 (kirjallisuusluettelo huomautuksin) see *annotation, bibliography*

anomaly (anomalialia, 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 (heittomerkki) marks ' and ', see *punctuation*

appendix (liite) 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 [Tanenbaum96], [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 (assistentti) a faculty member in a university ranking below an *assistant professor* or *senior assistant*

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

associate editor (apulaiseditori) 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 (arveteoria) value theory, a part of *philosophy*, inc. (i) *ethics*, (ii) *aesthetics*, and (iii) *religion* [Random House99]

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

axiomatic system (aksiomaattinen 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 (beettaprototyypipi) 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 (ennakkoluulo) prejudice [Random House99]

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

bibliographical data (luettelointitiedot) see *reference*

bibliography (kirjallisuusluettelo) 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 (biografia, henkilöhistoria) a written account of an *author's* life [Random House99], see *curriculum vitae*

bionics (bioniiikka) 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*

bootstrapping (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, rajaehto) 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 (kausaallinen)

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 (kausaalilaki) 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-arvause) 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, kytkentä) the complete path of an electric current, including generating apparatus and intervening *components* [Random House99], see *system*

circular reasoning (kehäpäätely) *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 (viitetietokanta) an *abstracts database* that includes also *references* of *publications*, see *electronic library*

cite (viitata) quote, *refer*

cited half-life (viittausten 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 (luokittelu) 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 (kilpaileva 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 (konseptualismi) 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 (samanaikaisuus) carrying out separate activities of the product development process at the same time rather than sequentially [Belliveau02]

concurrent (samanaikainen) see *parallel, modular*

concurrent engineering (samanaikainen 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 (konsistenssi, 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 (ristiriita, 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 (kattavuustodennäköisyys) 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 (aallosulku) *brace*

curriculum vitae (curriculum vitae, ansioluettelo) 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 (kierros aika) 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 (deduktio) 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 (demonstraatio, 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 (dosentti) 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 (tekniikan 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 *doctor of philosophy*, corresponding to *fellow*, especially in the United Kingdom (UK); in some countries (for example in the United States at the Massachusetts Institute of Technology, MIT) equivalent to *doctor of philosophy*

doctor of technology (tekniikan tohtori) see *doctor of philosophy, doctor of science*

doctrine (oppi, oppijärjestelmä, opinkappale, 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, opinkappale) 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 (epäily) 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 (duaali, 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 (kesto aika) 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 systeemitheoria) study of systems that evolve in time according to mathematical equations [Wolfram02], see *dynamic, nonlinear dynamics, systems engineering*

dynamic range (dynamiikka-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 (dynamiikka) 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 (sanapoisto) 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 (empiiris-induktiivinen 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 (väliviiva) 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 (tekniikka) 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 (tekniinen 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 (estetiikka) *aesthetics*

estimate (estimaatti)

estimation theory (estimointiteoria) see *telecommunications*, *detection theory*, *constraint*, *likelihood*, *mean-square error*, *least squares method*, *outlier*, *statistic*, *mathematical statistics*, *average*, *mean*, *median*, *mode*, *bias*, *standard deviation*

estimator (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 (kokeellinen) 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 (selitysvaima)

explicit (eksplisiittinen, 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, tekijä, osatekijä, syy, kerroin) see *cause*

false (virheellinen, epätosi) 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*, given for sustained long-term *contributions* in a specific field

fellowship (apuraha, fellow-jäsenyys) 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 (kenttätesti) see *field trial*

field trial (kenttätesti) 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 persoona) preferably use the first person in a *document* [Day98], [Young02], 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, keskusteluareena) see *alliance, standard*

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

foundation (säätio) 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 (vapaa tahto) 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  $X$  to  $Y$  is an object  $f$  such that every  $x \in X$  is uniquely associated with an object  $y \in Y$ , 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 (funktionaalinen) 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 (funktionaalinen 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 organisaatio) 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)

funding (rahoitus) financial support, see *marketing, customer, proposal, foundation, sponsor*

funds (rahavarat)

future perfect tense (futuurin perfekti) see *perfect tense, future tense*

future tense (futuuri) see *tense*

futurology (futurologia, tulevaisuudentutkimus) see *vision, scenario, roadmap*

game theory (peliteoria) 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 systeemiteoria) 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 (kielloppi) 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 *multi-sense 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 (hermeneutiikka) 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 (hotspotti, 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 ongelma) badly defined *problem*, opposite to *well-defined problem*, see *definition*, *customer needs*

illustration (kuva, kuvitus) see *figure*

image (arvojoukko; kuva) *range*

immediacy index (välitön vaikuttavuus) 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 (vaikuttavuusluku) 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 (induktio) 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 (induktiivinen) 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 (alkuehto, 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 (liityntä, 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 (vaikeasti käsiteltävä ongelma) 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, ennakkoavistus) 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 käsi) 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 (redusoimaton, 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 (pääpuhujaja) 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, tietämys, 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 (latenssi, alkuvive) 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, kirjasisivistys) *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, apuväittäjä) 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 (tekniikan 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 (kirjallisuusselvitys) 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 empiricism (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*

macroscopic 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 (mittausuure) *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 precision (mittaustäsmällisyys) *precision* [ISO Guide 99:2004]

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

measurement standard (mittanormaali)

measurement uncertainty (mittausepävarmuus) *uncertainty* [ISO Guide 99:2004]

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 (metafora, 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, metodiikka) 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 (mikroelektoniikka) 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 (uraaurtava 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, elämäntehtävä) 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 (moniliittymä) 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 (välttämätön) see *sufficient*

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

network layer (verkkokerros) 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, hälinä) 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 (objektiivinen, 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 (operatiivinen, 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 (vastaväittäjä) 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 (jäsenitys, 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 (sivuvédos, taittovédos) 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 (patentti) 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 (vertainen) 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 (aikakauslehti) 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 loppututkimuksen 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 (ennuste, 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 *predence*

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 (todennäköisysselitys) 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, menettelytapa) 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, (ii) *constraints* to be respected, (iii) *interfaces* to be used, (iv) *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, tuotemäärittäminen) 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 (projektioorganisaatio) an *organization* where organizational links are primarily among those who work on the same *project* [Ulrich95], see *matrix organization, functional organization*

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

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

proof (sivuedos, 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 (prototyyppi) *process of developing a prototype*, see *rapid prototyping*

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

pseudo-science (pseudotiede, näennäistiede) non-science 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, parenthesis, 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, määrällinen) 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 (kvanttietoliikenne) *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 (satunnaisuus) 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 prototyyppi) *prototypes* used to test quickly the *product's* technical feasibility or *consumer* interest

rational (rationaalinen, 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 (reaalinen, 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 (päätely, 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, luokittelu, 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

reference (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 (vertailuarvo) 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 (regressiomalli) 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, normaali-istunto) see *conference*, *oral presentation*

regulation (sääto, 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 organisoiija) 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 (tarkastajan lausunto, 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

[Webster's Dictionary02]; 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], [Rosenberg00], see *normal science, scientific revolution*

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

science politics (tiedepolitiikka)

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

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

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

scientific induction (tieteellinen induktio) *induction*

scientific journal (tieteellinen lehti) *archival journal*

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

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

scientific realism (tieteellinen realismi) *realism*

scientific revolution (tieteellinen 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 (tieteellinen 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*

semantics (semantiikka, merkitysoppi) study of the relation of *signs* to the *things* they represent [Honderich05], study of the interpretation of signs, in particular sentences or words in a language, a branch of *semiotics*, see *presentation layer*

semicolon (puolipiste) mark ";", see *punctuation*

seminar (seminaari) a group of supervised students doing *research* or advanced study, as at a university; a course for such a group, or any of its *sessions*; any similar group discussion [Webster's News World01], see *workshop*

semiotics (semiotiikka) 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 (vanhempi 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 (erikoistutkija) 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 (sekvenssi, sarja, jono)

sequential (sekventiaalinen, 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 (sekventiaalinen 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 (stabiilius, stabiilisuus) 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; muistiton) showing little or no *change* [Random House99]; memoryless (*system*); opposite to *dynamic*

statical 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 mekaniikka) 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* [Kamensky00], see *technology strategy*, *competitive strategy*, *business idea*

strong inference (vahva 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 (subjektiivinen, 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 (yhteenvedo) a comprehensive recapitulation of *things* previously stated in a *document* [Random House99], see *abstract*

sufficient (riittävä, tyhjentävä) see *necessary*, *estimator*

sufficient statistic (tyhjentävä tunnusluku) *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 (synonyminen, samanmerkityksinen) see *synonym*

syntax (syntaksi, muotosäännöt) 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* [Skytner06], see *complexity*

syntactics (syntaktiikka) the study of *syntax*, a branch of *semiotics*, see *grammar*

synthesis (synteesi) 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 (systeemilähestymistapa, järjestelmälahestymistapa) holistic approach, an approach based on *holism*, in contrast to *scientific approach* [Checkland99]

systems engineering (systeemitekniikka, järjestelmäteknikka) 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 (tekniologia) 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 (virkaoporaat, 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, väittäjä) 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 (tieteenteoria) *philosophy of science*

thermodynamics (terodynamiikka) a branch of *physics*, approaches statistical systems from a macroscopic, or large-scale, point of view, see *statistical mechanics*

thesaurus (synonymisanakirja) 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 (ajoituskaavio) 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, ylhäältä 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, yliluonnollinen) 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 (siirtofunktio) the Fourier transform of the *impulse response* of a *linear system*

transformation (transformaatio, 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 (kolmijakoinen 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*

uncertainty of measurement (mittausepävarmuus) *uncertainty* [ISO Guide 99:2004]

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, kelpuus, 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, pätevyys, paikkansapitävyys) 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 (verifiointi, 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 (virtuaaliodellisuus) 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 (virtuaalitiimi) geographically dispersed *teams* that communicate and work primarily electronically [Belliveau02]

vision (visio, tulevaisuudenkuva) the most desirable, ultimate state of a *product* or *organisation* [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 ongelma) 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](http://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](http://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](http://www.engineeringvillage2.org)

DAB digital audio broadcasting  
DOAJ Directory of Open Access Journals, [www.doaj.org](http://www.doaj.org)  
DSP digital signal processor  
DVB digital video broadcasting  
DVD digital versatile disc  
EI Engineering Index, [www.ei.org](http://www.ei.org)  
ENIAC Electronic Numerator, Integrator, and Computer  
ETSI European Telecommunication Standards Institute, [www.etsi.org](http://www.etsi.org)  
FM frequency modulation  
GPS Global Positioning System  
GSM Global System for Mobile Communications  
IEC International Electrotechnical Commission, [www.iec.org](http://www.iec.org)  
IEE Institution of Electrical Engineers (UK), now IET  
IEEE Institute of Electrical and Electronics Engineers (USA), [www.ieee.org](http://www.ieee.org)  
IEL IEEE/IET Electronic Library, [ieeexplore.ieee.org](http://ieeexplore.ieee.org),  
[www.ieee.org/products/onlinepubs/prod/iel\\_overview.html](http://www.ieee.org/products/onlinepubs/prod/iel_overview.html)  
IET Institution of Engineering and Technology, includes former IEE and IIE, [www.theiet.org](http://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](http://www.engineeringvillage2.org)  
ISI Institute for Scientific Information, now Thomson Scientific, [www.isinet.com](http://www.isinet.com)  
ISO International Standards Organization, [www.iso.ch](http://www.iso.ch)  
ITU International Telecommunication Union, [www.itu.int](http://www.itu.int)  
JCR ISI Journal Citation Reports, see ISI and [isi01.isiknowledge.com/portal.cg](http://isi01.isiknowledge.com/portal.cg)  
J-STAGE Japan Science and Technology Information Aggregator, Electronic,  
[www.jstage.jst.go.jp](http://www.jstage.jst.go.jp)  
LaTeX typesetting system developed by R. Lamport, based on TeX, [www.latex-project.org](http://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](http://isi01.isiknowledge.com/portal.cg)  
SPIE International Society for Optical Engineering, [www.spie.org](http://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

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I have used extensively definitions from many references. The encyclopedia of philosophy [Hoderich05] 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.

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