Glossary

This glossary defines terms and concepts from activity theory and ATIT as used in the text of S. R. Harris's 2007 Doctoral Thesis *Supporting Learning-in-Use: Some Applications of Activity Theory to the Analysis and Design of ICT-Enabled Collaborative Work and Learning*. The thesis focuses on the application of AT to the design of computer-mediated work and learning environments, and the glossary definitions given here reflect that focus. Accordingly, references to sources supporting, extending, or offering an alternative view on the given definitions are provided for some glossary entries, and the reader is advised to check other sources. An excellent glossary of activity-theoretical terms defined from the systems-structural perspective is to be found in the essential text Bedny, G. Z. & Karwowski, W. (2006) *A Systemic-Structural Theory of Activity: Applications to Human Performance and Work Design* (pp. 38-41). Boca Raton, CRC Press/Taylor & Francis, pps 491-6. Other AT glossaries can be found in Gilgen, A. R. & Gilgen, C. K. (1996). Historical Background, Analytical Overview and Glossary, in Koltsova, V. A., Oleinik, Y. N., Gilgen, A. R. & Gilgen, C. K. (Eds.) *Post-Soviet Perspectives on Russian Psychology* (pp. 3-52). Westport, CT, Greenwood Press; and in Tolman, C. W. (1988). The Basic Vocabulary of Activity Theory. *Activity Theory, 1*, pp. 14-20.

A

Abilities. In AT, ability, as distinct from *character* and *temperament*, is considered to be a substructure of personality characterized by the acquisition of knowledge and skills important for particular kinds of practical and theoretical performances. Abilities develop from an integration of intellectual and emotional-volitional (motivational) features of an individual and are exhibited through knowledge, skills, competencies and aptitudes. Ability is seen as a determinant of the dynamics of skill acquisition and performance and the overall level of performance. See also (Bedny and Seglin, 1999a, 1999b).

Action. An action is a discrete element of activity that fulfils an intermediate, conscious *goal* of activity. Actions involve the exploration, manipulation, or transformation of an *object* (either material or symbolic), from some initial state to a final state, in accordance with the goal. Actions include unconscious *operations*, the specific natures of which are determined by the concrete conditions under which activity takes place. All actions have a temporal dimension. The initiation of a conscious goal (goal acceptance or goal formulation) constitutes the starting point of an action; it concludes when the actual result of the action is evaluated in relation to the goal. The structure of activity during task performance is formed by a logically organized system of motor and mental actions. In order to extract individual actions from a task structure it is necessary to identify the object, *tool* and goal of action.
A number of different approaches to the **classification of actions** have been developed in system-structural theory. One differentiates between types of mental action based on two considerations: (1) the degree to which they require deliberate examination and analysis of the stimulus (their direct connection with, or transformation of, the input); and (2) the dominating psychological process during action performance: sensory, simultaneous perceptual, imaginative, mnemonic, *etc.* A second, more generalized classification scheme, categorizes actions according to the nature of their object (either material or symbolic), and their method of performance, (either practical or mental). This scheme thus distinguishes between: (a) **object-practical actions** performed with material objects; (b) **object-mental actions** performed on mental images; (c) **sign-practical actions** performed with external signs; (d) and **sign-mental actions** performed through the mental manipulation of signs or symbols.

A Glossary of Terms in Activity Theory

Action Regulation Theory, ART. (Sometimes also referred to as Action Theory). A German application of activity theory to work and organizational psychology developed by W. Hacker, W. Volpert, H. Heckhausen and others. ART combines *activity theory* with cognitive psychology to offer a coherent body of principles for human-centred task and work-process design. In ART the "work task" is a central category for the psychological consideration of activity and behavioural analysis. Action regulation theory assumes a hierarchical-sequential pattern of goal setting, action and evaluation. If the pattern is incomplete or interrupted, this is seen as impacting on both the quality of the result and the motivational value of the task. Action Regulation Theory is considered to be not only a description tool but also a normative guide to efficient and humanized work and has been influential on European developments in engineering and work psychology and HFE. German action theorists have contributed to the establishment of a number of international standards for work design, *e.g.* ISO 9241-2. See also (Hacker *et al.,* 1982, Hacker, 2003).

Activity, Human Activity. (In Russian *Deyatelnost*, German *Tätigkeit*). A coherent system of internal mental processes and external behaviours, motivated by needs, combined and organized by the mechanisms of self-regulation and directed toward the achievement of a conscious goal. This usage of the term activity denotes a specifically human form of behaviour which always has some conscious element (*action*), and where the relationship between the acting subject and objective reality is mediated through the use of physical and mental tools. Activities normally involve the completion of some kind of *task* with a specific *goal* or desired outcome. An activity is performed by a *subject*, interacting with an *object* through a system of *actions*, using (real and symbolic) tools. Actions are carried out through a series of non-conscious *operations* which depend upon the specific conditions in place at the time of task performance. In activity, subjects may also interact with other subjects, using (symbolic) tools such as language. This kind of intersubjective social activity is distinguished from object-transformational activity by the Russian term *obshenie* (social interaction). Both aspects of human activity, intersubjective and object-oriented, affect and continuously transform into each other. Activity is always situated, that is created by and adapted to specific circumstances through *self-regulation*; however it also always involves some pre-specified components such as plans, scripts, etc.

The term "activity" briefly translates the German t*ätigkeit*, which can be more accurately rendered as "the specifically human, inherently collective and societal, purposive and goal-directed, subjective and objective, internal and external, exploration and transformation of the human and natural environment" (*cf.* Leont'ev, 1978, esp. Chapters 2 & 3). It is clear that using the everyday English term "activity" risks seriously distorting this meaning; for this reason some have argued that tätigkeit should remain un-translated, as has been the case with the psychological term *gestalt* (*e.g.* Schurig, 1988).

Activity approach. See also: *Activity Theory, Action Regulation Theory, SSAT*. A term used here to indicate an epistemological orientation within the human sciences which originated in the Marxist-Leninist psychology, psychophysiology, and philosophy developed in the Soviet Union during the early part of the 20th Century. The activity approach encompasses activity-oriented strands in the development of dialectical materialism, and encompasses such interconnected and overlapping traditions as Cultural-Historical Psychology (CHP); Sociocultural Theory; General, Systemic-Structural, and Cultural-Historical Activity Theory (*AT, SSAT, CHAT*); the cultural, critical, literary and linguistic theories of the Bakhtin circle; and German *Action-Regulation Theory* (GAT) and *Critical Psychology* (CP).

The activity approach is a holistic materialist epistemological paradigm that contrasts with, and complements, naturalistic approaches to understanding reality. Whereas in naturalistic

A Glossary of Terms in Activity Theory

approaches individuals confront natural objects which are considered independent of their activity, the activity approach states that the meaning of life (for humans) takes shape through the process of human activity. The activity approach has resonance and interconnections with approaches developed from other philosophical roots, such as American Pragmatism, Ecological Psychology, and some aspects of Systems Theory.

Activity System. According to Engeström's *Cultural-Historical Activity Theory* the activity system is a model of the structure of collective activity which represents "the smallest and most simple unit that still preserves the essential unity and integral quality behind any human activity" (Engeström, 1987, p. 38). This *unit of analysis* interprets Vygotsky's work on tool mediation and Leont'ev's elucidation of the structure of activity and combines them with a basic Marxist-Leninist exegesis on the fundamental contradiction between production and consumption as the driver of growth and change in capitalist economies. It is often graphically depicted in a 6-point schema known as the "Engeström triangle".

Activity Theory, AT. (*Syn.* Human Activity Theory, The Russian Theory of Activity, General Theory of Activity; *related:* (German) Action Regulation Theory; Sociocultural Theory; *Cultural-Historical Psychology*; *Cultural-Historical Activity Theory* (CHAT). A general term for a psychological framework (meta-theory, paradigm) that portrays collective and individual human activity – both external-practical and internal-psychological - as a dynamic, self-regulating and hierarchically structured system. Activity theory originates in the works of the Soviet scientists S. L. Rubinshtein (1889-1960) and A. N. Leont'ev (1904-1979), and was significantly influenced by the cultural-historical psychology of L. S. Vygotsky (1896-1934). Activity theory is specifically concerned with the study of human, socially-situated, tool-mediated activity, understanding human activity as a self-regulating system involving motives and conscious goals. A fundamental principle of AT is the unity of consciousness and behaviour; cognitive mental processes evolve as a result of the external activity of subjects, mediated by intersubjective relations. Thus, according to activity theory, the human mind develops out of historically contextualized, object-practical activity.
Over the course of around 60 years of development, AT became a fundamental scientific approach within both theoretical and applied Soviet psychology. Since the fall of Communism it has continued to develop globally. Currently, AT contains three main strands: the General theory, which addresses general psychological principles; the systems-structural approach, which is more specifically oriented toward the understanding and design of work processes and tools (see *SSAT*); and the *Cultural-Historical Activity Theory* (CHAT) developed mainly in Scandinavia and the US.

Afferent (actions). *Lit.* "toward". Term originally from psychophysiology, now widely used in ergonomics. In systemic-structural AT, used to describe those actions of a subject which involve the reception and interpretation of information from perception and/or memory.

Algorithm, human algorithm, algorithmic analysis. Human algorithms are developed in the second stage of the *morphological* approach to *systemic-structural activity analysis*, being used to extend and refine qualitative descriptions of activity as a structured system. A human algorithm is a symbolic representation of goal-directed activity during task performance as a logically organized step-by-step problem-solving procedure, including both external-practical and internal-psychological actions. Discrete goal-oriented actions are clustered into qualitatively distinct units, called *members of algorithm*, each of which usually comprises 3-5 actions organized by a supervening goal. A notational system is used to represent members of the algorithm, which denote efferent or afferent actions, the deterministic and probabilistic

A Glossary of Terms in Activity Theory

logical conditions that structure their relationships, and the various links between them. Human algorithms, as the name implies, are strictly anthropocentric in their approach; this distinguishes them both from other modelling techniques such as flow charts and from computer algorithms. In conjunction with time-structure analyses, which are developed in the third stage of systemic-structural analysis, human algorithms provide a basis for quantification of task complexity. The idealized models of human activity during task performance produced during systemic-structural analysis can be used as a basis for evaluating alternative designs of *e.g.* work tools and processes.

Anthropocentric Approach. In HCI: an approach to man-machine system design that, in contrast to systemic-technical approaches, asserts that machines are tools for the human. By emphasizing man-machine asymmetry the anthropocentric approach makes central to the design enterprise a concern to support people in more effective, easy and enjoyable task performance. This general term can be seen to share many characteristics with Western approaches to system design such as User-Centred Design (Norman and Draper, 1986) Usability Engineering (Nielsen, 1994) *etc.* More generally, used to refer to human-centred approaches in general philosophy and the philosophy of science, *esp.* Marxism. The Soviet philosopher of activity Evald Ilyenkov (1924-79) argued for a philosophical anthropocentrism as a cornerstone of his approach to understanding the concept of the ideal, (see Bakhurst, 1991).

Anticipatory Reflection. Anticipatory reflection guides activity through the afferent synthesis of (extero- and proprio-) perception of the situation and memories (*i.e.* personal experience), forming an anticipation of the future state which may result from the activity about to be performed.

Appropriation. Process by which humans adopt, adapt, and adapt to the meanings and practices *objectified* in culturally-historically formed material and ideal artifacts such as tools, words and rules. In AT, the transmission of human culture and the production and reproduction of human subjectivity are visualized as taking place through cycles of objectification and appropriation as humans participate in collective, motivated, goal-oriented activity.

Artifact, Artefact. *Lit.* Any object produced or shaped by human craft. In AT, this is taken in the sense of indicating anything produced or shaped by human *activity* in its holistic sense. The products of collective human work are both material *and* non-material; procedures, rules, *etc.* are *ideal* artifacts produced by human labour, just as machinery, dwellings *etc.* are material ones. Moreover, as material artifacts are shaped by human activity, all such artifacts are seen as having a dual nature that includes not only their physical existence but also the meanings, experiences and practices they embody. The process of exteriorizing or embedding human activity into material form is referred to as *objectification*. Writers in AT use a variety of terms, with varying degrees of rigour, to signify specific kinds of material and ideal artifacts, *e.g.* tools, instruments, signs, symbols, rules, norms *etc.*

AT-HCI. Activity-theoretical human-computer interaction. Action-oriented approach within human-computer interaction research based on *activity theory*. Founded in the late 1980s by the Danish scientist S. Bødker, who also contributed to the establishment of the participatory design (PD) and computer-supported cooperative work (CSCW) movements in information technology design. AT-HCI seeks to develop design-oriented understandings of the role of computer artifacts as mediators and objects of human work activity, taking account of the

reality that the (actual or proposed) use of interactive systems always takes place in specific, complex, and historically developing sociocultural and technical contexts.

ATIT, AT-IT. Activity-theoretical information technology design, development, and evaluation. Term introduced by the Danish researcher O. B. Bertelsen to denote the use of "activity theory based practical methods for IT design… (software, IS, HCI, CSCW, PD…)" (Bertelsen, 2004, personal communication).

Automatization. (*Ant. Deautomatization, Conceptualization*) The process in skill acquisition whereby action control is transferred from conscious to largely unconscious psycho-physiological mechanisms. This transfer from the level of (conscious) action to (unconscious) operation is normally associated with the stabilization, *i.e.* decreased variability, of task performance. Also sometimes referred to (*e.g.* in Bødker, 1991, 1996a, 1999a) as *operationalization*.

B

Breakdown. Forced shifts of the subject's attentional focus that result in an interruption to, or the cessation of, transformative actions toward the *object* of activity. Breakdowns indicate contradictions within or between aspects of artifact design, individual characteristics of the subject, and sociocultural conditions. See also *focus shift*.

C

Character. Considered in AT to be a substructure of *personality* (the other main substructure being *abilities*). Denotes a consistent style or manner of relationship and behaviour in diverse situations. Character represents the totality of individual features that are elicited in typical circumstances occupied by a person, and determines the style of behaviour and attitudes under those circumstances. Character triggers programs of performance in typical situations – that is, while behaviour is principally derived from goals, the style and nature of behaviour director toward a goal varies among individuals, according to their character. Character has motivational force and its individual characteristics are closely connected with the subjects' *personal sense* acquired during social learning. Variations of character appear not only in multiple qualities but in the intensity of expression of specific features. Character is mainly treated as the socially acquired features of *personality*, but also considered as dependent on features of the neural system and temperament.

Conceptualization. (*Syn. Deautomatization*). Term for used by Bødker *et al* to denote the process of transformation of operations into actions. Avoided in this thesis in order to minimize confusion with the both the general English usage of the term and the specific developmental processes of concept formation described by Vygotsky.

Coordinated activity. When individuals are gathered together to work on a common object, but their individual actions are only externally related to each other. They act as separate individuals, each according to his individual task (Engeström, 1987). Each subject follows scripted roles, coded in rules, plans, schedules, traditions, norms *etc*. An example of coordinated activity is the activity of house building, where one person lays bricks, anther does carpentry tasks *etc*. This means that subjects may not hold a conscious image of the overall outcome of collective activity, but will each be focused on the goal of their own actions. This may mean that the subject does not see his action as part of a larger activity.

A Glossary of Terms in Activity Theory

Critical Psychology, German Critical Psychology. A system model of psychology originated by Klaus Holzkamp (1927-1995) in the late 1960s on the basis of Marxist-Leninist philosophy and Leont'ev's work in *activity theory*. Focused on the conceptual reconstruction of the basic categories of psychology to include *dialectical materialist* understandings of subjectivity. See also (Teo, 1998, Tolman, 1994, 1991).

Cultural-Historical Activity Theory, CHAT. Influential cultural-historical, activity-theoretical approach to collective and organizational learning developed during the 1980s by the Finnish educational psychologist Yrjö Engeström. Reformulates a number of the basic ideas of *CHP*, *AT*, and Marxist-Leninist dialectics to produce a generalized model of processes of learning and transformation in collective human activity. Based on a review and critique of developments in Vygotsky's *cultural-historical theory* and the Leont'evian tradition of *AT*, Engeström produced a graphical depiction of the "activity system" as a basic unit for the analysis of collective practice. Engeström used this schema as a basis for developing his views on individual, collective and organizational learning as a multi-level phenomenon driven by contradictions and conflicts both within and between past, present, and future activity systems. What began as an almost purely theoretical project has been operationalized through a program of participatory action research; the resulting empirical experience being formulated into a methodology called developmental work research (DWR).

Cultural-Historical Psychology, CHP. General term for psychological approaches based on Vygotsky's *cultural-historical theory*; in its modern form usually also draws on cultural-historical strands within *activity theory*.

Cultural-Historical Theory. *Dialectical materialist* theory of the sociocultural-historical determination of mind developed by L. S. Vygotsky (1896-1934). Asserts that the origins of human consciousness lie in the use of signs as tools to mediate mental activity.

D

Dialectical Materialism. (*Also "Diamat"*). A non-reductionist form of philosophical materialism, principally developed in the former Soviet Union, based on the writings of Marx, Engels and Lenin. Dialectical materialism asserts that an objective reality exists external to the human mind, and obeys natural laws. Knowledge is seen as deriving from the influence of the externally existing material world on the knowing subject (through *reflection*), who is understood as an entirely material being. All nature, including human nature, is seen as explicable in terms of matter and energy; it denies any supernatural influence on nature and opposes the view that there exist any forces or phenomena that are inaccessible, in principle, to scientific explanation. Dialectical materialism is committed to physical, biological, and evolutionary viewpoints. The development of matter during the history of the earth - through chemical and geological stages, the origins of life, evolution by natural selection, the advent of human beings, and their transition into the current cultural-historical phase of evolution - being seen as a series of quantitative transitions involving correlative qualitative changes. Diamat differs from earlier forms of materialism (such as Greek atomism and 19th Century scientific materialism) in repudiating reductionism - the belief that all phenomena in nature, including human behaviour, can ultimately be explained in terms of the simplest interactions of matter. This anti-reductionism, by asserting that social laws cannot be reduced to biological laws and biological laws cannot be reduced to physicochemical laws sought to preserve a place for uniquely human values within a materialistic framework and provide safeguards against scientistic exaggerations based on biological or behavioural explanations of social values, such

as eugenics, socio-biology, Behaviorism, or evolutionary psychology. While none of these approaches became as widespread in the Soviet Union as in the West, some principles of dialectical materialism (transformed into the ideology of historical materialism) were used by the Communist Party as a rationale for totalitarianism.

Deautomatization (*aka. Conceptualization*). The process whereby operations are made into conscious actions in order that they may be amended, adapted, or discarded in response to new conditions or demonstrated to others. The transfer from the level of operation to action may be either voluntary, that is initiated by the subject in response to some need; or involuntary, that is, the subject is forced to consciously examine formerly automatic or semi-automatic aspects of task performance by their failure to achieve the expected outcome. Processes of automatization and deautomatization may be closely associated with attributes of the mediating artifacts in use, and as such are central to a design-oriented analysis of tool-mediated activity.

Developmental Work Research, DWR. Participatory action research approach to organizational change and learning based on *CHAT*.

E

Efferent (actions). *Lit.* "away from". Term originally from psychophysiology, now widely used in ergonomics. In systemic-structural AT, used to describe those (object-oriented and/or communicative) actions of a subject directed toward the manipulation of external reality.

Errors. From a systemic-structural point of view, *learning* can be characterized as a movement from preliminary, through intermediate, to finalized strategies of action. *Errors* often signify the transition from one strategy to another - in fact they should be seen less as problems and more as iterations toward an adequate structure of activity. *AT* distinguishes operator errors from operator failures, and *SSAA* offers a number of taxonomies based on this distinction and other parameters.

F

Focus Shift. A shift of conscious or semi-conscious attentional focus in activity more deliberate than that caused by *breakdowns*, (Bødker, 1996a).

Focus-shift Analysis. Activity-theoretical HCI analysis technique developed by Bødker (1996a). The description of computer-mediated activity in terms of a movement of the acting subjects' focus of attention between the *object* undergoing exploration or transformation and the *artifacts* mediating actions toward that object. During interaction this necessary shifting is a response to changing conditions, as the mediating artifacts require exchange, adjustment or modification; as soon as adjustments are accomplished actions are easily redirected toward the work object. In a *breakdown* situation, the subject is forced to direct actions toward the mediating artifact by a discrepancy between the emerging results and the goal, caused by a failure of the subjects' repertoire of operations with the artifact to produce the desired/expected/envisaged result. This results in a *deautomatization* of operations with the artifact, with accompanying changes in the *motives, goals* and sub-goals of action. Focus-shift Analysis uses qualitative observational data to build a picture of how specific design attributes of computer applications and their use setting either support, hinder or force focus shifts during task performance. Concentrates on identifying voluntary and involuntary *deautomatization*

necessitated by characteristics of the components of the activity system under study, especially the artifacts in use.

Functional Analysis. SSAA method which traces various aspects of the (non-homeostatic) self-regulation processes which govern human goal-directed activity, at different levels of detail and different stages of activity. Based on the development and application of self-regulation models comprising *function blocks* and their interconnections. Produces functional descriptions which, firstly in conjunction with other methods of individual-psychological analysis such as *parametrical* and *morphological* analyses, and then in coordination with social-historical and objectively-logical descriptions, can be used to produce a holistic understanding of activity.

Function Block, Functional Block. A unit of macro- or micro-structural activity analysis that represents a coordinated system of sub-functions having a specific purpose within the structure of activity. While remaining functionally invariant, the specific content of a function block changes as activity unfolds; function blocks mutually affect each other through feed-forward and feedback influences. Used as components of self-regulation models of activity, function blocks are represented as 'black boxes' assumed to contain more molecular sub-functions that may need to be further decomposed at other stages of activity analysis. They can be applied at all levels of activity analysis, as models using function blocks are able to encompass a range of more or less specific and integrative elements into one top-level structural representation.

Functional Mechanism. Aspects of the functioning of activity that have a particular purpose in the self-regulative process of activity, and specific interconnections with other such mechanisms. Examples include the goal, subjectively-relevant task conditions, past and new experience, *etc.* When functional mechanisms are represented as constituent parts of *self-regulation* models of activity, they are called *function blocks*.

Functional System. According to Anokhin (1962) a functional system can be understood as a combination of processes and mechanisms, dynamically formed into a system in a particular situation, which can lead to an optimal adaptive result for the organism in that particular situation. A functional system acts as a self-regulating system with multiple feed-forward and feedback interconnections, and it includes various neural components. In *systemic-structural activity theory*, functional systems are understood as dynamic self-regulating entities which are mobilized and formed during activity and which disappear on consummation of their mobilizing activity. They embody the process of self-regulation at the physiological and psychophysiological levels.
The closely related concept of **functional organ** developed by Leont'ev (Leont'ev, 1981b 152-154) and Luria, and introduced to HCI by Kaptelinin (Kaptelinin, 1996b) presents the idea of functionally integrated, goal-oriented configurations of internal and external resources. External tools support and complement human abilities in ways that can lead to higher accomplishment. The use of external tools develops internal capacities for action. Examples: notepads and pencils as aids to memory and analysis; scissors/saws etc plus hands & eyes plus skills improve cutting and shaping; eyes plus eyeglasses improve visual perception and with language skills constitute functional organs for reading. From the point of view of the subject, during the initial stages of learning to use a tool its properties are conceived of as part of the objective outer world, to be mastered; once the tool becomes integrated into the subjects' actions as a constituent of a functional organ its properties are experienced as subjective. Computer tools offer a unique challenge from this point of view inasmuch as they often do not have one clearly identifiable fixed function; they are uniquely plastic, what Bødker calls "the clay of computing"

A Glossary of Terms in Activity Theory

(Bødker, 1999a). In general they may be said to extend the *internal plane of action,* that is, the ability to manipulate internal representations through *imaging* & *imagining*.

G, H

Goal. The cognitive component of activity. A more or less distinct, conscious, cognitive representation of the desired future result of activity. Goal-images are formed from various components – image, verbal-logical *etc.* Goals may be accepted in advance, or formulated and specified during activity. Sometimes the goal is very ambiguous during the preliminary stages of task performance; goals may be modified or even entirely transformed during the course of activity. Conscious awareness of the goal of action is a fundamental tenet of AT. The goal of activity is embodied in the active search for a required outcome.

Human Algorithm - see **Algorithm**.

I

Ideal. A term used to denote those things objectively existing in the world which are non-material, but which are produced from the material by human activity, such as word meanings, rules and norms of behaviour, *etc.*

Image. Images are formed during activity, with the act of perceiving being considered as an active process (c.f. Gibson, 1979). The image can be viewed as (a) a tool for understanding reality, *i.e.* as a cognitive function and (b) as a means of regulating activity, that is, as a regulative function. The most significant component of the image is the goal; the goal appears as an image of a future outcome. Comparison of actual outcomes during execution of a program of task performance with the image (influenced by other functional blocks in the self-regulation model of activity) is used to adjust the program of task performance and reassess strategies.

Imagining and Imaging. Imaging is the ability to form and manipulate internal representations of objects directly perceived by the senses; these are primary images. Primary images are determined by, but are not a direct copy of, external information, as they are also affected by subjective factors. Imagining is this visualizing ability exercised in the forming and manipulation of internal representations of objects retrieved from memory or never directly encountered through perception of the external world. These secondary images can be classified as either a) reproductive, *i.e.* directly derived from memory or b) productive or creative. Both abilities constitute elements of the *internal plane of actions.* The manipulation of images is performed through different mental actions, where the image is the object of action. Internal manipulation of the image is easier in the presence of some external functioning model of the imaged object, and in this way computer artifacts can extend the ability to manipulate images on the internal plane of action. It is important to note that the mental actions involved in internal imaging also have a motor component; micro-movements of the eyes and limbs always accompany the process of imaging. Visual perception performs the leading role in imaginative reflection; the leading role in the formation of conscious concepts is taken by the verbal-logical process. The interaction of thinking and imagination is present in activity performance. The **operative image** refers specifically to the image produced during task performance and used to guide actions. The operative image is affected by factors such as *set* and what are perceived as the most significant aspects of the task, and can change quite quickly. Operative images are contrasted with **conceptual models,** which are multidimensional reflections of reality described

in sensory-perceptual, symbolic and verbal languages, but in which imaginative processes are dominant. Conceptual models are characterized by informational redundancy, and are relatively constant over time, and change more slowly than the operative image.

Individual Style of Performance. Activity strategies derived from idiosyncratic features of personality.

Implementation. Stabilising the shared means of work in collaborative activity through communicative, instrumental and scripted coordination. See (Bardram, 1998).

Internal plane of action (IPA). Term used (in Kaptelinin, 1996b, derived from work of Ponomarenko) to denote the general human ability, developed usually in the early school years, to manipulate internal images of external objects. This ability is referred to by Bedny as *imaging* and *imagining*. Roughly corresponds to the cognitive science usage of 'mental models' in 'working memory'. One of the most powerful attributes of computer artifacts is their extension of capabilities of the IPA through the formation of new *functional organs*.

Internalisation *(aka interiorisation)*. The formation of internal, mental processes with ideal objects (symbols) based on external processes with material objects; the process through which objective, external actions are transformed into (Vygotsky, Early Leont'ev), or provoke and affect the formation of (late Leont'ev, SSAT), idealized, internal actions. Internalisation is key aspect of cultural-historical and AT viewpoints on phylo- and ontogenesis, initially formulated as a consequence of Vygotsky's analysis of the tool-mediated nature of human labour activity. The classic Vygotskian example is the transition from external, social, speaking to inner, individual, verbal thinking via the stage of egocentric speech. It should be noted that (in contradistinction to Piaget's formulation of the idea) this is considered as the transition from the *inter*psychological to the *intra*psychological regulation of behaviour through sign mediation. There are numerous approaches within CHP and AT to studying and theorizing the process of internalisation. All agree that the structure of inner, psychological actions can be usefully compared to that of external, instrumental actions, and that the higher psychological functions have at least part of their origin in practical activity.

J, K, L

Learning. From the systemic-structural point of view, *learning* is characterized as a movement from preliminary, through intermediate, to finalized strategies of action. *Errors* often signify the transition from one strategy to another - in fact they should be seen less as problems and more as iterations toward an adequate structure of activity. AT offers several theories of learning, including those of Gal'perin, Landa, and Bedny. Instruction can lead to learning, as outward instruction becomes transformed into self-instruction during dialogue then self-instruction through monologue (egocentric speech) leading to the formation of strategies of internal self-regulation through verbal thinking actions.

M

Meaning. "Meanings interpret the world in the consciousness of man" and are "the object world's ideal form of existence… as they have been brought forward from the total societal praxis" (Leont'ev, 1978). Meanings are thus an essential component of human consciousness, existing in concepts that are objectified in action schemes, social roles, norms and values. Meanings arise as referents in linguistic interaction. The objective meaning of things in the

A Glossary of Terms in Activity Theory

world is developed over the history of human interaction with the objective world; such generalized conscious objective meaning is contrasted with subjective *personal sense*. AT identifies two main types of meaning. **Object Meaning** describes the network of feelings and experiences that individuals associate with particular objects in particular situations through their experience of interacting with them during the performance of a particular action. **Categorical** or **Idealized Meaning** is an objective property of signs, that is it has a socio-historical character as part of the verbal categories mastered in ontogeny; it is relatively stable and independent of specific situations. Through the process of collective, social activity, object meaning can become transferred into categorical meaning.

Morphological Analysis. The description of activity as a structured system of *actions* and *operations*. A fundamental principle of activity theory is the unity of cognition and behaviour (Bedny, Karwowski, & Bedny, 2001). The structure of activity during task performance is understood as formed from a logically organized system of external-behavioural and internal-mental tool-mediated actions and operations, a structure which is continually changing in response to internal and external conditions. In *SSAT* morphological analysis refers to the structural description of human activity. The principal units of morphological analysis are *activity, actions, operations* and *members of algorithm*. Morphological analysis consist of four stages which are iterative or recursively connected a) qualitative description b) algorithmic analysis c) time-structure analysis d) quantitative (task complexity) analysis. Stages may be abbreviated or omitted according to the purpose of the study. Morphological analysis using action as a primary analytical unit focuses on the interconnectedness of, and transition between, mental and motor actions. Structural analyses of activity can provide insights into how external tools such as controls, displays, screens, instructions *etc.* interact with subjects' internal tools such as conceptual models, skills, knowledge *etc.* (Bedny & Karwowski, 2004a). This approach allows comparisons between the physical and logical configuration of the equipment in use (using descriptions developed from the objectively-logical perspective) and the temporal, spatial, and logical organization of subjects' (real or idealized) actions.

Motive. Leont'ev (Leont'ev, 1978) defined motive as a *need* which finds an *object*. That is, when a being in a need state comes into contact with an object that is perceived as having the potential of satisfying that need, the person is motivated to engage in activity involving exploratory or transformative goal-oriented actions with that object. In this sense, motive is the energetic component of activity. The vector motive$\rightarrow$goal is what gives activity its purposeful and directed character; motivation ensures that the individual expends energy in the transformation of an object, through actions guided by conscious goals. Individual's motives may be categorized into two groups 1) **sense formative motives** which are relatively stable and determine a person's general motivational direction; they are connected with personality and general character traits; 2) more flexible and unstable **situational motives** which are connected with immediate ongoing activity and the solving of specific tasks. The content of situational motives, their relative weighting and place in the hierarchical organization of motives can change in response to task characteristics, temporal stage of task performance, and informational feedback about task solution. For any individual subject involved in a task, the level of motivation will be directly related to subjectively relevant task conditions, such as their perception of task difficulty. **Motivation** is considered as the source of energy that drives *activity*. Motivation in general includes a hierarchy of individual motives, which may be conscious, semi-conscious or even sometimes unconscious. Motivation is always connected with emotions, and the level of motivation determines the energy expended toward attaining the *goal*. A person's motivation during task performance is always closely linked to the personal significance or *sense* that the activity has for them.

A Glossary of Terms in Activity Theory

N

Needs. All human activities begin with human needs – which by definition have both biological and cultural components. The most basic needs are associated with self – food, shelter, family/social – and also include the need for self-recognition, feelings of worth, and concerns for the community/society within which a person functions. Needs do not directly generate activity, they create dispositions directed toward need satisfaction. Activity is derived from the situation where a person images or imagines specific objects that can satisfy their need. Such images become *goals* which arouse *motivation*.

O

Object. The object of *activity* is that which is modified and explored by a subject according to the *goal* of activity. Modification or exploration include not only physical transformation, but also the classification of objects according to required goals, the discovery of features of the object that correspond to goal of explorative activity, and so on. Objects may be either concrete (material) or abstract (*ideal*). Ideal objects are *e.g.* signs, symbols or images, and their constitution as entities transformed by the subject in accordance with goals. In activity, initial, intermediate, and final states of objects may be distinguished.
In some (cultural-historical) interpretations of activity theory the term object is used - in a very loosely defined sense that roughly corresponds to the English word objective – to represent the association between a *motive*, a *goal* and a material or ideal object.

Objectification. (Russian *Objektivirovanie*, German *Vergenstandlichung*). The process through which the active forces and capabilities of humans become inscribed into those objects in the world that are incorporated into, or result from, human activity. Through work activity, humans actively remake the physical world, investing objects in that world with *meaning*, creating our own 'human reality', *i.e.* the world of culture. It is the process of objectification that both gives rise to, and embodies in artifacts, the *ideal* aspects of material reality, that is, meanings. Objectification is not necessarily, or even predominantly conscious, although it can be. In art, and through design and production processes, people may consciously strive to objectify certain meanings, knowledge, practices and norms in the artifacts they create; they invariably also unconsciously objectify many aspects of their own practice and its cultural-historical context. Thus, the design and production process always involves the objectification and transmission of cultural values.

Operations. Those aspects of actions which are shaped and directed by the immediate conditions in the (internal and external, material and ideal) environment of activity and which determine the mode of action. Operations are therefore the non-conscious or automatic aspects of actions; they can be derived from conscious actions through repetition; this is the process of *automatization*.

Orienting Basis. The orienting basis of actions and activity is mainly provided by perceptual, sensorimotor, mnemonic and other *operations* triggered by concrete material conditions. See also *orienting reflex.*

Orienting Stage of Activity. In *self-regulation* models, that aspect or stage of activity which precedes executive action and is subsequently affected by evaluations of the outcomes of executive action. The orienting stage of activity is principally concerned with creating a

dynamic reflection of the current situation, is gnostic and exploratory in nature, and involves both conscious and unconscious processes.

Orienting Activity. The term orienting activity is used to refer to those types of activity in which the *orienting stage* predominates and in which little or no executive action is involved. In orienting activity, the main goal is to create and maintain a reflection of the current situation, as in tasks involving vigilance, monitoring, *etc.*

Orienting Reflex. The orienting reflex is a largely physiological phenomena involving external movements (turning the head, *etc.*), and internal changes (*e.g.* in heart or respiration rate, brain activity). The orienting reflex underlies the *orienting basis* of operations and plays an important part in the functioning of the involuntary aspects of the *orienting stage of activity*.

Outcome, Result. The actual result or output of activity. Ongoing comparison of actual result and goal (desired result) during activity performance provides feedback for self-regulation.

P, Q

Personality. The totality of qualities and traits, as of character or behaviour, peculiar to a specific person. The main components of personality are 1) stylistic qualities of mental actions 2) personal ideology, interests, desires, values *etc.* 3) knowledge, skills and habits 4) biological factors. The interaction of these components determines stable individual social orientation as well as the developmental phenomenology of individual personality. The relation between the components determines specific development of *abilities* and *character*. In AT, personality is presented as a system of hierarchically organized substructures. These substructures are organized into a holistic system that determines the specificity of personality. An individual's substructures, especially high level substructures such as *social orientation* or *goal orientation* can be altered over time, through personal development.

Psychophysiology. Physiological psychology; the branch of psychology concerned with the physiological bases of psychological processes. Studies interactions between the mind and body by recording how the body is functioning and relating the recorded functions to behaviour, affect and cognition.

R

Reflection. One of the basic epistemological assumptions of *dialectical materialism* is that sense perceptions are the means by which humans develop a more or less accurate reflection of an actual and objectively existing material world. In AT, sense reflection is seen as an active and socially-mediated process involving selective attention dependent on the subject's goal and motivation, and personal and cultural history. In its most basic and general sense, reflection is seen simply as what happens when two entities interact; the state of each is changed by the interaction, and this changed state is, for each, a reflection of its interaction with the other. "Psychic reflection develops with the appearance and evolution of the nervous system and brain, through which the higher nervous conditioned reflex and psychic activity is exercised, securing the behavioural orientation and regulation of a subject-organism in the environment. The psychic reflection of men and animals has two sides: 1) content and 2) form, *i.e.*, the mode of existence, expression and transformation of this content. Human knowledge differs in quality from the psychic reflection of animals because it is social by nature" (Frolov, 1984).

A Glossary of Terms in Activity Theory

Regulation (of behaviour). Se also *self-regulation of activity*. The regulation of behaviour is seen as the maintenance of behaviour within parameters that are directed toward goal achievement. The regulation of behaviour can be achieved by two methods: reactive, *i.e.* behaviour regulation in response to external stimulation; and regulation by goal-direction, where the need to achieve a specific goal requires certain action within limits that are set in relation to the goal. Both types of regulation require that the subject is motivated.

Routinization. Stabilising shared means of work in collaborative activity through communicative, instrumental and scripted coordination. See (Bardram, 1998).

S

Self-Regulation (of behaviour). In general cybernetic terms, self-regulation is an influence on a system, derived from the system itself, which acts to correct its behaviour or activity; it is an intrinsic self-organizing property of the system itself. In human *activity theory*, **psychological self-regulation** refers to the adjustment of action during activity performance through comparison of the goal with the actual outcome. This is a non-homeostatic, goal-directed, multi-level process with both conscious and unconscious aspects and external (exteroceptive) and internal contours (Bedny and Karwowski, 2004b) which includes both cognitive (informational) and motivational (energetic) components. The conscious aspect of self-regulation is visualized as a recursive loop process which draws on updated input information during task performance to evaluate interim or final results, using subjective standards of success and admissible deviation in relation to the goal, as a basis for making decisions about, carrying out, and correcting programs of action. The models developed by G. Z. Bedny (Bedny and Meister, 1997 pp. 50-94) and others in systems-cybernetic AT portray (conscious) self-regulation primarily as information-processing, rather than the motivational or volitional process proposed by Kuhl and others. **Physiological self-regulation** is based on homeostasis, that is involves measures to reduce the discrepancies between the actual and optimal states of the system. It is mainly automatic, and, in contrast to psychological self-regulation, its processes are completely predetermined.

Sense, Personal Sense (Russian: *Smysyl*). Personal sense is a pre-logical function referring to the individual's reflection of those general meanings of the objective world which are principally acquired during social learning/acculturation. In the process of social learning, individuals acquire not only the meanings of different artifacts, situations *etc.*, but also emotional evaluations of situations. Personal sense is the realization of meaning in a subject's life activity, in relation to their needs and motives. Personal sense determines the significance of any situation for the individual, and as such is closely connected with both their general and situation-specific motivation.

Set. Concept developed by Soviet psychologist D. N. Uznadze (1886-1950) that denotes a subjects' readiness or disposition to perceive or handle situations or interact with objects. Set may be more or less conscious, and is connected with the previous experience of the subject. Set has three components which taken together determine the way an individual will act in relation to an object or situation 1) cognitive components that determine readiness to comprehend and perceive others 2) emotional-evaluative components consisting of the subjects' sympathies or antipathies toward different objects 3) behavioural components that are considered as a readiness to act in a particular way toward a set of objects.

A Glossary of Terms in Activity Theory

Social Interaction. (In Russian: *Obshenie*). Specific activities with an array of features that emerge during the joint performance of activities. Social information may be communicative, informative, and include intimate interpersonal relationships. Social interactions shape social behaviour and socialize the personal disposition of individuals – here norms, rules and standards are significant. Social interaction may also be considered as a social-perceptual program, where interpersonal cognition and perception are significant. Social interaction plays an important part in shaping the individual personality. Meaning and personal sense are a crucial aspect of social interaction, affecting, and being affected by, *e.g.* the subject's interpretation of observation of the behaviour of others.

Societal. (In German: *Gesellschaftlich*). Denotes the specifically human, cultural-historical form of social organization. Used by Holzkamp to distinguish human social behaviour, rooted in historically formed societies with distinct cultures, and animal social (*Ger: sozial*) behaviour, rooted in biological evolution (See Tolman, 1994). It is important to emphasize this distinction when considering the specifically human ("higher") psychological processes which arise in social interaction in a societal setting; subjective interests are formed by history and culture, and *subjectivity* as a category is both scientific and political.

Strategy. A plan for goal achievement that is responsive to external contingencies as well as the internal state of the system. In systemic-structural activity theory, strategies are those systems of actions that subjects can call upon during task performance. A strategy is the method of taking into consideration input information during planning and the process of achieving a goal. Strategies exhibit plasticity and variability of means, that is, use of the term strategy implies the capacity to change a program of performance based on task outcomes, changing external conditions and internal states. Strategies are thus less specific and stable than plans. From a systemic-structural point of view, *learning* can be characterized as a movement from preliminary, through intermediate, to finalized strategies of action. The notion of *action* and strategies of action acknowledge that learners can be empowered to change the task environment as well as their own behaviour - not simply adapting but also modifying the task situation. *Errors* often signify the transition from one strategy to another - in fact they can be seen less as problems and more as iterations toward an adequate structure of activity.

Subject. In activity theory, the subject of any activity is the individual, or group of individuals engaged in that activity. However, as human beings that are the subjects of activity are formed *as* subjects by their involvement in the production and reproduction of *societal* formations, cultural-historical *subjectivity* is a complex category that is both scientific and political.

Subjectivity and **Intersubjectivity**.

Sublation. (*German: aufheben*). Term coined by Hegel, and later used in dialectical materialism, to signify how the original thesis and antithesis are still present (*lit.* "stored away") in the newer, higher form that has resulted from their transcendence in development. Connects with the notion of "negation of the negation" to show how the dialectical components of earlier stages of development are preserved in present and future formations (*lit.* "lifted up"). This can be visualized as an ascending spiral model of development, with each higher loop reflecting features of those below it.

System. *Lit.* an assemblage of inter-related parts comprising a unified whole. In activity theory, an **organized system** is one where changes in any one element of the system affect the whole system but not other individual components. A **structural system** is one where changes to

individual elements change the system, its elements, and the relations between them. All structural systems, which include human activity, can be dynamic and develop over time. See also *functional systems*.

Systemic-Structural Activity Analysis, Systemic-Structural Analysis of Activity, SSAA. Decomposition of the structure of a system of activity into hierarchically related units of analysis – task, action, operation and function block – which represent different levels & stages of description linked in a loop structure: each stage and level of analysis informs the other, building a holistic picture of the structure of activity. Bedny (Bedny and Karwowski, 2003b, Bedny *et al.*, 2001b, Bedny and Meister, 1997, Bedny and Harris, 2005) defines 4 stages of activity analysis: (a) qualitative description, (b) algorithmic analysis, (c) time structure analysis and (d) quantitative analysis. Each stage involves a series of qualitative and quantitative procedures, and each stage consists of separate levels utilizing distinct languages of description and units of analysis. According to the analytical requirements, analysis at different stages and levels will focus on either morphological (structural) or functional aspects of the system of activity under study.

Systemic-Structural Activity Theory, SSAT, *sometimes aka.* **The Systemic-Structural Theory of Activity, SSAT.**   A modern synthesis of AT that is specifically oriented toward the analysis and design of human learning and work activity (*e.g.* in human factors/ergonomics and HCI) developed by G. Z. Bedny (Bedny and Meister, 1997, Bedny and Karwowski, 2003b). Integrates aspects of cultural-historical psychology, general activity theory and the systems and cybernetic approaches in AT associated with Anokhin, Bernshtein, Konopkin, Uznadze's theory of *set* and other concepts in Soviet psychology, and others with Western information-processing cognitive psychology. Provides a detailed, multi-stage, multi-level methodology, with action as the major unit of analysis, and activity and tasks as the objects of study.

Systems Science & Cybernetics. (*Syn.* (General) Systems Theory, Systems Research). Focuses on the study of complex, adaptive, self-regulating systems. Distinguished from the analytic approach by its emphasis on the interactions and connectedness of system components. Systems theorists consider that the organization of complex and diverse systems can be described by general concepts and principles independent of the specific substrate in which they are embodied. Many of the concepts of system science (*e.g.* information, control, feedback, communication) are shared with cybernetics, "the science of communication and control in the animal and the machine" (Wiener, 1948, now extended to include: in society and individual human beings). In the US, cybernetics grew out of information theory (Weaver and Shannon, 1949) and engineering control systems (Trask, 1971). In the USSR, early systems thinking developed within psychophysiology. Western systems theory has focused more on the structure of systems and their models, whereas cybernetics has focused on system functionality. Modern, "second-order cybernetics" (Heylighen and Joslyn, 2001), examines how observers construct models of the systems with which they interact.

T

Task. The task is a basic component of activity, defined as a situation requiring achievement of a goal under specific conditions. A goal embedded in certain conditions is a task. Tasks always involve goal-achievement and motivational forces. AT views the task partly as a problem-solving process – all human activity can be seen as a continuing attempt to solve or accomplish various tasks. The task may also be more narrowly defined as a situation that requires the discovery of the unknown based on what we already know – often when the method to solve

A Glossary of Terms in Activity Theory

the problem is also unknown.. The task is a (sub) set of human actions that can contribute to a specific functional object and, ultimately, to the output goal of a system. The **basic elements of a task** are an initiating stimulus, the required response, and the overall organizing goal. Any task involves requirements and conditions. **Task conditions** include interacting situational elements, rules and alternatives for situational transformation. **Task attributes** include complexity, subjective difficulty, and significance. Each task in the work process is regarded as a situation-bounded activity which is directed to achieve a goal under given conditions. Any task includes both the subject's activity and the material components of task, with all the elements of activity during task performance being organized by the task goal. It is only when the objectively given or subjectively formulated requirements of the task are accepted by the subject as a desired future result that they become the goal of task. Whatever is presented to the subject for the performance of the required actions constitutes the conditions of the task. **Task conditions** include the subject's past experience and such material components as instructions, means of work in given conditions, raw material and input information. These conditions also determine the possible constraints on activity performance. The raw material, or input information, is considered to be the object of activity. What is actually achieved (finished product, output) is the result of activity. The vector motive→goal determines the directedness of activity during task performance.

Task performance involves some initial situation, a transformed situation, and a final situation. The elements of any task situation possess meanings that can change as the situation is transformed. Any situational transformation is evaluated by the subject as having a positive or negative value, relative to both the final outcome of the program of performance, and in relationship to the general rules or norms relating to activity performance in a situation. The relationship between these two methods of evaluation will very, as when a strategy for achieving a successful outcome may be evaluated as positive even though it conflicts with rules or norms regarding *e.g.* efficiency.

Task structure includes requirements that help to specify the goal. These may be external, in the form of instructions or commands, or, as in creative task performance, generated by the subject. The task is also structured by the relationship between task requirements and initial task conditions. Task requirements and task conditions can vary according to their mode of presentation, and in some circumstances may contradict each other, causing *breakdown* in activity and initiating *defensive* or *expansive learning*.

Temperament. In AT, an individual's temperament is understood as determining the pace, speed, rhythm and intensity of their psychic processes and states. These dynamic features of personality are jointly determined by the structure of personality and events in the psychological or physical environment – that is, temperamental features are adapted to prevailing conditions and overt behaviour is attributable to both innate features **and** situationally induced states. There are 3 major, interconnected components of temperament 1) general psychological activation 2) motor activation and 3) emotionality. Temperament affects the individual style of performance but does not *predetermine* individual mental abilities. Temperament can be related to qualitative features of the neural system: strength, mobility, dynamics, and lability. The psychological characteristics of temperament can be formulated as 1) sensitivity (alertness to various stimuli) 2) reactivity (emotional intensity) 3) flexibility (adaptation to changes in the environment) 4) rigidity, extroversion/introversion and neuroticism (Bedny and Seglin, 1999a). Temperament renders more or less likely the development of certain features of character.

U, V, W

A Glossary of Terms in Activity Theory