Towards Adequate and Constructive Models of Meaning Processing

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ABSTRACT

Humans promote themselves in the universe, the totality of their realities while by processing of meanings they enhance the effectiveness and efficiency of the promotion.

Humans communicate by explanation and acquisition of meanings while acquire meanings by their understanding and learning.

In paper we provide language explanations of meanings on some realities tended to specifications of constructive and adequate models of meaning processing.

We discuss constrains on meanings induced by the models and corresponding constrains on cognition of realities as well as provide experimental evidence supporting a viability of the models.

Keywords

Cognition, meanings, modeling, chess, explanations, understanding.

1. INTRODUCTION

1.1.1. ***Playing the Game of Being in the Universe***

We, members of *a community* C, have *utilities, innate* and *acquired,* that **we do** *promote* in the *universe.* The *universe* is the totality of our realities, while *realities* are somehow causing *prints* in us (recall "thing in itself" by Kant).

In playing the *being in the universe* (BU) game, **we do** effect realities of the universe by controlled actions to transform them into ones favorable for our utilities.

Replication of cells, organizations of cells in the organisms, diversified reproduction of organisms, are ways to enhance the effectiveness and efficiency (e/e) of promotion of utilities, while *meaning processing* is one of those ways.

1.2.2. ***Meanings are Algorithms***

We are aware of the universe, including ourselves, particularly, by processing of meanings.

Meanings present the universe through assembles of relationships (rels) and regularities (regs), say rules by Markov or Post, organized, we assume, into network algorithms according to fundamental categories of *having, being* and *doing*.

These categories present basic dimensions of promotion of our utilities, namely, marketing of utilities we *have* for exchanges, classifying what *are* realities and producing utilities by *doing*.

While all algorithms are based on these categories, the object-oriented ones, say in Java, explicitly use "*have attributes"*, "*is child of*" and "*do"* types of references to relate abstract classes to each other.

1.1.3. ***Dimensions of Meaning Processing***

We do process meanings **of** genomes for assembling hardware and software of our children and process software embodying meanings of genomes, cultures and expertise for controlling, reasoning on and prognosis of having, being and doing of realities as well as for collaboration with communities and enhancing the *adequacy* of meanings.

For collaborations **we do** communicate by *explanation* and *acquisition* of meanings while acquire meanings by *understanding* and *learning* them.

Explanations of meanings, their acquisition, revelation from expertise and adequate enhancement **we do** *adaptively* by universal constructors (recall adaptation by Piaget). Namely, **we do** process meanings mR of realities R for prognosis of the impact of R on e/e of promotions of utilities w and, comparing an a priori prognosis with a posteriori affections of R on w, **we do** iteratively correct mR aimed to minimize a discrepancy between a priori expectations and a posteriori affection of R on w [14].

Meanings enhance qualitatively, by constructing new layers of meanings that are more abstract than the present ones, and quantitatively, by expansion of meanings of the same layers of abstractions (recall sensory-motor, operational and abstract layers by Piaget).

1.1.4. ***Mapping Meanings in Languages***

We do activate meanings to process them, while not necessary being aware about it (recall, e.g., somnambulists), and **do** or don't correspond *communicative units* (counits) to process meanings, where the counits are expressed either in personalized primary languages (*primes*) or in interpretations of primes by community languages, say in English.

The meanings present, model the universe, while humans model the meanings and, consequently, map the algorithms they perform into languages for communication.

1.1.5. ***Commonality of Languages***

Commonality of humans induce commonality of meaning processing of humans and, as a consequence, commonality, at least, of the kernels of the languages, i.e. the syntaxes (recall universal grammars by Chomsky).

Indeed, *have, be, do* (hbd) are the basic categories of meanings in English, splitting verbs and, therefore, English counits into corresponding classes [13]. Times, aspects, mood and other characteristics of meanings are inseparable categories of syntaxes of languages as well.

In this view, the natural, the specification, the algorithmic and the programming languages of communities are representations of meaning processing of humans.

1.2.1. ***Model vs. Language Explanations***

For estimation of a posteriori impacts of realities R on utilities **we do** provide and process *models,* i.e. meanings m of R or realities in certain aspects matching to m and being more available than R.

In fact, models are explanations of meanings and **we do** understand models if they activate, or match to, corresponding meanings.

To process our meanings, e.g. to explain and understand a meaning mR on R, **we do** activate mR and process mR with or without processing the names of constituents of mR.

To explain mR to communities **we do** put models or counits in accordance with mR.

Understanding of counits, say in common English or in engineering specification languages, is bounded, since counits (e.g. clauses in English) can activate only aspects of meanings whose names are included in counits [3].

1.2.2. ***Innate Drawbacks of Explanations***

Unfortunately, explanations are not perfect at all. Language explanations, for example, eventually rely on a finite expertise and counits with entirely personalized meanings that can be inferred in different logical contexts, hence can have malicious circles and other drawbacks.

For example, to explain regs, the basic units of algorithms, we address to the words of certain alphabets which, in order to be recognized, address to algorithms of recognition of symbols and words in those alphabets.

Model explanations are always assembled from certain units, while some of the units, like particles of matter, are still in the process of refinement.

1.2.3. ***Ordering Imperfect Explanations***

Nevertheless, explanations can be partially *ordered* by e/e according to the way they support our utilities, e.g. allowing to go in the depth of meanings, understandability and reproducibility by communities, consistency with theories and others.

Indeed, language explanations are systems, i.e. are composed from nominated realities, *nominals,* and they are symbolic systems, i.e. composed from counits which, in general, can be corresponded to the names of constituents of meanings by voluntary agreements in communities.

While models can be systems, the saying *God explains by realities* suits the models, since well designed models are not only assembled from units immediately presented in meanings they explain through a variety of constituents, but also allow us to continue studying the units to reveal new constituents, e.g. regs, and enrich the meanings.

Then, **we do** follow certain heuristically preferred explanations based on, or concisely inferred from, a minimal number of belief realities, from simple to compound ones, with communalized meanings, or their minimal communalized sub meanings sufficient for understanding.

1.2.4. ***Enhancing Quality of Explanations***

Assuming that model explanations have highest degrees in that ordering **we do** construct models R' of R and adaptively enhance the adequacy of R' to match R' to mR for some members of community C.

For further enhancement of the value of these *personalized* explanations **we do** construct models consistent with theories of C, understandable and reproducible by all members of C.

1.3. ***Towards Consistent, Understandable and Reproducible (cur) Models of Meanings***

What follows **are** explanations of my meanings on certain aspects of our BU game tended to approach the theoretically consistent, understandable and reproducible (*cur*) by all members of community C the model explanations (*curme*) of processing of meanings.

Chains of explanations of meanings we provide to approach cur models, in general, possess all drawbacks of explanations which can affect the efficiency of converging to cur models, and this efficiency cannot be unambiguously optimized since there are no proper measures of efficiency yet.

To minimize drawbacks of explanations as we converge to cur models, **we** follow heuristics of well dressed explanations, including sequential enhancement of their complexities, completeness of communalized meanings sufficient for explanations of new ones, etc.

If explanations of activated personalized meanings can resemble burning stars in the darkness of the space, the chains of explanations resemble a search of smooth pathways of stars to lead communities to cur model explanations.

1.4. ***Presentation and Roots.*** In the next sections we refine utilities and certain base occurrences of meanings, then present models and explanations to conclude with the outline in proving the validity of models, applications induced by projections of BU onto a class of games and a look to the value of the models.

Our models are based on and fuse of achievements of many outstanding people. For learning these achievements in depth we refer to some of their publications [1-8] as well as to some of works [9-16] which can add to understanding of our models.

1.5. Studying of models of processing of meanings in Computing Centre of Academy of Sciences and State University of Armenia (now the Institute for Informatics and Automation Problems) has started since foundation of the Institute in 1957 by Sergey Mergelyan in the Laboratory of "Mathematical Logics" by the team of Igor Zaslavski, a bright follower of Andrey Markov's school, and in the Laboratory of " Armenian/ Russian Machine Translator" by teams of Theodor Ter-Mikaelyan, Vladimir Grigoryan and Robert Urutyan. It is worth recalling the author of a pioneer research and a monograph (1974) in "Meaning-Text-Meaning", Ilya Melchuk, in the Translator team in its beginning.

Since 1973 studying of meaning processing was continued in Laboratory of "Cognitive Algorithms and Models", a branch of Zaslavski's team, with one of research aims in human-computer interface for chess vocabulary initiated by Tigran Petrosyan, the world champion in chess (1963 – 1966).

Simultaneously, since 1998 processing of meanings is studied in frame of the International project on UNL by the team led by Yuri Shoukuryan and Vladimir Sahakyan.

2. REFINING MEANINGS, UTILITIES AND MODELS

2.1. ***Constituents of Meanings***

Meanings **are** realities with identifiers, *names*, and **do** combine with each other by *have, be, do* (hbd) [13] types of links, *relationships* (rels), the subjects to be varied in time, aspects, modality and certain other syntax categories.

Meanings perform distributed or not algorithms including, at least, classifiers of prints and, therefore, classifiers of realities causing those prints.

Meanings **can be** basic or composed from sub meanings inherited and grounded, i.e. induced and relied on some sets of prints, *grounds*.

Basic and composed meanings can be acquired from cultures or expertise while inherited meanings are only basic. Acquired meanings are memorized in *stores of meanings* (SM).

Any set of regs, rels or other constituents of a meaning m are named *aspects* of m.

Apparently, if meanings m and m' have common not empty aspects then m and m' are mutual sub meanings.

Aspects can be identified or not and be processed with or without our awareness of them that can address to consciousness and unconsciousness meaning processing.

2.2. *Awareness* of hbd of ourselves and other realities is implied, particularly, by activation of our meanings or their aspects. While living realities, bacteria, ants, animals, etc., or some technical ones successfully promote their utilities but, seemingly, except humans only some of animals can be aware of hbd of themselves.

2.3. *Rhythmicity.* Prints, meanings and their aspects, other identified units are processed rhythmically in certain elementary discrete time periods, *tacts*, while completion of performances of all those units is regulated by controllers. At time periods, *cycles*, covering completions of activations of units the identifiers of activated units and certain imprints of outputs of those units: values, references to values, etc., are memorized as sequences of *t prints* in the *push-down store of prints* (SP).

Particularly, SP saves the history of activation of units of meaning processing including their cause-effect relationships in the processing.

2.4. *Matching to meanings.* Prints, or causing them realities R, match to a meaning m if they can activate some aspects of m. And R *completely match* to m, or *m is a meaning of R*, if R can activate all aspects of m.

Apparently, meanings and their aspects (*completely*) *identify, classify (completely)* realities matching them as well as classify single prints and causing those prints realities.

And prints /realities k *match* to a meaning m, 0≤k ≤1, if can activate certain aspects of m measured by definite *algorithm of evaluation of matching* to be of the value k (recall the majority and fuzzy sets by S Zadeh).

To measure k matching of a reality r to a meaning m, in general, algorithms have to evaluate what compositions of aspects of m can be found in r.

2.5. *Durable realities.* Realities matching to meanings are "quasi stable in time" durable realities, or *durables.*

We do link prints and meanings to realities of universe while operating with classes of realities, durables, presented by meanings.

2.6. *Realities R', R'' are equal for a member x of a community C* if R, R' match to a meaning m of x.

2.7. *Realities R',R'' are algorithmically equal for a member x of community C* iff R', R'' match to algorithmically equal meanings mR'x and mR''x, correspondingly.

Apparently, R',R'' are equal if mR'x = mR''x.

2.8. *Meanings* let us classify our realities and, at least, by that reason ***are our utilities****, or m-utilities,* and, correspondingly, realities matching meanings turn to be *reality*, or *rm-utilities*.

Meanings identifying, classifying ourselves and our constituents are our *base meaning utilities*, or *m-utilities*, while realities matching base m-utilities, i.e. ourselves and our constituents, are our *innate reality m-utilities,* or *innate rm-utilities*.

Durables R equal rm-utilities or having a capacity to be transformed by some strategies to durables equal rm-utilities are rm-utilities as well, while meanings classifying R become *m-utilities*.

We identify ourselves by base meanings being somewhat, named innate reality utilities, matching base meanings.

Finding strategies to transform durables R to ones equal to our utilities we do utilize R and, thus, expand the totality of our utilities.

2.9. *Constructive valid and adequate models.* Focused, targeted at the time m(rm)-utilities are named *m(rm)-goals.* And not empty aspects m' of a meaning m are *relevant aspects to goals g,* or *relevant gm-aspects* if either g contains the aspects m', or there are chains of rels linking m' with some aspects of g, or there are some other direct or indirect links between m' and g.

A meaning m is a *gm-model of meaning goals g* if m has relevant gm-aspects m' and provides algorithms Ag, at least, classifying matching to m' durables R. These durables R are named *reality gm-models*, or *rgm-models.*

Apparently,aspects m' of a meaning g are gm'-models of g.

If a meaning m is completely communalized and relevant to goals g while algorithms Ag of gm-models m not only classify durables R but also deliver R completely matching m then gm -models are *valid gm-models* while those durables R are named *valid reality gm-models* or *valid rgm-models*.

Valid gm-models are *adequate* if valid rgm-models R delivered by algorithms Ag are equal to reality g-utilities.

Correspondingly, valid rgm-models are *named adequate rgm model*s.

2.9.3. ***gm-models* are z2-*constructive*** if algorithms Ag can construct (compose, assemble) rgm-models (named z2-*constructive rgm –models*) from z2-elementary unit realities.

The variable z2 specifies a scale induced by degrees of both elementariness of units used in constructions of rgm-models and communalization of those units. Those units can range, for example, from min z2 where units are durables R themselves and max z2 where units can be particles revealed at the time (recall, e.g., elementary units processed in nanotechnology models).

For example, ancient Icaria's wings were constructive and valid g-models for Icaria's goal g *flying realities* but they were only partially adequate g-models. At the same time *planes* are completely adequate constructive g-models for *flying realities* and are valid for the constructors of planes while they cannot be valid for some members of C.

3. MODEL AND LANGUAGE EXPLANATIONS OF MEANINGS

3.1. *Explanations of a meaning* xm of a member x of a community C are either

- activated aspects axm of xm, or

-*models of durables* of activated aspects axm of xm, or

- prime counits, i.e. counits in primary languages (*primes*), composed of the names of activated aspects axm of xm, or

-counits of a language L (L counits) corresponded to the prime counits.

3.2. *Activated aspects of meanings* make us aware of realities, including ourselves, and are the base of the meaning processing. United with inherited meanings and activated prints of our expertise they, seemingly, cause "intuitive seeing", "insights" and "gestalt" modes.

Meaning processing of acquired and revealed meanings are conscious or not while inherited meaning might be mainly processed unconsciously. Particularly, Freud, Young, Lev Tolstoy in his book "My Childhood" and Andre Beliy in "Kotik Letaev" refer to their attempts to make inherited meanings conscious.

3.3.*Model explanations* explicitly manifest durables matching to certain examined meanings that allows to communicate even without languages, e.g. in early development of children and, seemingly, humans, as well as in some communities of animals.

We can explain a meaning m to others by providing realities that match to m.

Artifacts, sculptures, drawings, paintings, training motions of coaches, as well as equations in physics, computer simulation programs, etc., are examples of model explanations.

3.4. ***Language explanations***

3.4.1. ***Languages*** are reality models of meanings, i.e. there are certain equivalences between meanings on meanings and meanings on particular languages.

Languages **have** *basic* counits, i.e. certain sets of realities of types of motion, sound, visual, symbols, technology units, etc., and seem assembles of neurons that **can be** corresponded with the names of meanings and their constituents.

Semantics is the correspondence between counits of languages and aspects of meanings. Counits of languages are communalized while aspects can be only personalized and so semantics in its essence is a personalized reality and can be acquired in person only.

Syntax presents the base of semantics by certain counits and their dispositions, the attitude of explainers to realities involved in explanations as well as may be regulation standards of communications.

For example, in written English the basic counits are *alphabets*, *vocabularies,* etc., and syntax rules compose complex counits, *clauses, sentences, phrases, texts* etc., from the basic counits.

English noun and verb groups interpreted by the order of words in clauses, types of verbs, times, aspects, modality, voice, mood and others are distinguished by certain words or groups of letters (hbd words in different forms, -ing, -ed, etc. endings, modal verbs, orders for interrogation, exclamations and narratives, etc.).

Semantics: names of meanings ←→ counits of languages.

ID.s of classes of names of meanings ←→ types of syntax constructions of counits.

3.4.2. ***Prime languages***, seemingly, have counits, semantics and syntax of the first languages **we do** acquire in communities.

Indeed, **we do** acquire meanings of cultures, including languages, by understanding and learning meanings via explanations of meanings provided by the carriers of cultures, the people of communities, and **do** lose cultures with losing their carriers.

And **we do** embody the structures of counits of languages the communities provide to explain meanings into structures of our meanings.

3.4.3.***Specification languages*** of a community C are languages with **c**ounits able to activate common algorithmically equal aspects of meanings of C.

4. UNDERSTANDING OF EXPLANATIONS

4.1. ***Understanding of ourselves.***

Explanations of a member x of a community C to a member y of C assume that x, at least, understands itself.

Explanations EamRx of x are either activated amRx aspects of the meaning mRx on realities R, or counits in a language L corresponded to amRx, or models matching amRx.

For *complete understanding* by x its own explanations EamRx they have to activate all aspects amRx causing EamRx. Otherwise x understands EamRx only *partly*.

We can activate aspects of meanings, to be aware that we understand and successfully process them to find solutions without mapping those aspects into counits. It needs additional efforts to evolve the names of aspects into counits of primes or communication languages as well as to evolve the found solutions into chains of actions.

Recall also partial understanding of explanations of our own thoughts and feelings sometimes or difficulties with understanding of our own texts when we return to them after some pauses.

To minimize discrepancies between amRx and EamRx we modify EamRx by adding to EamRx new counits, correcting models of R, etc., or making efforts in activation of new aspects of mRx to approach to amRx and understand our former writings.

4.2.***Understanding of others.***

Ideally, a member *y of C completely understands explanations EamRx* of x if EamRx activates some aspects a'my of a meaning my of y which are algorithmically equal to amRx.

These aspects a'my can be aspects of the meaning mRy of y on realities R or be aspects of other meanings of y.

Humans understand each other and this phenomenon **we do** argue by

Assumption1. Meanings mRx, mRy can approach their algorithmic equivalency.

Indeed, if x, y would be clones of genetically identical cells and grow up in the same cultures seemingly we would accept Assumption1.

Since humans factually implement a kind of cloning and acquisition of meanings in certain cultures the background of occurrence of algorithmic equivalency of mRx and mRy can be in

- commonality of genes of humans and, corresponding, hardware and software embodying their genes
- commonality of cultures and ways humans acquire them
- independency, in general, of intrinsic to R regs from individuality of members of C studying R.

The more x,y meet these requirements the more mRx and mRy would be algorithmically equal.

Revelation of discrepancies in equivalencies of meanings and their corrections members of C is managed by iterative explanations and feed back control of understanding as well as by *learning of meanings* of each other if they fail to advance in their understanding.

A variety of e/e feedback techniques and heuristics have been developed in education for revelation and elimination of discrepancies in equivalency of a'my/ amRx which can be modeled to be used in applications of meaning processing.

An essential impact to understanding explanations comes from commonalities in languages of communities.

4.3. ***Commonalities in languages*** are implied from commonality of our meanings and universe they present as well as from basic dimensions of promotion of our utilities.

Indeed, proceeding from arguments to Assumption1 we can state that, ideally, meanings of members of communities on the same realities should be algorithmically equal.

Then, observing correspondences between hbd organization of object-oriented algorithms and ones in meanings and promotion of utilities it seems natural to accept that meanings belong to object-oriented type of algorithmic languages (***Assumption2***.).

Indeed, hbd relationships are in the core of promotion of our utilities. All people ***have*** somewhat and exchange them, they classify ***being*** of realities and **do** produce all over for being.

Languages are means to communicate with communities for collaboration and enhancing e/e of promotion of utilities.

Since the base of communications are maps of meanings into counits the commonalities of meanings have to imply commonalities of, at least, syntax of languages (***Assumption3***).

Commonalities of languages imply assumptions of some researchers (recall Chomsky) on genetic predisposition of humans to acquisition of languages while other living realities do not have appropriate genes.

It seems worth also recalling that brains of newborns are already structured and, at least, the right semisphere inherits meanings of our ancestors including predispositions to languages.
Seemingly, experiments of Wolf Messing in perceiving prime counits directly without counits of intermediate languages can add to these asumptions as well.
4.4.*Understanding of humans by computers* is essentially stipulated by the lack of computers in background of humans in the above-mentioned aspects . Many other deficiencies of computers are comprehensively analyzed in [3].
Experiments in acquisition of chess meanings and analysis of their strengths and weaknesses are presented in [11-16].
4.5. *Degrees of explanations*
By communications we do actualize our collaboration with communities aimed to enhance the promotion of our utilities. It is used to assume, especially in science, that consistent with theories, broadly understandable and reproducible model explanations (cur models, or curme) are e/e in supporting the promotion of utilities.
We do accept this ***Assumption 5*** and order other explanations by estimates of their proximity to cur models.
The chains of that ordering might include the following ones:
A chain: A1 activates aspects amx of meaning am of x€C <= A2 = A1+ x, explains A1 by Eamx in its prime and understands Eamx by itself, <= A3= A2+ Eamx are models of x <= A4= A3+: models of A3 that are consistent with theories of C by x <= A5=A4+ models of A4 are reproducible by x <= A6= A5+ models of A5 by x measurably promote the utilities of C.
B chain: B1= A2+ Eamx is explained in a language L of C <= B2=B1+ L, which is a specification language, <= B3= B2 + A4+ models of A4 are consistent **by C** with theories of C <= B4 =B3+ models of B3 are reproducible **by C** <= B5= B4+ models of B4 do measurably promote the utilities of C **by C**.
C chain might include , particularly, the following priorities and recommendations:
- avoid malicious circles
- rely on common expertise and grounds
- be aware on the logics of the inferences of your statements
- follow the syntax of languages
- check layer by layer the completeness of understanding of counits by their hbd dimensions.

Despite Assumption 5 is subjected to criticism including that some phenomena of individuals, like extra sense feelings, can be loosed if require understandability or reproducibility of models by the entire community it is acknowledged that, at present, there are no explanations more e/e/ than cur models.

CONCLUSION

Humans promote themselves in the universe, the totality of their realities while by processing of meanings they enhance the effectiveness and efficiency of the promotion.
"The meaning of it All?" all ever our question was asked again by Richard Feynman in [7].
The paper is a step to explanation of my meaning on the instruments we do gain "the meaning of it all including meanings on ourselves and our universe.
Some of our results in development and processing of meanings including acquisition of meanings by learning, enhancing consistency of meanings by explanations and revelation of meanings are presented in [9-14].
Java models of meaning processing and their applications as well as more references to our results can be found in [9,15,16].

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