ON MEASURABLE MODELS OF PROMOTION OF NEGENTROPIC STRATEGIES BY COGNITION

Pogossian Edward

Abstract*: Could models of mind be independent from living realities but be classified as mind if the mind uses the same criteria to form the class mind? In the paper a constructive view on the models of mind, cognizers, is presented and the measurable criteria and schemes of experiments on mentality of cognizers are discussed.*

Keywords*: modeling, cognition, measures, negentropic, strategies.*

ACM Classification Keywords*: A.0 General Literature.*

1. Introduction

Due mind forms models of any realities including itself raises the question whether models of mind can be mental not being living realties (LR), assembled from LR or developed from the springs of LR?

In other words, whether are models of mind which do not depend from LR but are classified as mind possible if mind uses the same criteria when forms the class mind?

To answer the question constructive models of mind and criteria of measuring their mentality as well as the exhaustive experiments on revealing the truth are needed.

In what follows a measurable approach to the models of mind, cognizers, is presented and the criteria and experiments of testing of mentality of cognizers are questioned.

This approach to refining of cogs continues the approach started in [Pogossian,1983] and continued in [Pogossian,2005,2007] on interpretation of the recognized views on mind [Flavell,1962,Neuman,1966, Botvinnik,1984, Atkinson1993, Pylyshin,2004, Roy,2005, Winograd, 986,Mendler,2004,] by models having unanimous communalized meanings followed by experiments on validity of those models.

The paper describes the author's view on mental behavior and traditionally we should address to the readers by using words "our view" ,"we think», etc.

On the other hand, mental behavior, we assume, is identified with ourselves and we plan to discuss personalized and communalized constituents in communications.

That explains why we find possible in the paper to use the pronoun "I" for the mind along with "we" and "our" when they seem to be appropriate

2. A View on Mind

2.1. I am a *mind* and I am able to interpret, or *model* the *realities* I *perceive,* including myself, evaluate the quality, or *validity* of models and use those models to promote my *utilities*.

The models are composed from cause-effect relationships between realities, particularly between realities and utilities, and any composition of those relationships comprise the *meanings* of the realities.

The basic, or *nucleus* utilities and meanings are inborn while mind incrementally enriches them by assimilating and accommodating by Piaget [Flavel,1962, Mandler, 2004] cause-effect relationships between realities and already known utilities and meanings *solving* corresponding *tasks* and *problems* .

By Piaget "Mind neither starts with cognition of itself nor with cognition of the meanings of realities but cognizes their interactions and expanding to those two poles of interactions mind organizes itself organizing the world" [Flavell,1962].

As much coincide ontology, or *communalized* (vs. *personalized*) meanings of realities with meanings of their models and as much those meanings are *operational*, i.e. allow to reproduce realities having equal with the models meanings, so better is the validity of the models.

In what follows a personalized model of mind, a view W, and a communalized version of W , *cognizers,* are presented with discussion of the validity of cognizers and schemas to meet the requirements.

2.2.1. Minds are algorithms for promoting by certain *effectors* the utilities of *living realities* (LR) in their games against or with other *players* of those games.

The players can be LR, assembles of LR like communities of humans or populations of animals as well as can be some realities that become players because not voluntarily but they affect LR inducing games with environments or the units like programs or devices that have to be tested and response to the actions of engineers . To compare and discuss some hypothetic mental realities like Cosmic Mind by Buddhists and Solaris by Stanislaw Lem are considered as players as well. Note, that descriptions of religious spiritual creatures resemble algorithm ones.

2.2.2. A variety of economic, military, etc. games can be processed by players. But all LR in different ways play the main negentropic games against overall increase of the entropy in the universe [Shrodinger,1956].

In those negentropic games with the environments LR and their populations realize some versified *reproduction* and on-the-job selection *strategy elaboration algorithms* (r SEA).

The parent rSEA periodically generates springs of LR where each child of the springs realizes some particular strategy of survival of those children in on going environments. LR with successful survival strategies get the chance to give a new spring and continue the survival games realizing some versions of strategies of their parents while unsuccessful LR die.

2.2.3. The utilities of LR and their assembles initially are determined by their nucleus, basic interests in the games but can be expanded by new mental constructions promoting already known utilities. For example, the nucleus utilities of LR, in general, include the codes (genetic) of rSEA and algorithms for reconstructing rSEA using their genetic codes.

2.2.4. The periods of reproduction, the power of the springs and other characteristics of rSEA are kinds of means to enhance survival abilities of LR and vary for different LR depending, particularly, from the resources of energy available to LR and the velocity of changes of the environments of LR.

2.2.5. Minds can be interpreted as one of means to enhance the survival of LR. In fact, minds realize SEA but in contrast to on-the-job performance rSEA the strategies elaborated by minds are auxiliary relatively to rSEA and are selected by a priory modeling.

Correspondingly, the nucleus of mental LR in addition to rSEA codes include codes of mind developing algorithms like the adaptation algorithms by Piaget [Flavel,1962, Mandler, 2004].

2.3. Thus, *modeling* SEA, or mSEA, do, particularly, the following:

- form the models of games and their constituents
- classify models to form classes and other mental constructions
- use mental constructions for a priori selection the most prospective strategies for the players
- elaborate instructions for the effectors of players using the prospective strategies.

The effectors transform the instructions into external and internal *actions* and apply to the environments of mSEA and mSEA themselves, correspondingly, for developing the environments and mSEA and enhancing the success of the players.

2.4. Whether are the models of mind which are not dependent from LR but are classified as mind possible if mind uses the same criteria when forms the class *mind*?

To answer to the question constructive models of mind and criteria of measuring their mentality as well as the exhaustive experiments on revealing the truth are needed.

2.5. Let's name *cognizers* the models of mind not depending from LR while the models of mental constructions name *mentals*.

Apparently, this ongoing view W on mind is a kind of cognizers, say, for certainty, *1-cognizers, 1cogs* or *cogs* in this paper.

In what follows a constructive approach to cogs, the criteria and experiments of testing of mentality of cogs are presented.

3. Basic Approaches and Assumptions

3.1. Further refining of cogs extends the approach described above on interpretation of the recognized views on mind by models having unanimous communalized meanings followed by experiments on validity of those models to mind.

3.2.1. Later on it is assumed that cogs are object-oriented programs, say in Java.

All programs in Java are either classes or sets of classes.

Therefore, it is worth to accept that cogs and their constituents, mentals, are either Java classes or their compositions as well.

3.3. Accepting the above stated assumption the experiments on quality of cogs were run for SSRGT games.

Particularly, because chess represents the class and by variety of reasons is recognized as a regular environment to estimate models of mind [Botvinnik,1984, Pogossian,1983,2007, Atkinson,1993, Furnkranz, 2001] in what follows the constructions of mentals and experiments on mentality of cogs are accompanied, as a rule, by interpretations in chess.

3.4. Following to the view W cogs elaborate instructions for the effectors of players to promote their utilities. The effectors in turn transform instructions into *actions* applied to the players and their *environments.* They can be parts of the players or be constructed by cogs in their work.

It is assumed that certain *nucleus* mentals of cogs as well as the players and their effectors are predetermined and process in discrete time intervals while mentals of cogs can evolve in time.

The fundamental question on the origin of nucleus mentals and other structures needs further profound examination.

4. Refining Constituents of Cognizers

4.1.1. In general, *percepts* are the inputs of cogs and have the structure of bundles of instances of the classes of cogs composed in discrete time intervals.

The *realities* of cogs are refined as the causes of their *percepts*.

The *environments* and the *universe* of cogs are the sets and the totality of all *realities of cogs*, correspondingly.

More in details, the bundles of instances of attributes of a class X of cogs at time t are named *X percepts at t* and the causes of X/t percepts are named *X/t realities.*

It is worth to consider *t percepts* and *percepts* as the elements of the unions of X/t percepts and t percepts, correspondingly, and assume that there may be multiple causes for the same percept.

Analogically, *t realities* and *X/t realities* are defined.

In case percepts are bundles of instances of attributes of certain classes of cogs the realities causing them are the classes represented by those attributes.

Otherwise, cogs learn about the realities by means of the percepts corresponded to realities and by means of the responses of those percepts when cogs arrange actions by effectors.

Due cogs are continuously developed they start with percepts formed by nucleus classes followed by percepts formed by the union of new constructed and nucleus classes.

4.1.2. Cogs promote utilities by using links between utilities and percepts. They continuously memorize percepts, by certain criteria unite them in classes as *concepts* and distinguish realities to operate with them using *matching* methods associated with the concepts.

In addition some concepts are nominated by *communicators* to communicate about the realities of the domains of the concepts with other cogs or minds and enhance the effectiveness of operations of cogs in the environments.

4.2.1. The base criteria to unite percepts in concepts are *cause-effect relationships* (cers) between percepts, particularly, between percepts and utilities.

For revealing cers cogs **form and solve** *tasks* and *problems.*

Tasks are requirements to link given percepts (or realities) by certain cers and represent those cers in frame of certain classes.

4.2.2. The basic tasks are the *utility* tasks requiring for given percepts to find utilities that by some cers can be achieved from the percepts. In chess utility tasks require to search strategies for enhancing the chances to win from given positions.

The *generalization*, or *classification* tasks unite percepts (as well as some classes) with similar values into more advanced by some criteria classes and associate corresponding matching procedures with those classes to distinguish the percepts of the classes and causing them realities.

The *acquisition* tasks create new classes of cogs by transferring ready to use classes from other cogs or minds while the *inference* tasks infer by some general rules new classes as consequences of already known to cogs classes.

The *question* tasks can be considered as a kind of formation tasks inference tasks which induce new tasks applying syntax rules of question tags to the solutions of already solved tasks.

The *modeling* tasks require revealing or constructing realities having certain similarities in *meanings* with the given ones.

Before refining meanings of realities let's note that to help to solve the original tasks some approximating them model tasks can be corresponded.

4.2.3. *Problems* are compositions of homogeneous tasks and *solutions of problems* are procedures composing the solutions of constituent tasks.

The problems can be with *given spaces* of possible *solutions* (GSS) or without GSS, or the *discovery* ones.

Tasks formation and *tasks solving procedures* form and solve tasks types.

4.3.1. To refine the meanings of realities and mentals it is convenient to interpret the percepts, uniting them concepts, nucleus classes and the constituents of those mentals as the nodes of the *graph of mentals* (GM) while the edges of GM are determined by utility, cers, attributive, part of and other relationships between those nodes.

Then the *meaning of a percept C* can be defined as the union of the totality of realities causing C and the connectivity sub graph of GM with root in C.

The *meaning of a concept X* is defined as the union of the meanings of the nodes of the connectivity sub graph of GM with the root in X.

The *meaning of realities R* causing the percept C is the union of the meanings of the nodes of the connectivity sub graph of GM with the root in the percept C.

4.3.2. Later on it is assumed that the *knowledge* of cogs unites, particularly, the cogs, GM and their constituents.

4.4.1. Processing of percepts and concepts is going either *consciously* or *unconsciously*. While unconsciousness, usually, addresses to the *intuition* and needs the long way of research efforts for its explanation, the

consciousness is associated with the named concepts and percepts in languages and their usage for communications. Particularly, the vocabularies of languages provide names of variety of concepts and realities causing those percepts.

Mind operates with percepts, concepts and other mentals while names realities causing those mentals when it should communicate.

Particularly, this ongoing description of cogs follows to the rules for named realities while internally refers to corresponding mentals.

4.4.2. When mind operates *internally* with the representations of realities it is always able to address to their meanings or *to ground* those representations [8].

For *external* communications mind uses representations of realities, *communicators,* which can be separated from the original carriers of the meanings of those realities, i.e. from the percepts of those realities, and become *ungrounded*.

The role of communicators is to trigger [12] the desired meanings in the partners of communications. Therefore, if partners are deprived of appropriate grounding of the communicators special arrangements are needed like the ones provided by ontologies. If the communicators are not sufficiently grounded well known difficulties like the ones in human-computer communications can rise.

Note, that if the model R` is a grounded reality the meaning of R' can induce new unknown aspects of the meaning of the original ones.

4.5. Realities R` *represent* realities R, or R` is a *model* of R, if meanings of R` and R intersect.

Model R` is *equal* to R if R' and R have the same meanings. The more is the intersection of the meanings of R and R` relative to the meaning of R the greater is the *validity* of R`. For measuring the validity of models a variety of aspects of the meanings of original realities can be emphasized. Particularly, descriptive or behavioral aspects of the meanings can be considered, or be questioned whether the meanings are views only of the common use or they are specifications.

5. Questioning Validity of Mind

5.1. Modeling problems require constructing realities having certain similarities in meanings with the original ones.

When those realities are problems as well cogs correspond model problems to the original ones, run them to find model solutions and interpret them back to solve the original ones.

Apparently, solutions of problems are the most valid models of those problems but, unfortunately, not always can be found in frame of available search resources.

Valid models trade off between the approximations of the meanings of solutions of problems and between available resources to choose the best available approximations.

Due of that inevitable trade off the models are forced to focus on only the particular aspects of those solutions.

If communication aspects are emphasized the *descriptive* models and criteria of validity can be in use require the realities-models be equal only by communicative means of the communities.

On-the-job or *behavioral* criteria evaluate validity of models by comparing the performances of corresponding procedures.

The records of computer programs provide examples of descriptive models while when processed programs become the subject of behavioral validity. Sorts of behavioral validity provide functional testing and question-answer ones like Turing test.

Productive behavioral validity criteria compare the results of affection of the outputs of realities and their models on the environment. Fun Newman requirement on self-reproducibility of automata [Neuman, 1966] provides an example of productive validity. In its interpretation as *reflexive reproducibility* (RR) validity that criterion requires to construct 1-models of realities able to produce 2-models equal to the 1-models and able to chain the process.

5.2. To formulate criteria of validity of cogs it is worth to summarize the refined to this end views on mind as the following:

mind is an algorithm to solve problems on promotion of utilities of LR in their negentropic games

mind is composed from certain constituent algorithms for forming and solving tasks of certain classes including the utility, classification, modeling, questioning classes

mind uses solutions of problems to elaborate instructions for certain effectors to make the strategies of LR more effective and the environments of LR more favorable to enhance the success of LR in negentropic games.

5.3. Criteria of validity of cogs to mind have to answer whether cogs have meanings that minds have about themselves.

On the long way in approaching to valid cogs a chain of inductive inferences is expected aimed to converge eventually to target validity.

Inductive inferences unite science with arts and, unfortunately, the term of their stabilization can not be determined algorithmically. Nevertheless, what can be done is to arrange those inferences with the trend to converge to the target stabilization in limit [19].

To approach to valid cogs it is worth to order the requirements to the validity of cogs and try to achieve them incrementally, step by step.

The requirements v1- v4 to validity of cogs condition them to meet the following:

v1. be well positioned relatively to known psychological models of mind

v2. be able to form and solve the utility, classification, modeling and question tasks with acceptable quality of the solutions

v.3. be able to use the solutions of tasks and enhance the success of the players

v4. be able to form acceptable models of themselves, or be able to *self modeling*

The requirements v2 - v4 follow the basic views on mind while v1 requires positioning cogs relatively, at least, to the recognized psychological models of mind to compare and discuss their strengths and weaknesses.

Note, that parent minds of LR reproduce themselves in the children minds in indirect ways using certain forms of cloning, heritage and learning procedures.

Some constituents of reproduction of LR can already be processed artificially, i.e. by regular for the human community procedures.

The requirement v4 is questioning, in fact, whether completely artificial minds, cogs, can reproduce new cogs equal themselves and to the biological ones.

5.4. What are the validity criteria to make cogs equal by meaning to mind and whether cogs valid by those criteria can be constructed?

It is a long way journey to answer to these questions and elaborate some approaches to implement.

6. Conclusion

Valid cogs, if constructed, confirm the assertion that mind is a modeling based problem formation and solving procedure able to use knowledge gained from the solutions to promote the utilities of LR in their negentropic games.

Synchronously, mental cogs provide a constructive model of mind as the ultimate instrument for cognition. Knowledge on the nature of instruments for revealing new knowledge gives a new look on the knowledge already gained or expected and raise new consequent questions.

Therefore, revealing by cogs the new knowledge on the instruments of cognition it is worth to question the new aspects of relationships between mind and the overall knowledge mind creates and uses.

Ongoing experiments on study of cogs are based on the technique of evaluating adaptive programs and their parts by local tournaments and use the game solving package with its kernel Personalized Planning and Integrated Testing (PPIT) and Strategy Evaluation units [Pogossian,1983,2005,2007].

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Authors' Information

Head of the Cognitive Algorithms and Models Laboratory at the Academy of Science of Armenia (IPIA) , professor at the State Engineering University of Armenia , Marshall Bagramyan Av.24, Academy of Sciences, Yerevan, 0019, epogossi@aua.am,

Major Fields of Scientific Research: models of cognition and knowledge processing, strategy elaboration, algorithms.