A SEMANTIC BASIS FOR MEANING CONSTRUCTION IN CONSTRUCTIVIST INTERACTIONS

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ABSTRACT

Regarding constructivism as a learning philosophy and/or a model of knowing, a person (learner or mentor) based on her/his preconceptions and on personal knowings could actively participate in an interaction with another person (learner or mentor) in order to construct her/his personal knowledge. In this research I will analyse 'meaning construction' within constructivism. I will focus on a semantic loop that the learner and mentor as intentional participants move through and organise their personal constructed conceptions in order to construct meanings and produce their individual meaningful comprehensions. Subsequently, I will provide a semantic framework for analysing the meaning construction based on personal knowings and personal conceptions within constructivist interactions. This research could propose a new scheme for interpretation based on semantics and on interaction.

KEYWORDS

Constructivism, Interaction, Semantics, Conceptualisation, Interpretation, Meaning.

1. INTRODUCTION AND MOTIVATION

An interaction between learners and mentors as intentional participants could exchange questions and answers concerning, e.g., description, specification, explanation, argumentation, analysing, justification, formulation, theorising etc. The multilevel agreement-oriented interactions among learners and mentors could be considered, be interpreted and be analysed based on the models of the underlying processes involved in complex human learning. As such they could be seen as a radical constructivist account of human cognition and comprehension. They are actually shaping a kind of ontology of human beings. They enable learners (and mentors) to develop their own understandings of the complex real underlying systematic processes, and also of themselves [Scott (2001)]. Learning based on constructivism with reference to Conversation Theory, which is designed by Gordon Pask, the enterprise begins with the negotiation of an agreement between learners and mentors to converse about a given domain and learn about some particular topics and skills in that domain. It could work as an explanatory, heuristic and developmental framework. For more detailed information see [Pask (1975), Pask (1980)]. In fact, learning based on constructivism could heuristically be concerned with the questions focusing on ’What is/does ...?’, ’Why is/does ...?’ and ’How is/does …?’. A person whose insights are based on her/his pre-structural knowledge, personal knowings and preconceptions may ask these heuristic questions and ask the interlocutor to produce some heuristic answers or some modified heuristic questions. What could be offered by learning based on constructivist interaction is a framework for thought and a semantic model to account for the emergence of the domain of human conceptual knowledge. As an abstract model, it is able to explain how the interactions lead humans to construct personal knowledge. In this framework the learner (mentor) manages to construct her/his personal knowledge within interaction. Consequently, s(he) gains an opportunity to attain a deeper personal understanding and greater motivation. According to constructivism, a learner is highly concerned with active ‘creation’ of personal mental structures. Constructivism requires negotiation of ’meaning’ and ’reflection’ of prior and new knowledge. Jean Piaget, the originator of constructivism, argued that all learning was mediated by the construction of ‘mental objects’ that he called schemata. For Piaget, schemata first emerge as concrete actions and then gradually develop into more abstract and conceptual mental entities [Husen and Postlethwaite (1989), Spiro et al. (1991), McGaw and Peterson (2007), Sawyer (2014)].

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In this research I will, from a new perspective, analyse meaning construction as the most significant production of learning based on constructivism. I will analyse the semantic loop that the learner (and mentor) move through in order to construct their personal meanings. I will deal with how the learner (mentor) (i) organises the personally constructed concepts, (ii) produces meaningful meanings and (iii) attains a deeper comprehension. I will finally provide a framework in order to demonstrate different steps of meaning construction based on personal constructed concepts within constructivist interactions.

2. CONCEPT

I emphasise that there is a general problem concerning the notion of 'concept', in linguistics, in psychology, in philosophy, in metaphysics, in computer and information sciences, but, for now, I assume the use of the expression *concept* to be comprehensible in the context. Walter Parker[1] writes: "concepts are the furniture of our minds. A well furnished mind is a source of success and lifelong learning. When a student forms a concept from its examples, he or she knows more than the definition of a term. This is deep conceptual learning rather than superficial knowledge of a vocabulary word." He also says that "a concept is defined by critical characteristics shared by all examples of the concept. For something to be an example of a concept, it must contain all these critical characteristics" [Parker (2008)].

Generally a concept is an unifying theme for something. In ontology a concept is a fundamental category of existence. Following [Margolis and Lawrence (2011)], concepts could be understood as the mental representations, where concepts are entities that exist in the brain. They could also be understood as abstract objects, where objects are the constituents of propositions that mediate between thought, language, and referents. In my research, a concept is an idea which corresponds to some 'distinct entity' or 'class of entities' or to its 'essential features and attributes'. It can determine the application of a term (especially a predicate), and thus plays a part in the use of reason or language [cf. Rudolph (2011), Baader et al. (2003)]. Analytically a concept as a linkage between linguistic expressions and the mental images (representations of the world, of inner experiences etc.) that humans have in their minds [Götzsche (2013)]. I focus on concepts (classes) because concepts and the relationships between them are used to establish the basic terminology adopted in my modelled pedagogical domain regarding the hierarchical structure. For example, relying on Description Logics [Baader et al. (2003)], the concept 'Mentor' can be analysed as a concept description (descriptions mainly follow the inductive rules) that demonstrates the mentor as a person who has a learner and the learner is a person. Formally: $Mentor \equiv Person \sqcap \exists hasLearner.Person$. This concept construction is able to support the formal, explicit specification of a shared conceptualisation of Mentor based on the constructor's conceptions.

3. DEFINITION & DEFINITENESS

A definition could semantically be seen as a kind of equation whose left-hand side is a concept and whose right-hand side is a description. They are used to introduce symbolic names for complex descriptions. In a pedagogical system learners and mentors could define something based upon multiple concept descriptions. Actually, these definitions could be constructed based on their own conceptions and background knowings. Logically, a set of definitions is (and must be) 'explicit' and 'unequivocal', ie. not vague and not ambiguous. In fact, 'explicitness' and 'unequivocality' are the prerequisites and preconditions for definiteness. So, actually, a set of someone's definitions in a category of her/his constructed concepts could provide a backbone for any construction. Then the provided backbone supports the person in defining more complex concepts and descriptions over abstract concepts. Subsequently, the learner (mentor) could employ inductive rules on her/his personal definitions of abstract concepts in order to produce more complex definitions for more complicated described concepts. For example, considering the description '$MaleMentor \equiv Person \sqcap Male \sqcap \exists hasLearner.Person$', the '*MaleMentor*' has been defined by being associated to a description.

[1] http://teachinghistory.org/teaching-materials/teaching-guides/25184

4. SEMANTIC INTERPRETATION

Generally the act of elucidation, explication and explaining the meaning of something is called interpretation [Simpson and Weiner (1989)]. Humans need to attempt to provide a way to determine the truth values of sentences. Linguistically, interpretation is the continually adjusted relation between the conventional meanings of sentences/statements and the actual mental universe of the individual (based on accumulated experience of that individual). Logically, an interpretation is an assignment of meanings to non-logical symbols. For instance, it can not assign meaning to logical symbols {Not (¬) , And (⊓), Or (⊔), Equality (=), Equivalency (≡)}. Actually we can not assign any meaning to a description until the non logical symbols are given interpretations. Considering *C* and *D* as two concepts and *R*(*C,D*) as any possible binary relationship between them, one could have different types of interpretations based on them. More specifically, the interpretation *I* assigns to *C* a set that contains the interpretation(s) of *C,* and it also assigns to *R* a binary relation between the elements of two sets (interpretation(s) of *C* and interpretation(s) of *D*). Actually, in translating from an informal (commonly English) language into a formal language, we need to provide symbolisation keys, which are the interpretations of all the non-logical symbols we use in the translation, see [Prior (1955)]. In case a given interpretation could assign the value TRUE to a sentence (or theory) that interpretation is called a *model* of that sentence (or theory). In fact, designing a proper model can make the definitions adequate.

5. INTERACTION & MEANING CONSTRUCTION

A person who undertakes to learn (train) something within a constructivist interaction primarily focuses on 'concept formation'. S(he) initiates to ask some questions and answer other questions asked by the interlocutor. In my research, the most significant necessity of modelling meaning construction in a constructivist interaction is to consider the personal mental structures (schemata). They have been created regarding what the participants (both learner and mentor) have been affected by. The person inductively develops her/his mental entities. The learner (mentor) finds new concepts for herself/himself. Hearing different words from the interlocutor could be conducive to new conceptions. A person may have formed a concept before participating in the constructivist interaction and then, regarding the feedbacks produced by interlocutor, tackles to reform them. So, in fact, 'forming', 'transforming' and 'reforming' concepts are three significant matters in constructivist interactions. The individual has to 'generalise' from different examples and this may lead her/him to discovering new concept(s). S(he) searches for and lists attributes and properties that can be used to distinguish exemplars from non exemplars of various concepts (classes). But what s(he) really does is more than generalising from different examples that s(he) hears or produces. More specifically, s(he) identifies, specifies and relates the generalised examples and 'compares' different examples. In fact, a very efficient way to form a new concept and induce new categorisation rules in constructivism is to compare a few individuals when their categorical relation(s) is known. On the other hand, s(he) could be able to make her/his personal labels of categorising the concepts in order to direct and employ different classes of concepts.

5.1 The Semantic Process

At the beginning the person proposes some 'schemata' as different types of concrete actions. Then s(he) gradually develops and divides them into more abstract concepts (conceptual entities). A proposed schema describes a pattern of the person's thought. I have already said that s(he) could either categorise different concepts or follow the categorised concepts. So, in fact, her/his proposed schema could support her/him in managing those concepts. I label the first semantic phase *Concept Construction* (presented in the Figure 1), where the individual constructs her/his personal concepts and conceptions based on her/his personal schemata. Subsequently, s(he) needs to focus on the 'reflection' of prior knowledge (what have been acquired/created before interacting) and new knowledge (what is being acquired/created during the interaction) and the initial meanings. So, in fact, s(he) 'searches for the (initiative) meanings' of the class/ classes of constructed concepts and their significant relationships. See *'Search for Meaning'* in the Figure 1. So s(he) defines her/his constructed concepts and searches for the initial definitions for the constructed concepts. Consequently, s(he) focuses on the 'interpretation' of the initial meanings and definitions. From the

logical point of view, the interpretation of a constructed concept is a 'function'. Generally this function assigns a 'meaning' to a 'symbol'. Formally: *Interpretation: Meaning → Symbol*. The Interpretation functions operate the person's definitions based on her/his constructed concepts. Therefore, they 'activate' the meanings. This phase is presented as *Semantic Interpretation* in the Figure 1. Accordingly, concerning *'Interpretation: Meaning → Symbol'*, meaning is the product of the inverse of interpretation function (*Symbol → Meaning*). I label this phase *Meaning Balancing* (see the Figure 1). There is a strong relationship between Semantic Interpretation and Meaning Balancing. The person could be able to balance and adjust the initial meanings based on the interrelationships between 'interpretation' and 'inverse of the interpretation'. The conclusions make an appropriate background for verifying the personally found meanings based on personal constructed concepts. Meaning Balancing is quite supportive in balancing the personal definitions and vice versa, see *'Meaning Formulation'* in the Figure 1. The person formulates the balanced meanings based on the balanced definitions for her/his personal constructed concepts. There is an appropriate relationship between formulated meanings and balanced definitions. In fact, a meaning would be given a better shape after checking the balanced definitions. The formulated meanings organise and reinforce the mental structures that the learner (mentor) uses them, as the pattern of her/his thought, in order to develop the individual conceptual knowledge. Subsequently, the formulated meanings are some applicable prerequisites for *Meaningful Conceptual Structuring* (see Figure 1) upon personally formulated meanings based on personally constructed concepts. On the other hand, the meaningful conceptual structures could induce new formulated meanings on higher conceptual levels (presented by the dashed arrow in the Figure 1). And, furthermore, the new formulated meanings are considered as new schemata in constructing higher levels of conceptions. Finally, the meaningful conceptual structures support her/him in providing meaningful meanings. The meaningful meanings highly reflect on the constructor and support her/him in proposing the modified schemata on higher conceptual levels. So, the person moves through this semantic loop in order to organise her/his personal constructed concepts and construct her/his personal meanings and produce meaningful meanings.

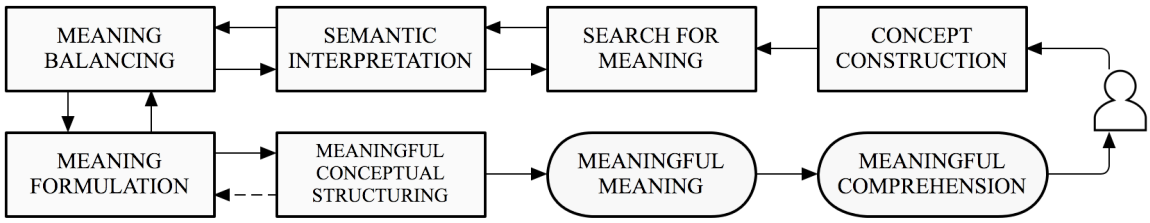

Figure 1. Meaning Construction Within Constructivist Interactions

6. CONCLUSIONS AND FUTURE WORK

Constructivism has been known as a learning philosophy and/or a model of knowing. Concerning constructivism, two persons whose insights are based on their preconceptions and on personal knowings can actively participate in an interaction. The most important objective is to construct their personal knowledge, to learn from each other and to train each other. Therefore, they have an opportunity to attain a deeper personal understanding, comprehension and greater motivation. In this research I have focused on 'meaning construction' as the most significant production of learning based on constructivism. I have worked on a semantic loop that the intentional participant in a constructivist interaction moves through. S(he) constructs her/his personal concepts based on concept formation, defines them (produces individual definitions based on constructed concepts), and organises concepts and definitions in order to construct meanings and produce meaningful meanings. Meaningful meanings support her/him in constructing knowledge, producing meaningful comprehension and reacting more appropriately in front of the interlocutor's acts. I have provided a framework for analysing meaning construction based on individual comprehension and personal

concept constructions within constructivist interactions. In fact, the proposed loop semantically transforms multiple constructed concepts into meaningful meanings (and meaningful comprehensions). It could be observed as a new scheme for interpretation based on semantics and on interpretation. Obviously, the proposed semantic loop is self-organised. Equivalently, it promotes itself on higher conceptual levels.

In future research I will focus on the logical analysis of meaning construction within constructivist interactions and work on its formal semantics. I will employ some fundamental descriptions in Concept Language (Description Logics : DLs) in order to analyse multiple semantic concepts within my progress and provide a DLs based formal semantics for analysing meaning construction in constructivist interactions. Subsequently, I will be concerned with semantically analysing meaning construction based on personal knowings and personal concept constructions in constructivist interactions. I will check the validity of the logical descriptions in conceptualising constructivism concerning the 'Structure of Observed Learning Outcomes (SOLO)'. The consequences will make a backbone for better conceptualisation of human's understanding. And, the results will be employed in the analysis of formal semantics in terminological knowledge for pedagogical knowledge representation systems. They can conceptually analyse pedagogical developments in the framework of constructivism and in the context of interactions for promoting human's understanding.

REFERENCES

A. N. Whitehead, 1929. *The Aims of Education*. Macmillan, The Free Press. New York, NY.

Alexander Borgida, 1994. *On the Relationship between Description Logic and Predicate logic*. Conference on Information and Knowledge Management. ACM - CIKM.

Prior, Arthur N., 1955 - 1962. *Formal Logic*. The Clarendon Press (Oxford University Press).

B. McGaw and P. Peterson, 2007. *Constructivism and Learning*. International Encyclopaedia of Education 3rd Edition, Oxford: Elsevier.

Bernard Scott, 2001. *Conversation theory: A Constructivist, Dialogical Approach to Educational Technology*. Cybernetics and Human Knowing. Imprint Academic: UK.

Elliott Mendelson, 2009. *Introduction to Mathematical Logic*. Chapman and Hall. CRC Press: USA.

Eric Margolis, Stephen Laurence, 2011. Stanford Encyclopaedia of Philosophy

Franz Baader, Diego Calvanese, Deborah McGuinness, Daniele Nardi, and Peter Patel-Schneider, 2003. *The Description Logic Handbook: Theory, Implementation and Applications*. Cambridge University Press.

Gordon Pask, 1975. *Conversation, Cognition and Learning: A Cybernetic Theory and Methodology*. Elsevier Publishing Company, New York.

Gordon Pask, 1980. *Developments in Conversation Theory (part 1)*. International Journal of Man-Machine Studies, Elsevier Publishers.

Hans Götzsche, 2013. *Deviational Syntactic Structures*. Bloomsbury Academic: London / New Delhi / New York / Sydney.

Hans Jrgen Ohlbach, 1985. *Predicate Logic Hacker Tricks*. Journal of Automated Reasoning. Springer.

J. A. Simpson and E. S. C. Weiner, 1989. *The Oxford English Dictionary*. Oxford University Press.

M. Schmidt-Schauß and G. Smolka, 1991. *Attributive Concept Descriptions with Complements*. Artificial Intelligence. Elsevier Science Publishers. Essex. UK.

Parker, W. C., 2008. *Pluto's Demotion and Deep Conceptual Learning in Social Studies.* Social Studies Review; Spring/ Summer2008, Vol. 47 Issue 2, p10.

R. Keith Sawyer, 2014. *The Cambridge Handbook of the Learning Sciences*, Cambridge Handbooks in Psychology - second edition.

Rand Spiro, Paul Feltovich, Michael Jacobson, and Richard Coulson, 1991. *Cognitive Flexibility, Constructivism, and Hypertext. Random Access Instruction for Advanced Knowledge Acquisition in ill-Structured domains*. Educational Technology.

Sebastian Rudolph, 2011. *Foundations of Description Logics.* in Reasoning Web, Semantic Technologies for the Web of Data. volume 6848 of LNCS. Springer.

T. Husen and T. N. Postlethwaite, 1989. *Constructivism in Education*. The International Encyclopaedia of Education, Supplement Vol.1. Oxford/New York: Pergamon Press.