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“Artificial Intelligence (AI) Teaching Approach by Integrating PROLOG into Extended Logical Reasoning on the Base of Stories and Natural Language in the Philosophy of Children Domain: Hands on Application Example by Means of a Logic-Construction-Set.”

Nowadays the Artificial Intelligence (AI) paradigm is increasingly pervading our lives and our working environments. The effects of AI on our world as an increasing Popper’s world III application and implementation, by this, are emanating and increasing the interconnection of world I and II by means of a changing physical environment through AI-devices and a change in consciousness. This, as consequence, leads to different teaching methods and concerns philosophy deeply. The core of this development can be seen two-folded: Firstly by the mechanization of work as a result of the first industrial revolution and secondly by the mechanization of thought by means of machines. Up to the 1970’s the procedural paradigm in programming prevailed. Since then the logic oriented programming was implemented, with PROLOG as an important logical-programming computer language, which realized Wittgenstein’s foundation of language as a collection of thoughts in a language, and the assumption that the natural language is based on logic, equivalent to other formal logic language implementations. By this the logic base, according to the correspondence theory, “Wahr ist was den Tatsachen entspricht”, which goes back to the Aristotelean discovery of logic, is formulated algorithmically as a computer language. In our application case, we use PROLOG, that has mainly declarative use or can be regarded approximately equivalent to the formal logic of predicate logic, which is then called clausal logic. With these properties of PROLOG, it is in principle possible to “speak” (nearly) with the computer application in natural language. The idea of the work presented here is to implement a children philosophy application of logical reasoning, as a backup of the evident mental logic solution, with a PROLOG implementation and hence an algorithmic solution of queries to the story. For this, some examples are given for a part of PIXIE’s children’s philosophy tutorial and its parallel SWI-PROLOG implementation.

The example sentences are analyzed and brought into predicates. Those predicates are then (1) formulated and implemented in PROLOG as the database of knowledge or facts. (2) The logical relations are then implemented in a second step as a rule set, as well as auxiliary conditions and constraints. With this the children philosophical story is set as a data set, containing all the necessary logical content which is stored in a file. (3) Finally, the query is formulated, out of a query as a question in the context of the database of facts as well as predicates and rules are defined. The question itself has a logical structure. The answers can then be compared with the answers that are given by natural language reasoning, based on the same story or sentences. The logical sentence analysis is supported by a material which is designed according to the generalized Montessori principle of Heiden.

For (1),(2) and (3) there takes place a logical analysis of sentences. This is supported by a material, a logic-construction-set, containing plates, which stand for the (i) predicates and their arity (1,2,3..), logical (ii) operators (<and><,><or><;><:-><if then><sentence closing or neutral sign><.><...>) and (iii) words, representing facts, as grounding terms. By this, the means of a tool according to the Montessori principle is applied to the logic-set construction. So first, the logical analysis leads to a transformation according to the PROLOG language, which then is implemented and tested. Pupils can then discover the world of logic by means of reasoning, asking the machine, but also by implementing their increasing, knowledge basis, and by this, experimenting with logical sentences and structures of the natural language.