

Chapter 10

Conclusions

It has been discovered two decade ago that autistic people cannot properly understand and reproduce mental states and emotions. The proposed account of autism, *reasoning engine* \rightarrow *behavior*, is based on the observation that people with autism suffer from difficulties in learning social rules from examples but nevertheless can memorize and apply rules independently. Many remediation strategies have not taken this into account. Therefore an appropriate intervention strategy is to teach not simply via examples but to teach the rule along with it. In this book we suggested a reasoning intervention strategy, based in particular on playing with a computer based mental simulator that is capable of modeling mental and emotional states of the real world. A model of the mental world has been presented in twenty-three steps. We described our implementation of the natural language multiagent system NL_MAMS that implements this model. In addition, we described the system's user interface for autistic intervention. This system was subject to short-term and long-term evaluation of rehabilitation of autistic reasoning. Case studies with children who used it extensively are presented. Implications specifically in terms of autistic rehabilitation as well as generally in terms of reasoning about mental states are discussed.

The main contribution of this book is the model of reasoning about mental world and the simulation means for children with autism to learn this model. The following steps were accomplished in the path from the former to the latter:

1. The theory of mind is subject to a formal treatment from the standpoint of logical artificial intelligence;
2. The possibilities of the theory of mind teaching are re-evaluated, taking into account the developed formal framework for reasoning about the mental world;
3. Appropriateness of formal reasoning as an educational means and associated cognitive issues are assessed;
4. The model of mental world is constructed to serve as a basis for education means;

5. The simulation-based hybrid algorithm of deriving consecutive mental states and its software implementation is designed and evaluated;
6. Theory of mind teaching using this software is evaluated on a short-term and long-term basis;
7. Implications for the practical intervention strategies are analyzed;

Results of short-term and long-term rehabilitation of autistic reasoning have been presented, and we demonstrated the benefits of using the tool in autism intervention centers. We showed that children with NL_MAMS-based training perform better than those without theory of mind training, both in testing environment and interacting with other children in real world. Hence we recommend using the developed tool, NL_MAMS, in autism rehabilitation facilities in various languages across the world, having tested it in “Our Sunny World” center and other organizations. A number of intervention tools and exercises are available at relevance-based-on-parse-trees.googlecode.com/files/autistic_rehabilitation.zip.

A computational approach to studying the phenomena of autism has been introduced. We critiqued modern accounts of autism, proposed a computationally-centered one and explained how a reasoning-based account can assist in understanding the nature of autism as well as in curing it. We also explained how autistic reasoning due to its purity can help computer scientists evaluate their reasoning models. It has been demonstrated that knowledge in a formalized form is more suitable to reproduce the peculiarities of autistic reasoning on one hand and to directly teach reasoning and domain-specific rules to children with autism on the other hand. We outlined the common features of teaching autistic children and computers various forms of reasoning and machine learning. We also discussed how our experience accumulated while teaching children with autism in the above domains can be applied to the design of intelligent software systems.

We showed that CwA are not alone in their problems with reasoning. The real world multiagent systems such as groups of people performing the common goals, partnerships and corporations, as well as engineering AI systems, frequently experience similar difficulties to CwA. In this book we attempted to find a common cure for human and engineering reasoning systems to overcome these difficulties, and demonstrated the remediation results for the former case. Additional material is available at <http://extras.springer.com>.