Distance Learning Rehabilitation of Autistic Reasoning

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INTRODUCTION: THE VALUE OF DISTANCE LEARNING FOR AUTISTIC TREATMENT

Recent psychological studies have revealed that autistic children can neither reason properly about mental states of themselves and others, nor understand emotions (Leslie, 1987; Perner 1991; Pilowsky, Yirmiya, Arbelle, & Mozes 2000). Autism is a multifactor disorder that is characterized by impaired social interaction and communication, combined with repetitive and stereotyped patterns of behavior, and affects up to 1% of school-aged children in some geographic areas. In this article we are concerned with the strategies of rehabilitation of reasoning to improve communication skills of children with autism.

It has been confirmed by multiple clinical studies that the properly timed treatment is essential for the autistic patient to increase the chance for recovery. An early behavioral intervention is highly beneficial for autistic children (Green, 1996; Jensen & Sinclair, 2002; Rogers, 1998). There is an opinion with increasing support by multiple researchers that intensive behavioral intervention (that can be stimulated in distance learning) may result in a dramatic improvement of autistic reasoning (McEachin, Smith, & Lovaas, 1993). From the viewpoint of autism experts who believe that there is no alternative to behavioral intervention (thought of as the only way to facilitate compensatory learning; see, e.g., Frith, 2001; Howlin, 1998), distance learning may be a useful aid for the education of parents and rehabilitation personnel.

Multiple technologies have been suggested to support autistic learning, including playing LEGO (Resnick, 1987), video-clips together with a set of dolls, and autonomous mobile robots. Also, asking questions about mental states of the scene characters, textual scenarios, and characters of the works of literature (Galitsky, 2003) is a good assistance to parents and rehabilitation personnel in the proper diagnosis and training of the corrupted autistic reasoning.

Virtual educational facilities introduced in this article are delivered primarily online, that is, by networks such as the Internet or intranets, using asynchronous technologies such as computer conferencing or Web-based technologies especially customized for education (Hietz, 1995; Nasseh, 1999). These learning technologies enable and support active, collaborative learning approaches, and the software provides tools for: designing courses and developing an interactive course syllabus, conducting individual and group learning activities, and recording and accessing evaluations and grades. In cases of autistic distance learning, collaborative learning is essential for communication skills. Using this technology the learners are encouraged to perform introspection to communicate the fact that they are capable of understanding this very capability of communication (Meyen, Lian & Tangen, 1997).

We outline the reasons of the high rehabilitation value of distance learning:

- Autistic children frequently prefer computer-based interaction than inter-human interaction; also, they enjoy unique content available online to impress their peers.
- Exchange of successful treatment strategies between rehabilitation centers is easier.
- It provides access to treatment for remote communities currently lacking rehabilitation professionals in the proximity of their residences.
- The distance learning infrastructure, augmented with inter-communication framework, would support the interaction between the members of community of autistic children and their parents. This feature on its own is a useful support for developing communication skills of autistic patients, even though it is not the most natural mode of communication.

However, in addition to the requirement of being delivered online, distance learning software for autistic rehabilitation must impress its users by a number of intelligent features. This requirement is due to the fact that in contrast to conventional learning process, such software has to be capable of substituting interaction with humans to a certain degree. Frequently, autistic patients prefer to deal with software agents rather than with humans. These software agents need to demonstrate the reasoning skills, which are expected to be developed by the learners, rather than just to introduce a domain for reasoning.

TEACHING AUTISTIC CHILDREN TO UNDERSTAND THE MENTAL WORLD

Building an adequate formal model of the mental world including emotions is important for teaching individuals whose understanding of mental worlds are (genetically) corrupted and need thorough specification. A non-humanized resource, readily acceptable by autistic children, is used to introduce them to the mental world (of humans) via formalized reasoning. The paradox of our methodological principle is that the reasoning in the mental world, usually supposed to be irrational and displayed as an emotion, can nevertheless be considered from an abstract perspective, formalized and used as a training means. This hypothesis (Galitsky, 2002) is used to form the backbone of our rehabilitation strategy to develop the rational and emotional behavior in the real mental world.

Our model of the corruption of human reasoning is based on the supposition that there are a number of standard axioms for mental entities; these axioms are genetically set for normal children and are corrupted in the autistic brain (Galitsky, 2002). The patterns of corruption vary from patient to patient and are correlated with the specifically outlined groups of autistic children. The simplest of such axiom is not see, therefore not know, highlighted in the so-called Sally-Anne test (Baron-Cohen, Leslie, & Frith, 1985).

The children with autism have to acquire these axioms explicitly, by means of direct training, using a variety of ways to introduce intentions, beliefs, knowledge, and other attitudes of agents and relations between these attitudes. Teaching of such axioms may occur in both formal and natural languages; some of the patients prefer the former over the latter. Frequently,

autism is not accompanied by learning disabilities, so the patents willingly participate in training programs of distance learning.

Our practical experience shows that using software-based training allows us to hold the attention of autistic patients for much longer periods than the traditional means of one-to-one treatment by a human. Conventional rehabilitation is always associated with the problem of keeping a patient in a responsive mode. Since for the autistic patients the strict rule-based learning is usually much easier than the direct introduction of the various forms of reasoning about the mental world, the latter is achieved via the former. The methodology of using artificial mental reasoning systems for rehabilitation is based on teaching autistic children the "mechanical" forms of reasoning about the mental world, because the attempts to directly introduce the emotional interaction with the others in a natural manner (e.g., teaching by examples, imitating) frequently fail.

EXERCISES FOR DISTANCE LEARNING

In this section we present a set of exercises that are available online and used in rehabilitation centers in cities across Russia (see Figures 1-4). The common goal of these exercises is to encourage a trainee to focus on such mental entities as intention, knowledge, and belief, as well as cheating and pretending, offending and forgiving, and so forth. In accordance to our underlying formal model of the mental world (Galitsky, 2003), an arbitrary mental state or action can be defined in the basis of intention, knowledge, and belief. Autistic children are encouraged to learn these definitions in a formal or informal way, using formulas, user interface controls of the software systems, or in the natural language. Then the software means are used to evaluate how the definitions were acquired, to perform generalization and abstraction of the perceived entities, and to stimulate its application to the real mental world.

Having been explained the entities of offending and forgiving, a patient is encouraged to build his or her definitions of the above basis, using list box controls to choose from the available set of mental actions, temporal parameters, negations, and other modalities.

The mental attitudes of characters are schematically drawn to illustrate their inter-dependence and attachment to an individual (Figure 2). An automated question answering system (Galitsky, 2003) is used to

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