

We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

186,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com



Constructing Healthy Experiences through Human-Animal Interactions for Autistic Children and Their Families: Implications for Research and Education

Alina S. Rusu

Additional information is available at the end of the chapter

<http://dx.doi.org/10.5772/65395>

Abstract

A significant body of research in the field of animal assistance in autism spectrum disorder (ASD) therapy indicates that positive human-animal interactions (HAIs), such as playing with therapy dogs or dogs presence while reading Social Stories, improve the social interactions and the level of the behavioral indicators of positive moods (smiling, laughing) in autistic children. In this chapter, we aim to present a series of evidence-based modalities of including animal-assisted activities in standard therapeutic settings but also in the home environment (e.g., interactions with family animals), targeting the socio-emotional development of autistic children and their optimal communication with the family members, including the companion animals. The studies presented here are discussed from the perspective of potential mechanisms, such as oxytocin system, and several attachment-related views. Our studies point toward the valorization of companion animals in the process of development and optimizing the interpersonal communication abilities of ASD children in a positive and engaging manner for both humans and animals.

Keywords: human-animal interactions, animal-assisted enhanced therapy, autistic children, socio-emotional skills

1. Introduction

A significant body of research in the field of animal assistance in the therapy of autism spectrum disorders (ASD) indicates that positive human-animal interactions (HAI), such as playing with therapy dogs or dogs presence while reading Social Stories (SS), have the

potential to improve the social interactions at level of displaying behavioral indicators of positive moods (smiling, laughing) in autistic children [1, 2]. It appears that the direct contact with life forms other than humans, especially companion animals, has a modulatory effect on the psychophysiological parameters associated to social interactions [3, 4]. In this light, oxytocin, which is a hormone produced in the hypothalamus, has been considered an optimal candidate for the investigation of the beneficial psycho-physiological effects of friendly interactions with animals in general population and in ASD children [3]. It is hypothesized that the interaction between the hypothalamic-pituitary-adrenal (HPA) axis and the oxytocin system might be the central neurobiological mechanism behind the beneficial psychophysiological effects of the positive HAI, such as stress reduction and facilitation of social extroversion. Physical contact is considered a classical marker of secure attachment and caregiving relationship, and it is often assumed that oxytocin system might be activated in situations that involve direct physical contact, such as play with peers or positive human-animal interactions [3, 5]. Also, the effect of a friendly animal on the perception of the human in its company and on the facilitation of interpersonal interactions is known in the literature as *the social catalyst effect* [3].

Experts in the area of HAI management indicate a large and growing number of companion animals within EU countries, including Romania, i.e., there are an estimated number of 64 million cats and 60 million dogs in EU countries [6]. While it is well known that companion animals can make crucial contributions to human societies as working animals, a growing scientific body of evidence supports the benefits of animals in human healthcare, especially in the case of socially impaired children (ASD children). Recent statistics indicate a prevalence of autistic children and adolescents in Romania of around 15,000 [7]. Also, there is a growing interest of autism-oriented associations toward the inter-professional educational and therapeutic methods, such as animal-assisted therapy (AAT) and activities. Based on this growing interest of professionals in the field of autism toward the benefits of positive human-animal interactions, in this chapter, we aim to present a series of evidence-based studies that have investigated several modalities of including positive animal-assisted activities in standard therapeutic settings targeting the socio-emotional development of ASD children. The modalities presented here can be easily designed and implemented in the home environment of ASD children (i.e., interactions with other family members and resident companion animals).

2. Social Story in the presence of dogs: an animal-assisted enhanced method

The first study to be described in this chapter combines an already validated method addressing the social skills of ASD children, i.e., Social Story (SS) method [8], with the presence of therapy animals (dogs). The method of designing and incorporation of the dog presence in the Social Story procedure will be presented, as well as the ways of assessing significant outcome variables at behavioral level. Animal-assisted interventions (AAI) have started to be approached by specialists designing therapeutic programs for children with social impairments, such as ASD children, which appear to perceive and comprehend animal communication better than the human communication [9, 10]. It is generally acknowledged that one of the most important deficits that ASD individuals experience across their life span is the impairment in

social abilities [11]. Recently, several authors in the ASD field suggested that the use of all the possible elements of social environment, including companion animals, should be considered when planning therapeutic interventions for ASD children [10]. Our study [1] describes for the first time in the ASD literature the effects and the procedure of implementing the dog presence in the Social Story method [12], under the form of a low-cost and short-term intervention (3 months), with significant results on the social ability development of ASD children.

It is generally acknowledged that humans and animals (especially companion animals) tend to naturally establish connections based on attachment, empathy, and affection [5]. The human-animal bond is considered to be an authentic one if the following criteria are met: (1) it involves a continuous relationship, not a temporary one and (2) it brings reciprocal benefits on humans and animals [5, 13]. There is evidence that ASD individuals appear to better perceive and comprehend animal nonverbal communication than the verbal and nonverbal human communication [10], which might indicate that dogs communicate their intentions on a level that ASD children find easier to understand [9].

When directed toward a specific objective and delivered in a structured and documented manner, animal-assisted activities become components of animal-assisted therapy [5]. According to Delta Society [14], which is one of the most active organizations in the field of therapeutic HAI, animal-assisted therapies (AATs) are goal-directed interventions, which are delivered by a health/human service professional with specialized expertise and within the scope of practice of his/her profession. AATs include animal-assisted activities aiming to improve the physical, social, emotional, and cognitive functioning of several categories of persons [5, 13], and it can be incorporated in a large variety of standard procedures for physiological recovery, attention-related problems, speech-related problems, depression treatments, successful aging programs for institutionalized elderly persons, etc. [15, 16].

In the case of ASD children, specialists agree that social impairment does not necessarily imply a lack of desire or interest of children to socially interact, but rather a lack of necessary social skills to successfully carry out social interactions [11]. In this direction, several types of interventions are focusing on improving the social skills of ASD children, and among them, Social Story [8] is one of the most popular methods used in special education in general and in the treatment of autism, in particular. Social Story (SS) method aims at providing ASD individuals with the social information and procedural knowledge they lack and thus helping them develop appropriate behaviors in social interactions and interpersonal relationships [8, 17]. It is assumed that SS provides a learning environment that might help the children to better understand and internalize appropriate social behavioral elements [18]. Over the last decade, several authors have evaluated and validated the effectiveness of the SS method in decreasing the frequency and the intensity of several problematic behaviors, such as aggression, screaming, grabbing toys, and crying [17], and in increasing the frequency and intensity of desirable behaviors, such as greeting and sharing things, playful behavior, etc. [11]. In many of these studies, SS has been used either as a sole intervention [11] or combined with other interventions, such as verbal and pictorial prompts, reinforcement of appropriate responses, robot-assisted programs [19], and various priming strategies [20].

In line with the trend depicted in the ASD literature of developing enhanced therapy plans, we performed an exploratory investigation entitled *Interaction with a therapy dog enhances the effects of Social Story method in autistic children* [1], aiming to combine the Social Story method [12] with naturally occurring elements that are supposed to be socially relevant to autistic individuals, such as therapy dogs. The main hypothesis was that a social environment heterospecifically enriched by the presence of a therapy dog while reading a Social Story might improve the effectiveness of the method at level of increasing the social abilities of ASD children. Two social skills were targeted: (1) the ability to greet a social partner and (2) the ability to introduce oneself to a social partner, following a standard *single-subject research design*. This exploratory investigation took place at a Romanian therapy center for ASD children (Transylvania Autism Association). Each participant had one 15-min intervention session per day (i.e., Social Story or Social Story plus dog presence), twice per week, for a period of three month (March–June 2012). An individualized Social Story was designed for each participant by the child's therapist together with the experimenter, by using Gray's construction guidelines [12]. A Labrador retriever dog, Arwan (male, 2 years), and his handler were involved in the study (the team was certified in AAT). Prior to the study, the AAT team had several visits to the Autism Day Center.

The dependent variables were the following: (1) frequency of appropriate social interactions relevant to the target social skill, (2) level of prompt needed to provide the expected social response, and (3) frequency of initiations of the social interactions relevant to the target social skill. Hypotheses were constructed for each of the variable, assuming that, compared to the sessions in which the Social Story was solely administrated, the enhanced version of the SS (SS plus dog presence) will be associated with a higher frequency of the appropriate social interactions, a lower level of prompt provided by the therapist (Note: A total level of prompt was considered here, comprising the sum of verbal prompt, gestural prompt, and the combination of the two; the lack of prompt was also recorded; for a detailed description of the coding system of the prompt, see Ref. [1].) and a higher level of initiations of appropriate social interactions. The following events were considered as appropriate social interactions: (a) any verbal, physical, or gestural appropriate response to the presence of a social partner; (b) any comment or a relevant question addressed to a social partner; (c) any appropriate response to questions or comments of a social partner; and (d) any direct eye contact or at least a look toward a social partner [11].

The exploratory study included three single case experiments, each one consisting of a succession of three phases (phases A, B and C). In the phase A (i.e. the baseline phase), each child was observed for 15 minutes of social interactions that required the usage of a specific social skill, which was aimed to be improved by the phase B (i.e. the Social Story method) or by the phase C (i.e. SS plus dog presence). For each participant, the Social Story was introduced prior the observation period. After six sessions, the intervention was withdrawn to the baseline condition. All the sessions were video-recorded and analyzed frame by frame for the extraction of behavioral data.

The analysis of the *frequency of the appropriate social interactions* relevant to the target social skills revealed that, for the first participant, the frequency did significantly improve from a mean

value of 0.33 (SD = 0.51) in the baseline to a value of 5.16 (SD = 0.75) in the first phase of the SS plus dog presence intervention ($U = 0.00, p < 0.05$). The withdrawal of the SS plus dog presence intervention was associated with a decrease in the frequency to a mean value of 3.33 (SD = 0.51), followed by a nonsignificant increase when the SS intervention was introduced in the phase C. The size effect when comparing the two interventions had a high value (Cohen's $d = 0.83, p < 0.05$). For the other two participants, no significant increase in the frequency of the appropriate social interactions neither after the introduction of the SS intervention nor after the introduction of the SS plus dog presence intervention was registered.

The results on the *level of prompt needed to provide the expected social response* indicated that, for the first participant, as soon as the SS plus dog presence intervention was introduced, there was a significant decrease in the total level of prompt, from a mean value of 5.00 (SD = 0.00) to a value of 0.66 (SD = 0.81) after the first intervention (phase C; $U = 0.00, p < 0.02$). When the SS plus dog presence intervention was withdrawn, the level of prompt did increase (mean value = 2.50, SD = 0.51), yet it remained lower than the baseline values (Cohen's $d = 0.47; p < 0.05$). For the second participant, the data showed a decreasing trend during the initial baseline, but not significant. When the SS intervention was introduced (phase B), the decrease in the level of prompt was observed (mean value = 1.50, SD = 0.83). At the subsequent withdrawal of the SS intervention, the value of the level of prompt did not change, indicating no treatment reversal. When SS plus dog presence was introduced in phase C, the level of prompt decreased to a mean value of 0.66 (SD = 0.51), but with no significance. For the third participant, the SS plus dog presence intervention was associated with a significant decrease in the level of prompt. The value of the prompt level continued to significantly decrease throughout the SS plus dog presence intervention, compared to the baseline phase (U Mann-Whitney = 4.5, $p < 0.05$).

The results on the *frequency of the initiations of social interactions* indicate that, for all the three participants, no initiations were registered in the baseline phase. In the case of the first participant, the SS plus dog presence intervention was associated with a significant increase in the frequency of the initiations (mean = 2.33, SD = 0.11; U Mann-Whitney = 0.00, $p < 0.05$). After the introduction of the SS intervention, a small but nonsignificant increase in the frequency of the social initiations was observed compared to the baseline level. For the second participant, there was no significant difference in the level of the social initiations between the baseline and the SS intervention (phase B). The introduction of the SS plus dog presence intervention was marked by an increase in the frequency (mean value for phase A = 0.16, SD = 0.40; mean value for phase B = 0.16, SD = 0.40; mean value for phase C = 2.0, SD = 0.89). In the case of the third participant, SS intervention was associated with a slight, but not significant increase in the frequency of social initiations, whereas the introduction of the SS plus dog presence intervention was associated with a sudden and significant increase in the frequency (mean = 2.33, SD = 0.81). The frequency of the social initiations was significantly higher in the Social Story plus dog presence intervention than the second baseline phase (U Mann-Whitney = 1.5, $p < 0.05$). The comparison of the SS and SS plus dog presence interventions indicated a high-effect size for all the three participants (Cohen's $d = 0.83$ for the first participant, $d = 0.92$ for the second one, and $d = 0.79$ for the third participant, $p < 0.05$).

In conclusions, the findings of this exploratory investigation of the effects of the combined methods SS plus dog presence indicate that the presence of the therapy dog was associated with a statistically significant increase in the frequency of the social initiations for all the participants and a significant decrease in the level of prompt needed to perform the specific social tasks in two of the participants in the study. The frequency of the appropriate social interactions appeared to significantly increase in the dog presence only in one out of the three participants in the study. It is important to mention that, in this study, the aim was to explore the minimal elements (i.e., the presence of the animal) needed for inclusion of a trained dog in the therapeutic context, without any other exercises, such as active playing on specific commands. In summary, our findings suggest that the presence of a dog while reading a SS is a low-cost method that can bring significant improvements to the Social Story therapy method, by increasing the frequency of social initiations and by decreasing the level of prompt that ASD children usually need from their therapists to perform appropriate social interactions. The findings presented here come in line with the results of previous studies on the effectiveness of animal-assisted therapy in enhancing the social motivation and communication of autistic children [21, 22].

3. Active participation of dogs in therapy of ASD children: dog-assisted functional play

The next study refers to the investigation of the effects of *active participation* of therapy dogs in the functional play of autistic children, targeting the development of their imitation skills, task performance, and communication with others. ASD children are often characterized by deficits in social abilities, narrowed or lack of motivation for different activities, and the presence of repetitive behavioral patterns [23]. Also, compared to their typically developed peers, ASD children are often described as having limited playing abilities, and when engaged in leisure activities, they often tend to rely on the help of others [24].

Playing behavior is often considered in the literature as providing opportunities to practice already acquired abilities or to acquire new ones in a safe and encouraging environment [25]. Functional play (which is related to the cognitive development) is defined as the specific use of an object or conventional association of several objects in the context of everyday life activities in the direction of developing functional individual autonomy [26]. In ASD children, the deficits in the capacity to pretend are related to a series of difficulties in the following abilities: (1) realize the need for reciprocity, (2) recognize different interpretations of actions, and (3) use imagination [24]. Another deficit of the ASD children, often placed within the category of theory of mind that might impair their ability to play and to properly interact within the play context, is their impaired ability to recognize that other persons make different interpretations of the events, according to their own knowledge and experiences [27, 28].

Play is considered to offer an optimal context to learn about social aspects, such as trust, negotiation, and compromises, as well as to explore the environment and to perceive its physical and social safety [29, 30]. During the symbolic play, typically developed children tend

to explore social roles and rules in order to build a common understanding language with their play partner [30]. Because ASD children are generally known to have a low motivation level to share experiences, their imagination capabilities and the symbolic communication do not always appear to be reflected in their playing activities [24]. Hence, compared to the playing behavior of typically developed children, the play of ASD children is short in duration, and it has fewer functional and symbolic play sequences [27]. Also, the ASD children show lower levels of appropriate use of objects [31], less variety in play, and fewer functional and age-appropriate activities [32], as well as the tendency to use repetitive and precise verbal and/or gesture elements, which are rarely spontaneous [33, 34]. Although they may engage in symbolic play, ASD children often appear not to realize the need to motivate their social partners to play with them, and even in the case of verbally functional ASD children, they tend to display a passive participation in the play [34]. The term motivation refers here to the child's observable behavioral reactions to external stimuli, so that increased motivation is reflected by an increased responsiveness to social and environmental stimuli, as well as by a short latency of response to elements of the social interaction repertoire, such as instructions and questions [35].

The passive participation in play of ASD children, along with their low level of motivation to get involved in the social interactions that are normally expected to take place during play [35], is often interpreted as indifference to ambient stimuli [36]. Compared to typically developed children, ASD children appear to assess social stimuli in an atypical manner and tend to pay more attention to objects than to people [37]. Also, common indicators of joint attention, such as eye contact with other humans during social interactions, as well as spontaneous initiations of activities, are less frequent or less visible in the case of ASD children [38]. These deficits are being associated in the literature with a low level of general social motivation, i.e., *the social motivation model*, which can be observed from early childhood, and it might have consequences on the development of other aspects of their social life later on [39–41].

In order to develop social skills that are typical for a certain chronological age, especially in relation to the play behavior, which represents one of the most positive and basic ways of social interactions in humans and it has a significant moderating value of the family cohesion and of the individual quality of life, early therapeutic interventions are seriously considered in the case of ASD children. There is a consensus in the literature regarding the importance and benefits of early therapeutic interventions targeting the development and improvement of social skills in autistic children, including their playing abilities [42]. In this regard, literature analysis reveals a wide variety of therapeutic approaches, such as applied behavior analysis (ABA), peer-mediated intervention [43], robot-assisted therapy [19], video modeling, and Social Stories [12]. These methods can be efficient by themselves, or they can be administered in an enhanced form of combinations of elements and procedures. For example, the efficiency of Social Story method (originally developed by Gray [12]) can be enhanced at level of efficiency by the assistance of the therapist by a social robot who tells the Social Story while automatically expressing emotions [19] or by the presence of a therapy dog while reading the Social Story and asking the ASD children several comprehensive questions [1].

Literature in the field of ASD treatment supports more and more the positive effects of including therapy dogs in the therapeutic plans of ASD children aiming to improve their socio-emotional skills, especially because the interaction with animals is usually constructed on the species-specific playful and exploratory behavioral tendencies of the dogs, as well as on their evolved abilities to understand human emotions, which are expressed at verbal and nonverbal levels [44, 45]. In a play context (ball game, playing with a stuffed animal, and playing with a real dog), ASD children manifested an increased frequency of social initiations with the therapist in the condition of playing with the dog [46]. In another study that incorporated playing activities with dogs in a 15-week program of standard occupational therapy [47], data indicated a higher frequency of social initiations in the case of ASD children in the experimental group than those from the control group (occupational therapy). However, most of the studies cited above do not refer to the possibility of including the positive interactions with companion and/or therapy animals in the functional plays which children tend to naturally display during childhood and which are commonly incorporated in the educational curricula of children with special needs in the direction of improving their functional autonomy in everyday life situations.

The aim of the present study was to investigate the efficiency of actively including a therapy dog in the functional play of ASD children, by using a *randomized clinical trial* type of design. Based on the positive results regarding the efficiency of dog presence in Social Story method [1], the functional play of *bathing a doll* was incorporated in a SS scenario, in which the instructions and questions were specially adapted to the context of bathing (the SS was identical for the experimental and control groups). The bathing theme, which is an important component of nurturing behavior and human quality of life, was chosen based on autonomy-related needs identified by the therapists of the ASD children. Functional play consisted in “bathing the doll” game, in which the object of bathing was a medium-size doll and a real dog (experimental group), respectively, a doll, and a toy dog, similar in size to the real dog (control group).

The hypotheses were the following: (1) the play-related task performance of ASD children in the experimental group (functional play with a real dog) will be higher than the task play-related performance of ASD children in the control group (functional play with a toy dog). The play-related task performance was assessed by the frequency of imitations of the therapist's movements and the frequency of physical and verbal answers to the instructions and questions included in the adapted SS scenario; (2) the level of motivation to participate in the play of the children from the experimental group will be higher than the children from the control group (response latency to instructions and questions and frequency of the joint attention events).

The study included 20 children from the Day Center of Transylvania Autism Association (Romania). Participation of each child was based on informal consent signed by the parents. The study was conducted by two master students, under the supervision of the author, in collaboration with the psychologist of the Day Center. The ASD children (age between 3 and 9 years) had no allergies to animals or history of aggression with dogs. The playing session took place in the occupational therapy room of the Day Center, which was a carpeted room with a surface of 12 m². The therapy dog (Loki) was a male cocker spaniel, 8 years old, certified

for animal-assisted therapy. The handler, who was also a psychologist, participated in all the play sessions. Loki was specially included in this study due to his high level of willingness to positively interact with children (playing with toys, retrieving the ball, playing football, etc.).

The experimental procedure consisted in eight functional play sessions for each ASD child (two sessions/week) and three follow-up sessions (two months after the post-intervention phase), with the length duration of 15 min (in average)/session, with slight variations depending on the behavioral particularities of each child. The first two sessions allowed us to establish a basal level for each of the dependent variables and to distribute the children in a randomized manner in the experimental ($N = 10$) and control ($N = 10$) groups. The children from the control group were then individually administered the functional bathing game (bathing the doll and a toy dog) and a Social Story adapted to the bathing situation, several comprehensive questions on the utility and components of bathing, while the experimental group was administered the functional game (bathing the doll) and bathing-related activities with a real dog. The social scenario was similar for both groups of ASD children.

The structure of the functional play consisted in a set of specific items, such as a toy bath tube, a comb, a brush, a towel, and a toy bottle of shampoo, which were introduced to the child alongside a protocol of 28 steps, embedded in a bathing-related Social Story. The protocol included 10 instructions (e.g., *open the shampoo bottle; let's brush the hair of the doll; let's brush the fur of the dog.*), five contextual questions (e.g., *what do you need to wash the hair of the doll? How do you brush your hair?*), and four imitation tasks (e.g., *look, can you do like I do?*). For each task, the child was expected to offer a verbal and/or physical response in a maximum of 5 s; After 5 s, in the absence of an answer, the therapist was allowed to prompt the child toward the optimal answer (i.e., prompt was offered either verbal, gestural, or in a combined version). The dependent variables related to the efficiency of the functional play in the two conditions (functional play with a toy dog and functional play with a real dog) were *play task performance* and *motivation to participate in the play*.

Play task performance was assessed by (1) the frequency of physical answers to the instructions, (2) frequency of imitations of the therapist's movements (after the instruction to imitate was given), and (3) frequency of verbal answers to the questions included in the protocol. *Frequency of physical answers to the instructions* refers to the numbers/sessions of the proper physical responses of the ASD children to the instructions given by the therapists, in accordance to the intervention protocol. *Imitation* refers here to the voluntary copying of the therapist's movement by the child, following the therapist's instruction, regardless of the level of familiarity with the movement [48]. In the case of children with motor disabilities, successful imitation is also counted for the partial copying of the movement, not only for the complete copying. *Frequency of verbal answers to the questions* refers to the numbers/sessions of the proper verbal responses of the ASD children to the instructions given by the therapists, in accordance to the intervention protocol. A latency period of 5 s was assigned for the answer to appear. After 5 s, the therapist was allowed to offer a prompt to the child in the direction of the proper answer.

Motivation to participate in the functional play was assessed by (1) response latency to verbal questions (latency lower or equal to 5 s, i.e., verbal answers without any prompt from the

therapist) and (2) the frequency of joint attention events. Motivation to participate in the play refers to the child's enthusiasm and tendency to direct his/her playing-related interests to others, in order to develop the social interaction context needed for the play to take place [49]. *Response latency* was assessed by the time in seconds of the verbal and/or physical response of the child from the moment the therapist was giving a verbal instruction, a question, or an imitation task. After 5 s of waiting for an answer to occur, a prompt was offered by the therapist in the direction of the proper answer. The frequency of responses with latency lower than 5 s was counted for each session. *Joint attention* was measured by the frequency of voluntary eye contact of the child with the therapist during each play session. All the play sessions were recorded based on the informal consent signed by the parents. The first two play sessions were considered the pre-intervention phase, followed by six sessions. Among these six sessions, the last two were considered the post-intervention phase. After 2 months, another two sessions were conducted, which are considered the follow-up phase. Statistical analysis was conducted in order to reveal the differences between the control and the experimental groups on each of the dependent variables.

3.1. Effects of playing with real dog on the play task performance

The results on the *frequency of physical answers to the instructions* indicated that the two groups of ASD children started from similar frequencies of physical answers of children to the instructions of the therapist (Mann-Whitney test, $U = 43$, $Z = -0.53$, $p = 0.56$), while in the post-intervention phase, a significant difference between groups was recorded ($U = 14$, $Z = -2.78$, $p < 0.05$), in the favor of the experimental group. The effect of the interactions with the real dog was statistically significant (Cohen's $d = 1.44$). In the follow-up phase, the difference between groups was also significant ($U = 7.5$, $Z = -2.82$, $p < 0.05$, Cohen's $d = 1.73$). For the experimental group, we recorded a statistical difference between pre- and post-intervention phases at level of the frequency of physical answers to the instructions ($\chi^2 = 13.24$, $p < 0.05$), while no statistical difference was recorded for the control group between the phases. For the experimental group, the effect of the interaction with the real dog on the physical answers to the instructions was preserved from the post-intervention phase to the follow-up phase ($Z = -0.37$, $p = 0.7$).

The analysis of *frequency of imitations* in the pre-intervention phases indicated that the two groups started from similar levels of frequency ($U = 43.50$, $Z = -0.51$, $p = 0.6$), while in the post-intervention phase, the experimental group manifested a significantly higher frequency of imitations than the control group ($U = 1$, $Z = -2.75$, $p < 0.05$, Cohen's $d = 1.41$). In the follow-up, the difference between groups remained in the same direction and significant ($U = 6.5$, $Z = -3.09$, $p < 0.05$, Cohen's $d = 1.58$). While no significant evolution was recorded for the control group, the post hoc analysis for the experimental group revealed a significant improvement at level of frequency of imitations from pre-intervention to post-intervention ($Z = -2.04$, $p < 0.05$) but without statistical significance from post-intervention to the follow-up phase ($Z = -0.99$, $p = 0.31$).

Data collected on the *frequency of verbal answers to questions* in the pre-intervention phase indicated no differences between the two groups ($U = 39.50$, $Z = -0.81$, $p = 0.639$). Also, in the post-intervention phase, no significant difference between groups was registered ($U = 25.50$,

$Z = -1.38, p = 0.166$), as well as in the follow-up phase ($U = 22, Z = -1.38, p = 0.168$). No statistical differences were registered for the two groups from the pre- to post-interventions and for the post-intervention to the follow-up phase.

3.2. Effects of playing with real dog on the motivation of ASD children to participate in the play

The analysis of the *response latency to verbal questions* revealed that the two groups started from similar levels of response latency to verbal questions in the pre-intervention phase (Mann-Whitney test, $U = 46, Z = -0.3, p = 0.57$), while in the post-intervention phase, a significant difference between groups was recorded, with the experimental group having lower values of the response latency to verbal questions ($U = 10.5, Z = -2.98, p = 0.003$, Cohen's $d = 1.78$). The difference between groups in the post-intervention phase was also statistically significant ($U = 2, Z = -3.28, p < 0.05$, Cohen's $d = 2.61$). Statistically significant differences were registered for the experimental group of ASD children between the pre- to post-intervention phases ($\chi^2 = 12.40, p < 0.05$) and between the post-intervention phase and the follow-up. No significant differences were registered for the control group between the phases.

The two groups (control and experimental) started from similar levels of *frequency of joint attention episodes* (eye contacts with the therapist in the context of the functional play) in the pre-intervention phase ($U = 34, Z = -0.93, p = 0.34$). Significant differences were registered in post-intervention ($U = 23, Z = -2.06, p < 0.05$), indicating that the ASD children from the experimental group had a higher frequency of joint attention episode than those from the control group (Cohen's $d = 0.87$). While for the control group there were no significant differences between phases, for the experimental group, there was a significant difference between the post-intervention and the follow-up ($Z = -2.53, p = 0.01$), but not between the pre- and post-interventions.

The aim of the present study was to investigate the efficiency of actively including a therapy dog in the functional play of ASD children, by using a randomized clinical trial type of design. The theme of bathing process, which is an important component of nurturing behavior and human quality of life, was chosen based on autonomy-related needs identified by the therapists of the ASD children. Functional play consisted in "bathing the doll" game, in which the object of bathing was a medium-size doll and a real dog (experimental group), respectively, a doll, and a toy dog, similar in size to the real dog (control group). Our results indicated a significant positive effect of playing with the therapy dogs (comparisons between the experimental and control groups) at level of the following variables: frequency of physical answers to the instructions offered by the therapist in the context of the adapted social scenario to the bathing game, frequency of imitations (playing with the real dog was associated with a higher frequency of imitations than the condition of playing with a toy dog), response latency to the verbal instructions (ASD children from the experimental group, even though did not differ significantly in the frequency of verbal responses from the control group, had a shorter latency to respond to the verbal instructions), and frequency of joint attention episodes (ASD children that played with a real dog had significantly higher frequency of joint attention episodes in the post-intervention phase than the children in the control group). To summarize, the active

interaction with the real dog in the context of functional play was associated with a significant improvement of the indicators of motivation of ASD children to participate in the play and to maintain the social interactions with the therapist during this activity. Because the active interaction with the dog involved direct contact with the animal, we can conclude that our data support the hypothesis of social catalyst effect of positive human-animal interactions [3].

Besides the quantitative data presented above, several qualitative data provided by the parents of ASD children indicated that some of the children expressed willingness to participate to the therapy sessions where the real dog was present and, in one case of a child with motor disability, his ability to stand up (gross motor skills) has improved due to his motivation to move closer to the dog during the interactions. Some of the ASD children were also reported to show a higher interest toward their family pets (dogs and cats), and they were more willing to participate in games and other activities involving the animal and their siblings or other family members, such as fetching the ball games or brushing and feeding the dogs. To summarize, functional play for ASD children can be significantly enhanced in terms of efficacy by the active inclusion of therapy animals (in therapy or educational settings) or of resident companion.

While in this study, the interaction with the dog took place indoor (the occupational therapy room) and it was included in the specific steps of the adapted Social Story scenario, in the next study, we aimed to investigate the association of active playing with behavioral indicators of positive moods in ASD children of two types of outdoor positive human-animal interactions, such as (1) active playing with dogs in a structured manner (i.e., agility type of exercises, in an organized spatial environment) or (2) in a free style (playing fetch the ball, football, running around, and walking the dog). Also, in this study, we aimed to investigate not only the behavioral indicators of positive affects in humans but also in dogs, by using methods from ethology (the scientific study of animal behavior), such as focal animal sampling and sequential analysis.

4. Agility exercises for ASD children and their families: free-style play or structured activities?

While most of the families with children, including children with special needs, tend to adopt companion animals, not all of them are aware of the importance of spending quality time with their pets in activities involving direct contact (play, agility), which is an important prerequisite of the benefits of social catalyst effect of animals in human life to occur [50]. Positive interactions between humans and dogs, such as play, petting, talking to the dog [51], or even prolonged eye contact [52], are known to be associated with health benefits for both species. It is generally acknowledged that animal assistance can provide opportunities for motivational, educational, recreational, and/or therapeutic benefits to enhance the quality of life of humans, especially in the socio-emotional skills' development of children with autism.

There are studies indicating that in the case of ASD children, "there is low baseline cardiac parasympathetic activity with evidence of elevated sympathetic tone" [53, 54], which might

predispose them to express high levels of stress and anxiety. However, there is a growing scientific evidence of the positive outcomes of interactions with animals in many dimensions of the social life of ASD children, such as increase in frequency of imitations during functional play; increase in initiations of social interactions; decrease in the number, duration, and intensity of stereotypic behaviors [1, 55]; as well as decreased social anxiety [21]. Hence, a possible explanation of the positive effects of human-animal interactions in the case of autistic children is that the parasympathetic nervous system (PNS) becomes activated through the positive interactions with the animals, which are known to be more tolerated by ASD children (as a presence and as object of active interactions) than human individuals [54]. Although dogs are known for their evolved abilities for understanding human facial and vocal emotions [44, 45], they may encounter difficulties when interacting with human individuals with deficits at level of expressing emotions, such as ASD children. Such difficulties might be associated with signs of stress in animals that might impair not only the efficiency of the therapy interventions but also the well-being of the therapy animals and their motivation to further participate in assistance activities.

The aspect of well-being of dogs involved in animal-assisted interventions has become of great concern for specialists designing this type of interventions, which are more and more aware that interactions with sentient beings involve responsibilities for their biological needs [56]. In this regard, assessment techniques (behavioral, physiological, or combinations) to assess the well-being of therapy animals are highly recommended. Several authors investigating the stress indicators concluded that working long hours with no breaks was associated with high level of cortisol (stress hormone) in therapy dogs [57, 58]. Familiarity with the therapy environment was associated with a decrease in the cortisol level in therapy dogs [58].

In the present study, we aimed to investigate the effect at level behavioral indicators of positive affects in ASD children and dogs of two types of outdoor activities with dogs, which can be easily organized in the open spaces of any institution or in the home courtyards. The first type of activity was a structured one, inspired from the agility sport, in which a handler directs a dog through an obstacle course, without touching or leading the dog in a leash. In the case of autistic children, the structure activity was adapted to their special needs, so that a double leash was provided, one for the handler and one for the child. Hence, the structured activities are placed within the category of para-agility (i.e., the dog is directed not only by the handler but also by a person with special needs). The structured activities were implemented in collaboration with a local dog training school (Cluj-Napoca, Romania), within a research grant on the improvement of socio-emotional abilities of ASD children. The second type of activity consisted in free-style interactions, such as walking the dog (by using a double leash) and playing fetch the ball and football with the dog, in an *ad hoc* succession of playing and walking. During playing, the leash of the dog was removed by the handler, who was present during the whole session. The two types of activities were compared in terms of frequency of behavioral indicators of positive affects (e.g., smile and laughing for the child, tail wagging and petting acceptance for the dog).

Having in mind that interactions with animals offer continuous possibilities for positive design and behavioral engineering of healthy human and animal life experiences, this is an explora-

tory investigation of two types of dog-children outdoor interactions, aiming to identify the optimal associations of activity sequences and behavioral indicators of positive affects in human and animals in order to offer further guidelines for constructing optimal human-animal interactions in both institutional (therapy and educational) settings and in home environment.

Eleven children diagnosed with autism (ages between 4 and 12 years, enrolled at the Day Center of Transylvania Autism Association (Cluj-Napoca, Romania) participated in the program, based on informal consent signed by their parents. Prescreening for their inclusion in the animal-assisted activities indicated no allergies and no history of aggression with animals. All the families of the children had animals at home (dogs and/or cats). Each child was able to communicate using verbalization and each of them was able to walk. The program took place outdoor, in the courtyard of the Day Center, from April to July 2015. Six certified therapy dogs of different breeds (three Australian shepherd, one male and two females; one female beagle; one male cocker Spaniel; and one male former stray dog) together with their handlers participated in the program. All the dogs belonged to the Pet Joy Dog Training School (Cluj-Napoca, Romania). The handlers were certified in AAT, with previous experience on working with ASD children.

Before the beginning of the program, two visits of the dogs were organized at the Center, so the children had the chance to familiarize with the presence of the animal-assisted therapy teams. Each session had duration of 20 min, with slight variations. In the structured interaction sessions (SIS), after a demonstration offered by the handler and the dog, the dog was individually led by the children through an agility arena, consisting of a line of five obstacles and a play tunnel (3 m length). The handler was always present next to the child, as well as the therapist (the last one intervenes only when the child did not understand the guidance offered by the handler or when the child specifically asked for help). The structured sessions were designed in a way that encouraged positive human-animal interactions, so that the children were instructed to verbally praise the dog after each segment of the agility course and to offer small items of food reward (after a short previous training on how to properly offer dry food to the dogs). Also, depending on their time availability, parents were invited to assist the sessions and qualitative feedback was collected from them (perception of the utility of exercises, perception of signs of joy and motivation to play expressed by their children compared to other activities, etc.). In the unstructured interaction sessions (UIS), the dog and child were allowed to walk and play freely (fetch the ball, football, or other types of play-related activities), being closely supervised by the handler and the therapist from the Day Center. Dog walking was done with the help of a double leash system, which was gradually removed, and only one leash remained attached to the dog's collar. The succession of SS and SS was randomly established for each child, but they were always delivered within the same time interval of 2 h/day.

The behavioral indicators of the positive affects in children and of the lack of distress in dogs were selected from previous studies found in the literature, in which significant associations were found between several behavioral elements and physiological markers of stress, such as gazing into dog's eyes was associated with the activation of parasympathetic nervous system [52]; petting and playing with the dog were associated with oxytocin release and decrease in

cortisol [51, 59]; laughter and smile were associated with dog presence [1]. The behavioral indicators (activity, gestures, and postures) of positive affects in children toward the dogs were coded as it follows [54]: petting the dog, reaching for the dog, touching the dog, playing with the dog (usually the play involved activities such as throwing the ball by hand or hitting the ball by foot, in order for the dog to fetch it or to push the ball with the nose), gazing into the dog's eyes, smiling while interacting with the dog, and laughing while interacting with the dog. The behavioral indicators of positive affects of dogs toward children were considered the following: playing with the child, gazing into the child's eyes, acceptance of being touched, acceptance of being petted, and tail wagging while interacting with the child.

Each session was video-recorded, based on the informal consent signed by the parents of the ASD children [54]. The recorded materials were analyzed frame by frame using continuous sampling and focal individual observations. Among the recorded sessions, those that allowed the extraction of data (high-quality records) were 28 structured interaction sessions (SIS) and 13 unstructured interaction sessions (UIS) for the extraction of behavioral indicators of children toward the dogs and 27 SS and 7 US for the extraction of behavioral indicators of the positive affects of dogs toward children. For each session, the behavioral indicators were registered as sequences (one sequence followed by another), and chains of sequences were generated for each session. Transition matrices between behavioral sequences were generated for each session, allowing for the calculation of relative frequencies of occurrence of each behavioral indicator per time unit, i.e., 60 s. The relative frequencies of behavioral indicators of positive affects in children and dogs were then compared between structured and unstructured sessions.

The analysis of the results is presented in summary (for details on the results, see [54]). Even though the one-way ANOVA analysis revealed no statistically significant differences between the behavioral indicators of positive affects of dogs toward children (SIS, $N = 22$, $m = 1.42$, $SD = 0.41$), in the unstructured sessions (walking, playing fetch and football), dogs expressed more behavioral indicators of positive affects toward children (UIS, $N = 7$, $m = 1.66$, $SD = 0.42$) than in the structured sessions (SIS, $N = 28$, $m = 1.42$, $SD = 0.41$). Data on the behavioral indicators of positive affects of children toward dogs, although with no statistical significance (one-way ANOVA, $F = 0.60$, $p = 0.44$), indicated that the mean value in the structured sessions (SS, $N = 28$, $m = 1.78$, $SD = 0.45$) was higher than in the unstructured ones (UIS, $N = 13$, $m = 1.66$, $SD = 0.72$).

Our findings indicated that the structured human-animal positive interactions (para-agility exercises) were associated with higher mean values of the behavioral indicators of positive affects displayed by the ASD children toward the dog, whereas the free play style (unstructured interactions) was associated with a higher mean value of the positive behaviors displayed by dogs toward the children. It is important to mention that para-agility exercises involved more guidance from the handler compared to the free-style interactions with the dogs. The guidance from the handler might have functioned as gestural and verbal prompts for the children, who, as a consequence, might tended to pay more attention to the handlers than to the dogs. This aspect might be considered of important educational and therapeutic value in

terms of mediating the development of interpersonal interactions (child handler) in a playful environment, in which the main action agent is the animal.

Another important aspect revealed by our data in terms of considering it for designing future positive ASD children-animal interactions is that each type of session had specific predominant behavioral indicators of the positive affects [54]. For example, in the structured sessions (SS), the predominant behavior of children toward the dog was petting the dog (i.e., direct contact with the dog), while in the unstructured sessions, the predominant one was playing with the dog by using the toys provided. Hence, in the case of ASD children, we can conclude that a structured environment of HAI is associated with higher opportunities of direct contact with the animals. As pointed out in the literature, the direct contact with animals is an important prerequisite for psychophysiological positive effects of animal assistance to occur, i.e., release of oxytocin and decrease in stress hormones. Also, in the case of structured sessions, the dogs accepted more petting behavior from ASD children than in the case of unstructured sessions, in which they responded to the play invitations and/or initiated the play, but they received a lower level of petting and touching. Also, in the unstructured sessions, dogs had more eye contacts with the handlers than with the children, as they were looking for a security base during the interactions.

Further studies are necessary to assess the physiological indicators of positive affects in children and animals in order to compare the similarities and differences in terms of facilitating the positive affects in children and animals. This preliminary study [54] indicates that both types of interactions (structured and unstructured activities) were associated with behavioral indicators of positive affects of humans toward animals (smiling, laughing, petting) and of animals toward humans (acceptance of petting, initiations of play, eye contact). Even though the sample size was a small one, the results of this investigation indicated that one should consider a *combination of both types of exercises* when designing outdoor animal-assisted activities for ASD children in institutions or at home, in the direction of creating the chance for healthy experiences to occur for both humans and animals. Agility routes can be easily set up in any type of environment, by using low-cost elements to build up mazes and/or simple barriers to be crossed by dogs. Besides the therapeutic value that animal assistance is known to have upon the socio-emotional development of ASD children, the animal-assisted structured activities such as para-agility have the potential to increase the motivation of ASD children for physical activity.

In line with the existing literature, the studies presented in this chapter indicate positive results of the incorporation of animal assistance in standard therapeutic methods for ASD children and also in play-type interactions, which can be easily organized at institutional level or at home, together with their family members, including the resident companion animals. Recent surveys indicate that dogs are the most common pets in Romania [60] and that they are affordable companion animals to families with children with special needs, such as autistic children. In this light, the findings of the studies presented in this chapter represent valuable guidelines of designing low-cost and efficient animal-assisted interactions, taking into considerations the well-being of both humans and animals. Our studies point toward the valorization of companion animals in the process of developing and optimizing the interper-

sonal communication abilities of ASD children in a positive and engaging manner for both humans and animals. Also, it is important to consider that, in order to optimally implement animal-assisted activities by professionals and parents of ASD children, appropriate theoretical and practical knowledge of the principles of human-animal interactions and zoonotic risk management are mandatory. These healthy principles addressing the quality of life of both humans and animals are often found under the umbrella of *One Health concept*, which implies a multidimensional and inter-professional partnership between specialists and beneficiaries of human-animal interactions, in the direction of promoting human and animal well-being [61].

Acknowledgements

The first and the second studies were supported by the research grant PN-II-RU-TE-3-2011-3-0080 (director: Alina S. Rusu). The third study was supported by the research grant PN-II-PT-PCCA-2013-4-0781 (director: Alina S. Rusu). The author would like to thank all the research team members (master students, PhD students, and research assistants) that have contributed to the data collection, analysis, and elaboration of the papers cited in this chapter. A special thank goes to the personnel of Transylvania Autism Association for facilitating the access to the ASD children and their families, as well as to the teams (handlers and dogs) of Pet Joy Dog Training School, Cluj-Napoca, Romania.

Author details

Alina S. Rusu

Address all correspondence to: alina.rusu@ubbcluj.ro

Faculty of Psychology and Sciences of Education, Babeş-Bolyai University, Cluj-Napoca, Romania

References

- [1] Grigore AA, Rusu AS. Interaction with a therapy dog enhances the effects of social story method in autistic children. *Society & Animals*. 2014 Apr 22;22(3):241–61.
- [2] Prothmann A, Bienert M, Ettrich C. Dogs in child psychotherapy: Effects on state of mind. *Anthrozoos: A Multidisciplinary Journal of the Interactions of People & Animals*. 2006 Sep 1;19(3):265–77.

- [3] Beetz A, Uvnäs-Moberg K, Julius H, Kotrschal K. Psychosocial and Psychophysiological effects of human-animal interactions: The possible role of Oxytocin. *Frontiers in Psychology*. 2012;3:1–15.
- [4] Wilson E.O. *Biophilia*. Cambridge, MA: Harvard University Press; 1984.
- [5] Chandler CK. *Animal Assisted Therapy in Counseling*. London, United Kingdom: Routledge; 2011.
- [6] Home. Home [Internet]. 2015 [cited 2016 Aug 17]. Available from: <http://www.callis-toproject.eu/joomla/>
- [7] Europe A. Latest news [Internet]. 2016 [cited 2016 Aug 17]. Available from: <http://www.autismeurope.org/>
- [8] Gray CA, Garand JD. Social stories: Improving responses of students with autism with accurate social information. *Focus on Autism and Other Developmental Disabilities*. 1993 Apr 1;8(1):1–10.
- [9] Hirschfeld LA, Gelman SA. *Mapping the Mind: Domain Specificity in Cognition and Culture*. Cambridge: Cambridge University Press; 1994.
- [10] Prothmann A, Ettrich C, Prothmann S. Preference for, and responsiveness to, people, dogs and objects in children with autism. *Anthrozoos: A Multidisciplinary Journal of the Interactions of People & Animals*. 2009 Jun 1;22(2):161–71.
- [11] Scattone D. Social skills interventions for children with autism. *Psychology in the Schools*. 2007;44(7):717–26.
- [12] Gray C. Carol Gray – social stories; [Internet]. 2016 [cited 2016 Aug 17]. Available from: <http://carolgraysocialstories.com/about-2/carol-gray/>
- [13] Fine AH. *Handbook on Animal-Assisted Therapy: Theoretical Foundations and Guidelines for Practice*. 2nd ed. Amsterdam: Elsevier/Academic Press; 2006.
- [14] Fredrickson M, Howie AR, Burch M, Shay E, Albert T. *The pet partners team training course: A Delta Society program for animal-assisted activities and therapy*. 5th ed. Renton, WA: The Society; 2000.
- [15] Nimer J, Lundahl B. Animal-assisted therapy: A meta-analysis. *Anthrozoos: A Multidisciplinary Journal of the Interactions of People & Animals*. 2007 Sep 1;20(3): 225–38.
- [16] Chitic V, Rusu AS, Szamoskozi S. The effects of animal assisted therapy on communication and social skills: A meta-analysis. *Transylvanian Journal of Psychology [Internet]*. 2016 Mar 2 [cited 2016 Aug 17];13. Available from: <http://connection.ebscohost.com/c/articles/79980461/effects-animal-assisted-therapy-communication-social-skills-meta-analysis>

- [17] Kuoch H, Mirenda P. Social story interventions for young children with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*. 2003 Jan 1;18(4):219–27.
- [18] Sansosti FJ, Powell-Smith KA, Kincaid D. A research synthesis of social story interventions for children with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*. 2004 Jan 1;19(4):194–204.
- [19] Vanderborght B, Simut R, Saldien J, Pop C, Rusu AS, Pintea S, et al. Using the social robot probio as a social story telling agent for children with ASD. *Interaction Studies Social Behaviour and Communication in Biological and Artificial Systems*. 2012;13(3): 348–72.
- [20] Crozier S, Tincani MJ. Using a modified social story to decrease disruptive behavior of a child with autism. *Focus on Autism and Other Developmental Disabilities*. 2005 Jan 1;20(3):150–7.
- [21] O’Haire ME. Animal-assisted intervention for autism spectrum disorder: A systematic literature review. *Journal of Autism and Developmental Disorders*. 2012 Nov 5;43(7): 1606–22.
- [22] Solomon O. What a dog can do: Children with autism and therapy dogs in social interaction. *Ethos*; 2010 Mar;38(1):143–66.
- [23] Association the AP, Association AP. *Diagnostic and statistical manual of mental disorders, text revision (DSM-IV-TR)*. 4th ed. Arlington, VA: American Psychiatric Association; 2000.
- [24] Hobson RP. Understanding self and other. *Behavioral and Brain Sciences*. 2004 Feb; 27(01):109–110.
- [25] Naber FBA, Bakermans-Kranenburg MJ, van Ijzendoorn MH, Swinkels SHN, Buitelaar JK, Dietz C, et al. Play behavior and attachment in toddlers with autism. *Journal of Autism and Developmental Disorders*. 2007 Sep 26;38(5):857–66.
- [26] Ungerer JA, Sigman M. Symbolic play and language comprehension in autistic children. *Journal of the American Academy of Child Psychiatry*. 1981 Mar;20(2):318–37.
- [27] Baron-Cohen S, Leslie AM, Frith U. Does the autistic child have a “theory of mind”? *Cognition*. 1985 Oct;21(1):37–46.
- [28] Yirmiya N, Solomonica-Levi D, Shulman C, Pilowsky T. Theory of mind abilities in individuals with autism, down syndrome, and mental retardation of unknown Etiology: The role of age and intelligence. *Journal of Child Psychology and Psychiatry*. 1996 Nov;37(8):1003–14.
- [29] Ainsworth MDS. The Bowlby-Ainsworth attachment theory. *Behavioral and Brain Sciences*. 1978 Sep;1(03):436.

- [30] Casby MW. The development of play in infants, toddlers, and young children. *Communication Disorders Quarterly*. 2003 Jan 1;24(4):163–74.
- [31] Freeman BJ, Ritvo ER, Schroth PC. Behavior assessment of the syndrome of autism: Behavior observation system. *Journal of the American Academy of Child Psychiatry*. 1984 Sep;23(5):588–94.
- [32] Mundy P, Sigman M, Kasari C. A longitudinal study of joint attention and language development in autistic children. *Journal of Autism and Developmental Disorders*. 1990 Mar;20(1):115–28.
- [33] Jordan R. Social play and autistic spectrum disorders: A perspective on theory, implications and educational approaches. *Autism*. 2003 Dec 1;7(4):347–60.
- [34] Sherratt D, Peter M. *Developing Play and Drama in Children with Autistic Spectrum Disorders*. London: David Fulton Publishers; 2001.
- [35] Koegel RL, Bradshaw JL, Ashbaugh K, Koegel LK. Improving question-asking Initiations in young children with autism using pivotal response treatment. *Journal of Autism and Developmental Disorders*. 2013 Sep 7;44(4):816–27.
- [36] Sigman M, Dijamco A, Gratier M, Rozga A. Early detection of core deficits in autism. *Mental Retardation and Developmental Disabilities Research Reviews*. 2004 Nov;10(4):221–33.
- [37] Sasson NJ, Turner-Brown LM, Holtzclaw TN, Lam KSL, Bodfish JW. Children with autism demonstrate circumscribed attention during passive viewing of complex social and nonsocial picture arrays. *Autism Research*. 2008;1(1):31–42.
- [38] Petrina N, Carter M, Stephenson J. The nature of friendship in children with autism spectrum disorders: A systematic review. *Research in Autism Spectrum Disorders*. 2014 Feb;8(2):111–26.
- [39] Dawson G, Toth K, Abbott R, Osterling J, Munson J, Estes A, et al. Early social attention impairments in autism: Social orienting, joint attention, and attention to distress. *Developmental Psychology*. 2004;40(2):271–83.
- [40] Schultz RT, Grelotti DJ, Klin A, Kleinman J, Van der Gaag C, Marois R, et al. The role of the fusiform face area in social cognition: Implications for the pathobiology of autism. *Philosophical Transactions of the Royal Society B: Biological Sciences*. 2003 Feb 28;358(1430):415–27.
- [41] Chevallier C, Kohls G, Troiani V, Brodtkin ES, Schultz RT. The social motivation theory of autism. *Trends in Cognitive Sciences*. 2012 Apr;16(4):231–9.
- [42] Howlin P. Practitioner review: Psychological and educational treatments for autism. *Journal of Child Psychology and Psychiatry*. 1998 Mar;39(3):307–22.

- [43] Hundert J, Rowe S, Harrison E. The combined effects of social script training and peer buddies on generalized peer interaction of children with ASD in inclusive classrooms. *Focus on Autism and Other Developmental Disabilities*. 2014 Feb 27;29(4):206–15.
- [44] Andics A, Gácsi M, Faragó T, Kis A, Miklósi Á. Voice-sensitive regions in the dog and human brain are revealed by comparative fMRI. *Current Biology*. 2014 Mar;24(5):574–8.
- [45] Albuquerque N, Guo K, Wilkinson A, Savalli C, Otta E, Mills D. Dogs recognize dog and human emotions. *Biology Letters*. 2016 Jan;12(1):20150883.
- [46] Martin F, Farnum J. Animal-assisted therapy for children with pervasive developmental disorders. *Western Journal of Nursing Research*. 2002 Oct 1;24(6):657–70.
- [47] Sams MJ, Fortney EV, Willenbring S. Occupational therapy incorporating animals for children with autism: A pilot investigation. *American Journal of Occupational Therapy*. 2006 May 1;60(3):268–74.
- [48] Volkmar FR, Cohen DJ. *Handbook of Autism and Pervasive Developmental Disorders, Diagnosis, Development, Neurobiology, and Behavior*, volume 1, 3rd ed. Volkmar MFR, Paul R, Klin A, editors. New York: John Wiley & Sons; 2005.
- [49] Landreth GL, Homeyer LE, Glover GJ, L GL, Sweeney DS. *Play Therapy Interventions with Children's Problems: Case Studies with DSM-IV Diagnoses*. reth LH, editor. New York, NY, United States: Jason Aronson Inc. Publishers; 1996.
- [50] Beetz A, Julius H, Turner D, Kotrschal K. Effects of social support by a dog on stress modulation in male children with insecure attachment. *Frontiers in Psychology*. 2012;3:1–9.
- [51] Odendaal JS., Meintjes R. Neurophysiological correlates of affiliative behaviour between humans and dogs. *The Veterinary Journal*. 2003 May;165(3):296–301.
- [52] Nagasawa M, Mitsui S, En S, Ohtani N, Ohta M, Sakuma Y, et al. Oxytocin-gaze positive loop and the coevolution of human-dog bonds. *Science*. 2015 Apr 16;348(6232):333–6.
- [53] Ming X, Julu POO, Brimacombe M, Connor S, Daniels ML. Reduced cardiac parasympathetic activity in children with autism. *Brain and Development*. 2005 Oct;27(7):509–16.
- [54] Pop D, Rusu AS, Miresan V. The development of a canine Para-Agility program: Positive affects in children with autism and in therapy dogs. *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca Animal Sciences and Biotechnologies*. 2016 Feb;73(1):1–6.
- [55] Redeker LA, Goodman JF. Brief report: Pet-facilitated therapy with autistic children. *Journal of Autism and Developmental Disorders*. 1989 Sep;19(3):461–7.

- [56] Podberscek AL. Positive and negative aspects of our relationship with companion animals. *Veterinary Research Communications*. 2006 Aug;30(S1):21–7.
- [57] Haubenhofer DK, Kirchengast S. Physiological arousal for companion dogs working with their owners in animal-assisted activities and animal-assisted therapy. *Journal of Applied Animal Welfare Science*. 2006 Apr;9(2):165–72.
- [58] Glenk L, Kothgassner O, Stetina B, Palme R, Kepplinger B, Baran H. Therapy dogs' salivary cortisol levels vary during animal-assisted interventions. *Animal Welfare*. 2013 Aug 1;22(3):369–78.
- [59] Handlin L, Hydbring-Sandberg E, Nilsson A, Ejdebäck M, Jansson A, Uvnäs-Moberg K. Short-term interaction between dogs and their owners: Effects on oxytocin, cortisol, insulin and heart rate – An exploratory study. *Anthrozoos: A Multidisciplinary Journal of the Interactions of People & Animals*. 2011 Sep 1;24(3):301–15.
- [60] Cocia RI, Rusu AS. Attitudes of Romanian pet caretakers towards sterilization of their animals: Gender conflict over male, but not female, companion animals. *Anthrozoos: A Multidisciplinary Journal of the Interactions of People & Animals*. 2010 Jun 1;23(2):185–91.
- [61] Evans BR, Leighton FA. A history of one health. *Revue Scientifique et Technique de l'OIE*. 2014 Aug 1;33(2):413–20.