

Dolphin-Assisted Therapy: Changes in Interaction and Communication between Children with Severe Disabilities and Their Caregivers

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ABSTRACT The goal of this study was to test if dolphin-assisted therapy could be an effective therapeutic intervention for children with significant social and communication disabilities. Furthermore, it was crucial to determine the relative importance of the dolphin and the parent consultation factors implicit in the therapy. The method employed was a before-and-after comparison of three control groups and one experimental group. In the experimental group, all three aspects of the therapeutic intervention—interaction with dolphins, parent counseling and a curative, relaxed environment—were included. Control group 1 (outpatient therapy group) was limited to just interaction with dolphins. In control group 2 (farm animal group), the parents were counseled after the children interacted with farm animals (which replaced dolphins). Control group 3 received no treatment. The post-treatment parent questionnaire results revealed therapeutic success in the areas of both productive and receptive language, processing of non-verbal cues, social skills, and self-confidence. Observations of parent-child interaction indicated that after treatment in the experimental group, interactions of children could be interpreted more accurately, on a long-term basis. The discovered therapeutic effects occurred regardless of whether the children were in the water during therapy or not.

Keywords: animal-assisted therapy, children, disabilities, dolphin-assisted therapy



Accounts of dolphin-assisted therapy having therapeutic effects can be found in the scientific literature and in the media. However, close scrutiny of the research reveals that most studies on dolphin-assisted therapy have serious methodological flaws. For example, sample sizes are too small and thus not representative; there are a lack of control groups; and the reliability and quality of the methods used are questionable. Marino and Lilienfeld (2007) examined five scientific studies on the effectiveness of dolphin-assisted therapy which were conducted between 1999 and 2005. The authors found that all five contained methodological errors and that therefore their conclusions were questionable. They criticized, for example, that important influencing factors, such as length of time spent in the water, were not controlled for. Thus, the existing studies do not offer reliable conclusions about the therapeutic effects or the mechanisms of dolphin-assisted therapy. The reported effects can only be used to generate further hypotheses about possible therapeutic effects and their mechanisms. The following overview briefly summarizes the postulated effects in connection with dolphin-assisted therapy.

Some studies report that children with disabilities seem to become more alert, receptive, and attentive to their environment during or after dolphin-assisted therapy: they seem to be able to focus better and to concentrate on activities longer after the therapy. (Smith 1983, 1984, 1987; Nathanson and Defaria 1993; Nathanson et al. 1997; Nathanson 1998; Servais 1999). In addition, it has been observed that children seem to put greater effort into expressive communication, such as sustaining eye contact, increasing sound production, and producing first or new words (Smith 1984; Nathanson 1989, 1998; Nathanson and Defaria 1993; Lukina 1999; Kohn and Oerter 2004).

Smith (1983), Nathanson (1998), and Lukina (1999) describe changes in social interaction. Post therapy, children with autism appear to allow more physical and social proximity and cooperate with other children for the first time. When questioned, parents report an increase in their children's participation in family life and initiation of social contacts following dolphin-assisted therapy. Smith (1984) and Servais (1999) found children to be braver and to have greater self-esteem. Other observed changes in connection with dolphin-assisted therapy are improved goal-oriented behavior and improved independent activities (Servais 1999; Lukina 1999; Kohn and Oerter 2004). Smith (1983, 1984) described the children she studied as calmer, more relaxed, and even happier. Effects such as tranquility and contentment were also found by Lukina (1999).

Even though parental involvement is a critical component of all dolphin-assisted therapy, none of the above-mentioned studies considered possible changes in parental behavior as a mediator of these positive effects. This is a significant flaw. Studies about the effectiveness of early intervention, for example, concluded that studying the treatment effects in the child alone are not productive; instead, changes in parental behavior have to be considered, as well (Davies 1991; Spiker and Hopman 1997; Kühl 2002).

Horstman (1982), Mahoney, Finger and Powell (1985), and Ihle et al. (1996) all observed a connection between significant developmental progress in children and responsive maternal behavior. Such behavior is neither controlling nor directive; instead, it supports the child's initiatives, processing level, and processing time. Bartsch (2004) analyzed two family systems and discovered an increase in parental responsiveness following dolphin-assisted therapy.

Many parents of children with severe disabilities have little faith in their own and their children's strategies to deal with challenging situations (Sarimski and Hoffmann 1994; Weiss 2002).

Bode (2002) points out that early intervention can only be successful if parents are included in the therapeutic process. Strategies in early intervention lead to developmental progress in children, if the parents begin to trust themselves and their children and look hopefully, yet realistically, to the future. Bartsch (2004) presented two case studies describing parents who apparently gained greater trust in their own abilities and that of their children following dolphin-assisted therapy.

Furthermore, Mersch (2003) and Bartsch (2004) observed changes in parental perception of their children and in dealing with their children on an every-day basis, in conjunction with dolphin-assisted therapy. Stumpf (2006) hypothesizes that parents can evaluate and observe their child during a therapeutic situation without being directly responsible for the child. Consequently, they have the opportunity to pick up on subtle signals from their child. New behaviors can be recognized and known behavior patterns can be viewed and interpreted from a different perspective. As a result, they react more consistently and sensitively to their child's signals, which encourages the child to interact more actively with the environment. A similar explanation can be found in Breitenbach and Stumpf (2003) and Breitenbach et al. (2004, 2006).

Other possible factors influencing the therapeutic effects of dolphin-assisted therapy are the healing effects of water. Concepts such as positive reinforcement and the developmental effects of the ultrasound waves produced by the dolphins are also used to explain the effects of dolphin-assisted therapy. None of these hypotheses have been supported with scientific research.

Therapeutic Program

The therapeutic program used in our study was developed in accordance with the methods employed by various dolphin centers. It consists of three modules:

Recreational/ Vacation Atmosphere: By providing a vacation atmosphere, a respite and relaxation effect is hoped for. The families stay at a hotel, with meals and child-care for all children (with and without disabilities) provided. Recreational activities for the entire family, as well as activities exclusively for parents and children are offered. The program is organized and executed by a social worker and five child-care workers.

Counseling: The entire family is included in the therapeutic process. This occurs through individual counseling sessions at the beginning and at the end of the treatment week. In addition, daily group counseling sessions take place, focusing on the behavior of the child with disabilities while interacting with the dolphins. The interactions are videotaped in the dolphinarium. The groups are run by professional psychologists.

Interaction with Dolphins: On the first day, families receive a tour of the dolphinarium at Nürnberg Zoo, Germany and the areas relevant to the therapy. They get to know the dolphins and also observe a dolphin performance. Each child participates in daily 30-minute dolphin-assisted-therapy sessions in the dolphinarium. A dolphin trainer and a therapist are present during these sessions, as well. The parents observe the activities in an adjacent room via a television monitor.

The program consists of five units, which ensure that the children become comfortable with the setting and therapeutic situation. In the first unit, the child is introduced to the dolphin, and possible ways of interacting with the dolphin are demonstrated. During each subsequent session, the already known interaction patterns are repeated and new ones

added. In the next unit, the child interacts with the dolphin from a distance. The child throws different balls and rings to the dolphin, which are returned to the child by the animal. In unit three, indirect contact between the child and dolphin is facilitated through closer proximity. The child kneels at the pool or sits on a platform and holds differently sized rings above the water, which are touched by the dolphin with its nose. The distance between child and dolphin is reduced, but the contact is still only established through an object. The fourth unit consists of the first direct contact between child and dolphin. The child sits at the pool or on the platform and dangles his/her feet in the water. The dolphin gently pushes against the child's feet or legs. The child can now touch the fin, the back, or head of the dolphin. In the final unit, the child and the therapist are in the water and the dolphin swims near them. The therapist holds and supports the child, while the dolphin pushes and pulls the pair. If the child is physically able, he/she can be pushed and pulled without the therapist's assistance.

Study Questions

The aforementioned methodological problems in previous scientific research on dolphin-assisted therapy informed the rationale for the present study. The goal of the study was to test if the reported changes in social and communicative behavior of children with disabilities can also be shown in a study using control groups, valid research instruments, and a relatively large sample size. If changes can be proven under these conditions, it would provide evidence for the therapeutic benefits of dolphin-assisted therapy. In addition, we wanted to study the importance of the factors "dolphin" and "parent consultation" in the therapeutic effects on social and communicative behavior.

Our hypotheses were as follows:

H1: Participation in dolphin-assisted therapy leads to an improvement in children's communicative abilities, which remains stable for a period of 6 months.

H2: Participation in dolphin-assisted therapy leads to an improvement in children's social-emotional behavior, which remains stable for a period of 6 months.

H3: Participation in dolphin-assisted therapy leads to an improvement in parent-child interaction.

H4: Effects described in hypotheses 1 to 3 will be achieved only if the family participates in all three modules of the therapy program (recreational/vacation atmosphere, counseling, and interaction with dolphins). These effects cannot be triggered alone by therapy sessions within the dolphinarium.

H5: The effects described in hypotheses 1 to 3 are specific to the use of dolphins as a therapeutic modality and cannot be achieved by comparable interventions with other animals.

Methods

A controlled pre-test/ post-test research design including four treatment groups and three measurement schedules was implemented, in order to test the above-mentioned hypotheses (Figure 1). All participants of these four groups were investigated in the same time intervals using the same research instruments. Pre-testing was conducted 4 weeks before the therapy week. Post-testing followed 4 weeks and 6 months after the therapy week, to measure the changes in communication (H1), social-emotional behavior (H2) and parent-child-interaction (H3). Participants, research instruments, and conceptual differences between the research groups are described below.

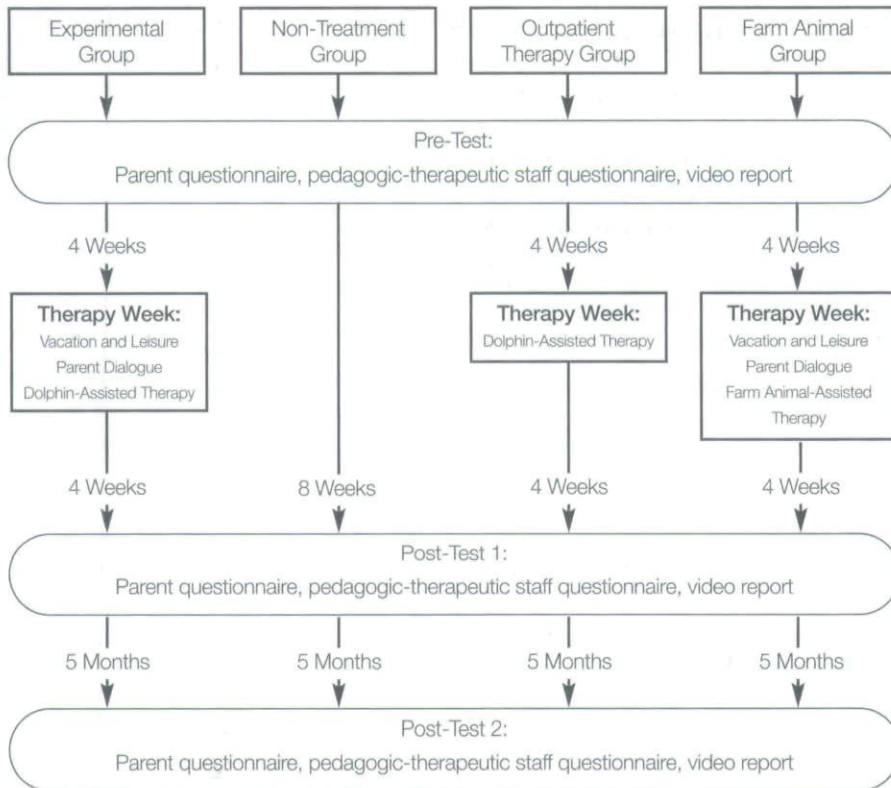


Figure 1. Research design and instruments.

Research Groups

Families of the experimental group participated in all three modules of the therapy (recreational/vacation atmosphere, counseling, and interaction with the dolphins). Children in the non-treatment group did not participate in any of the modules of the therapy. This group was designed to control for the effect of the normal development of the children. Examination of hypotheses 1 to 3 was carried out by data comparison of the experimental and non-treatment groups.

To test hypothesis 4, we included a further control group: the outpatient therapy group. This group only interacted with the dolphins: in contrast to the experimental group, modules 1 (recreational/vacation atmosphere) and 2 (counseling) were not carried out.

To test hypothesis 5, a further control group, the farm animal group, was included. Families included in this sample participated in short-term (5 days) farm animal-assisted therapy. Therapy was carried out at the Institute for Social Learning with Animals in Wedemark, Germany. As in the experimental group, the therapy setting comprised three modules. Instead of interaction with dolphins, though, children with disabilities were offered daily interaction with farm animals (cattle, donkey, goat, horse, and chickens; Figure 1).

Participants and Assignment to Groups

All groups comprised children with different disabilities who were aged between 5 and 10 years and who were strongly limited in their communication abilities. These communicational limitations were caused by different disabilities, such as autism, Down's syndrome, and mental

or physical disabilities. The composition of the research groups were comparable regarding sex, age, and disability type.

More than 2000 families applied to participate in our study. From these documents we selected triplets of children with the same sex, disability type, and similar age. Afterwards, the assignment of these children to the experimental group, non-treatment-group or outpatient therapy group was decided by drawing lots. The children who participated in the farm animal group were recruited by the Institute for Social Learning with Animals in Wedemark, which carried out the farm animal therapy (see above).

Research Instruments

In order to measure the effectiveness of the therapy, we used questionnaires and behavioral observations. According to our hypotheses, communication ability, the child's social-emotional competence, and parent-child interaction were the major issues. Questionnaires were presented to parents and pedagogic-therapeutic staff in charge of the program. Behavioral observations focused on situations showing mother-child interactions.

Questionnaire

Questionnaire design was based on diagnosis instruments for children showing serious disabilities, for example, primary pedagogic analysis and curriculum of social development (Günzburg 1973), Topeka Kansas Association for Retarded Citizens (Niedermann, Müller and Simmen 1987), and assessment observation forms (in accordance with Franger and Pfeffer 1986). By taking items from these procedures, which are important in the evaluation of communication and interaction, one questionnaire was developed to record communication ability (19 items) and a second questionnaire was designed to include social-emotional behavior (43 items). For item response, a frequency scale was chosen comprising seven categories: "always," "very often," "often," "intermediate," "seldom," "very seldom," and "never." These were assigned values of 6, 5, 4, 3, 2, 1, and 0, respectively.

An earlier study was carried out to analyze and evaluate these questionnaires, using one independent sample of parents of children with disabilities ($n = 138$). Factor analysis of the questionnaire focusing on communication ability resulted in three factors. The first factor included verbal capabilities ("Comprehension and Use of Verbal Speech"). Factor 2 reflected "Non-Verbal Reaction," whereas factor 3 contained those items implying non-verbal communication initiated by the child ("Self-Initiated Non-Verbal Communication").

The 43 items of the questionnaire referring to social-emotional behavior were also analyzed using factor analysis, resulting in five factors. Factors 1 ("Social-Emotional Competence"), 3 ("Sociability") and 5 ("Self-Confidence") describe personal and behavioral features, whereas factors 2 ("Responsiveness") and 4 ("Unstable Acting-Out Behavior") reflect the degree of adaptation to social situations. The reliability values (Cronbach's alpha) of the factors/subscales are within a satisfactory range: 0.71 to 0.90.

Behavioral Observation

For behavioral observations, a 20- to 30-minute video recording of parent-child interaction was carried out in each child's home at each time-point (pre-test, 4 weeks after therapy, and 6 months after therapy). Situations were primarily recorded which showed the children concerned and one of their parents playing and having meals. A category system was developed for analysis of the videos, based on the interaction-process-analysis (IPA) of Bales (1950) and the revised version by Hackenberg and Helbig (1999). The resulting category system distinguished between

content-focused interaction and relationship-focused interaction (Table 1). In addition, the parent-child interactions were classified as either "Harmonious" or "Disharmonious." It was necessary to have a "Stereotypic Behavior" category, as this behavior cannot be interpreted precisely. Finally, a remainder category ("Behavior Non-Interpretable") was used, as it offered the possibility to classify behavioral segments which were unclear.

Table 1. Category system for behavioral interpretation (video analysis).

(0) Behavior Non-Interpretable	
(1) Relationship-Focused Harmonious	(2) Relationship-Focused Disharmonious
<ul style="list-style-type: none"> ■ Interaction offer accepted ■ Addressing interaction partner ■ Showing affection ■ To seek body contact 	<ul style="list-style-type: none"> ■ Interaction offer refused ■ Ignoring interaction offer ■ Deliberate disturbance of interaction process ■ To show aggressive behavior
(3) Show Relaxation/Tension Decline	(4) Show Tension
<ul style="list-style-type: none"> ■ To show satisfaction ■ Joking without disturbing interaction process ■ Laughing, being carefree 	<ul style="list-style-type: none"> ■ To show indisposition ■ Disturbing interaction process by joking ■ To turn away, retreat
(5) Content-Focused Harmonious	(6) Content-Focused Disharmonious
<ul style="list-style-type: none"> ■ Cooperation, following instructions ■ To agree, to consent ■ To be attentive 	<ul style="list-style-type: none"> ■ To ignore content offer ■ To reject cooperation/denial ■ Being distracted by an external stimulus
(7) Stereotypic Behavior	

Analysis of videos used an event-sampling procedure and was implemented by three observers, using *The Observer* software (version 4.1; Noldus Information Technology). The observers were students who had had special training. To ensure an objective analysis, they were blind to which group the children had been allocated. The inter-rater reliability values ranged from 59 to 94% (Cohen's Kappa: 0.48 to 0.90). Mean observer reliability was between 71 and 78% (Cohen's Kappa: 0.61 to 0.68).

Statistical Analyses

Data from the parent questionnaires revealed a normal distribution and were therefore analyzed using parametric tests. First, we tested the existence of significant global effects using multivariate analysis of variance (MANOVA) with repeated measures (4 groups; 3 time-point measurements). When we did find significant global effects, we used univariate analysis of covariance (ANCOVA) to determine which groups were statistically different from the non-treatment group. Here, the age of the children was a covariate. If tests revealed therapy effects, the intensity was determined by calculating the effect size, using the formula of McGaw and Glass (1980; according to Hartmann and Herzog 1995). Staff questionnaires and data derived from the videos showed a non-normal distribution, so non-parametric tests were used (global analysis: Kruskal-Wallis test; post-hoc test: Mann-Whitney *U* test). Significance was set at $p \leq 0.1$ because in small groups it is difficult to detect effects.

Results

Sample Description

Data were obtained on 118 children, who ranged in age from 5 to 8 years ($M = 7.7$ years). Most of these children ($n = 40$) were in the experimental group (participated in all three modules of dolphin-assisted therapy); the other three groups had between 24 and 29 children (see Table 2). There were no significant age differences between the groups. The proportion of boys participating in these groups varied between 59 and 62%, but the gender distribution between the groups was not different ($\chi^2_{(3)} = 0.140, n = 118, p > 0.10$). There were no significant differences in the number of siblings the children had ($\chi^2_{(6)} = 6.53, n = 109, p > 0.10$) or the parents' educational standard ($p > 0.10$) between groups. In addition, the distribution of disability types did not differ significantly between the four groups ($\chi^2_{(9)} = 13.13, n = 118, p > 0.10$). However, the farm animal group had a higher proportion of children with autism (38%) and physical disability (42%) than the other groups (Table 2). These differences were probably due to this group of participants being selected by the Institute for Social Learning with Animals and not by us.

Table 2. Distribution of disability types within groups (total $n = 118$).

Disability Type	Experimental Group		Non-Treatment Group		Outpatient Therapy Group		Farm Animal Group	
	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>
Autism	15	6	14	4	8	2	38	9
Down's Syndrome	15	6	14	4	16	4	4	1
Mental Disability	42	17	38	11	44	11	16	4
Physical Disability	28	11	34	10	32	8	42	10
Total	100	40	100	29	100	25	100	24

Changes in Communicative Abilities of the Children

The subscale "Comprehension and Use of Verbal Speech" in the parent questionnaire (factor 1, see above) revealed a weak global effect ($F_{(6, n = 118)} = 1.83; p < 0.10$, see Figure 2). Paired comparisons following the univariate analysis of covariance exposed a therapy effect for children in the experimental group, compared with the non-treatment group. This result was significant at both post-test measurements (4 weeks and 6 months after dolphin-therapy; $p < 0.05$). The experimental group showed an effect size of $d = 0.35$ for the short-term effect, and $d = 0.28$ for the long-term effect. Children of the outpatient therapy group also revealed significantly improved scores within the subscale "Comprehension and Use of Verbal Speech" 4 weeks after dolphin therapy, compared with children in the non-treatment group ($p < 0.05$). The intensity of this effect was $d = 0.39$. It could no longer be detected in the outpatient therapy group ($p > 0.5$) 6 months after participation in the dolphin-assisted therapy.

The subscale "Non-Verbal Reactivity" (factor 2) of the parent questionnaire also showed a weak global effect when considering all groups and time points ($F_{(6, n = 118)} = 1.80; p < 0.10$, see Figure 2). Subsequent univariate analysis of variance tests revealed significantly improved development of children within the experimental and outpatient therapy groups, compared with the non-treatment group. Within the experimental group, the short-term effect had an effect size of $d = 0.42$ ($p < 0.05$), and 6 months after therapy the intensity of the effect was $d = 0.31$ ($p < 0.10$). Within the outpatient therapy group, the effect was significant 4 weeks after therapy ($d = 0.49; p < 0.05$) and a tendency could still be observed 6 months after therapy

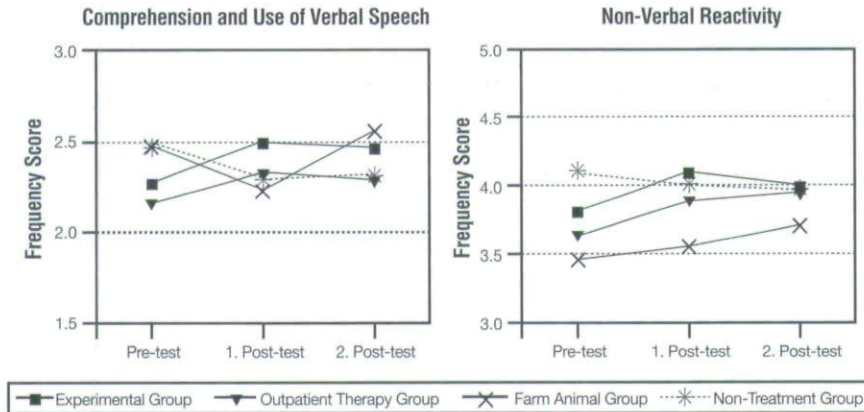


Figure 2. Therapy effect on communication ability (parent questionnaire): mean frequency of activity over time, where 0 = never, 1 = very seldom, 2 = seldom, 3 = intermediate, 4 = often, 5 = very often, and 6 = always.

($d = 0.47$; $p < 0.10$). The factor "Self Initiated Use of Non-Verbal Communication" (factor 3 of the parent questionnaire focused on communication ability) revealed no global effect ($F_{(6, n=118)} = 1.02$; $p > 0.10$). Furthermore, therapy effects could not be detected in the parent questionnaire of the farm animal group ($p > 0.10$).

Statistical analysis of staff questionnaire data did not reveal any significant differences between therapy groups and the non-treatment group ($Z < -1.37$; $n = 35-54$; $p > 0.10$).

Changes in Social-Emotional Behavior of Children

Analysis of the parent questionnaire referring to social-emotional behavior of children revealed a global effect for the subscale "Social-Emotional Competence" (factor 1; $F_{(6, n=118)} = 3.10$; $p < 0.05$, see Figure 3). Furthermore, children belonging to the experimental group showed short- and long-term benefits from their participation in the therapy ($p < 0.05$). In this group, 4 weeks after the therapy, the effect size was $d = 0.62$, and was $d = 0.70$ at the 6-month measurement point. The subscale "Social-Emotional Competence" for the outpatient therapy group was only significant, compared with the non-treatment group, at the 4-week measurement point ($p < 0.10$). The effect size was $d = 0.15$.

Multivariate analysis of variance of the subscale "Self-Confidence" showed a significant global effect ($F_{(6, n=118)} = 2.09$; $p < 0.05$, see Figure 3). Significant therapy effects were found for the experimental group ($p < 0.05$) compared with the non-treatment group, which were of moderate intensity (4 weeks: $d = 0.56$; 6 months: $d = 0.55$). Children in the farm animal group benefited from therapy in the short-term with regards to their self confidence ($p < 0.10$; $d = 0.42$). This effect was not present 6 months after treatment, though. Further significant effects in social-emotional behavior of the farm animal group were not detected. Analysis of the other parent questionnaire subscales referring to social-emotional behavior of children did not reveal any significant results ($F_{(6, n=118)} < 1.02$; $p > 0.10$).

Global analysis of the staff questionnaire concerning social-emotional behavior resulted in a significant short-term effect for the subscale "Self-Confidence" ($\chi^2_{(3)} = 10.26$, $n = 102$, $p < 0.05$). Paired group comparisons revealed a significant therapy effect within this subscale for the experimental group ($Z = -2.33$; $n = 65$; $p < 0.05$). This effect could not be detected 6 months after

the therapy. Global differences between groups could not be revealed within the other four subscales of the staff questionnaire representing social-emotional behavior ($\chi^2_{(3)} < 5.30$, $n = 86-103$, $p > 0.10$).

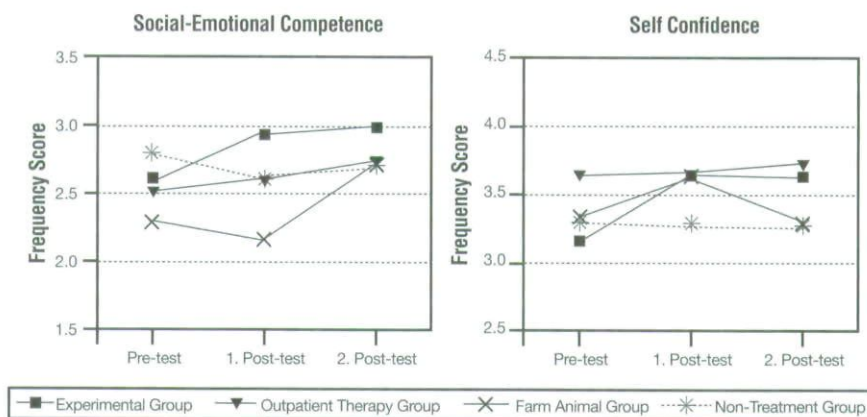


Figure 3. Therapy effect on social-emotional behavior in children (parent questionnaire): mean frequency of activity over time, where 0 = never, 1 = very seldom, 2 = seldom, 3 = intermediate, 4 = often, 5 = very often, and 6 = always.

Changes in Mother-Child Interaction

Two summary categories were established in order to analyze video recordings: "Harmonious Interaction" (relationship-focused, content-focused, relaxation) and "Disharmonious Interaction" (relationship-focused, content-focused, tense) (see Table 1).

Six months after therapy a mild effect could be detected in the experimental group in the clearness of their behavior ($p < 0.10$); the amount of time spent on behavioral observations which were non-interpretable by the observers decreased in comparison with the non-treatment group (see Figure 4). Significant differences between groups could not be detected for the categories "Harmonious" or "Disharmonious" behavior. Also, analysis of the video recordings did not reveal any effects for the outpatient therapy group. The results of video analysis suggest that independent observers are able to interpret parent-child interaction in the experimental group more clearly in the long-term following participation in dolphin-assisted therapy.

Further Analysis: Influence of Aquatic Surrounding on the Child During Therapy

In almost every commercial institution that uses dolphin-assisted therapy the influence of the aquatic surrounding on children plays an important role, since most people believe in the healing effect of water and in particular of the ultrasonic waves emitted by dolphins. During the therapy week, each child had the possibility to go into the water. In our study, 50% of the children in the experimental group ($n = 20$) stayed outside the water during therapy week. In order to examine the possible influence of this parameter, factors of the parent questionnaire which revealed therapy effects for the experimental group (verbal speech, non-verbal reactivity, social-emotional competence, self-confidence) were regarded as dependant; we contrasted the children in the experimental group who took the chance and stayed in the water with the dolphins versus those children who did not go in the water. No statistically significant differences were detected (univariate analysis of variance, $p > 0.10$). Benefits of dolphin-assisted therapy are therefore not dependent on being in or outside the water.

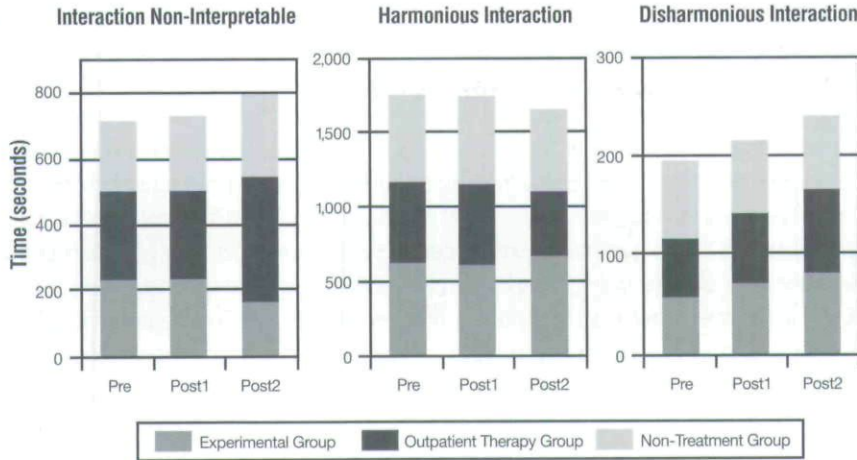


Figure 4. Mean time (seconds) spent in interaction (video analysis). Pre = Pre-test, Post1 = Post-test 1 (4 weeks after therapy), Post2 = Post-test 2 (6 months after therapy).

Discussion

Parents of both dolphin-assisted therapy groups (experimental and outpatient) reported stable and important functional therapy effects in verbal speech and non-verbal reactivity. Furthermore, parents of the experimental group observed positive effects in social-emotional competence and self-confidence of their children. Questioning of pedagogic-therapeutic staff did not reveal similar effects; however, changes in parent-child interaction were confirmed via objective video analysis.

Referring to our research questions, the results confirm hypotheses 1 to 3 to a large extent. Participation in dolphin-assisted therapy leads to an improvement in children's communicative abilities and social-emotional behavior, according to their parents. These therapeutic effects remain stable for a period of 6 months. In addition, behaviors within parent-child interactions became more clearly interpretable after dolphin-assisted therapy, although the proportion of content-focused versus relationship-focused interactions did not change, and neither did the proportion of harmonious versus disharmonious behaviors.

We showed differentiated results referring to hypothesis 4. Therapeutic effects in children's communicative abilities were achieved in isolated therapeutic sessions with dolphins (outpatient therapy group). But to obtain effects in children's social-emotional behavior, therapeutic sessions with dolphins alone were not proven to be a sufficient intervention: the combination of all three modules of the therapy program seems to be required.

Finally, the results confirmed hypothesis 5: the therapeutic effects were not achieved by comparable interventions with other animals (in this study, farm animals). However, the participants were not well matched for this "other animal" treatment group, so it is possible that this finding is less meaningful than the others.

Why the therapeutic effects were not verified by the staff questionnaires is not clear. It might be that the effects on communicative and social-emotional behavior are primarily seen within the family, and are not transferred to other social contacts. This would not be surprising, as a goal of dolphin-assisted therapy is to produce a change in mother-child interaction, and as described in developmental theories, communication and interaction patterns are regarded as the origin of social behavior within larger systems. Alternatively, parents' perceptions may have changed without there being actual changes in child behavior. Nevertheless, since relationships between the

child and persons to whom it relates most closely are regarded as a dyadic system of closely associated persons who develop individually and in cooperation in a dynamic process of mutual adaptation, a change simply in the awareness of parents towards their children might not be without influence on the experiences and behavior of the treated children. A variety of studies on early support reveal the influence of parent behavior on the development of children with disabilities. Bode (2002) shows in his review that therapeutic measures in early support can only be successful if the coping strategies of the parents are integrated within the process of early child support; for example, if the parents are influenced in such a way that they gain confidence in themselves and their child to look forward to a more hopeful, but also realistic, future.

Analysis of the videos revealed that parent-child interaction in the experimental group became clearer in the long-term and therefore more interpretable and comprehensible for independent observers. This indicates an improved mutual adaptation of parent-child interaction through dolphin-assisted therapy, which should have a positive effect on the future development of the children.

The results derived from the parent questionnaire lead to far-reaching conclusions concerning the effects of dolphin-assisted therapy. In relation to the assumption expressed in hypothesis 4, it is necessary to include the entire family in the therapy process, in order to achieve stable effects in the social-emotional behavior of the children. Comparable effects were achieved for child communication abilities if children participated in dolphin-assisted therapy sessions (module 3 of therapy program). This result is of great relevance, taking into consideration the enormous amount of time and staff requirements to provide modules 1 (recreational/vacation atmosphere) and 2 (counseling). Therefore dolphin-assisted therapy should enhance its focus on the social-emotional behavior of children in order to reach the desired effects in this area, as well.

Parent-reported effects on communication ability and social-emotional behavior were not dependant on the aquatic surrounding of the child during therapy sessions. This result thoroughly refutes the mystical explanation of the healing effect of ultrasonic waves emitted by dolphins, which is often given by representatives of commercial dolphin-assisted therapy institutions. Our result is also supported by the findings of Brensing's ethological study of dolphins (2004).

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