

Behavioral effects of the presence of a dog in a classroom

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Abstract

To test the idea that dogs have a positive influence on the social behavior of school children, one of three dogs was introduced alternately into a class at an elementary school in Vienna, attended by 24 children (mean age: 6.7 years). Most of the 14 boys and ten girls came from first-generation immigrant families. With parental consent, their behavior was videotaped for two hours every week, during "open teaching situations," first during a one-month control period in the absence of dogs, followed by an experimental period of similar duration, when a dog was present in the classroom. Frequency and duration of all observable behaviors of individuals and their interactions were coded from these tapes. Although major individual differences were found in the children's interest in the dog and their behavioral responses, the group became socially more homogenous due to decreased behavioral extremes, such as aggressiveness and hyperactivity; also, formerly withdrawn individuals became socially more integrated. Effects were more pronounced in the boys than the girls. Even though the children spent considerable time watching and making contact with the dog, they also paid more attention to the teacher. We conclude that the presence of a dog in a classroom could positively stimulate social cohesion in children and provide a relatively cheap and easy means of improving teaching conditions. © 2003 International Society for Anthrozoology

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Historically, people have kept animals for companionship and for utilitarian reasons (Wilson 1984; Robinson 1995a,b; Serpell 1996). Outstanding in this respect is the relationship between humans and dogs, lasting at least 30 000 years, but possibly more than 100 000 years (Vilá et al. 1997; Leonard et al. 2002). Among all the domestic animals, wolves/dogs have the longest continuous relationship with

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humans. The main reason for this may be a close fit in social dispositions between wolves and humans (Hediger 1965; Clutton-Brock 1994; Eibl-Eibesfeldt 1997; Schleidt and Shalter 2003), explaining why humans have developed such a strong mutual social relationship, particularly with dogs (Greiffenhagen 1993; Oeser 2001).

Dogs play an important role in animal-assisted therapy (Robinson 1995a; Ford and Olbrich 1997; Podberscek, Paul and Serpell 2000; Otterstedt 2001; Olbrich and Otterstedt 2003). It has been shown that children who grow up in the company of dogs develop into socially more competent adults than other children (Endenburg and Baarda 1995; Melson 1995). In addition, beneficial effects of dogs have been reported for the physically and mentally challenged (Ruckert 1987; Redeker and Goodman 1989), for children (Melson 1995) and for the elderly (Hart 1995; Beck and Katcher 1996; Serpell 1996). Besides furthering subjective well-being and leading to objective behavioral changes, pets may even significantly affect physiological parameters related to longevity and good health (Friedmann 1995).

However, most of these studies are correlational; longitudinal studies are needed to establish causality, but are rare (Endenburg and Baarda 1995). In this study, we presented a dog to a class of elementary school children to test its short term effects on the children's behavior, on their social interactions, and on the teaching situation, in general. To our knowledge, this is the first study of its kind. Furthermore, in contrast to questionnaire or psychological testing, our ethological approach yields direct evidence for the potential behavioral effects of the dog.

Our null-hypothesis was that there is no significant effect of the dog's presence on the behavioral parameters observed, as compared to a control period without a dog. As a working hypothesis, we predicted that the dog would act as a "social lubricant" (Mugford and M'Comisky 1975) or "social catalyst," for example, by making socially withdrawn children more open to communication. We also predicted the dog would dampen the potentially cumbersome behavior of some of the more outgoing children, thereby improving social integration in this group. Questions were whether and how much children would be attentive to, or interact with, the dog, and whether and how the dog's presence would affect the activity, behavior and social interactions of the children. The psychological mechanisms behind such behavioral changes could be care, affection and an increase in the children's self-esteem and empathy (Endenburg and Baarda 1995); this was investigated in a parallel psychological study (Hergovich et al. 2002).

We also expected the dog to affect the teaching situation, either by increasing or decreasing the pupils' attention towards the teacher. To test our

hypotheses, we video-taped the classroom situation of a group of elementary school children during standard teaching situations, and compared all observable behavioral parameters of individuals during an initial one-month control period without a dog, as well as a one-month experimental period in which a dog was present.

Methods

We observed 24 elementary school children of multi-ethnic back-

ground (see Hergovich et al. 2002) at a school in Vienna. Their mean age was 6.7 years ($SD=0.65$). The classroom was arranged as shown in Figure 1, and throughout the study number codes were used for the ten girls and 14 boys.

Because it is hard to overcome the legal and bureaucratic hurdles associated with bringing dogs to a school in Austria, our sample was chosen opportunistically. We took advantage of the unlikely co-occurrence of an elementary school teacher owning suitable and well-trained dogs, a dog-friendly and open-minded school principal, and the co-operative Vienna school administration. By coincidence, the class was multi-ethnic; this was an additional benefit for our study, because the children may have been behaviorally less homogenous and certainly were more challenging to teach (requiring two teachers and one translator in the classroom) than a group of children with a more homogenous cultural background. Our impression was that the potential effects of the dogs on behavior would be particularly pronounced in our sample.

The three dogs in the study were a male retriever (five years old), a female husky (three years old) and a female cross-breed (eight months old), all owned by the main classroom teacher, Veronika Poszvek. They were medium-sized (50–55 cm high at their shoulders) and the retriever and husky were certified therapy dogs. They were gentle and friendly with the

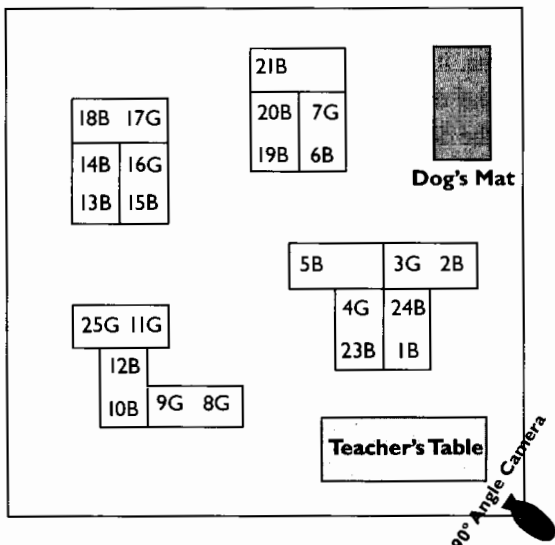


Figure 1. Distribution of tables, dog mat, camera and assigned seats of the 24 children (B: boys, G: girls) in the classroom. Video-taping during the control (without dog) and experimental (with dog) studies was done during “free teaching situations”, i.e., children had to solve tasks, but were allowed to move freely in the classroom

children, who were allowed to interact with the dogs in a respectful way at any time. It was only when it was on its mat that the children were asked to leave the dog alone. At the start of the project, children were instructed about the dogs' needs and were shown how to care for and handle the dogs.

Before the beginning of our observations, the children had been together for a four-month period, with approximately five hours per day, five times per week classroom contact. Hence, social equilibrium was already established when our project started with a one-month control period (no dog present). This was followed by a one-month experimental period, when a single dog was present every day, for the entire time children spent in the classroom. During the two periods (control and experimental) the children were video-taped three times per week for one hour "open teaching situations" (in which children were asked to solve tasks, but did not have to remain seated), with parental consent. For this purpose a video camera was fixed in a front corner of the classroom covering a 90° angle (Figure 1). Children were able to interact freely with their classmates, the two teachers in the class, and with the dog present during the experimental period.

Behavioral data were coded from videotapes. We applied two different methods: 1) focal sampling: a certain individual was observed and the predefined behavioral categories (see below) were used, and 2) scan sampling, where the behavior of all individuals at certain time points was recorded (Martin and Bateson 1993). These two approaches complemented one another. The scan method was used to survey the behavior of the entire class at a given point of time, whereas the focal method served to look at individual behavior in more detail.

During focal observations, nine behavioral categories of within-children interactions and two categories of child-dog interactions were coded (comp. Grammer 1988): 1) *conspicuous behavior*: Focal individual (FI) loud and conspicuous, teacher and other individuals take notice, but do not get in contact; 2) *locomotory play*: FI in co-ordinated contact with one or more other children, within or not within reach—for example, they play tag or rough and tumble, but without explicitly aggressive behavior; 3) *mild aggression*: FI provokes others without obvious reason—for example, by slight beating, pushing, kicking or shouting; 4) *intermediate aggression*: FI moderate, but distinctly agonistic, often in response to a provocation or for other reasons; 5) *strong aggression*: Similar to (4), but FI acts more violently. Opponent within reach; 6) *escalating aggression*: FI in an escalated fight with one or more other children. Similar to (4) and (5), but more violent. Opponents are within each others' reach, fight brought to an end by someone else; 7) *intervene*: FI tries to intervene in a quarrel of others and to settle it; 8) *dog-con-*

tact: Dog within reach of the FI, who touches, strokes, plays or talks to it; 9) *interest in dog*: The dog may or may not be within reach of the FI, who watches it or asks the teacher questions about the dog. The behavior of each child was observed and coded for the full length of the video tapes. At the occurrence of any of these categories, it was recorded with whom the focal individual had interacted, and the duration of this interaction was noted.

For the scan method, a total of 25 behavioral categories were defined, covering virtually all of the observable behaviors of the children (Grammer 1988). 1) *sit*: scanned individual (SI) sits; 2) *walk/stand*: SI walks or stands; 3) *run*: SI runs; 4) *move*: Any other movement of SI except for walking and running—for example, jumping, dancing, crawling; 5) *alone*: No other individual within reach of SI; 6) *in group*: One or more others within reach of SI; 7) *seated*: SI at her/his chair; 8) *not seated*: SI not at his/her chair; 9) *concentration*: Attention of SI drawn to an exercise, object, towards him/herself (automanipulation), not in contact with other children over an exercise; 10) *attention towards teacher*: SI attentive towards the teacher, but does not get in contact; 11) *watch*: Attention of SI drawn towards other children, but does not get in contact; 12) *conspicuous behavior*: SI loud and conspicuous, teacher and other individuals take notice; 13) *close contact with teacher*: Teacher in contact with SI—for example, by talking or handing over an object; 14) *close contact with neighbor*: Child at nearest chair within reach of SI, they are in contact, for example by talking or handing over an object, or via aggressive behavior; 15) *close contact with other child*: Child other than the nearest neighbor is within reach of SI, they are in contact, by talking, or handing over an object, or via aggressive behavior; 16) *talk/touch/object*: SI talks to individual within reach, touches the other, shows, takes or handles over an object; 17) *aggression, close range*: A child within reach is attacked by SI—for example, by beating, pushing, kicking; 18) *aggression received, close range*: SI attacked by a child within reach—for example, by beating, pushing, kicking; 19) *rough-and-tumble*: SI and partner within reach of each other, showing behavior such as slight beating, pushing or kicking, but in a playful context without aggression, which can be seen in the facial expressions of the children (Eibl-Eibesfeldt 1997; 20) *contact from distance with teacher*: Teacher not within reach of FI, in contact, for example, by calling or loud talking; 21) *contact over a distance with neighbor*: Child at the chair beside SI not within reach of SI, they are in contact, for example, by calling, talking loudly, throwing of objects, or aggressive behavior; 22) *contact over a distance with other child*: Contact with child other than neighbor and not within reach of SI—for example, by calling, talking loudly, throwing of objects, or aggressive behavior; 23) *shout/object-throw*: SI talks loudly to, shouts, or throws an object towards another one, not within reach; 24) *play*

or playful challenge from distance: SI plays with another child or challenges from a distance; 25) aggression from distance: SI not within the reach of partner, both showing aggressive behavior—for example, shouting or throwing objects at each other.

Multiple scoring of categories was possible; for example, categories “sit” and “alone” could be registered at the same time. Coding was done from the same videotapes as those used for the focal observations. The tape was stopped every four minutes (in the case of the control study), or five minutes in case of the experimental study. Therefore a near-match of sample size was reached for the two periods. The total observation time of the control period was 369 minutes, resulting in 84 scans; the experimental period lasted 428 minutes, resulting in 82 scans. If a child was not in the classroom at the time of a scan, no value was registered.

We did not employ a parallel, external control group (a different class where no dog or a dog model/toy would be introduced in the experimental study; see Hergovich et al. 2002) because our approach was particularly labor-intensive, and studying an external control group would have exceeded our resources. Also, each group of children may be unique in how they interact with their individual teachers. Indeed, our results showed considerable individual variation in the children’s responses to the dog, supporting this initial assumption. Hence, we resorted to using only the internal control design (before/after).

Mean frequencies of occurrence and duration were calculated for each variable and child in the case of the focal data, and mean frequencies were calculated in the case of scan data. This was done to standardize for differences in observation time, due to differences in length of the control and experimental studies, and due to different times individuals were absent from school. This resulted in data scores between 0 and 1 in the case of scan sampling, which were arcsine transformed before analysis. As data were not normally distributed (Kolmogorov-Smirnov Test), we employed non-parametric tests; Mann-Whitney *U* for independent samples (sex differences within group) and Wilcoxon for dependent samples (differences between groups). The SPSS 8.0 statistical software package was employed for analysis.

Results

Focal observations revealed that children showed considerable interest in the dog, with large differences between individuals. On average, boys watched the dog three times per hour ($SD \pm 1.3$, min. 0.9, max. 5.5) and girls watched the dog 2.7 times per hour ($SD \pm 1.2$, min. 1, max. 4.7). Boys spent, on average, 275.9 seconds per hour ($SD \pm 100.4$, min. 129.1, max. 474.5) watching

the dog, while girls did so for 291.8 seconds ($SD \pm 92.9$, min. 167.8, max. 477.2). On average, boys touched or stroked the dog 3.2 times per hour ($SD \pm 2.1$, min. 0.9, max. 7.3), while girls did this 2.7 times per hour ($SD \pm 1.8$, min. 0.7, max. 5.8), with boys taking, on average, 56.7 seconds ($SD \pm 70.1$, min. 1.3, max. 236.5) to do this, while girls took 89 seconds ($SD \pm 92.7$, min. 4.9, max. 325.6). Hence, the boys spent, on average, 9.2% of their time in class relating to the dog, and girls spent 10.6% of their time. None of these differences between the sexes were statistically significant.

Scan sampling revealed, with the dog in the classroom, that children in the class were significantly less alone (Wilcoxon $Z = -2.8$, $p = 0.005$), more often found in a group ($Z = -2.77$, $p = 0.006$), less often in their assigned seat ($Z = -3.2$, $p = 0.001$), concentrated less on what they were doing individually ($Z = -3.06$, $p = 0.002$), and had significantly fewer vocal ($Z = -2.89$, $p = 0.004$) and provocative ($Z = -2.58$, $p = 0.01$) interactions over a distance. Quite remarkably, children paid more attention to the teacher ($Z = -3.91$, $p < 0.000$) when the dog was in the classroom. The same pattern for children was found in boys, in general (Wilcoxon: alone: $Z = -2.04$, $p = 0.041$; in group: $Z = -2.23$, $p = 0.026$; seated: $Z = -2.42$, $p = 0.016$; concentrated: $Z = -2.73$, $p = 0.006$; vocal: $Z = -2.54$, $p = 0.011$; provocative: $Z = -2.31$, $p = 0.021$). In contrast, girls showed fewer behavioral changes with the presence of the dog, than did the boys. When the dog was present, girls were less often at their assigned seat (Wilcoxon $Z = -2.09$, $p = 0.037$), had less contact with their direct neighbor ($Z = -2.29$, $p = 0.022$) and were more attentive towards their teacher ($Z = -2.29$, $p = 0.022$).

A closer examination of individual interactions via focal sampling revealed that children showed conspicuous and troublesome behavior considerably less often when the dog was in the classroom (Wilcoxon $Z = -2.17$, $p = 0.03$), and were significantly less aggressive. With the dog in the classroom, the children showed all categories of aggressive behavior less often than in the preceding control period when the dog was absent (mild: $Z = -3.77$, $p < 0.000$; intermediate: $Z = -3.3$, $p = 0.001$; strong: $Z = -2.8$, $p = 0.005$; escalating: $Z = -2.38$, $p = 0.017$) and, hence, also intervened less often to terminate agonistic interactions ($Z = -2.86$, $p = 0.004$). Concomitantly, duration of conspicuous behavior decreased with the presence of the dog ($Z = -3.29$, $p = 0.001$), as did duration of mild, intermediate and strong aggression (mild: $Z = -3.04$, $p = 0.002$; intermediate: $Z = -3.3$, $p = 0.001$; strong: $Z = -2.8$, $p = 0.005$). Interestingly, locomotory play remained unaffected by the presence of the dog ($Z = -1.61$, $p = 0.11$).

The same pattern was found for the boys alone; they showed less conspicuous behavior when the dog was present (Wilcoxon $Z = -2.29$, $p = 0.022$) and for a shorter duration ($Z = -2.79$, $p = 0.005$), compared with when there was no dog. With the dog in the classroom, boys were less often aggressive

(mild: $Z=-3.11$, $p=0.002$; intermediate: $Z=-2.93$, $p=0.003$; strong: $Z=-2.37$, $p=0.018$; escalating: $Z=-2.2$, $p=0.028$) and, hence, interventions to terminate aggressive interactions occurred less frequently ($Z=-2.2$, $p=0.028$). Also, with the dog present, the boys' agonistic interactions lasted for shorter periods of time (mild: $Z=-2.86$, $p=0.004$; intermediate: $Z=-2.93$, $p=0.003$; strong: $Z=-2.37$, $p=0.018$). For the girls, only two behavioral categories decreased significantly in frequency when the dog was present: mild aggression (Wilcoxon $Z=-1.96$, $p=0.051$) and interventions to terminate agonistic interactions ($Z=-2.1$, $p=0.036$).

Although attentiveness towards the dog did not significantly differ between the sexes (see above), the dog seemingly affected the social behavior of the boys more profoundly than it did for the girls. This may be explained by the fact that the boys were generally more "rough-and-tumble" in their behavior than the girls and, hence, showed conspicuous behavior significantly more often than girls did during the control period (Mann-Whitney $U=18$, $p=0.004$). During this time, boys showed locomotory play ($U=30.5$, $p=0.032$) and agonistic interactions (mild: $U=24.5$, $p=0.012$; intermediate: $U=27.5$, $p=0.015$; escalating: $U=38.5$, $p=0.044$) more often than girls. Also, boys were engaged in conspicuous behavior and mild, as well as intermediate, aggression for longer periods of time than girls (conspicuous: $U=19$, $p=0.004$; mild aggression: $U=30.5$, $p=0.032$; intermediate aggression: $U=27.5$, $p=0.015$). The basic sex differences in behavior remained unchanged during the experimental period (dog present); boys still showed significantly more conspicuous behavior (Mann-Whitney $U=24$, $p=0.011$), more locomotory play ($U=29$, $p=0.026$), as well as mild ($U=21$, $p=0.006$) and intermediate aggression ($U=30$, $p=0.008$) than the girls, even though the dog mainly affected the behavior of the boys (see above).

Discussion

Social integration via the dog

Most of the observed children came from families who recently emigrated to Austria (see Hergovich et al. 2002), and many still faced language problems. It is therefore no surprise that individual behavior was diverse, ranging from withdrawal to near-permanent overt activity and aggressiveness, creating a difficult teaching situation. Still, independent of the diverse cultural backgrounds and individual histories, most of the observed children, of both sexes, were attracted to the dog.

We provide direct behavioral evidence that the mere presence of a dog had significant positive effects on the socialization of these children. Although individuals differed substantially in their interest in the dog and in their behavioral

responses, the dog's presence resulted in social integration of the group, mainly by decreasing behavioral extremes. The dog also influenced more intense communication between children and between child and teacher. When the dog was present, overt activity and withdrawal, as well as aggressive interactions, decreased and group activities increased. Animal-assisted therapy has produced similar effects in autistic children (Redefer and Goodman 1989; Otterstedt 2001). Even though children in our study concentrated less on their individual exercises when there was a dog present, they were at the same time more attentive to their teacher. Children seemed to assume responsibility for the dog by acting considerate and observing its needs. In return, in sitting close by and through stroking, children received affection from the dog, which they may have tried to attract before through troublesome behavior (Ruckert 1987).

Our findings fit the known gender differences in behavior: girls showed generally less rough-and-tumble play than boys (Grammer 1988; Nelson 1995; Eibl-Eibesfeldt 1997). For this reason, the potential for change was greater for the boys than the girls, which was indeed the case in our study (see also Guttman et al. 1983); the presence of a dog influenced the behavior of the boys and girls in a similar way, but had more pronounced effects on the boys.

Mechanisms of social integration

The mechanisms leading to the observed behavioral changes were diverse. A number of children spent a considerable amount of time in contact with the dog. For some, this simply decreased their time available for bothering classmates. This is exemplified by individual 18, a boy, who was loud and troublesome during the control study and therefore permanently distracted the attention of his classmates from the teaching situation. In the presence of a dog, whom he frequently stroked and played with, his behavior changed dramatically. This simply decreased the amount of time available for troubling his classmates. Others watched the dog extensively, but avoided direct contact and kept a respectful distance. Still others (mainly girls) did not seem to take particular interest in the dog. In general, children acted in a considerate way towards the dog and obeyed the teacher's advice not to be overly noisy or impetuous in its presence. Also, it was obvious that some of the more active pupils were especially eager to learn more about the dog's behavior and needs. Finally, it seemed that the teacher's authority increased in the presence of her compliant dog companion, particularly towards some of her male pupils. Hence, the dog did not distract the children from being attentive towards the teacher; instead, it increased their attentiveness toward the teacher.

The dog facilitates child development

It is well documented that children who grow up with dogs or other animal companions enjoy benefits with respect to their socio-emotional and cognitive development (Robinson 1995a; Ford 1997; Podberscek, Paul and Serpell 2000). Children growing up with pets generally show higher self-esteem, empathy and responsibility, and develop into socially more competent adults than children who do not grow up with pets (see Endenburg and Baarda 1995 for review). However, in these studies the family environment can never be excluded as a confounding variable. Potentially, the "social climate" in families where parents associate with pets may be different to that in families without pets. This makes the causal effects of parenting style on the development of children difficult to disentangle from the contribution made by the pet animal. In support of the idea that the causal variable is indeed the pet, our present experimental study showed profound short-term effects on the individual and social behaviors of children, and also showed how these were achieved via interacting with the dog. Although the attention towards the teacher was positively affected, the primary cause for the observed behavioral changes was the dog's presence.

The objection may be raised that only an internal control was used and that the observed changes may have occurred even without the dog—an effect of the groups' social dynamics over time. This is unlikely because the group had already been together for four months before the control observations started, and therefore they probably had reached some stability in social interactions already. Furthermore, changes were rather specific and could in part be attributed to the interactions with the dog or with the teacher. In addition, a parallel psychological study with the same children, employing a parallel external control group, produced similar results. In that study, only the group with the dog present showed an increase in empathy with animals and an increased development of autonomy and of self/non-self segregation, which is regarded as a foundation of sensitivity towards the needs and moods of other people (Hergovich et al. 2002). Furthermore, only in the dog group did the teachers report higher social integration and a decrease in the number of aggressive children. These ratings are substantiated by our present behavioral data.

No more behavioral data were taken after the experimental period ended. However, the teacher continued to bring her dogs to school during the following year and reported that the effects found in this study were lasting. In addition, psychological testing revealed positive effects of the

dogs on the children's social and cognitive development after only three months (Hergovich et al. 2002), hardening the evidence that pets, particularly dogs, are indeed positive causal agents in child development (Endenburg and Baarda 1995).

Conclusions

Despite the multi-cultural background of our focal class, we are confident that the present results can be generalized to similar teaching situations, because basic behavioral dispositions, social interactions and interest in animals seem independent of culture (Grammer 1988). This is supported by numerous case reports of teachers found in the press and at a number of meetings (e.g., Ford and Olbrich 1997) which, without exception, are consistent with our present findings. We conclude that the use of dogs at schools would be a cheap and potentially easy means for counteracting individual child behavioral problems, for supporting social and cognitive development, for aiding social integration, and for improving teaching situations. However, a number of hurdles prevent a more widespread use of dogs in schools. First of all, there has to be a teacher with a docile and well-trained dog, because dogs need an individual relationship with someone and cannot simply be kept at school under communal care. Such teachers will remain an exception rather than the rule. Furthermore, such a project needs to consider the relevant legal background, and needs an open-minded school board, parental consent and suitable liability arrangements. Such hurdles are unfortunate, considering the potential benefits of having dogs at school. The benefits far outweigh the potential risks, such as the danger of injuries or hygiene.

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References

- Beck, A. and Katcher, A. 1996. *Between Pets and People: The Importance of Animal Companionship*. West Lafayette, Indiana: Purdue University Press.
- Clutton-Brock, J. 1994. The unnatural world: behavioral aspects of humans and animals in the process of domestication. In *Animals and Human Society: Changing Perspectives*, 23–35, eds. A. Manning and J. Serpell. London: Routledge.
- Eibl-Eibesfeldt, I. 1997. *Die Biologie des menschlichen Verhaltens—Grundriß der Humanethologie*. Weyarn: Seehamer Verlag.
- Endenburg, N. and Baarda, B. 1995. The roles of pets in enhancing human well-being: Effects on child development. In *The Waltham Book of Human–Animal Interaction: Benefits and Responsibilities of Pet Ownership*, 1–17, ed. I. Robinson. Exeter: Pergamon.
- Ford, G. and Olbrich, E. eds. 1997. *Tiere helfen Menschen*. Würzburg: Graham Ford.
- Friedmann, E. 1995. The role of pets in enhancing human well-being: Physiological effects. In *The Waltham Book of Human–Animal Interaction: Benefits and Responsibilities of Pet Ownership*, 33–53, ed. I. Robinson. Exeter: Pergamon.
- Grammer, K. 1988. *Biologische Grundlagen des Sozialverhaltens*. Darmstadt: Wissenschaftliche Buchgesellschaft.
- Greiffenhagen, S. 1993. *Tiere als Therapie—Neue Wege in Erziehung und Heilung*. München: Knaur.
- Guttmann, G., Predovic, M. and Zemanek, M. 1983. Einfluss der Heimtierhaltung auf die nonverbale Kommunikation und die soziale Kompetenz bei Kindern. In *Die Mensch-Tier Beziehung: Dokumentation des Internationalen Symposiums aus Anlass des 80. Geburtstages von Nobelpreisträger Prof. DDr. Konrad Lorenz*, 27. und 28. October 1983: 62–66. Wien: IEMT.
- Hart, L. A. 1995. The role of pets in enhancing human well-being: Effects for older people. In *The Waltham Book of Human–Animal Interaction: Benefits and Responsibilities of Pet Ownership*, 19–31, ed. I. Robinson. Exeter: Pergamon.
- Hediger, H. 1965. Man as social partners of animals and vice versa. In *Symposia of the Zoological Society of London, Vol. 14*, 291–300, ed. P. E. Ellis. London: Royal Society.
- Hergovich, A., Monshi, B., Semmler, G. and Ziegler, V. 2002. The effects of the presence of a dog in the classroom. *Anthrozoös* 15: 37–50.
- Leonard, J. A., Wayne, R. K., Wheeler, J., Valadez, J., Guillen, S. and Vilà, C. 2002. Ancient DNA evidence for old world origin of new world dogs. *Science* 298: 1613–1616.
- Martin, P. and Bateson, P. 1993. *Measuring Behaviour: An Introductory Guide*. 2nd ed. Cambridge: Cambridge University Press.
- Melson, G. F. 1995. The role of companion animals in human development. Paper presented at 'Animals, Health and Quality of Life,' 7th International Conference on Human–Animal Interactions, 6–9 September, Geneva, 1995.
- Mugford, R. A. and M'Comisky, J. G. M. 1975. Some recent work on the psychotherapeutic value of caged birds with old people. In *Pet Animals and Society*, 54–85, ed. R. S. Anderson. Springfield, Illinois: C. C. Thomas.

- Nelson, R. J. 1995. *An Introduction to Behavioural Endocrinology*. Sunderland, Massachusetts: Sinauer Associates.
- Oeser, E. 2001. Der Anteil des Hundes an der Menschwerdung des Affen: Von Platon zu Lorenz. In *Konrad Lorenz und seine verhaltensbiologischen Konzepte aus heutiger Sicht*, 225–232, eds. K. Kotrschal, G. Müller and H. Winkler. Fürth: Filander Verlag
- Olbrich, E. and Otterstedt, C. eds. 2003. *Menschen brauchen Tiere. Grundlagen und Praxis der tiergestützten Pädagogik und Therapie*. Stuttgart: Kosmos Verlag.
- Otterstedt, C. 2001. *Tiere als therapeutische Begleiter*. Stuttgart: Kosmos Verlag.
- Podberscek, A. L., Paul, E. S. and Serpell, J. A. eds. 2000. *Companion Animals and Us: Exploring the Relationships between People and Pets*. Cambridge: Cambridge University Press.
- Redefer, L. A. and Goodman, J. F. 1989. Brief report: Pet-facilitated therapy with autistic children. *Journal of Autism and Developmental Disorders* 19: 461–467.
- Robinson, I. ed. 1995a. *The Waltham Book of Human–Animal Interaction: Benefits and Responsibilities of Pet Ownership*. Exeter: Pergamon.
- Robinson, I. 1995b. Associations between man and animals. In *The Waltham Book of Human–Animal Interaction: Benefits and Responsibilities of Pet Ownership*, 1–6, ed. I. Robinson. Exeter: Pergamon.
- Ruckert, J. 1987. *The Four-Footed Therapist: How Your Pet can Help to Solve Your Problems*. California: Ten Speed Press.
- Schleidt, W. and Shalter, M. D. 2003. Co-evolution of humans and canids. An alternative view of dog domestication: *Homo homini lupus? Evolution and Cognition* 9: 57–72.
- Serpell, J. 1996. *In the Company of Animals: A Study of Human–Animal Relationships*. Cambridge: Cambridge University Press.
- Vilá, C., Savolainen, P., Maldonado, J. E., Amorim, I. R., Rice, J. E., Honeycutt, R. L., Crandall, K. A., Lundberg, J. and Wayne, R. K. 1997. Multiple and ancient origins of the domestic dog. *Science* 276: 1687–1689.
- Wilson, E. O. 1984. *Biophilia*. Cambridge, MA: Harvard University Press.