Diplomarbeit

LEASH WALKING AS A MODEL FOR COOPERATION BETWEEN HUMANS AND WOLVES: THE EFFECTS OF PERSONALITY AND INTENSITY OF CONTACT

angestrebter akademischer Grad

Magistra der Naturwissenschaften (Mag^a. rer. nat.)

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Graz, am 13. Oktober 2010

in Kooperation mit

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Graz, am 13. Oktober 2010

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1 Zusammenfassung (German summary)

Hunde sind dafür bekannt, mit Menschen bereitwillig zu kooperieren. Um die potentiellen Ursprünge dieser einzigartigen kooperativen Beziehung zu untersuchen, beobachteten wir Wölfe - die nächstverwandten wild lebenden Caniden des Hundes – und Menschen während eines Leinen-Spaziergangs. An der Studie waren vier Timberwölfe (vom Wolf Science Center, Österreich) und acht Personen in unterschiedlichen dyadischen Kombinationen beteiligt. Die vier Wölfe (zwei männlich, zwei weiblich) wurden von diesen acht Personen mit der Hand aufgezogen und wuchsen, ähnlich wie Hunde, nahe an Menschen sozialisiert auf. Während der ersten sechs Monate hatten die Wölfe Tag und Nacht intensiven Kontakt zu Menschen. Sie wurden darin trainiert, „sitz“ und „platz“ auf Kommando auszuüben und an einer Leine spazieren zu gehen. Alle acht HandaufzieherInnen wurden ersucht mit jedem Wolf an drei verschiedenen Plätzen und an unterschiedlichen Tagen einen standardisierten Leinen-Spaziergang durchzuführen. Die SpaziergeherInnen hatten zusätzlich einen Neo-FFI Persönlichkeitstest, einen Einstellungsfragebogen zu Wölfen, und ein Persönlichkeits-Rating der Wölfe auszufüllen. Während der Datennahme waren die Wölfe 7 bis 11 Monate alt. Die Spaziergänge wurden auf Video festgehalten und mit dem Programm THE OBSERVER Video Pro® (Version 5.0; Noldus) codiert. Die statistische Analyse umfasste Kruskal-Wallis-Tests, Spearman Rangkorrelations-Tests, Pearson Korrelationen und GLMs (allgemeine und verallgemeinerte lineare Modelle). Allein die Möglichkeit angemessene Spaziergänge und hundeartige Übungen mit Wölfen durchzuführen zeigt, dass sozialisierte Wölfe fähig sind mit dem Menschen zu kooperieren. Unsere Ergebnisse offenbaren, dass sowohl Wölfe als auch Menschen sich in ihrer kooperativen Leistung unterscheiden und dass beide Einfluss auf kooperative Interaktionen nehmen. Dies verdeutlicht, dass während eines dyadischen Leinen-Spaziergangs beide Beteiligten zur Interaktion beitragen und sie nicht unabhängig voneinander agieren. Ein dyadischer Leinen-Spaziergang wird von uns als eine kooperative Ausübung betrachtet. Wir entdeckten dabei interessante Wechselwirkungen von verschiedenen Interaktionsstilen. So zeigt sich, dass gehäuftes Belohnen mit Futter nicht die Qualität der Zusammenarbeit steigert, jedoch die Führung des Spaziergehers verbessert. Gute Führung seitens des Spaziergehers bedeutet, dass dieser länger voran geht, sozusagen die Führungsposition inne hat, und dass das Voranschreiten seltener aufgrund unterschiedlicher Motivationen von Wolf und Spaziergeher stoppt. Schwache Führung ist dabei nicht notwendigerweise mit Zwang (zB durch Leinenzug) und Ungehorsam verbunden. Gegenseitiges an der Leine ziehen scheint wie ein positiver Rückkopplungs-Prozess zu funktionieren, was ein interessanter Aspekt für das Training der Leinenführigkeit

von Hunden sein könnte. Wie es von der Mensch-Hund Kooperation bereits bekannt ist, fanden wir Auswirkungen von menschlicher Persönlichkeit auf den Interaktionsstil und die kooperative Leistung. Auch die Vertrautheit der Wölfe mit ihren menschlichen Begleitern beeinflusst die Kooperation zwischen Mensch und Wolf. Bisherige Wolf-Hund-Vergleichsstudien zeigen, dass auch sozialisierte Wölfe offenbar weniger bereitwillig mit Menschen kooperieren als Hunde. Dazu wurde eine hohe Variabilität im Kommunikationsverhalten der Wölfe mit Menschen beschrieben, die möglicherweise eine Ausgangslage für den Domestikationsprozess der Hunde darstellt. Die Wölfe in unserer Studie variierten in ihrem Kooperationsverhalten mit Menschen, was die oben beschriebene Hypothese unterstützen würde.

2 Abstract

Dogs are known to readily cooperate with humans. To investigate the potential origins of these cooperative interactions between humans and dogs, we have observed wolves, dogs' closest wild-living relatives and humans during leash walking. The study includes different dyadic combinations of four timber wolves, from the Wolf Science Center (Austria) and their eight human hand-raisers. During their upbringing, the tested wolves (two males, two females) have been socialized with humans as closely as companion dogs. Until they were six months old, the wolves had intensive human contact day and night. They were trained to sit and lie down on command and to walk on a leash. Each person who was involved in hand raising was asked to do standardized walks with each wolf at three different sites and on different days. During data taking, the wolves were 7 to 11 months old. Questionnaires answered by the wolf walkers included the Neo-FFI personality test, an attitude-towards-wolves scale and a wolf personality rating. The walks were videotaped and encoded with THE OBSERVER Video Pro® (version 5.0; Noldus). Data was analyzed with Kruskal-Wallis-Test, Spearman rank correlation, Pearson correlation and GLMs (general and generalized linear models). The mere chance of doing reasonably coordinated leash walks and doggie exercises with wolves shows that properly socialized wolves are able to cooperate with humans. Our results reveal that both, wolves and walkers differ in their cooperative performance and have influence on cooperative interactions. This indicates that during a dyadic leash walk both individuals are responsible for performance and do not behave independently from their walking partner. Regarding a dyadic leash walk as a cooperative action we discovered interesting reciprocal effects of different interaction styles. Increased food rewardings do not improve cooperative performance but enhance the walkers' guidance behavior. Guidance behavior describes who walks ahead (guides) and how often or how long the dyad has to stop due to different motivations. Thereby poor guidance behavior is not necessarily linked to enforcement (e.g. straining at the leash) and disobedience. Straining at the leash seems to function as a positive feedback process between walker and wolf which could be an interesting aspect in dogs' training leash walking. Further we have discovered similarities to human-dog cooperation concerning the effects of walkers' personalities. The cooperative performance of socialized wolves is also influenced by their familiarity to their cooperating partner. Present studies show that even socialized wolves cooperate less readily with humans than dogs and that wolves reveal a high variability in communicative behavior with humans. Our results indicate that wolves even vary in their cooperative behavior with humans, and therefore support the hypothesis in which the high variability

of wolves' behavior to humans (communication, cooperation) provides the basis for the domestication process of the dog.

3 Introduction

“The wolf is a social animal; it depends for its survival on cooperation, not strife.”

Barry Holstun Lopez

When we think about wolves we may not only think about the closest wild-living relatives to our dogs (Vilà et al., 1997) but also about a very cooperative species. Wolves are known to live in packs with complex social organization (Mech, 1970; Mech and Boitani, 2003) and to show complex cooperative behavior in hunting (Mech, 1970; Peters and Mech, 1975; Sharp, 1978), rearing pups (Zimen, 2003) and even while playing (see Heufelder, 2010). Those social and cooperative skills probably provided the basis that made wolves in their domesticated form as dogs so successful in human society. The discussion on when and how the domestication process started, is still going on (see Clutton-Brock, 1995; Coppinger and Coppinger, 2001; Schleidt and Shalter, 2003). However, genetic (Vilà et al., 1997, Savolainen et al., 2002; Pang et al., 2009) and archeological (Davis and Valla, 1978; Nobis, 1979) findings reveal that the dog was the first domesticated animal and that it had a special relationship with humans from very early on (Morey, 2006).

3.1 Human-dog - / human-wolf cooperation

Dogs are known to cooperate very readily and all-roundly with humans. In many cases dogs assume important duties in humans' lives ranging from being a social supporter (see Kotrschal et al., 2009) to leading blind people (see Johnston 1990), assisting disabled people and helping in herding and hunting (see Naderi et al., 2001). For many people dogs become an essential component of life. Studies on human-dog cooperation are rare and most of them investigate communicative skills with humans. Comparative research shows that dogs as well as socialized wolves understand the meaning of human pointing gestures (Soproni et al., 2002; Udell et al., 2008; Virányi et al., 2008; Gácsi et al., 2009). Naderi et al. (2001) observed the cooperative behavior between blind people and their guide dogs and discovered that during a walk the initiation of actions alternates continuously and that there are qualitative similarities in pet dogs leading their blindfolded owners. They supposed that “co-operative behaviour is an inherited trait in dogs, ...” (p. 59). In our study we investigated the possible origins of this inherited trait

by observing cooperative performance of humans and socialized wolves during a dyadic leash walk.

3.2 Definition of cooperation

Cooperation is defined by Boesch and Boesch (1989) as “individuals acting together to achieve a common goal”. Naderi et al. (2001) added that there should be distinguished between individuals’ actions aiming at a specific goal directly (e.g. wolves chasing their prey alternately (Sharp, 1978)) or indirectly. Aiming at a goal indirectly is often seen in dominant animals which manipulate submissives by aggression (see Naderi et al., 2001). The question remains unanswered to what extent such behavior can be considered as cooperation. To analyze cooperative behavior Naderi et al. (2001) defined three independent dimensions based on definitions by Boesch and Boesch (1989) and Chalmeau and Gallo (1996). First, they mentioned congruence to describe if the interacting individuals perform behavior similar or dissimilar. Second, synchrony characterizes the timing of the actions, if these are performed in parallel or sequentially. Finally, spatial coordination specifies if the individuals act together in a homospheric (in close spatial proximity) or heterospheric (individuals depart and act independently) way. Communication is another important part of cooperative behavior (Chalmeau and Gallo, 1996) but was excluded in this definition.

3.3 Leash walking as a cooperative task

Taking a dog for a walk on a leash is a daily routine for most dog owners, though supposedly few of them think of a cooperative action. We assume that leash walking is a complex cooperative task in which, due to the leash, two individuals are forced to cooperate (to particular extent). In reference to the dimensions mentioned above (see Naderi et al., 2001) cooperation during a dyadic leash walk would follow these three criteria. First, the two individuals perform actions similarly (congruence), second they are synchronized in parallel and third they are coordinated within close spatial proximity (depending on the length of the leash). Communication provides a helpful tool for a successful cooperative performance. Cooperative performance during a dyadic leash walk can be measured by observing several parameters. The leash is more or less a tool for the walker to ensure that the wolf can not escape but it can also be used as a tool for enforcement. Straining at the leash and walking on a strained leash is caused by dyadic asymmetry (non-congruence and non-synchrony of behavior and no spatial coordination (see Naderi et al., 2001)) and considered as poor cooperative performance. In relation to

spatial coordination we further measured the proximity between the walking individuals, what is rather meaningful as the leashes were up to 10m. To achieve information on guidance behavior we observed which individual walks in front. When the walk stopped due to non-congruence in behavior this was considered as conflicts in guidance and poor performance. In addition to these interaction parameters we investigated locomotion, orientation and vocalization of both walking individuals and their initiations of several actions.

3.4 Issues and hypotheses

By the mere chance of doing reasonably coordinated leash walks, it is shown that socialized wolves are capable of cooperating with humans. As already mentioned above socialized wolves even understand the meaning of human pointing gestures (Udell et al., 2008; Virányi et al., 2008; Gácsi et al., 2009) which is related to communicative skills between humans and wolves. In order to investigate wolves' cognitive skills, they are often asked to cooperate with humans during diverse experiments. Kubinyi et al. (2007) describes differences in handling socialized wolves and dogs during experimental tasks and observed that wolves struggle more than dogs (see also Gácsi et al., 2009). When cooperating with unknown people, even intensive socialized wolves have difficulties (Kubinyi et al., 2007). The hand-raised wolves from the Wolf Science Center (Austria) mostly showed dreadful and avoiding behavior when they faced strangers. Therefore walking a wolf was only possible with familiar people whereupon the degree of familiarity should play an important role for cooperative performance.

Gácsi et al. (2009) pointed out that in comparison to dogs the “delayed emergence of utilizing human distal momentary pointing in wolves shows that these wild canines react to a lesser degree to intensive socialization ...” (p. 1). They claimed that this is related to a better control in dogs of agonistic behavior and inhibitions of actions. Socialized wolves are further described to have decreased willingness to look at humans (Kubinyi et al., 2007). Gácsi et al. (2009) points out that the success of adult wolves in utilizing human pointing gestures comes along with their increased willingness to cooperate (latency to perform eye-contact) and confirm the previous thesis by Virányi et al. (2008) that a high variability in wolves' communicative performance with humans might have provided a basis for the domestication process of the dog. Therefore we predict that, compared to human-dog cooperation, socialized wolves though show similar, however, less readily cooperation with humans and a high variability in cooperative performance.

The dogs' cooperative abilities are mentioned to be closely related to their affiliative (e.g. Topál et al., 1998) and communicative (e.g. Miklósi et al., 1998) behavior towards humans (see Naderi et al., 2001). Recent studies on human-dog relationships discovered links between owner personality, attitude and sex and dog personality, owner dog interaction style, stress coping and performance in operational tasks (Kotrschal et al., 2009; Schöberl, 2009; Schöberl et al., 2009; Aliabadi, 2010; Wedl et al., 2010). The influence of human's personality on the interaction style with undomesticated animals was observed by Phillips and Peck (2007) by studying keepers' and tigers' behavior in an interactive zoo exhibit. If we can draw conclusions of this results mentioned above to our survey, we should find links between human and wolf personality, their relationship, interaction style, stress condition and cooperative performance. According to Kotrschal et al. (2009) extraverted people should show clear interaction styles whereas neurotic people should interact emphatic-tactile with a poor cooperative performance.

Cooperation between humans has often been investigated by game theoretical and mathematical models (e.g. Axelrod and Hamilton 1981). The "Tit for Tat" strategy as a reciprocal cooperative strategy tended to be very stable in success and nearly independent from its environment (Diekmann and Manhart, 1989). Intra-specific reciprocal cooperation has already been found among mammals (e.g. Wilkinson, 1984, 1988; DeNault and McFarlane, 1995). By observing cooperative interactions between blind people and their guide dogs, Naderi et al. (2001) point out that neither the dog nor the owner hold the role of the initiator – they rather alter in initiating actions. During leash walking, which is regarded as a cooperative task, we suggest reciprocal actions between the walking individuals' behaviors.

4 Material and method

4.1 Subjects and setting

The study took place at the former housing of the Wolf Science Center (WSC, www.wolfscience.at) at the Cumberland game park in Grünau im Almtal (Austria). Wolves and dogs are hand raised there in order to investigate and compare their cognitive and cooperative skills.

Our study is based on four timber wolves (*Canis lupus occidentalis*) – Aragorn, Kaspar, Shima, Tayanita (Table 1) - born on 4th of May 2008 at the zoo Herberstein. The pups were separated from their mothers in the first 10 days after birth (before eye opening), (see Klinghammer and Goodman, 1987; Frank et al., 1989) and have been hand raised by eight human hand-raisers (six women and two men, age 24-57). Until the wolf puppies were about four weeks old, they lived in the human hand-raisers' flats and were bottle-fed and later hand-fed every few hours. Afterwards they were settled to an enclosure of about 10m x 20m at the Cumberland game park in Grünau im Almtal, where the human hand-raisers took care of them every day and night until they were five month old. From their sixth month on they received a bigger enclosure and had human contact every day. The wolves also had contact to adult dogs, owned by the hand-raisers. The wolf curator, one of the hand-raisers, was responsible for the wolves' training which was similar to dogs' training. The wolves were trained to cooperate with humans by rewarding. In addition to exercises such as “sit down” or “lie down” they learned to walk on a leash, not to pull and to come back by calling. The hand-raisers were allowed and able to take the wolves on a 10m-leash (towing line) for a walk outside the enclosure.

Table 1. Participating wolves

wolf	sex	special	mother
A (Aragorn)	♂		Jakrina
K (Kaspar)	♂	alpha male	Sitca
S (Shima)	♀	alpha female	Jakrina
T (Tayanita)	♀	hydrocephalus – blind, epilepsy	Sitca

All eight human hand-raisers had close contact to the wolves during their first month which is known to be important for building social relationships (see Freedman et al., 1961; Serpell und Jagoe 1995). Further all hand-raisers have experience with dogs. After the wolves were five

months old, the hand-raisers' intensity of contact varied between the hand-raisers. Within a given frame of how to handle the wolves each hand-raiser established an individual relationship to the wolves. All hand-raisers were asked to participate in this research. The hand-raisers will herein be referred to as "walkers" in this paper. Forming different dyadic walker-wolf combinations we were able to test 32 different human-wolf dyads (Table 2). In statistical analysis Tayanita's walks were excluded (for reasons see paragraph: data preparation).

Table 2. Dyads: 8 walkers * 4 wolves = 32 walker-wolf dyads; without Tayanita (T) = 24 dyads

		WALKERS (hand-raisers)							
		b	d	e	f	h	r	v	z
WOLVES	A	Ab	Ad	Ae	Af	Ah	Ar	Av	Az
	K	Kb	Kd	Ke	Kf	Kh	Kr	Kv	Kz
	S	Sb	Sd	Se	Sf	Sh	Sr	Sv	Sz
	(T)	<i>Tb</i>	<i>Td</i>	<i>Te</i>	<i>Tf</i>	<i>Th</i>	<i>Tr</i>	<i>Tv</i>	<i>Tz</i>

4.2 Procedure

4.2.1 Standardized walk

For testing cooperative behavior of human-wolf dyads we have designed a standardized walk (Figure 1) inside the Cumberland game park at three different sites. Colored markings, made of wooden spiles, next to the route showed the walker what he/she had to do. Each walker was asked to do a walk with each wolf at each site. Finally every human-wolf dyad should have done three standardized walks.

Figure 1. Layout of the standardized walk: The red colored markings show where the walk starts, turns and stops. The exercise “sit down” (es) has to be done next to the green and the exercise “lie down” (ed) next to the blue marking.

The standardized walk starts at the red marking. The dyad walks on until they reach the green marking. At this point they do the exercise “sit down”. Afterwards they continue walking; they pass the blue marking and turn around at the red one. When reaching the blue marking again the dyad does the exercise “lie down”. Having finished the exercise they walk on again to the starting position (red mark), where they turn around and repeat the whole procedure once again.

The exercises

All wolves were able to do the requested exercises generally. The exercises were executed with both a verbal and a hand command. Doing the exercise “sit down”, the walker speaks the verbal command “sit” as often as necessary and raises his/her hand. The exercise was successfully

passed as soon as the wolf sat down. “Lie down” was fulfilled when the wolf lied down after the verbal command “down” and with the walker’s hand down.

Walking conditions for the walkers

Previously, each walker achieved an information sheet (Appendix A) with exact instructions on the procedure. The most important facts were shortly repeated before each walk. All walks were done with a 10m-leash (towing line) usually used for walks with these wolves. During the standardized walk, the walkers were requested not to talk to the camerawoman (M. Auer), to walk as usual and not to aim at a perfect performance. Time was not limited. Rewarding with dry food was allowed. The WSC rules for wolf treatment and walking a wolf had to be adhered. Some walkers were not allowed to take a wolf for a walk alone. In this case the escort to the site of the standardized walk had to be out of sight before the dyad started the standardized walk. For safety reasons the escort stayed within visual range in exceptional cases.

4.2.2 Prearrangement

Two months before the study started the camerawoman (M. Auer) visited the wolves at least once a week to become familiar with them. Test-walks made sure that all wolves were able to do the standardized walk successfully. The wolf curator did at least one test-walk with each wolf. An important aim was that the wolves were not afraid of or too much attracted by the colored markings, the camcorder, the tripod and the camerawoman.

4.2.3 Timing

The walks included in analysis were done from January to April 2009. During data taking the wolves were seven to eleven months old. They do not mature sexually in their first year. Walking with young instead of adult wolves was also done for safety reasons (see Kubinyi et al., 2007). Because of videotaping, walking was only possible by adequate daylight. Doing walks about noon was avoided because the wolves normally take a rest at that time. We also considered to do only one walk with each wolf per day. Between the three runs per dyad there was at least one day or a walk with another walker in between. Normally one of the walkers did one walk with each of the wolves per day.

4.2.4 Provide equal conditions

To avoid the wolves getting bored walking always the same way, we altered walking at the three sites. This should also minimize data distortion by external natural influences (e.g. ambience, animals or humans in visual range, weather). To provide similar conditions for each walker, we considered that, walkers who first walked at one site, to last walk at another site.

Further the walks were done in a game park open for visitors meaning that during a walk the wolves often met strangers. In consideration of this, walks only were done when the game park was closed for visitors (during winter season: entrance free every day; hours of opening from 10 am to 4 pm) or when visitor frequency was low (e.g. on weekdays). In sporadic cases the dyadic walks were interrupted by strangers for a very short period of time. Analyses thereto had shown that in those cases the overall walk performance has not been influenced.

4.2.5 Recording the walk

The walk was recorded with a digital camcorder (Sony DCR-SR35). The camcorder was positioned on a tripod in the middle of the route; three to five meters aside (see Figure 1). To provide an optimal voice recording the walker wore a small microphone attached on his/her clothes connected with a voice recorder. Before each walk the walker got an instruction on how to handle the voice recorder. The camcorder was always handled by the same camerawoman (M. Auer). During recording the camerawoman was supposed not to talk and to avoid noise.

4.3 Additional information

A protocol was done for each walk noting date and time of the walk, the walking dyad, the route, the wolf's motivation and stress during advance (both rated by the walker, from 1 (high) to 3 (low)), weather, escort, number of days since the last feeding of the wolves (big meal e.g. rabbit, deer), how the dyad got out of the enclosure (putting the leash on the wolf with or without help by other people) and other special occurrences. Questionnaires answered by the wolf walker during data taking included a walker personality test done with the German version (Borkenau & Ostendorf, 2008) of the NEO-Five Factor Inventory (McCrae & Costa, 1987, 1989; Costa & McCrae, 1992), an attitude-towards-wolves scale (modified, after Topàl et al., 1997; Johannson, 1999; Kotrschal et al., 2009; Appendix B) and a wolf personality rating (modified after Feaver et al., 1986; Kotrschal et al., 2009; Appendix C).

4.4 Observation

Video and voice files were merged with the software Adobe Premiere Pro CS4. Behavior was encoded with THE OBSERVER Video Pro® (version 5.0; Noldus). The Configuration based on hours of preliminary observations included 11 behavioral classes (Appendix D). Additionally an overall cooperation rating from 1 (good) to 5 (bad) was done (Appendix E). Before

starting behavior coding an inter-observer-reliability test was done on five one-minute video sequences with a person (IA) not included in the study. Mean ($\pm$ S.D.) inter-observer agreement on all items was 0.80 ± 0.02 . The reliability of the overall cooperation rating was tested with the same person (IA) by rating 12 walks. The index of concordance was 0.83. Results of the cooperation rating showed significant influences of parameters included in the rating. The rating was better (lower value) when the duration of conflicts in guidance was shorter (Pearson correlation two-sided: $r_p=0.467$, $p<0.05$, $n=21$ dyads), when the duration of strained leash was shorter ($r_p=0.826$, $p<0.001$, $n=21$ dyads) and when the duration for doing the exercise “lie down” was shorter (Spearman rank correlation two-sided: $r_s=0.433$, $p<0.5$, $n=21$ dyads).

Behavior coding was done from June to August 2009 by one observer (M. Auer). An intra-observer-reliability test over time (beginning, halftime, end) ensured an observer bias within an acceptable frame. Mean ($\pm$ S.D.) intra-observer agreement on all items was 0.87 ± 0.05 .

4.5 Data preparation

The blind wolf Tayanita behaved abnormally. It showed a stronger attachment to humans and less dread of strangers. The obvious difference appeared in the wolf’s personality rating and of course in the walking performance. Therefore we excluded dyadic walks with Tayanita in the statistical analysis. From a total of 72 walks (excl. walks with Tayanita; $24 \text{ dyads} * 3 \text{ sites}$) 61 walks were done completely (from beginning to the end, incl. exercises). Nine walks were aborted because of a seriously stressed wolf and two walks had not been tried (decided by the walker). The 61 complete walks are distributed to 19 dyads with complete walks at all three sites and two dyads (Av, Ke) with complete walks at only two sites. Three dyads (Kb, Kv, Sb) were not able to do at least one complete walk. Hence the statistical analysis includes 61 standardized walks by 21 different dyads (including two dyads with only two complete walks).

The data set was prepared with MS Excel 2003. For measuring walk variables we took the absolute duration in seconds for variables based on duration independent from the total duration of a walk (e.g. duration for exercises). Variables based on duration dependent from the total duration have been relativized to the totally observed duration of the walk (e.g. duration for a strained leash). The total duration of the walk is higher than the totally observed duration (“duration walk” – “duration behavior is out of sight” = “totally observed duration”). Also frequencies (events) were relativized as a rate per minute observed walk (e.g. initiate strained

leash). Relative data was transformed with an arcus-sinus-transformation. The average value out of three or two walks per dyad was taken for statistical analysis.

4.6 Statistical analysis

The statistical analysis was done with the software SPSS 15.0 for Windows using Kruskal-Wallis-Test, Spearman rank correlation, Pearson correlation and GLMs. Normal distribution was tested with Shapiro-Wilk ($p > 0.05$). Homogeneity of variance was tested with Levene-Test ($p > 0.05$). For testing individual walk-performances we used univariate ANOVA for data with normal distribution and homogeneity of variance and Kruskal-Wallis-Test for data without normal distribution and/or without homogeneity of variance.

To test the effects of walkers' and wolves' personalities and the intensity of contact we used eight covariates (the distribution of the covariates is shown in Figure 2):

- the five Neo-FFI personality factors (**neuroticism, extraversion, openness, agreeableness, conscientiousness**) describing human personality,
- two wolf personality items (**sociable, excitable**) and
- **contact intensity** (time spent together) as an indicator of familiarity and relationship

The covariates were chosen from the additional information we got from the questionnaires. Because of the small sample size, calculating PCAs was not possible. For describing human personality and attitude towards wolves, we decided only to use the five Neo-FFI personality factors because the humans' attitude may be explained by their personalities (Kotrschal et al., 2009).

To measure the wolf's personality we took the median out of eight ratings (Appendix C) done by the hand raisers. Further we selected the wolves' personality variables on the basis of Kotrschal et al. (2009) and took only those with at least 50% variation of the total range. This resulted in seven variables which we reduced to two variables that are related to others (see below; calculating correlations was not possible due to the small sample size):

- sociable (also meaning to be less anxious and less nervous)
- excitable (also meaning to be less dependable, less calm and less self-confident)

We also added the factor "contact intensity" which should neither be explained by human personality nor by wolf personality but may influence cooperative performance. Contact in-

tensity was measured by the walker's frequency of wolf walks (since wolf walks were done; excl. standardized walks for the study) answered in the questionnaire "attitude-towards-wolves scale" (Appendix B, Question B6). The frequency of wolf walks also correlated with the amount of days spent with the wolves (attitude-towards-wolves scale, Appendix B, Question A6) (Spearman rank correlation two-sided: $r_s=0.944$, $n=8$, $p<0.001$). Due to the small sample size, effects of human's and wolf's sex have not been tested.

Figure 2. Distribution of the covariates; wolf personality item "sociable", wolf personality item "excitable", contact intensity: total range = 100; neuroticism, extraversion, openness, agreeableness, conscientiousness: total range = 48.

We conducted 12 general linear models and one generalized linear model with a log-link function and based on Poisson distribution. Explanatory variables were removed if $p>0.1$ in order to decrease significance. Only terms with $p<0.1$ remained in the final model. Excluded terms were re-entered one by one into the final model to confirm that they did not explain a significant part of the variation (Poesel et al., 2006).

5 Results

5.1 Individual effects on walking-performance

Twenty-one variables were selected for testing and separated into three groups. One group of variables is described by involving both, walker and wolf. This group is called: interaction-related parameters (see introduction). Variables which refer to the wolf-related parameters group only involve the wolf's behavior and variables in the walker-related parameters group only involve the walker's behavior. Each group includes seven tested variables. In 18 variables a significant ($p < 0.05$) individual influence or a trend ($0.1 > p \geq 0.05$) was found (Table 3).

Table 3. Individual differences in walking parameters; ^a: univariate ANOVA; ^b: Kruskal-Wallis-Test; ex.=exercise; Factor wolf: n=3; Factor walker: n=8; parameters with $p > 0.1$ are not listed in the table.

Group	Variable	Factor wolf	Factor walker
Interaction	Cooperation rating (1-5) ^a	p=0.068	
	Leash strained ^b [% of observed walk]		p=0.098
	Guidance walker ^a [% of observed walk]		p=0.056
	Guidance wolf along route ^a [% of observed walk]	p<0.01	
	Distance close (less 1m) ^a [% of observed walk]	p=0.058	p<0.05
	Walk-phase: call close ^b [sec]		p=0.096
	Walk-phase: ex. "lie down" ^b [sec]	p<0.05	
Wolf	Wolf orientated to walker ^a [% of observed walk]		p<0.05
	Wolf exploring ^b [% of observed walk]		p=0.05
	Wolf initiates strained leash ^b [1/min]		p=0.091
	Wolf initiates locomotion ^a [% of all locomotion initiations]	p<0.05	
Walker	Walker orientated to wolf ^b [% of observed walk]		p<0.05
	Walker initiates strained leash ^b [1/min]		p<0.05
	Walker rewards with food ^a [1/min]		p<0.05
	Walker speaks to wolf ^b [% of observed walk]		p<0.05
	Walker calls "wolf's name" ^b [1/min]		p<0.05
	Walker calls "come" ^a [1/min]		p<0.001
	Walker calls "down" per ex. down (mean) ^b		p=0.053

As we can see in table three, walking performance differs more within walkers (14 variables) than within wolves (five variables). Interaction parameters involving both, wolf and walker, even show individual influences by the wolves and the walkers. There is a trend that the cooperation rating of a dyadic walk depends on the wolf which would be supported by the significant influence of the wolf on the duration needed for doing the exercise "lie down" (cooperation rating is better when exercises are done quickly and successfully). Guidance in the case of a dyadic walk describes which individual walks in front (see introduction). There is a trend of

the walker's influence on the duration of guidance walker and a significant influence of the wolves on the duration of guidance wolf (along the route). The duration of a strained leash and for calling a wolf close seem to depend on the walker. Concerning a close distance (less than 1m) between walker and wolf, we discovered a trend on the influence of wolves and a significant dependence on walkers.

Only four of the seven tested wolf-related parameters show individual influences (Table 3). Interestingly three of them depend on the walker. The wolf's orientation towards the walker is significantly influenced by the walker. There are trends that the walker also influences the duration of the wolf's explorative behavior and the wolf's initiating behavior for straining at the leash. Only the wolf's initiating behavior for changing locomotion depends significantly on the wolf.

The walkers differ significantly in six of the seven tested walker-related parameters (Table 3). They pay different attention to a wolf (walker orientated to wolf), vary in initiating a strained leash, in the amount of food rewards, the duration of speaking to a wolf and in the number of calling the wolf's name or calling "come". There also seems to be a difference in the number of calling verbal commands per exercise (trend in walker calls "down" per exercise down). Concerning the wolves, no influences on walker related parameters were found.

5.2 Effects of walkers' and wolves' personalities and the intensity of contact

The 13 tested variables are divided in three groups characterizing three important parameters for describing a dyadic walk performance. The first group "cooperation" (Table 4) includes the overall cooperation rating and the usage of the leash and food rewards. The second group characterizes guidance behavior (Table 5) and the third describes the orientation towards the walking partner (Table 6).

5.2.1 Cooperation

Wolf personality

The observer's rating of cooperation for a dyadic walk is better (lower value), when the wolf is more sociable (Table 4). Further sociable wolves have shorter durations of a strained leash and less frequently initiations of a strained leash by both wolf and walker (Table 4). Also excitable

wolves have less frequently initiations of a strained leash by the walker (Table 4). Sociable and excitable wolves gain more food rewards (Table 4).

Walker personality and contact intensity

The walkers' personalities and contact intensity had no effect on the cooperation rating. Walkers high in neuroticism (Neo-FFI dimension 1) and low in openness (Neo-FFI dimension 3) and agreeableness (Neo-FFI dimension 4) and with low intensity of contact have longer durations of a strained leash and more frequently initiations of a strained leash by both wolf and walker (Table 4). Walkers low in extraversion (Neo-FFI dimension 2) initiate less frequently a strained leash and reward less with food (Table 4). Walkers high in conscientiousness (Neo-FFI dimension 5) also reward less with food but have more often initiations of a strained leash by both wolf and walker (Table 4).

5.2.2 Guidance

Wolf personality

Both sociable and excitable wolves have on the one hand shorter conflicts in guidance and on the other hand longer durations of "guidance wolf (along route)" (Table 5). Only sociable wolves appear to stay longer in close distance to the walker (Table 5).

Walker personality and contact intensity

Walkers high in extraversion (Neo-FFI dimension 2) and openness (Neo-FFI dimension 3) have longer conflicts in guidance and shorter durations of "guidance walker" and "staying close" (Table 5). The higher the walker in extraversion (Neo-FFI dimension 2) and conscientiousness (Neo-FFI dimension 5) the more the wolf explores (Table 5).

5.2.3 Orientation to walking partner

Wolf personality

There were no effects of wolf's personality on walker's and wolf's orientation to the walking partner found.

Walker personality and contact intensity

Walkers high in neuroticism (Neo-FFI dimension 1) show less general orientation though more tactile orientation towards the wolf (Table 6). Walkers high in openness (Neo-FFI dimension 3) are less tactile orientated towards the wolf (Table 6). The higher the walker in agreeableness (Neo-FFI dimension 4) the more the walker orientates to the wolf (Table 6). Walkers low in neuroticism (Neo-FFI dimension 1) and extraversion (Neo-FFI dimension 2) but with high intensity of contact gain more attention (wolf is longer orientated to them) from the wolf (Table 6).

Table 4. Statistics for GLMs 1-5 (characterizing cooperation), with 1. “Cooperation Rating (1-5)” (mean rating of complete walks), 2. “Duration of strained leash” (mean duration of complete walks [% of observed walk]), 3. “Rate of wolf initiates strained leash” (mean rate of complete walks [1/min observed walk]), 4. “Rate of walker initiates strained leash” (mean rate of complete walks [1/min observed walk]), 5. “Rate of food rewards” (mean rate of complete walks [1/min observed walk]) as dependent variables. Excluded = term was excluded from this final model because $p > 0.1$.

Model Term	General and Generalized Linear Models (GLMs) 1-5														
	1: Cooperation Rating (1 – 5)			2: Duration of strained leash			3: Rate of wolf initiates strained leash			4: Rate of walker initiates strained leash			5: Rate of food rewards		
	df	F	p	df	F	p	df	F	p	df	Wald Statistic	p	df	F	p
Neuroticism		Excluded		1	7.066	0.018	1	14.677	0.002	1	285.985	$p < 0.001$		Excluded	
Extraversion		Excluded			Excluded			Excluded		1	22.713	$p < 0.001$	1	9.424	0.007
Openness		Excluded		1	4.318	0.055	1	10.562	0.006	1	237.330	$p < 0.001$		Excluded	
Agreeableness		Excluded		1	5.863	0.029	1	12.337	0.003	1	117.671	$p < 0.001$		Excluded	
Conscientiousness		Excluded			Excluded		1	4.171	0.060	1	39.806	$p < 0.001$	1	3.389	0.084
Contact intensity		Excluded		1	6.089	0.026	1	9.024	0.009	1	28.571	$p < 0.001$		Excluded	
Sociable - wolf	1	5.699	0.028	1	4.890	0.043	1	3.200	0.095	1	45.366	$p < 0.001$	1	6.577	0.021
Excitable - wolf		Excluded			Excluded			Excluded		1	31.362	$p < 0.001$	1	3.296	0.088

Table 5. Statistics for GLMs 6-10 (characterizing guidance), with 6. “Duration of conflicts in guidance” (mean duration of complete walks [% of observed walk]), 7. “Duration of guidance walker” (mean duration of complete walks [% of observed walk]), 8. “Duration of guidance wolf (along route)” (mean duration of complete walks [% of observed walk]), 9. “Duration of staying close (less 1m)” (mean duration of complete walks [% of observed walk]), 10. “Duration of wolf exploring” (mean duration of complete walks [% of observed walk]) as dependent variables. Excluded = term was excluded from this final model because $p > 0.1$.

Model Term	General Linear Models (GLMs) 6-10														
	6: Duration of conflicts in guidance			7: Duration of guidance walker			8: Duration of guidance wolf (along route)			9: Duration of staying close (less 1m)			10: Duration of wolf exploring		
	df	F	p	df	F	p	df	F	p	df	F	p	df	F	p
Neuroticism		Excluded			Excluded			Excluded			Excluded			Excluded	
Extraversion	1	14.527	0.002	1	21.681	$p < 0.001$		Excluded		1	18.393	$p < 0.001$	1	6.975	0.017
Openness	1	6.621	0.020	1	8.046	0.011		Excluded		1	22.464	$p < 0.001$		Excluded	
Agreeableness		Excluded			Excluded			Excluded			Excluded			Excluded	
Conscientiousness		Excluded			Excluded			Excluded			Excluded		1	17.532	0.001
Contact intensity		Excluded			Excluded			Excluded			Excluded			Excluded	
Sociable - wolf	1	7.066	0.017		Excluded		1	19.765	$p < 0.001$	1	12.943	0.002		Excluded	
Excitable - wolf	1	5.698	0.030		Excluded		1	8.605	0.009		Excluded			Excluded	

Table 6. Statistics for GLMs 11-13 (characterizing orientation to walking partner), with 11. “Duration of walker orientated to wolf” (mean duration of complete walks [% of observed walk]), 12. “Duration of tactile orientation to wolf” (mean duration of complete walks [% of observed walk]), 13. “Duration of wolf orientated to walker” (mean duration of complete walks [% of observed walk]) as dependent variables. Excluded = term was excluded from this final model because $p > 0.1$.

Model Term	General Linear Models (GLMs) 11-13								
	11: Duration of walker orientated to wolf			12: Duration of tactile orientation to wolf			13: Duration of wolf orientated to walker		
	df	F	p	df	F	p	df	F	p
Neuroticism	1	5.638	0.029	1	15.097	0.001	1	13.034	0.002
Extraversion		Excluded			Excluded		1	14.310	0.001
Openness		Excluded		1	7.811	0.012		Excluded	
Agreeableness	1	9.080	0.007		Excluded			Excluded	
Conscientiousness		Excluded			Excluded			Excluded	
Contact intensity		Excluded			Excluded		1	7.812	0.012
Sociable - wolf		Excluded			Excluded			Excluded	
Excitable - wolf		Excluded			Excluded			Excluded	

5.3 Dyadic influences on walking behavior

5.3.1 Effects on the wolf’s explorative behavior

The wolf explored more when the duration of strained leash was shorter, when there were less initiations of strained leash by the walker and when the walker guided less during the walk (Figure 3).

5.3.2 Effect of food rewarding

There were no correlations found between the rate of food rewards and parameters characterizing cooperation (cooperation rating, duration of strained leash, rate of initiating strained leash, duration needed for exercises). There was also no evidence that wolves pay more attention to the walker (wolf orientated to walker) when they gain more food rewards. However we noticed an effect on parameters characterizing guidance behavior. The duration of guidance walker was longer when the wolf was more often rewarded with food (Figure 4). Furthermore conflicts in guidance were shorter and walker and wolf stayed longer in close distance (Figure 4). There was also a trend that wolves explored less when they gained more food rewards (Pearson correlation two-sided: $r_p = -0.414$, $p = 0.062$, $n = 21$).

Figure 3. The relationship between “Duration of wolf exploring” (mean duration of complete walks [% of observed walk]), Pearson correlation two-sided: $r_p = -0.502$, $p < 0.05$ and (b) “Walker initiates strained leash” (mean rate of complete walks [1/min observed walk]), Spearman rank correlation two-sided: $r_s = -0.565$, $p < 0.01$ and (c) “Duration of guidance walker” (mean duration of complete walks [% of observed walk]), $r_p = -0.461$, $p < 0.05$, $n = 21$ dyads.

Figure 4. The relationship between “Rate of food rewards” (mean rate of complete walks [1/min observed walk]) and (a) “Duration of guidance walker” (mean duration of complete walks [% of observed walk]), $r_p = 0.712$, $p < 0.001$ and (b) “Duration of conflicts in guidance” (mean duration of complete walks [% of observed walk]), $r_p = -0.626$, $p < 0.01$ and (c) “Duration of staying close (less 1m)” (mean duration of complete walks [% of observed walk]), $r_p = 0.742$, $p < 0.001$, $n = 21$ dyads.

5.3.3 Relationship between wolf's and walker's rate of initiating strained leash

We found that the more often a wolf or a walker initiates a strained leash, the more often the walking partner initiates a strained leash in turn (Figure 5).

Figure 5. Dyadic correlation between wolf's and walker's rate of initiating a strained leash, (mean rate of complete walks [1/min observed walk]), $r_s=0.732$, $p<0.01$, $n=21$ dyads.

5.4 Effect of familiarity on doing complete walks

Two wolf walkers who were less familiar (had less contact intensity) with the wolves were not able to do at least one complete walk with each wolf (Table 7). Seven uncompleted walks were related to wolf K, three to wolf S and only one to wolf A (Table 7).

5.5 Effect of wolf personality on the wolf's stress level

While walking to the route the walker rated the wolf's stress level ranging from 1 (low) to 3 (high). We found that more sociable wolves have lower stress levels (Figure 6).

Table 7. Coherency of familiarity (contact intensity) (mm per 100 mm scale) and number of complete walks (maximum: nine walks (three walks per wolf)).

familiarity	number of complete walks			
	with all wolves	with wolf A	with wolf K	with wolf S
8	3	3	0	0
21	5	2	0	3
21	9	3	3	3
50	9	3	3	3
50	9	3	3	3
69	9	3	3	3
71	9	3	3	3
77	8	3	2	3

Figure 6. Relationship between wolf personality item “sociable” and the wolf’s stress level while walking to the route (rated by the walker on a range from 1 (low) to 3 (high)), Kruskal-Wallis-Test: $\chi^2=7.988$, $df=2$, $n=66$, $p<0.05$.

6 Discussion

The interpretation of our results based on eight humans and three wolves has to be done very carefully. Also the combined dyadic structure causes pseudo-replication of personality data. It is known that human's and dog's sex affects human-dog interactions (Wells & Hepper, 1999; Prato-Previde et al., 2006; Kotrschal et al., 2009). Due to the small sample size such effects have not been considered in this study. However, we found interesting results on cooperative performance during a dyadic leash walk and similarities between human-wolf and human-dog cooperation.

6.1 Methodic annotation

To make sure that the walk performance was not influenced by environmental conditions we did three walks at three different sites and noted variables that might had an influence on the walk performance. Among others the wolf's motivation for cooperation (e.g. doing exercises) and the wolf's stress level were rated by the walker while walking to the standardized walk. The wolf's motivation was generally rated to be very high and the stress level was mostly between low and middle stress. Both, motivation and stress level did not influence walking performance in the standardized walk. However, we discovered a connection between the walkers' rating of the stress level and the rating for the wolves to be sociable. The wolf's stress level during a walk outside the enclosure was usually linked to the occurrences of strangers and strange objects (e.g. cars). The connection between personality and stress rating may denote that being a sociable wolf means to be not (or less) afraid of strangers and strange objects.

The overall cooperation rating of a dyadic walk (Appendix E) appears to depend only on the wolf. This is also supported by our GLM results. However, by regarding parameters used as criterions for the rating (conflicts in guidance, occurrence of strained leash and duration needed for doing exercises; see material and method) we found effects of wolves and walkers related to their personalities and their relationship (contact intensity). The overall rating may be rather imprecise to describe such a complex situation within a small sample size.

6.2 Leash walking as a model for cooperation

Virányi et al. (2008) mentioned a high variability in the wolves' communicative behavior and argued that this circumstance provided a basis for the domestication process of the dog. Further Ginsburg and Hiestand (1991) noted that during domestication dogs were unconsciously selected for improved cooperative abilities. Therefore we assumed a high variability in wolves' cooperative performance. The three tested wolves, all of them raised the same way, differ significantly in some cooperative walking parameters. The distribution of uncompleted walks (seven uncompleted walks were related to wolf K, three to wolf S and only one to wolf A) also indicates a variability of cooperative behavior. Further the cooperation rating showed that sociable wolves cooperate better. This may be a sign for a high cooperative variability in wolves but of course more wolves have to be tested to get clear information about that.

In addition we have discovered that wolf's behavior differs significantly between walks with different walkers. This indicates cooperative variability even within an individual wolf. Our results on individual effects reveal more differences between walkers than between wolves which may suggest that the walk is rather controlled by the walker. But our findings are certainly also influenced by the unequal sample size of three wolves and eight walkers. Naderi et al. (2001) made clear that initiations during a cooperative walk of blind people and their guide dogs alternate and that in comparison to blind folded owners and their pet dogs lower performance is not only due to an untrained dog but also to their owners in having difficulty to relinquish initiations. Inferential cooperative performance in human-dog dyads as well as in human-wolf dyads depends on both partners.

As we assumed that familiarity (intensity of contact) is important for human-wolf cooperative performance (see Kubinyi et al., 2007) we found that high contact intensity increases the wolf's attention towards the walker and has a positive effect on leash handling. Furthermore ten out of eleven uncompleted walks were related to walkers with less familiarity to the wolves. As already mentioned in the introduction it was not possible to do wolf walks with strangers because these wolves behaved very shyly when strangers appeared. Schöberl (2009) has indicated that dogs also feel stressed when strangers visit their home. The socialized wolves we tested were certainly more stressed facing strangers than most dogs would have been. To be sure about that and to investigate whether dogs cooperate more readily with humans than socialized wolves, dogs need to be tested under similar conditions.

Research on human-dog interactions has already revealed that personality plays an important role in relationship, attachment and interaction styles which are again important for the performance in dyadic operational tasks (Asendorpf and Wilpers, 1989; Kotrschal et al., 2009; Schöberl, 2009; Aliabadi, 2010; Wedl et al., 2010; see also Wedl and Kotrschal, 2009). Our results show that human personality influences several aspects of human-wolf cooperation. The duration of the wolf's head orientation to the walker is significantly influenced by the walker. GLMs indicate that this is related to the walker's personality and relationship. Wolves were more orientated to walkers more familiar with them and they were less orientated to neurotic and extravert walkers. The head orientation towards the walking partner is one way to approximate the attention paid to him/her (see Wedl et al., 2010) which is further related to communication. Communication between humans and wolves which is an important component of cooperation (Chalmeau and Gallo, 1996), has already been investigated by testing the wolf's understanding of human pointing gestures. In this matter Kubinyi et al. (2007) notes that "wolves had decreased willingness to look at humans even after intensive socialization" (p. 37). Recent studies show that adult wolves that successfully utilize human pointing gestures have increased willingness to cooperate (measured with the latency of eye-contact), (Gácsi et al., 2009). Our study now indicates that the high variation in the communicative behavior between humans and wolves (Virányi et al., 2008) is also accompanied by human personality and familiarity.

According to recent findings by Kotrschal et al. (2009) we discovered similarities of human personality influencing interaction style and cooperative performance. Their research on human-dog dyads reveal that owners high in neuroticism had an emphatic-tactile interaction style and were less successful in operational tasks. Our study indicates that this also applies to human-wolf dyads. Walkers high in neuroticism were more tactile towards the wolves and had more often a strained leash (duration and initiation). Further Kotrschal et al. (2009) point out that dog owners high in extraversion are action-orientated and have a clear interaction style during an operational task with their dogs. We discovered that wolves showed more explorative behavior when walking with a walker high in extraversion. That wolves explored more could mean that they perhaps enjoy the walk more. Walkers high in extraversion also used the leash less often as a tool for enforcement (straining at the leash) and tended to guide less during a dyadic leash walk.

Further we found influence of human personality on rewarding behavior. The wolves from the Wolf Science Center are trained to cooperate with humans by being rewarded with food.

Therefore the food reward forms a part of the cooperative action. Less extraverted and conscientious walkers rewarded more often with food. Among dog owners anecdotal reports exist, claiming that dogs cooperate more readily when they are more often rewarded with food. Our results on the effects of food rewards do not indicate a better cooperative performance when wolves are more often rewarded. But a higher frequency of food rewards improves the walker's guidance by decreasing conflicts in guidance and by closer proximity to the wolves indicating reciprocal actions. It appears that there were two different walking strategies due to human personality. Those who gave more food rewards saw the walk as a task and were interested in performing well. On the opposite side walkers who gave less food rewards were less interested in performance but more in the wolf enjoying the walk (wolves also explored more when walking with an extraverted or conscientious walker). Further the trend that wolves explore less when gaining more food rewards supports this hypothesis. Conflicts in guidance were related to poor performance (see introduction), however long conflict situations were not necessarily accompanied by enforcement (straining at the leash) and disobedient wolves. Some walkers even did not try to call wolves back and willingly waited when those were sniffing long and intensive at one place. Maybe we should reconsider if conflict in guidance is related to poor performance. Besides, to be focused on a good performance may also mean to be more stressed during a walk. This is discussed in the following paragraph.

The wolf's explorative behavior was important for us because we used it as an indicator for stress (due to fear or excitement). Scared or very excited wolves often did not enjoy the walk by exploring the environment (sniffing, chewing or playing with objects). As already mentioned above walker's personality influenced the wolf's explorative behavior. Interestingly we discovered no influence of wolf personality. Further wolves explored less when the leash was strained often (duration and initiation by the walker) and when the walker tended to guide the walk most of the time. That sociable wolves are easier to handle (have less often a strained leash) was conceivable but it was surprising that walkers tended not only to influence the duration of a strained leash but also the wolf's initiation behavior to strain at the leash. This indicates that the walker is more in charge of leash handling. Moreover a reciprocal effect was found on leash-straining initiations between the walking partners. Therefore by reducing straining at the leash and guiding the walk, the walker seems to be able to reduce the wolf's leash-straining and stress condition (increase the wolf's explorative behavior). We think that this could be an important issue in dogs' training walking on a loose leash.

Studies investigating human-dog stress coping reveals that human's personality (Kotrschal et al., 2009; Schöberl et al., 2009; Aliabadi, 2010), dog's sex (Aliabadi, 2010) and personality (Schöberl, 2009) as well as attachment, relationship and interaction style (Schöberl et al., 2009) affects the dog's cortisol levels. Horvath (2008) points out that behaviors associated with control, authority or aggression rise cortisol concentrations, whereas playing and affiliative behaviors drop cortisol values. Concerning human-wolf dyads we can say that the interaction style and the walker's personality influence the wolf's stress condition. Further, related to the previous paragraph (food rewards affects guidance behavior), it may help to calm down a wolf and probably also a dog in being less focused on a good performance.

6.3 Conclusion

Cooperation during a dyadic leash walk is a complex situation and influenced by many parameters (see Figure 7). This study shows that socialized wolves are able to cooperate with humans in such a complex situation. There were several findings indicating a reciprocal interaction style and as it is already known that personality and relationship affect human-dog cooperation, this also seems to be the case in human-wolf dyads. Once more a study provides results that let us think about dominant related dog training mainly focused on dog's behavior. As Ley and Bennett (2007) makes clear that studying dog personality provides a better understanding of human personality this may also apply to human cooperation. Thus studying human-wolf cooperation may not only draw attention to human-dog cooperation but also to cooperation among humans.

Figure 7. Proposed chain-linking from personality and relationship to dyadic cooperation. In reference to Kotrschal et al. (2009).

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8 Acknowledgements

First of all I want to thank my supervisor Prof. Dr. Kurt Kotrschal who offered me the unique opportunity to study human-wolf cooperation. Further thanks to Dr. Friederike Range, Dr. Zsófia Virányi and Beatrix Belényi for their helpful inputs, encouragement and participation. Great thanks to Manuela Wedl for sharing her scientific experience and for answering all my questions so patiently. I wish you the best for your promotion. For financial support I have to thank IEMT Austria. I also want to thank my advisor Prof. Dr. Heinrich Römer for accepting such an uncommon topic in his department. For statistical support I want to thank Prof. Dr. Wolfgang Desch. Of course thanks to all walkers for participating in this study and also thanks to the wolves, Aragorn, Kaspar, Shima and Tyanita. Last but not least thanks to my parents for providing me the opportunity to study zoology, thank you Barbara for correcting language, thank you Georg for your social support and your help in graphic design and thanks to my dogs Jessy and Asterix.

9 Appendix

9.1 Appendix A: Handout for doing standardized walks

- 1) Please read through the Handout. If you have any queries, please ask me.
- 2) Conditions for a walk: no rain- or snowfall (because of the camera); good daylight; motivated wolves
- 3) Each dyad has to do the walk three times. The same dyad is not allowed to do the walk two or three times in serial and if possible it should not walk more than once at the same day.
- 4) Performance
 - ✓ Try to walk uninfluenced, “as usual”! Do not brace one self or mind on perfectness because of video recording.
 - ✓ During the walk please do not contact with the camerawoman. Also there should be no intervisibility with the escort (persons, wolves, dogs).
 - ✓ The order and place (look after colored markings) of the practices have to be considered.
 - ✓ Do not do the practices with your back to the camera. The camera should see the faces of human and wolf – lateral presentation is optimal.
- 5) Course

Also the spoken words are important for the analysis. Thus each wolf-walker gets a dictaphone and a small microphone with a short introduction about the handling. Afterwards we leash the wolves. From the enclosure to the beginning of the walk it takes about 10 minutes. I will go ahead with the camera to be timely at my position. The red dowel marks the beginning of the standardized walk. (**Important:** Switch on the dictaphone!). You walk until the green marking. There you do the first exercise “sit”. You walk on, pass the blue marking and turn at the red marking. Back at the blue marking you do the second exercise “down” and walk on. Pass the green marking and turn at the red marking. Now you repeat this once again: do the exercise three “sit” at the green marking, walk on, pass the blue and turn at the red marking. At the blue marking you do the exercise four “down” and walk on pass the green marking. As soon as you pass the red marking the standardized walk is finished.
- 6) Schedule

The walks should be done from January to March 2009.
- 7) Anonymity

For the analysis each wolf-walker gets a number. Full anonymity can not be given during taking the data but for analysis and publication it is guaranteed.
- 8) Further

Additionally to the walks, each wolf-walker has to fill out a personality-test (NEO-FFI), a wolf-attitude questionnaire and a wolf-personality-scoring questionnaire.

9.2 Appendix B: Attitude-towards-wolves-scale (German)

Bitte beantworten Sie folgende Fragen so gewissenhaft wie möglich. Es gibt keine „richtigen“ oder „falschen“ Antworten, bitte beantworten Sie alle Fragen nach Gefühl. Sollte eine Frage auf Sie nicht zutreffen (z.B. Wasser geben, füttern), bitte einfach übergehen.

Je nach Art der Fragestellung bitte zutreffenden Punkt oder zutreffende Position auf der Skala ankreuzen.

Bitte beachten Sie, dass die Skalen seitlich begrenzt sind und diese vollständig genutzt werden können (siehe Beispiele).

Bitte auch alle Unterfragen beantworten!

Falls Sie sich mit Ihrer Antwort geirrt haben, diese bitte deutlich durchstreichen und dafür die zutreffende Antwort ankreuzen.

Die Fragen beziehen sich immer auf alle vier Wölfe.

Beispiele:

- x) Wie oft gehst Du mit den Wölfen spazieren (mit allen 4; generelle Frequenz)?

- xi) Wie oft gehst Du mit den Wölfen spazieren (mit allen 4; generelle Frequenz)?

- xii) Wie oft gehst Du mit den Wölfen spazieren (mit allen 4; generelle Frequenz)?

Der Fragebogen wird anonym und vertraulich behandelt.

A) Allgemeine Fragen:

1. Wolf-Walker:
2. Geschlecht: ☐ weiblich ☐ männlich
3. Alter zum Zeitpunkt der Datenaufnahme:
4. Beruf:
5. Lebst du mit Haus-/Heim-/Kumpantieren?
☐ Nein
☐ Ja
 Wenn ja, welche und wie viele:
6. Wie viele Tage bist du durchschnittlich bei den Wölfen?
 ☐ mehr als 3 Tage pro Woche ☐ 1 bis 3 Tage pro Woche
 ☐ 1 bis 3 Tage pro Monat ☐ weniger als 1 Tag pro Monat

B) Fragen zur Einstellung

1. Wie schätzt Du Deine tägliche Belastung ein bzw. wie stressintensiv ist Dein Alltag?
 - a. während eines Arbeitstages:

sehr gering *sehr hoch*
 - b. während eines Ruhetages:

sehr gering *sehr hoch*
2. Wie schätzt Du die tägliche Belastung unserer Wölfe ein bzw. wie stressintensiv ist ihr Alltag?
 - a. während eines Arbeitstages (viel Training, Tests, ...):

sehr gering *sehr hoch*
 - b. während eines Ruhetages (keine besonderen Geschehnisse oder Aufregungen):

sehr gering *sehr hoch*

3. Wie reagierst Du, wenn sich eine fremde Person dem Wolf während eines Spaziergangs nähert?

a. Ich ziehe ihn mit der Leine in meinen Kontrollbereich und halte ihn an kurzer Leine bis die Person vorbeigegangen ist.

trifft gar nicht zu trifft sehr zu

b. Ich gebe ein Kommando (sitz, platz, bleib, fuß, ...).

trifft gar nicht zu trifft sehr zu

c. Ich weiche aus und lenke den Wolf ab.

trifft gar nicht zu trifft sehr zu

d. Ich reagiere gar nicht und gehe normal weiter.

trifft gar nicht zu trifft sehr zu

e. Ich belohne den Wolf, wenn er die Person ignoriert.

trifft gar nicht zu trifft sehr zu

f. Ich reagiere indem ich ... (falls sie auf eine andere Art reagieren, die nicht angegeben ist, diese bitte hier beschreiben)

.....
trifft gar nicht zu trifft sehr zu

4. Die Wölfe lassen sich von mir gerne anfassen.

trifft gar nicht zu trifft sehr zu

5. Wie oft spielst Du mit den Wölfen?

nie täglich

6. Wie oft gehst Du mit den Wölfen spazieren (mit allen 4; generelle Frequenz)?

|-----|
nie *mind. 3x wöchentlich*

7. Wie regelmäßig sprichst Du mit den Wölfen bzw. führst Du eine „Unterhaltung“ die über Befehle und Kommandos hinausgeht, wenn du im Wolfsgehege bist?

|-----|
nie *regelmäßig*

8. Was bedeuten Dir die Wölfe?

|-----|
„nur ein Tier“ / Zweckpartner *Sozialpartner*

9. Die Wölfe freuen sich/leiden mit uns.

|-----|
trifft gar nicht zu *trifft sehr zu*

10. Für wie stressanfällig hältst Du unsere Wölfe?

|-----|
gar nicht stressanfällig *sehr stressanfällig*

11. Wie leicht kannst Du einem Wolf etwas Neues beibringen?

|-----|
gar nicht *sehr*

12. Wie arbeitsfreudig sind die Wölfe bei Dir?

|-----|
gar nicht *sehr*

13. Wie gut hören die Wölfe auf Deine Kommandos?

|-----|
gar nicht *sehr*

14. Wie oft drückst Du dem Wolf gegenüber folgendermaßen Dein Missfallen aus?

a. „mildes“ Schimpfen

b. Körperliches zurechtweisen im Sinne von wegdrücken oder an der Leine ziehen

c. Ignorieren

d. Schnauzengriff (mit der Hand über die Schnauze des Wolfes greifen)

15. Wie oft belohnst du den Wolf mit folgenden Methoden?

a. Leckerli

b. Loben

c. Spielen

d. Knuddeln/ soziopositive Interaktion

e. Kurzes Berühren/Streicheln

16. Ich bringe einem Wolf gerne was bei.

trifft gar nicht zu trifft sehr zu

17. Ich trainiere/spiele ausführlich mit den Wölfen.

nie mind. 3x wöchentlich

18. Selbst wenn andere WSC-Mitglieder anwesend sind, wenden sich die Wölfe meist an mich, wenn sie was wollen.

trifft gar nicht zu trifft sehr zu

19. Ich stelle sicher, dass die Wölfe immer frisches Wasser haben.

trifft gar nicht zu trifft sehr zu

20. Ich glaube, die Wölfe verstehen mich.

trifft gar nicht zu trifft sehr zu

21. Es ist ein gutes Gefühl, mit den Wölfen zu reden.

trifft gar nicht zu trifft sehr zu

22. Manchmal bringt mich ein Wolf, durch das was er tut, zum Lachen.

trifft gar nicht zu trifft sehr zu

23. Die Wölfe wollen oft Aufmerksamkeit von mir.

trifft gar nicht zu trifft sehr zu

24. Die Wölfe sind Schlawiner, haben nur Unsinn im Kopf.

trifft gar nicht zu trifft sehr zu

25. Ich kümmere mich gerne um die Wölfe, die täglichen Routinen machen mir nichts aus.

trifft gar nicht zu trifft sehr zu

26. Manchmal beschäftige ich mich mit den Wölfen, wenn ich eigentlich was anderes wichtiges zu tun hätte.

trifft gar nicht zu trifft sehr zu

27. Ich fühle mich für die Wölfe mitverantwortlich und das ist gut so.

trifft gar nicht zu trifft sehr zu

28. Ich wäre sehr traurig, wenn wir einen Wolf verlieren würden, wenn er krank wäre oder sich verletzen würde.

trifft gar nicht zu trifft sehr zu

29. Die Wölfe bedeuten mir sehr viel.

trifft gar nicht zu trifft sehr zu

30. Ich mag es, mit den Wölfen einfach nur herum zu hängen und zu entspannen.

trifft gar nicht zu trifft sehr zu

31. Alleine durch das Zusammensein mit den Wölfen fühle ich mich gut.

trifft gar nicht zu trifft sehr zu

32. Die Wölfe wissen, wenn ich wirklich traurig, beunruhigt oder verärgert bin.

trifft gar nicht zu trifft sehr zu

33. Es tut mir gut, bei den Wölfen zu sein, wenn ich traurig, beunruhigt oder verärgert bin.

trifft gar nicht zu trifft sehr zu

34. Die Wölfe scheinen nicht zu bemerken, wie ich mich fühle.

trifft gar nicht zu trifft sehr zu

35. Die Wölfe fehlen mir, wenn wir nicht zusammen sein können.

trifft gar nicht zu trifft sehr zu

36. Die Wölfe sind gute Gefährten/Freunde.

trifft gar nicht zu trifft sehr zu

37. Ich schmuse gerne mit den Wölfen.

trifft gar nicht zu trifft sehr zu

38. Ich lege Wert darauf, Zeit mit den Wölfen zu verbringen.

trifft gar nicht zu *trifft sehr zu*

39. Die Wölfe helfen mir, mit mir selbst im Gleichgewicht zu sein.

trifft gar nicht zu *trifft sehr zu*

40. Ich verbringe ziemlich viel Zeit mit den Wölfen.

trifft gar nicht zu *trifft sehr zu*

41. Ich wollte immer Wölfe haben bzw. mit Wölfen arbeiten.

trifft gar nicht zu *trifft sehr zu*

42. Die Wölfe mögen mich.

trifft gar nicht zu *trifft sehr zu*

9.3 Appendix C: Wolf-personality-rating (German)

Beurteilt von:

Beurteilter Wolf:

Bitte zutreffende Position auf der Skala ankreuzen.

Der Wolf ist:

inaktiv	aktiv
sanft	stürmisch
uninteressiert	interessiert
gleichmütig	erregbar
unsicher	selbstbewusst
nicht spielfreudig	spielfreudig
distanziert	kontaktfreudig
defensiv	offensiv
still	vokal
unaufmerksam	aufmerksam

Welche der folgenden Eigenschaften würden sie dem Wolf wie stark zuordnen:

- Er ist verspielt.

trifft gar nicht zu trifft sehr zu

- Er ist ängstlich.

trifft gar nicht zu trifft sehr zu

- Er ist aggressiv.

trifft gar nicht zu trifft sehr zu

- Er ist nervös.

trifft gar nicht zu trifft sehr zu

- Er ist ruhig und ausgeglichen.

trifft gar nicht zu trifft sehr zu

- Er ist fröhlich.

trifft gar nicht zu trifft sehr zu

- Er ist klug/pfiffig.

trifft gar nicht zu trifft sehr zu

- Er ist verlässlich.

trifft gar nicht zu trifft sehr zu

- Er ist temperamentvoll.

trifft gar nicht zu trifft sehr zu

- Er ist aufmerksam.

trifft gar nicht zu trifft sehr zu

- Er ist manchmal doof.

trifft gar nicht zu trifft sehr zu

- Er mag andere Menschen.

trifft gar nicht zu *trifft sehr zu*

- Er mag andere Tiere.

trifft gar nicht zu *trifft sehr zu*

- Er ist schwer von Begriff.

trifft gar nicht zu *trifft sehr zu*

- Er ist freundlich.

trifft gar nicht zu *trifft sehr zu*

- Er ist neugierig.

trifft gar nicht zu *trifft sehr zu*

- Er ist stur.

trifft gar nicht zu *trifft sehr zu*

Für wie stressanfällig halten sie den Wolf?

gar nicht stressanfällig *sehr stressanfällig*

9.4 Appendix D: Configuration

Behavioral Class 1: leash

Behavior Name	Code	Description	Type	Modifier 1	Modifier 2
leash strained	ls	walker or wolf strains at the leash	State	initiator	direction
leash tight soft	lt	walker keeps leash tight without pulling	State		
leash loose	ll	walker keeps leash loose and it droops	State		
leash out of sight	lo	leash is out of sight	State		
leash unspecified	lq	leash is not defined	State		

Behavioral Class 2: walk phases

Behavior Name	Code	Description	Type	Modifier 1	Modifier 2
walk/no exercise	pw	the walk starts when walker and wolf have passed the red mark and also end when both have passed the red mark; they do not do any exercise, or just have done an exercise (e.g. wolf is sitting on command)	State		
exercise "sit down"	ps	do exercise "sit down"; start when walker speaks the command or shows the hand signal (hand up); end when wolf does the exercise successfully (as soon as the wolf is sitting) or when walker breaks off	State	exercise success	
exercise "lie down"	pd	do exercise "lie down"; start when walker speaks the command or shows the hand signal (hand down); end when wolf does the exercise successfully (as soon as the wolf lies down) or when walker breaks off; sometimes the walker starts this exercise with the exercise "sit down"	State	exercise success	
exercise turn	pt	about-face at the red mark; start when walker initiates by turning, passing the red mark or calling the wolf; end when both walk new direction	State		
extra exercises	px	walker does some extra exercises during the walk; start and end see exercise "sit down" or "lie down"	State	kind of exercise	exercise success
call close	pc	walker calls the wolf close for doing the exercises "sit down" or "lie down"; not when calling for extra exercises	State		
meet stranger	pm	event occurs when walker or wolf show the first reaction on strange park visitors (single or in a group), cars or other strange things.	Event		
walk break off	pf	break off the walk	Event	brake off	
phases out of sight	po	walker and wolf are out of sight	State		
phase unspecified	pq	phases is not defined	State		

Behavioral Class 3: posture/locomotion walker

Behavior Name	Code	Description	Type	Modifier 1	Modifier 2
stand still	cs	walker stands at one place and do not move, crouch, sit or lie; duration at least one second; inclusive scurry at the same spot	State	initiator	
crouch/lie/sit	cc	walker crouches, knees get strongly bend up or walker reclines on surface	State		
walk/go	cw	walker walks forwards, backwards or sideways inclusive pauses between the steps of maximum one second	State	initiator	
run	cr	walker moves faster than walking; like jogging	State	initiator	
loco. walker out of sight	co	walker is out of sight, not visible	State		
loco. walker unspecified	cq	posture or locomotion of the walker is not defined	State		

Behavioral Class 4: posture/locomotion wolf

Behavior Name	Code	Description	Type	Modifier 1	Modifier 2
stand	ms	wolf stands at one place and do not sit, lie, explore or play; duration at least one second; inclusive scurry at the same spot	State	tail	
sit	mi	wolf is sitting down on the surface and does not explore or play – except during sitting on command	State	command	
lie	ml	wolf lie on the surface, not wallowing, exploring or playing – except during lie on command	State	command	
walk	mw	wolf walks slowly forward, sideward or backward; inclusive pauses between the steps of maximum one second and does not explore or play	State	tail	
run/trot/jump	mr	wolf move faster than walk and does not explore or play	State		
explore	me	wolf plays with objects (no interaction with walker), in the snow (eg. mouse jump), is sniffing or wallowing in something, eating or chewing, not during lie or sit on command	State		
play with walker	ma	wolf plays and interact with walker; wolf at least shows interest for the manipulated object by the walker; not when lying or sitting on command	State		
pee	mp	urinate with its hind leg on the ground; not especially on an object	Event		
defecate	mf	evacuate solid waste	Event		
locomotion out of sight	mo	wolf is out of sight, not visible	State		
locom. wolf unspecified	mq	posture or locomotion of the wolf is not defined	State		

Behavioral Class 5: head orientation walker

Behavior Name	Code	Description	Type	Modifier 1	Modifier 2
orientation not to wolf	on	the walkers head is not orientated to the wolfs body	State		
orientation to wolf	of	the walkers head is orientated to the wolfs body	State	kind walker orie	

walker orient. out of sight	oo	the walkers head orientation is out of sight	State
walker orient. unspecified	oq	orientation of the walker is not defined	State

Behavioral Class 6: head orientation wolf

Behavior Name	Code	Description	Type	Modifier 1	Modifier 2
orientation not to walker	rn	the wolfs head is not oriented to the walkers body	State		
orientation to walker	rk	the wolfs head is oriented to the walkers body	State		
lick mouth	rl	wolf licks walkers mouth	Event		
wolf orient. out of sight	ro	the wolfs head orientation is out of sight	State		
wolf orient. unspecified	rq	the wolfs orientation is not defined	State		

Behavioral Class 7: vocalization walker

Behavior Name	Code	Description	Type	Modifier 1	Modifier 2
call wolf name	va	walker calls the wolfs name	Event		
call sit	vs	walker calls "sit" as command	Event		
call down	vd	walker calls "down" as command	Event		
call come	vc	walker calls "come/komm"	Event		
call foot	vt	walker calls "foot"	Event		
speaks with wolf	vf	walker speaks to wolf; any kind of vocalization (eg. whistle ...); with pauses in between not longer than one second	State		
speaks with persons	vp	walker speaks to persons or to him/herself; any kind of vocalization (eg. whistle...); with pauses in between not longer than one second	State		
do not speak	vn	walker does not speak anything	State		
do not hear	vh	the voice recording is too quiet to decide if the walker speaks or not	State		

Behavioral Class 8: vocalization wolf

Behavior Name	Code	Description	Type	Modifier 1	Modifier 2
howl	sh	point the muzzle upward and forward and make a long wavering open-mouthed vocalization like hauu; with pauses in between not longer than one second	Event		
growl	sg	a low guttural, menacing sound; sometimes with showing the teeth; sounds like grrrrrr; with pauses in between not longer than one second	Event		
whimper	sm	high tough soft, intermittent and plaintive sound like hihihiii; with pauses in between not longer than one second	Event		
whisper	ss	sounds like waawaa; often occurs if someone approach the wolf; with pauses in between not longer than one second	Event		

Behavioral Class 9: guidance

Behavior Name	Code	Description	Type	Modifier 1	Modifier 2
guidance walker	gk	wolf walk/run behind or lateral the walker or does the exercises the walker wants to do (even standing next to the walker without showing interest for going on)	State		
guidance wolf (along route)	gr	wolf walks in front of the walker along the route	State		
guidance wolf (leave route)	gf	wolf walks in front of the walker and the walker follows and leave the route	State		
guidance conflict	gc	walker wants to go on along the route but the wolf dose not come with him/her (waiting for the wolf) or walker stops and wolf wants to go on (calling the wolf close)	State		
guidance out of sight	go	wolf and/or walker are/is out of sight so that it is not possible to decide guidance	State		
guidance unspecified	gq	guidance is not defined	State		

Behavioral Class 10: distance walker-wolf

Behavior Name	Code	Description	Type	Modifier 1	Modifier 2
less 1m	dl	distance between walker and wolf is not more than one meter; so that the wolf can easily be touched by the walker	State		
between 1m and 3m	db	distance between walker and wolf is between one and three meters	State		
more than 3m	dm	distance between walker and wolf is more than three meters; the walker is not possible to touch the wolf	State		
distance out of sight	do	wolf and/or walker is out of sight and its not possible to decide the distance	State		

Behavioral Class 11: reward with food

Behavior Name	Code	Description	Type	Modifier 1	Modifier 2
food in hand	fh	walker has some dry food in his/her hand or just grab for some and the hand is in the pocket	State		
give food	fg	walker gives the wolf dry food	State	take food	
no food in hand	fn	walker has no dry food in his/her hand	State		
food out of sight	fo	it is not visible if the walker has some dry food in his/her hand	State		
feeding unspecified	fq	feeding is not defined	State		

Modifier Class 1: initiator

Modifier Name	Code	Description
wolf	if	wolf initiate interaction e.g. by walking away and pulling at the leash or being the first starting the action
walker	ik	walker initiate interaction e.g. by pulling at the leash to get the wolf closer or being the first starting the action
initiator unclear	iu	initiator is not visible
initiator out of sight	io	wolf and/or walker are/is out of sight and the initiator is not visible
initiator unspecified	iq	initiator is not defined

Modifier Class 2: kind of walker orientation

Modifier Name	Code	Description
tactile	kt	walker touches the wolf for at least one second; e.g. to stroke the wolf; not when playing with the wolf and not during offering food when the wolf touches the walkers hand
playing	kp	walker plays with the wolf mostly by manipulating an object like a stick or a snowball
not tactile/playing	kn	walkers head is orientated to the wolves body but no tactile or playing interaction
kind orient out of sight	ko	it is not visible how the walker is orientated to the wolf
kind orient unspecified	kq	walkers orientation to the wolf is not defined

Modifier Class 3: exercise success

Modifier Name	Code	Description
successful	es	wolf achieves exercise
incomplete	ei	wolf achieves exercise incomplete; e.g. doing exercise down and only make sit or does not put its backside down; wolf shows interest for doing exerc.
not successful	en	wolf does not achieve the exercise; wolf does not show any interest for doing the exercise
exercise out of sight	eo	it is not visible if the wolf achieves the exercise
exercise unspecified	eq	exercise success is not defined

Modifier Class 4: direction

Modifier Name	Code	Description
forwards	hf	move forwards or sideways
backwards	hb	move backwards
direction out of sight	ho	moving direction is out of sight

Modifier Class 5: brake off

Modifier Name	Code	Description
walker brake off	bk	walker decides to break off the walk
other person	bp	other person decide to break off the walk
weather brake off	bw	break off the walk because of weather changing (snowstorm)
brake off unspecified	bq	reason for brake off not defined

Modifier Class 6: take food

Modifier Name	Code	Description
take food	at	wolf feeds the offered dry food
do not take food	an	wolf does not feed the offered dry food
take food out of sight	ao	its out of sight if the wolf takes the food

Modifier Class 7: kind of exercise

Modifier Name	Code	Description
ex. sit down	xs	walker does extra exercise sit
ex. lie down	xd	walker does extra exercise down
ex. turn/twist	xt	walker does extra exercise turn
ex. stand	xa	walker does extra exercise stand
ex. stay	xy	walker does extra exercise stay
ex. foot	xf	walker does extra exercise foot
ex. wait	xw	walker does extra exercise wait
ex. touch	xu	walker does extra exercies touch
kind of ex. out of sight	xo	kind of exercise is out of sight
extra exercise unspecified	xq	walker does an undefined exercise

Modifier Class 8: command

Modifier Name	Code	Description
on command	nc	wolf sits or lie down after walker gave the command
no command	nn	wolf sits or lie down without any command
command out of sight	no	its not visible if the walker give any command

Modifier Class 9: tail

Modifier Name	Code	Description
tail not tucked	tn	the wolfs tail is not tucked; it is hanging relaxed or other
tail tucked	tt	the wolfs tail is tucked between its hind legs
tail out of sight	to	the wolfs tail is out of sight
tail unspecified	tq	posture of the wolfs tail is not defined

9.5 Appendix E: Cooperation rating

Rating of cooperation	
Rating	Description
1	<p>Wolf is immediately responsive to the walker if he/she tries to get contact.</p> <p>Conflict situations* are rare and short.</p> <p>Leash is mostly loose.</p> <p>Exercises are done quickly and successfully.</p> <p>Walker supports the wolf if necessary (e.g. to get the legs out of the leash).</p>
2	<p>Wolf is responsive to the walker if he/she tries to get contact.</p> <p>Conflict situations* are short.</p> <p>Exercises are done successfully</p> <p>Leash is rarely tense.</p>
3	<p>between 2 and 4 ... cooperation sufficient</p> <p>Wolf is more or less responsive to the walker if he/she tries to get contact.</p> <p>Conflict situations* are more often and longer.</p> <p>Exercises are mostly done successfully (sometimes only after long try).</p> <p>Leash is more often tense.</p>
4	<p>Wolf is hardly responsive to the walker if he/she tries to get contact.</p> <p>Conflict situations* appear more often and much longer.</p> <p>Leash is often tense.</p> <p>Exercises are not always done successfully.</p> <p>Walker seems to be a little insecure by handling the wolf.</p>
5	<p>Wolf is not responsive to the walker if he/she tries to get contact.</p> <p>Permanent long conflicts in guidance.</p> <p>Leash is often strongly tense.</p> <p>Exercises are not done successfully.</p> <p>Walker is insecure by handling the wolf.</p>

* see Appendix D, p. 57 (guidance conflict)

9.6 Appendix F: Curriculum Vitae

Margit Auer

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EDUCATION AND TRAINING

since 01/2009	Accomplishment of my diploma thesis “Leash walking as a model for cooperation between humans and wolves” at the Wolf Science Center, Austria
since 01/2009	Project collaborator at the “Human-Animal Relationship Group”, University of Vienna (http://mensch-tier-beziehung.univie.ac.at/)
since 10/2007	Master’s study of Zoology, Karl-Franzens University Graz
10/2004 – 09/2007	Bachelor of Science in Ethology, Karl-Franzens University Graz
09/1999 – 07/2004	Business-academy, Kirchdorf/Krems

WORK EXPERIENCE

since 03/2010	Energie Graz GmbH & Co KG (customer service)
09/2007 – 06/2010	Karl-Franzens University of Graz, Department of Zoology (assistant)
03/2009 – 06/2009	Jugend & Familiengästehäuser Holding GmbH (coaching schoolkids)

PERSONAL SKILLS

Languages	German (mother tongue) English (B2*, independent user) French (A2*, elementary user) *Common European Framework (CEF) levels
Social skills	Certified (JUFA) in coaching schoolkids (outdoor games, team-training, confidence building) Certified (aufZAQ) Alpine Education Worker (ÖAV youth director) Dog owner since 1999 Musician in the “Mollner Wind Band”
Computer skills	Excellent knowledge of MS Word, Excel, PowerPoint User of The Observer Video Pro (Noldus), SPSS and Adobe Photoshop

INTERNATIONAL EXPERIENCES

04/2008	Zoological excursion to Lake Tanganyika (Mpulungu, Zambia)
09/2006	HYDRA Marine biology course (Fetovaia, Italy)
07/2005	IBG Workcamp for conservation (Sainte-Thérèse, Canada)

PUBLICATION AND POSTER PRESENTATION

Auer, M., Wedl, M., Range, F., Virányi, Z., Belényi, B. & Kotrschal, K.: Leash walking as a model for cooperation between humans and wolves: the effects of personality and intensity of contact:

Poster: Canine Science Forum 2010, 25. – 28. 7. 2010, Vienna
KLF Anniversary Symposium, 24. - 25. 9. 2010, Vienna

Published Abstract: Journal of Veterinary Behavior: Clinical Applications and Research, in press.