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Playing styles and possible causative factors in dogs' behaviour when playing with humans

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Abstract

Individual differences and causative factors could modify the behaviour of dogs in object related games played with a human partner. In a two-by-two within-subject design we observed 68 family dogs' behaviour when playing two different types of games (ball game and tugging) with two different play partners (owner or unfamiliar experimenter) in order to categorize each dog's playing style. In all four conditions we have measured the following behavioural variables: tendency for possession, willingness to retrieve, behaviours related to fear/avoidance and aggression, and occurrence of play bows. We also calculated the relative duration of time when the dogs oriented ''outwards'' from the play situation to the other non-interacting person (owner or experimenter) during a session. Than we examined the effect of six factors on dog–human play behaviour: the familiarity of the play partner, the type of the game, the dogs' gender, age and breed, and the duration of daily active interaction between dog and owner.

We used factor analysis to unfold the relationship among the recorded variables and revealed three factors that accounted for 63% of the total variance. On Factor 1 variables measured in tugging with both the experimenter and owner had high loadings (labelled ''Motivation for tugging''). Factor 2 contained all variables measuring fear and avoidance (Fear/Avoidance), and Factor 3 consisted of variables measured in ball game (Motivation for ball game). The cluster analysis of the dogs' individual factor scores classified them into 5 significantly different groups on the basis of their tendency to be involved in playing with a ball, a rag and to show fear/avoidance during the tests. Moreover, the gender (but not the age or breed) of the dogs and the duration of the daily active interaction with the owner had significant effects on the distribution of dogs between the cluster groups. These results suggest that in play situations the behaviour of well socialized family dogs is influenced more by their motivation to play and to a certain extent by the level of

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fear than by the familiarity of the play partner or their possible general tendencies for cooperative or competitive behaviours.

Keywords: Dog; Social play; Ball game; Tug-of-war; Factor and cluster analysis

1. Introduction

Social play represents one of the most complex interactions between two individuals. This complexity can be revealed by identifying at least two levels of behavioural organisation. At the lower level, play is based on actions borrowed from various behavioural contexts (i.e. predatory, agonistic, and sexual). At the higher level, however, interacting partners need to cooperate in order to achieve their common goal of playing together (Mitchell and Thompson, 1991).

Dogs (*Canis familiaris*) offer a good model for the investigation of play behaviour, because they display a high level of such activities. Observations from various canid species describe social play where interacting juvenile animals use their own or the other's body as a focus of the game. Dogs living with humans often use objects as means of play when playing with other dogs, not just humans (Hubrecht and Serpell, 1993; Rooney et al., 2000; Bauer and Smuts, 2007). Given the variability of play behaviour in wild canids and the use of overlapping behavioural repertoire for various aspects of behaviour, the origin of such object-related play between humans and dogs is not clear.

Recently, evidence has been accumulating that individuals differ consistently in their behavioural tendencies and their behaviour in one context is correlated with the behaviour in multiple other contexts. Thus, personalities are not only found in humans but also in a wide range of other animal species (Wolf et al., 2007), however, they are often referred to as coping styles (Overli et al., 2007), or behaviour syndromes (Sih et al., 2004). A number of reviews have already addressed the question of personality in dogs from several different perspectives, such as behavioural genetics (Ruefenacht et al., 2002), comparative psychology (e.g. Jones and Gosling, 2005) or practical application (Taylor and Mills, 2007; Diederich and Giffroy, 2006). In the Dog Mentality Assessment test battery (Svartberg and Forkman, 2002) five factors were obtained (playfulness, curiosity/fearlessness, chase-proneness, sociability and aggressiveness), and play behaviour turned out to be consistent in the two slightly different ''play'' test units.

Comparing dog–human play with dog–dog interactions Rooney et al. (2000) found that dogs were more likely to give up in competition, to show and present the toy to the human partner, they were more interactive, less likely to possess the toy in the games when they interact with humans, in contrast to playing with nonspecifics. It is not clear, however, whether the revealed tendencies are consistent irrespective of the human partner's identity, or the familiarity of the person had a significant effect on the behaviour of the dogs. We may assume that in case of well socialized family dogs in this procedure the observed tendencies in play behaviour would not depend on the familiarity of the playing partner (Mitchell and Thompson, 1991b).

An other important, but unexplored factor of the dog–human play is the type of the game (object retrieval or tugging) or the focal object which could also have an effect on the mode of the play behaviour of dogs. We suggest that depending on the dog's individual bias towards possessive or object-sharing behaviours, some of them might participate more likely in ''tug-of-war'' while others would prefer to play with the ball.

The duration of the daily interactions with the owner might also influence the behaviour of dogs, as well as past experiences and the effects of training. For example, increased retrieving and tugging in dog–owner partnerships could possibly be a result of these owners' spending more time teaching their dogs to perform these behaviours.

The gender, breed and age of the dog can also be causative factors. Possible gender differences can be due to biological differences in the playfulness or a sex bias in the amount of training or play devoted to male vs. female dogs. It would be a rather complex task to fully unfold the effect of breed, taking that there are so many, so we decided to compare the behaviour of a single breed (Belgian shepherd) to a mixed breed group. Moreover, if play behaviour has some connection with full maturity or dominance relationships one could predict young dogs to show different behaviour patterns compared to older ones.

In sum the purpose of the present study was to investigate factors affecting the individual differences in the behaviour of dogs playing with humans such as: (1) the familiarity of the playing partner (owner and an unfamiliar experimenter), (2) the type of the game (ball and tugging), (3) the daily active interaction between owner and dog, (4) gender, (5) age and (6) breed.

We applied factor analysis for the evaluation of our data to reduce the number of dependent variables and to arrive at a smaller number of independent derived factors that can explain the most variability in the original variables. This method is appropriate to get theoretical dimensions (superordinate variables) thought to account for individual differences in a set of behaviours observed in the dog–human play. Factor analysis followed by cluster analysis, has previously been used in the study of complex behaviours of dogs (Hart and Miller, 1985; Topál et al., 1998; Bradshaw and Goodwin, 1998). Cluster analysis is a proper method to classify the individuals according to their behaviour patterns when playing with humans and to establish categories for the individuals with most similar behaviour patterns.

2. Methods

2.1. Subjects

Sixty-eight adult dogs from several breeds (30 males and 38 females; mean age: 4.9 ± 3.2 years, range 1–12) took part in our experiment. These subjects were part of a larger sample participating in a test-series designed to evaluate the personality characteristics of pet dogs (Kubinyi et al., 2006). Our subjects were chosen from a larger sample to make balanced groups. The dogs were from 13 different breeds: Belgian Shepherd (Tervueren ($n = 18$) + Groenandael ($n = 17$) + Malinois ($n = 1$)), Rough Collie ($n = 5$), German Shepherd ($n = 4$), Mudi ($n = 4$), Golden Retriever ($n = 3$), Sheltie ($n = 2$), West Highland White Terrier ($n = 1$), Hovawart ($n = 1$), Labrador Retriever ($n = 1$), Doberman Pinscher ($n = 1$), Miniature Pinscher ($n = 1$), Hungarian Vizsla ($n = 1$), Rhodesian Ridgeback ($n = 1$), and the sample contained also mongrels ($n = 7$).

To study the possible effect of breed differences on the dogs' behaviour we selected two subgroups from the 68 subjects. Subgroup 1 was a homogeneous group; it included the 36 Belgian Shepherds (Tervueren, Groenandael, Malinois). Subgroup 2 included 32 dogs of different breeds and also the mongrels. Subgroups were balanced for gender and age.

The sample was also divided into two age categories; young (12–24 months, $n = 26$) and old (>24 months, $n = 42$), which were also balanced for gender and breed.

Subjects were recruited by phone from our 'Family Dog Project' database. These dogs can be classified as 'pet dogs' because they live in the house or in the garden, their owners regularly walk them and/or they often take part in some training class in a dog school (basic obedience, agility). The owners' (59 women and 9 men) age ranged between 14 and 60 years.

2.2. Experimental design

Observations were carried out from July 2003 to September 2004 at the Department of Ethology, Eötvös Loránd University in Budapest (64 dogs) and in another Hungarian town, Debrecen (4 dogs). The experiments were conducted in a relatively empty room (in Budapest 6 m × 3 m; in Debrecen 5 m × 5 m) that was unfamiliar for the subjects. Before the test the owners were asked how much time they spent daily with the dog in active interaction (play, training, walking, etc.). During all tests the unfamiliar female experimenter, the owner, and the camera-woman were present.

2.3. Procedure

All dogs participated in 4, 1-min-long play sessions with 30 s breaks between them. In the first two sessions the dogs played with the experimenter, in the last two they played with their owner. There were two different types of game sessions: a ball game and a tugging with each partner. In case of all dogs the order of the testing episodes was the same: (1) ''ball game'' with the experimenter, (2) ''tugging'' with the experimenter, (3) ''ball game'' with the owner, (4) ''tugging'' with the owner. We applied this fixed test order because these subjects were a sub-sample of a larger project on personality testing, so individual evaluation and comparability were of great importance. To ensure, however, that group-level analysis can also be applied, we ran a control test to look for possible order effects. Ten dogs were tested with the same protocol in a balanced order for playing partner and game type. Control subjects were chosen to make balanced groups.

We asked the playing partners (experimenter and owners) to play the ''usual'' way with the rag and the ball. Both of them were instructed to play as intensively as possible, but at the same time, to adjust their behaviour to the dog's reactions. The only restrictions were the following: (1) the human play partners were instructed to throw both the ball and the rag minimum once, encouraging the dog to fetch it, and (2) to try to take the object (both the ball and the rag) from the dog's mouth. The human partner always tried to take the object by asking for it kindly at first, but if the dog did not lose hold of it he/she gave increasingly firm orders and tried to take the object by grabbing it and finally by gently opening the mouth of the dog. Compliance with the protocol was controlled by the experimenter.

During the ''ball game'' tests the human partners could use one or more of the following play items: 2 compact rubber balls (5–7 cm in a diameter) and 2 tennis balls. In the ''tugging'' sessions the human partners could use a rag (one of two towelling ropes, 20 and 40 cm long with knots on both ends) for inducing play behaviour. During the play sessions with one partner the other human stood still turning towards the dog and did not interfere.

2.4. Variables and data analysis

The tendency for possession, the willingness to retrieve, behaviours related to fear/avoidance and aggression, and the occurrences of play bows were measured. We also calculated the relative duration of time when the dog oriented ''outwards'' from the play situation to the other non-interacting person (owner or experimenter) during a session. The occurrence of the characteristic playing signal, the bow was so sparse during both games and with both partners (with the experimenter: 3 times both in ball game and in tugging, with the owner: 5 times in ball game and 2 times in tugging), that no meaningful statistical analysis could be done for this variable. We experienced a similar result with the behaviours connected to aggression. Considering the playful characteristics, the rather rare occurrence and the uneven distribution of these behaviours, we did not use the scores of aggression for further analysis. For the detailed description of the analysed behavioural variables see Table 1.

Based on the answers for the question ''How much time do you spend daily with the dog in active interaction (play, training, walk)?'' we classified two groups: less than 1 h interaction per day ($n = 30$), or more than 1 h interaction per day ($n = 36$). We excluded two dogs from this classification since not their owners but other member of the family was in active interaction with them.

Table 1
Short description of behavioural variables coded in both types of play sessions (ball game and tugging) and with both partners (experimenter and owner)

Behavioural variables and abbreviations	Values of the variable
Willingness to retrieve RET score (0–2)	0: The dog never brings the object to the human partner or there is not any physical contact between the dog and the object (e.g. the dog does not hold or chew the toy at least once in its mouth) 1: The dog does not always bring the object back or although it always starts to move towards the human with the object in its mouth, the human cannot get the object without approaching the dog 2: The dog always brings the object back
Possessivity POS score (0–3)	0: The dog does not hold or chew the object in its mouth 1: The human can take the object from the dog's mouth without any sign of aggression or struggle 2: There are visible signs of wrangle when the human tries to take the object or the dog shows avoidance with the object in its mouth, but finally the human can take it from the dog 3: The human is unable to take the object from the dog during the session
Fear FEA score (0–2)	Signs of fear/avoidance: the dog's tail is retracted between its hind legs, avoids or recoils, seeks support (e.g. hides behind human's leg), crouches, trembles, and attempts to flee 0: No signs of fear can be observed during the play session 1: The dog shows at least one of the behaviours described above once or just for a short time during the play session 2: The dog shows at least one of the behaviours described above for a longer period (more than 2 s) during the play session
Orientation outwards (%) ORIO	The duration of the orientation "outwards" is orientation to the other human partner with which the dog was not playing at the time (e.g. orientation to the owner during the play with the experimenter and reverse). This was measured in seconds and as the duration of the test sessions varied slightly we calculated the relative percentage of the time spent engaged in this behaviour. (The value was divided by the duration of the whole episode and multiplied by 100)

In the result section we indicated the human partner (i.e. experimenter or owner) and the type of toy (i.e. ball or rag) with relevant letters before the abbreviation of the variables. (For example, experimenter rag POS: possession was coded while the dog played with experimenter with the rag).

All tests were video recorded and analysed later by one of the experimenters (L.T.) by watching the video. Interobserver agreement between her and a naïve observer was assessed by comparing their parallel coding of the behaviour categories on the same video records and the evaluation of the 20% (15 dogs) of the whole sample. The following Cohen Kappa results were obtained: "Willingness to retrieve": 0.85; "Possessivity": 0.85; "Fear": 0.89; "Orientation outwards": 0.94; "Bow": 0.82. The high Kappa values show that there was a good agreement between the independent observers.

2.5. Statistical analysis

We analysed the tests for controlling possible order effects of the playing partners (experimenter or owner) and the type of the toy (ball or rag) using Wilcoxon signed-ranks test.

For further analyses multivariate methods (factor analysis followed by cluster analysis) were also used to unfold the correlational pattern of the behavioural variables and to determine the behaviours that have major effects on the individual differences. Factor analysis (complemented with Varimax rotation) was performed on 16 variables: four behaviour categories (RET, POS, FEA, ORIO) were recorded in all (4) conditions. Items were required to have a minimum factor loading ≥ 0.5. We also calculated the individual factor scores to reveal the position the individuals on the different factors. The factor scores were standardized using z-transformation to make the scores comparable on different factors. (After the standardisation all scores have a value between 0 and 1.) These standardized individual factor scores had normal distributions, so parametrical tests could be used for the analyses. After the factor analysis, we applied a hierarchical cluster analysis for the classification of the individuals depending on their standardized individual factor scores. One-way analysis of variance (with Bonferroni post hoc test) was used to test the distribution of standardized individual factor scores among the clusters.

We analysed the distribution of the gender, breed, age and the two groups of interaction categories among the clusters with χ^2-test. We used χ^2-test to compare the distribution of gender, age and breed between the groups characterized by different levels of interaction with the owner (less vs. more than 1 h daily interaction).

For all statistical tests the SPSS 10 statistical package was used.

3. Results

First we analysed the control experiment looking for possible order effects, comparing their results in the same episodes of the different orders, but neither the order of the type of the game (ball game or tugging), nor the order of the playing partners (experimenter or owner) caused significant difference in any of the behaviour variables of the dogs (all $p > 0.05$).

Table 2
Factor loadings (correlation between the factors and the behavioural variables) following Varimax rotation

Behavioural variables	Factor 1 Motivation for tugging (42.0%)	Factor 2 Fear/Avoidance (11.9%)	Factor 3 Motivation for ball game (9.4%)
Exp. rag POS	**0.83**	−0.26	0.14
Exp. rag RET	**0.71**	−0.11	0.29
Exp. rag ORIO	**−0.72**	0.26	0.01
Own. rag POS	**0.78**	−0.33	0.23
Own. rag RET	**0.78**	−0.24	0.13
Own. rag ORIO	**−0.53**	−0.35	0.06
Exp. ball FEA	−0.12	**0.70**	−0.26
Exp. rag FEA	−0.25	**0.84**	−0.22
Own. ball FEA	−0.22	**0.77**	−0.22
Own. rag FEA	−0.22	**0.82**	−0.13
Exp. ball POS	0.48	−0.28	**0.66**
Exp. ball RET	0.35	−0.23	**0.71**
Exp. ball ORIO	0.01	0.12	−0.20
Own. ball POS	0.29	−0.29	**0.77**
Own. ball RET	0.26	−0.34	**0.78**
Own. ball ORIO	0.29	−0.20	**−0.60**

The factor pattern yielded three factors (Eigenvalues >1.5) that account for 63% of the total variance. Afore all the abbreviated behavioural variables (capital) we used two letters: the first one referring to the person who played with the dog (exp: experimenter, own: owner), the second one referring to the game-type (ball or rag). POS; Possessivity, RET; Willingness to retrieve, ORIO; Orientation outwards, FEA; Fear/Avoidance. Factor loadings (behavioural variables) belong to the certain factor signify bold values.

3.1. Factor analysis

The factor analysis of the coded variables revealed three factors that accounted for 63% of the total variance (Table 2). Behavioural variables measured in ''tugging'' with both the experimenter and the owner had high loadings on the first factor. Individuals with high values on this factor showed marked interest in playing with the rag: they retrieved it but at the same time also tried to possess it during the tests, and did not orient outwards (at the passive human) for long. This factor was named as ''Motivation for tugging''.

The second factor, characterized by variables indicating fear and avoidance in all four test situations was labelled as ''Fear/Avoidance''.

Similarly to the first factor, behavioural variables recorded in the ''ball game'' situation with both the experimenter and owner had high loadings on the third factor (and only here), so it was labelled as ''Motivation for ball game''. On this factor there were all but one (exp. ball ORIO) behavioural variables observed in episodes where the toy object was a ball. In both cases ''Willingness to retrieve'' and ''Possessivity'' showed high positive loadings, however, ''Orientation outwards'' was always represented with negative loadings. It is interesting to note that irrespectively of the type of game the structures of both motivation factors are very similar.

3.2. Hierarchical cluster analysis

The standardized individual factorial variables (''Motivation for tugging'', ''Fear/Avoidance'' and ''Motivation for ball game'') of the tested dogs were used to group them by a hierarchical cluster analysis. Visual examination of the dendrogram revealed that the dogs could be divided into five separate groups at the rescaled distance of 15. Since the 5th cluster consisted of only two individuals we excluded it from the further analyses. (As Fig. 1 shows, these dogs represented a rather rare combination of high motivation for tugging without any tendency for engaging in retrieving the ball.) The analysis of variance showed significant differences among the four

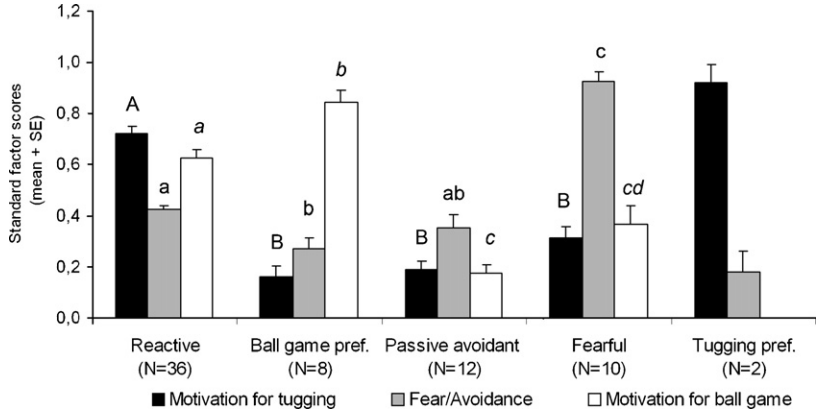

Fig. 1. The 5 clusters represent different patterns of the three factors. We used ''labels'' for the clusters on the figure, see details in the text. Comparing the mean of the individual factor scores among the clusters significant differences are signed by different letters in case of each factor. We used different letter types for reason of simpler readability: capitals show the differences among clusters in case of the factor ''Motivation for tugging'', lowercase in case of the factor ''Fear/Avoidance'', and italics (lowercase) in case of the factor ''Motivation for ball game''.

clusters in the case of all three factors; ''Motivation for tugging'': $F(3,65) = 57.4$, $p < 0.01$; ''Fear/Avoidance'': $F(3,65) = 59.0$, $p < 0.01$; ''Motivation for ball game'': $F(3,65) = 28.9$, $p < 0.01$ (Fig. 1).

The Bonferroni post hoc comparisons showed that each group represented a distinctive pattern with regard to play behaviour. There are significant differences between clusters 1 vs. 2, 3, and 4 in factor ''Motivation for tugging'' ($p < 0.01$ in all three cases) while clusters 2, 3 and 4 do not differ from each other (all $p > 0.05$). In the factor ''Fear/Avoidance'' cluster 1 is different from 2 and 4 ($p < 0.01$, $p < 0.01$ and $p = 0.49$ in case of cluster 3), while cluster 4 differs also from 2 and 3 clusters ($p < 0.01$ in both cases), while clusters 2 and 3 do not differ from each other ($p = 0.92$). In the case of factor ''Motivation for ball game'' all clusters are significantly different from each other ($p < 0.05$) with the exception that clusters 3 and 4 do not differ significantly ($p = 0.09$).

Dogs in cluster 1 ($n = 36$) were characterized by relatively high individual factor scores on both ''Motivation for tugging'' and ''Motivation for ball game'', and a moderate level on ''Fear/Avoidance'', so cluster 1 can be labelled as a ''*reactive*'' group. Dogs in cluster 2 engaged preferably only in the ball game, thus this cluster can be described as a ''*ball game preference*'' group, consisting of individuals with high scores on the factor ''Motivation for ball game'' and low scores on ''Motivation for tugging'' and ''Fear/Avoidance''. Dogs in clusters 3 and 4 did not show explicit motivation for interactive games; they were characterized by relatively low scores of both ''Motivation for tugging'' and ''Motivation for ball game''. Individuals in cluster 3 ($n = 12$) seemed to be rather passive showing little fear and also not much affinity to play any games, so cluster 3 could be labelled as a ''*passive avoidant*'' group. A relative minority of dogs showed definite signs of fear/avoidance while engaging in both games just on medium level (cluster 4: $n = 10$). Thus, cluster 4 was labelled as a ''*fearful*'' group.

The distribution of the males and females was significantly different among the cluster-groups ($\chi^2(3) = 10.4$; $p < 0.05$), with the most males in the ''*reactive*'' group (Fig. 2). There were also differences depending on the duration of daily interaction with the owner ($\chi^2(3) = 13.7$; $p < 0.05$). Dogs with more active interaction with their owners were mainly sorted into the ''*reactive*'' and ''*ball game preference*'' groups (Fig. 3). The distribution of Belgian Shepherd and non-Belgian groups ($\chi^2(3) = 1.2$; $p = 0.8$) and the age groups ($\chi^2(3) = 1.1$; $p = 0.8$) did not differ across the cluster groups.

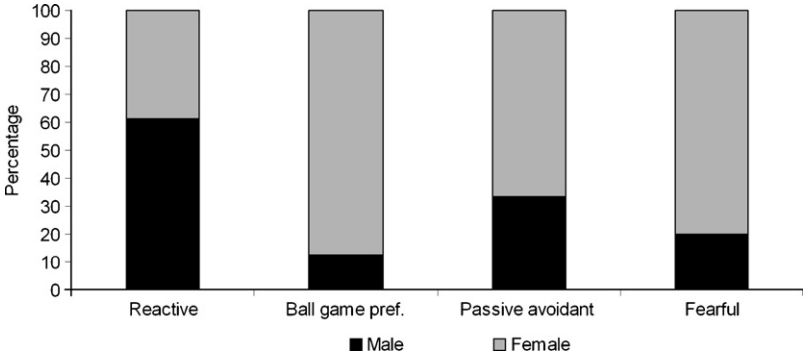

Fig. 2. Percentage distribution of males and females within clusters. We used ''labels'' for the clusters on the figure, see details in the text.

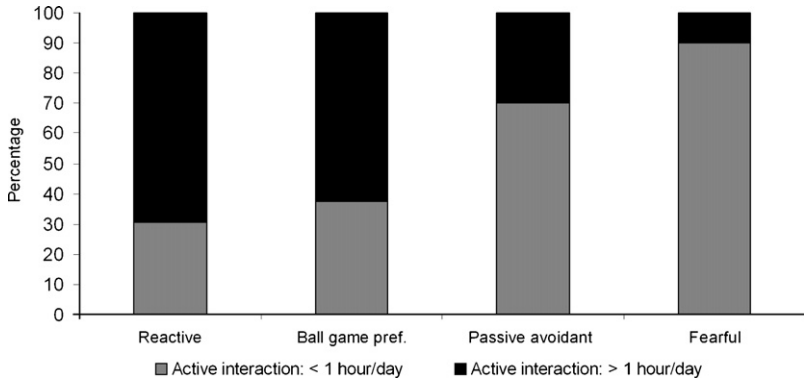

Fig. 3. Percentage distribution of dogs within clusters depending on the duration of active interaction with their owners. We used ''labels'' for the clusters on the figure, see details in the text.

Analyzing the owners' answers we found that the Belgian Shepherds had more daily interaction with their owners ($\chi^2(1) = 11.0$; $p < 0.05$) than non-Belgians. There were no significant differences in the daily interaction between males and females ($\chi^2(1) = 2.5$; $p = 0.12$) or the age categories ($\chi^2(1) = 2.8$; $p = 0.09$).

4. Discussion

In this study, we have observed the play behaviour of well-socialized pet dogs with both their owner and an unfamiliar play-partner. We used the same behavioural criteria for describing both types of games (ball game and tugging) and we examined the effect of these factors on dog–human play behaviour: the familiarity of the play partner (owner or unfamiliar experimenter), the type of the game, the gender, age and breed of the dog and the duration of daily active interaction between dog and owner.

Our data shows that family dogs are better distinguished in terms of their reaction to different toys than to different humans, which could be explained by the familiarity of the situations in case of well-socialized dogs. As mainly the human partners initialized the games by verbal communication and body language, even dogs less experienced in tug-of-war games could be ensured of the playful context of the situation. This might also account for the relatively rare occurrence of the standard species-specific play signal, the bow and also for the lacking or the playful nature of aggressive behaviours.

In our sample about half of the dogs engaged in both types of games whilst there were ''specialists'' who showed a preference for one type of game. Importantly, these results contradict the widely held view that there is a general tendency in a dog either to transfer objects to humans after taking possession of them or to engage in tug-of-war. In this case the appropriate variables (tendency to retrieve or to be possessive) should have defined distinct factors representing this aspect of their behaviour. Even if the factors define the two game types, high loadings on ''Willingness to retrieve'' variables and low on ''Possessivity'' variables would be expected in ball game and the opposite tendencies in tugging. On the contrary, however, we have found that separate factor variables have emerged for the different types of games with high and positive loadings for both ''Willingness to retrieve'' and ''Possessivity''.

Our observations also point to the importance of individual differences in play behaviour that could have been influenced by learning and experience. Dogs that received more playful interaction with their owner were less likely to show fear during play in an unfamiliar place, moreover, these dogs show either stronger motivation to play tugging or decreased inhibition. Previous experiences probably increase the predictability of the play partner's behaviour for the dog, fostering the use of mutually accepted behaviour rules to avoid conflicts (Mitchell and Thompson, 1991). Dogs without such experiences are more prone to misunderstanding humans' enticement and for lack of clear play signals they respond showing avoidance or fear. It is likely that over time dog and owner develop a routine of games, but dogs do not generalise these behaviour routines to other, functionally different situations. The habitual play of games is also supported by the observation that the dogs in this sample did not discriminate between the owners and the unfamiliar play partners. However, it should be emphasized that owners often teach their dogs to retrieve, so the playing of ball game may simply be a trained response, and not the manifestation of any underlying behavioural tendencies. Additionally, due to more daily interaction with the owner dogs could be not only more familiar with the games but also more active and stimulated.

Males and females did not distribute evenly in the clusters: more males were in the ''reactive'' and less in the ''preference for ball'', ''passive avoidant'' and ''fearful'' group. It could be assumed that males receive more training, this way are more experienced in playing games, but we did not find such a relationship comparing the duration of the daily active interaction between the genders. Thus, we suggest that gender differences refer to temperament differences in males and females, as was revealed by Svartberg (2001) in case of the ''Boldness'' factor.

The distribution of young and older dogs in the clusters was not different, which may follow from the interacting effect of two factors; younger dogs may be more reactive and/or show more fear or avoidance in unfamiliar situations. The even distribution of breed groups can have a similar reason, as the Belgian shepherd is known as a highly reactive and sometimes shy breed. Less time spent in active interaction with the owner in the Belgian shepherd group might be explained by the fact that there are more individuals used for show/breeding purposes in this group.

Games can be characterized as being either cooperative or competitive (object-sharing or object possessing) or a mixture of these which also often can be observed in dogs' dyadic play interactions (Bauer and Smuts, 2007). In tug-of-war game the competitive (possessing) tendencies might be more dominant than in ball game, while in each type of play the cooperation between dogs and humans plays a significant role. As recent work on dog personalities described cooperability or competitive tendencies as background behavioural factors (Svartberg and Forkman, 2002), one could ask about the relationship between these traits and play behaviour. One way to interpret our results is that each type of game has its own (probably biologically also determined) set of rules, and to play the game efficiently the rules should be adhered to independently from the fact whether they are competitive or cooperative. This suggests that playing such games actually suppresses some types of individual differences in the behaviour of dogs, and therefore the behaviour in such games might not be a good indicator for personality measures like cooperativeness or sociability.

Earlier it has been assumed that competitive games increase agonistic tendencies in the behaviour, suggesting an effect of play activity on later sociability with partners (McBride, 1995), although Rooney and Bradshaw (2002, 2003) found no evidence that competitive games increased competitiveness. On the basis of our results one could also assume just the opposite case; ''cooperability'' and ''competitiveness'' of an individual might determine the type of game

it would prefer to play. It is more likely that in some dogs the tendency to be dominant has a genetic origin that gains expression through interaction with the social environment. It has been questioned even on an ethological basis whether dogs generalize from play experiences to the dominant/submissive nature of social relationships (Rooney et al., 2001).

One can even assume that no such direct relationship exists between competitive behaviour in tug-of-war game and striving after dominance because play signals, in our case the human partners' play signals, clearly distinguish games from real competitive situations.

5. Conclusion

Present study pointed to individual differences in the dog behaviour during ball game and tugging. The effect of several factors, which could modify the dog–human play, was revealed. The behaviour of family dogs was influenced more by the type of the game (and to a certain extent by the level of fear) than by their familiarity to the play partner or their willingness to retrieve and tendency for being possessive. The gender and the duration of the daily active interaction with the owner also had a significant effect on the play behaviour. We assume that over time dog and owner develop a routine of games, and dogs do not generalise these behaviour routines to other, functionally different situations.

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