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A comparison of dog–dog and dog–human play behaviour

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Abstract

In the popular literature, it is often assumed that a single conceptual framework can be applied to both dog–dog and dog–human interactions, including play. We have, through three studies, tested the hypothesis that dog–dog and dog–human play are motivationally distinct. In an observational study of dogs being walked by their owners ($N = 402$), dogs which were walked together, and had opportunities to play with one another, played with their owners with the same frequency as dogs being walked alone. This finding was supported by a questionnaire survey of 2585 dog owners in which dogs in multi-dog households played slightly more often with their owners than dogs in single-dog households. The performance of dog–dog play does not, therefore, seem to suppress the dogs' motivation to play with their owners as would be predicted if they were motivationally interchangeable. In an experimental comparison of dog–dog and dog–human toy-centred play, the dogs were more likely to give up on a competition, to show and present the toy to their play partner, if that partner was human. When two toys were available, dogs playing with other dogs spent less time showing interest in both toys and possessed one of the toys for longer, than dogs playing with people. Overall, the dogs were more interactive and less likely to possess the object when playing with a person. We conclude that dog–dog and dog–human play are structurally different, supporting the idea that they are motivationally distinct. We therefore suggest there is no reason to assume that the consequences of dog–dog play can be extrapolated to play with humans.

Keywords: Dog; Play behaviour; Motivation; Human–animal relationships

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1. Introduction

Since their domestication at least 12,000 years ago (Davis and Valla, 1979), domestic dogs, *Canis familiaris* have lived in close association with people fulfilling a variety of roles, many of which require the dog to be trained. Today, the majority of dogs in Western society are kept as companions. Within this capacity the importance of training and the formation of a successful dog–human relationship remains paramount. Consequently, there has amassed a large amount of popular literature advocating methods for training and modifying relationships between dogs and people (e.g., Rogerson, 1992; Abrantes, 1997; Appleby, 1997).

Many of the ideas put forward in these texts are based on ethological concepts relating to intraspecific social behaviour of the dog, and many refer to the behaviour of the ancestor, the wolf, *Canis lupus*. There is one extremely common assumption, that dogs behave towards people as though they were conspecifics which have been incorporated within their hierarchy (e.g., Blackshaw, 1985). It is consequently assumed that dog–human interactions have the same social implications as their dog–dog counterparts. This opinion is summed up by Hediger (1965, p. 295) who states that ''there is no doubt about the fact that the dog considers its human master as a socially superior member of its own species — as a member of its pack''. This lack of doubt is surprising given the absence of empirical data on this subject. Extrapolation from dog–dog behaviour to the dog–human context occurs with reference to all aspects of social behaviour, and is particularly common when discussing play.

The domestic dog is renowned for exhibiting high levels of play. In addition to intraspecific play, which is ubiquitous amongst mammals (Suomi, 1982), the dog is one of the few species to engage in interspecific play (Russell, 1936). Play occupies a large proportion of the interaction time between dog and owner (Hart, 1995), yet has received very little scientific study (Nott, 1992). Common opinion is that interspecific play is equivalent to intraspecific play and general acceptance of this homogeneity has led to ideas about the effects of dog–dog play being applied to dog–human play.

Assumptions of homogeneity take two forms. Firstly, it is claimed that dog–human play can serve as compensation for a deficiency in dog–dog play, e.g., ''when no other dog is available then the owner can fill the need of being a playmate'' (Whitney, 1989, p. 98), ''if deprived of the opportunity to play with other dogs, they have no other choice but to direct play behaviour towards humans'' (Askew, 1996, p. 171) and ''a dog that lives with another dog will usually play more games with that dog than with its owner'' (Rogerson, 1992, p. 55). These authors suggest that opportunities for intraspecific play reduce the performance of interspecific play, thereby implying the two are motivationally homogeneous, but we know of no data to support this claim. Secondly, there are observations about the structure of play. Aldis (1975) states that dog–human play is composed of the same behavioural patterns as dog–dog play. Mitchell and Thompson (1991a) compared their own observations of dog–human play to others' (e.g., Aldis, 1975) of dog–dog play. They noted the performance of only two additional ''projects'' [1] by dogs when playing with humans (one of which was in response to a

[1] ''Projects'' are defined as ''sequences of actions that are repeated in order to calibrate an organism's control over these actions or the actions of the play partner'' (Mitchell and Thompson, 1991a, p. 189).

person pretending to throw a ball, which a dog would not be capable of doing). On this basis they describe the two play types as similar. However, the observation that similar actions occur when playing with other dogs and with humans is not evidence that the structure is the same, since identical actions can be combined in different ways to fulfil different functions. There exists no quantitative data comparing the structure of dog–dog and dog–human play.

In this paper we examine the hypothesis that dog–human and dog–dog play are not homogeneous categories. To do so we examine both quantity and quality of play. We present two investigations which test the claim that dogs living with other dogs play less frequently with their owner than dogs that live alone. The first investigation involved focal sampling in dog walking areas and compared the incidence of play in one and multi-dog partnerships. In the second we incorporated questions within a national survey of dog owners, and examined reported dog–human play frequencies with single and multiple-housed dogs. The initial hypothesis would predict a higher incidence of interspecific play in single-housed dogs.

We then test the null hypothesis that the structure of dog–dog and dog–human play are the same, even when the actions compared are restricted to those occurring in intraspecific play. In an experimental study of 12 Labrador Retrievers, we compared both the composition and the competitiveness of intra- and interspecific object-oriented play.

2. Focal sampling

2.1. Methods

During the period October 1995–January 1996, 25 visits were made to five popular dog walking locations in the south of England (Southampton Common; Mayflower Park, Southampton; Grandpont Nature Reserve, Oxford; Shotover Park, Oxford; University Parks, Oxford). A total of 16 h of observations was made. Repeat visits to the same site occurred at different times of day to minimise multiple recordings of the same subjects. During observations, the experimenter was accompanied by a dog and attempted to remain unnoticed. The experimenter recorded each person visibly walking a dog, who remained in view for 30 s or more. Groups of dog walkers were only included if walker–dog partnerships could easily be identified. We assumed that dogs being walked alone were also housed alone, and multiple dogs being walked by one person belonged to the same household. For each partnership we recorded;

(a) number of dogs being walked, classified as one or multiple,
(b) sex of person,
(c) size of dog, on a 3-point scale: small, medium or large,
(d) whether they played together whilst in view.

We were particularly interested in the effect of the number of dogs upon the incidence of play, but the other independent variables were recorded to allow examination of possible interactive effects.

2.2. Statistical analysis

Log-linear analysis was used to compare the characteristics of those partnerships which were observed playing together to those which were not. Using partnerships as the observational unit meant that only one dog within each partnership was represented, thus maintaining independence of the data. The variables tested were; number of dogs, sex of walker, size of dog and play presence (present or absent). Two-way backwards selections were carried out, once using all the two-way interaction terms, and once using all the three-way interactions. The final models were examined and any significant effects ($P < 0.05$), which included the term ''play presence'' were examined further via contingency tests.

2.3. Results

A total of 402 dog–owner partnerships were recorded of which 311 comprised single dogs (owners: 165 female, 146 male) and 91 multiple dogs (owners: 58 female, 33 male: 76 with 2 dogs, 15 with 3 or more). Play was observed in 51 of the partnerships; 17.8% of one-dog partnerships and 17.6% of multiple-dog partnerships. Log-linear analysis using two-way interactions produced a final model with two significant effects. The only variable which interacted with play presence was size of dog ($\chi^2 = 8.9,\ P = 0.01$). Subsequent contingency tests showed that medium-sized dogs were more likely to play than were large or small ($\chi^2 = 10.6,\ P < 0.005$). The model using three-way interactions showed a significant interaction between dog size, dog number and play presence ($\chi^2 = 8.7,\ P = 0.01$). Contingency tests showed that dog number only had a significant effect in the case of small dogs, with multiple-dog partnerships (16%) being more likely to play than single-dog partnerships (3%; $\chi^2 = 4.4,\ P < 0.05$).

2.4. Discussion

The results do not support the hypothesis that dogs in multi-dog households are less likely to play with their owner than dogs that live in single-dog households. During dog walks, number of dogs did not affect the overall incidence of play, whilst the size of the dog did. For small dogs, a dog within a multi-dog partnership was more likely to play with their owner than was a single-dog, further disproving the initial hypothesis. There may be other factors which affect the incidence of play such as the age of the owner, and the age, sex and breed of the dog. However, the methodology employed did not allow these variables to be determined accurately.

In this study we have compared the presence of play between samples. Play occurrence however, is not determined exclusively by the dog. Owners also assume a role, and it may be argued that multiple-dog owners are keener dog enthusiasts and therefore more likely to instigate play. However, the dog must be receptive for play to take place and these observations suggest that there is no reduction in the willingness to play shown by multiple-housed as compared to single dogs.

Our results suggest that the initial hypothesis is incorrect. Focal sampling had the advantage that it allowed non-intrusive examination of the incidence of play without

reliance on owners' subjective reports, but only examined play in one context; a walk. We therefore carried out a further study to confirm this finding. This used a large sample size, different methodology (surveying owners), and recorded frequency of play (instead of point sampling occurrence).

3. Dog owner survey

3.1. Methods

We designed questions which were incorporated within a verbal door-to-door survey of dog owners conducted by Pedigree MasterFoods (Melton Mowbray, UK). The survey was of 2585 dog-owners, distributed throughout mainland UK. Two thousand and seven owned one dog and 578 owned more than one dog. An owner was defined as ''the person who lived in a household with a dog and regularly purchased the dog food''. Respondents were almost exclusively female. This produced a biassed sample, but the effect of sex of owner on play occurrence in Study 1 was insignificant and so is probably not a great limitation. Each respondent was asked a range of questions about ownership style and pet food choice, but data were also collected on the number of dogs owned, their ages and sizes. One of the questions had five components which related to play behaviour. Respondents owning multiple dogs were instructed to answer with reference to the one they had owned for longest (the focal dog). Each owner was asked to rate the approximate frequency with which they played each of six sorts of games with their dog. The game types were those which a preliminary questionnaire had identified as the most common: fetch, tug-of-war, chase, hide-and-seek and rough-and-tumble (Rooney, 1999), plus an additional category of ''other games''. For each game the owner rated the frequency of playing as: 0: never; 1: occasionally; 2: approximately weekly; 3: several times a week; 4: approximately daily; or 5: several times a day.

Two indices of play frequency were compiled. Play index 1 represented the maximum score (1–5) which the respondent gave for any of the six game types. Play index 2 was calculated by adding the scores for each game type, giving a total which ranged from 0 to 30. The two indices are not independent, but both were retained as index 1 has the advantage of simplicity, whilst index 2 is a more accurate measure of overall frequency and diversity of play.

3.2. Statistical analysis

We performed Analysis of Variance (ANOVA) to examine the effect of independent variables upon the dependent variable play frequency (as measured using each of the play indices). The model included the independent variables; dog number (one or multiple) and size of dog; small, medium or large (as this was seen in Study 1 to affect play incidence). The multiple-dog owners answered the play questions with reference to their longest owned dog which led to a difference in age distribution; singly housed dogs (mean $= 7.94 \pm 0.07$) were significantly younger than multiple housed dogs (mean $= 9.20 \pm 0.11$; $\chi^2 = 84.9$, $P < 0.001$). Dog age was therefore included as a covariate within the model. ANOVA was performed twice, once using each of the play indices.

3.3. Results

3.3.1. Play index 1

ANOVA showed that the number of dogs in the household significantly affected the frequency of dog-owner play ($F_{(1,2545)} = 43.6,\ P < 0.001$). Mean frequencies were similar for both dog number groups: multiple dogs (mean = 3.2; 25th percentile 2, 75th percentile 5), single dogs (mean = 3.1; 1, 5). The covariate, dog age, exerted a highly significant effect upon the incidence of play ($F_{(1,2545)} = 639.4,\ P < 0.001$), with frequency of play decreasing with age of dog. Neither the main effect of dog size ($F_{(2,2545)} = 5.1,\ P = 0.43$), nor the interaction of dog size and number of dogs ($F_{(2,2545)} = 5.4,\ P = 0.42$), had a significant effect.

3.3.2. Play index 2

Play index 2 showed a similar pattern to index 1. Multiple-housed dogs showed a slightly higher mean play frequency (9.0; 25th percentile 3, 75th percentile 13) than single-housed dogs (8.9; 3, 14). ANOVA showed that number of dogs in the household had a significant effect ($F_{(1,2545)} = 5.6,\ P = 0.02$), but the magnitude of the effect was much less than that of age ($F_{(1,2545)} = 257,\ P < 0.001$). As with index 1, size of dog exerted no significant main effect ($F_{(2,2545)} = 0.39,\ P = 0.68$), and neither did the interaction with number of dogs ($F_{(2,2545)} = 1.8,\ P = 0.16$).

3.4. Discussion

These results confirm the findings of Study 1. Dogs that live in single-dog households do not exhibit more play with their owners than dogs that live with other dogs. In fact, our results show the frequency of play between a dog and owner is higher in multiple-dog than in single-dog households. However, examination of the *F*-ratios reveals that the effect of dog number, although significant (due to the very large sample size), is much smaller than the effect of dog age. It is not surprising that age plays a major role in determining the frequency of dog–human play — this is also the case in intraspecific play of many species (Byers, 1998).

The results of Study 2 are not identical to Study 1. During focal sampling there was no significant difference in play incidence between one and multiple-dog partnerships, but the survey showed that dogs in multi-dog households played slightly more often than those in single-dog households. This difference is probably a consequence of the difference in sample size, which is considerably larger in Study 2, giving greater statistical power, and reducing the possibility of Type 2 errors. Also, Study 1 produced an interaction between dog size and number not seen in Study 2. This may be a result of sampling technique, as play behaviour on walks differs from that in the home (Rooney, 1999). However, both studies show that single dogs do not play with their owners more often than multiple-housed dogs, under normal domestic conditions. This is in contrast to observations of domestic cats (Mertens, 1991; Bradshaw and Smart, 1993). Singly housed cats played with their owners more often than pair-housed cats. This may reflect

a species-specific difference, or may be due to ownership style; people choosing whether to obtain one or several cats may do so for different reasons than do dog owners. For the dog, it appears that opportunities to engage in intraspecific play afforded by living with other dogs, do not satiate the motivation to engage in interspecific play. To further explore this concept experimental studies would be necessary, manipulating intraspecific play levels and examining the effects on interspecific play. Manipulation of play opportunities without changing general social contact levels is problematic and poses welfare considerations. To further investigate the inter-/intraspecific distinction we therefore examined the composition of play.

4. Comparison of the structure of dog–dog and dog–human play

4.1. Methods

4.1.1. Subjects

The subjects were 12 adult Labrador Retrievers. Labradors were selected as they are particularly playful (Bradshaw et al., 1996) and are the most popular dog breed in the UK (Pedigree MasterFoods survey 1997 and Kennel Club UK Registration data 1997). There were three males (2 entire, 1 neutered) and nine females (8 entire, 1 neutered), ranging in age from 6.5 to 62.5 months (mean = 23.5 months). They were housed singly or in pairs at the Waltham Centre for Pet Nutrition, UK, and used primarily for nutrition trials (for further details of housing and husbandry see Loveridge, 1994). All received daily contact with other dogs and people.

4.1.2. Design

The experiment followed a within-subjects, repeated measures design.

4.1.3. Procedure

Each subject was trialed four times on four different days (within a period of one week). Play behaviour varies with time of day (Pellis, 1991) and so each subject was trialed at the same time, in each condition. Sessions were in a large grass paddock (approximately 120 m^2), familiar to all the dogs. They were filmed from an adjacent paddock using a video camera (Philips Explorer VKR6850).

Each session followed the same format. The dog was released in the paddock with its play partner (dog or human dependent upon condition) and allowed to acclimatise for 2 min. A ''Ragger'' toy (Petlove: a 30-cm long piece of rope knotted at each end which can simultaneously be held by two animals) was then thrown into the paddock by the camera operator. The partners played freely for 3 min. This constituted Phase 1. A second Ragger was then thrown into the paddock and Phase 2 began. This phase was designed specifically to examine the level of competition. It continued for a maximum of 3 min, but was terminated if the focal dog lost interest in the object, or possessed it for an uninterrupted period of 30 s.

In the first two sessions the play partner was a dog, in the next two, a person. Play behaviour is affected by the familiarity of partners (Mitchell and Thompson, 1991b) so for each focal dog, human and dog partners were selected which showed a similar degree of familiarity. The dog partner was either the dog routinely housed with the focal dog, or a regular companion during communal exercise periods, and was matched in age and sex as these factors are known to affect play (Biben, 1998; Thompson, 1998). Where practical, a different partner was used for each of the two dog–dog sessions, but in eight cases this was not possible due to logistic problems such as one of the dogs being in oestrus or lack of familiarity. Restricted dog numbers meant that play partners were also experimental subjects. The human partner was a member of the dog-care staff, who had regular contact with the dog (at least twice a week). Staff were familiar with different dogs, so three people were used and all were unaware of the hypotheses of the experiment.

To compare behaviours in specific situations it was necessary to present subjects with similar stimuli during interspecific and intraspecific sessions. Preliminary observations of intraspecific play were carried out and a set of guidelines for the human players compiled. They were each briefed prior to each session and were encouraged to:

(a) produce no motor actions that a dog was not capable of, e.g., throw the toy, or raise it above the dog's head,
(b) keep the focal dog playing,
(c) include all possible permutations of an object competition game.

4.1.4. Behavioural measures

To minimise subjectivity, no attempt was made to distinguish exploration from play. Play was defined structurally, as any object-oriented activity comprising of the 11 activities listed in Table 1. Videotaped sessions were analysed using the Observer data recording package (Noldus Information Technology). Each dog took part in two intraspecific sessions, but to maintain independence they were the focal animal in one

Table 1
Definitions of object-oriented play activities

Play activity	Description
Chase object	dog moves in same direction as a moving object, which is usually held by play partner
Watch object	dog orientates towards and pays close attention to object, tracking object's movement with its eyes
Tug object	dog pulls longitudinally on object which is simultaneously held by partner
Shake object	dog moves head from side to side whilst holding object which is simultaneously held by partner
Chew object	dog places object in its mouth repeatedly opening and closing its jaws around it
Hold object	dog maintains possession of object
Run chased	dog moves away from partner whilst holding object and being pursued by partner
Run ignored	dog moves away from partner whilst holding object and not being pursued by partner
Show object	dog approaches partner carrying object and then withdraws, maintaining possession
Mutual run	dog moves in same direction as partner whilst both simultaneously hold the object (no tugging is apparent)
Run tugging	dog runs in same direction as partner whilst simultaneously holding the object, and competing to gain sole possession

Table 2
Descriptions of variables measured during Phase 1 (one object)

Variable name	Description
Interest duration	total time for which dog shows interest in the toy; comprising the 11 object-oriented activities (Table 1)
Competition frequency	number of times dog holds toy simultaneously with partner whilst attempting to gain sole possession, via tug or shake
Show frequency	number of times dog approaches partner carrying toy and then withdraws still holding toy
Presentation frequency	number of times dog approaches partner while holding toy and surrenders it without contest
Win frequency	number of competitions in which dog maintains possession of toy
Proportion give-up	proportion of competitions in which dog appears to surrender possession of toy
Proportion time shake	proportion of time spent in competition (as defined in competition frequency variable) during which dog moves head from side to side whilst holding toy between teeth

and served as the play partner in the other. Phases 1 and 2 were examined separately. Ten of the sessions were selected at random. These were observed twice and intra-observer reliability concordance calculated using the Observer package. Concordance between equivalent 5-s sample intervals was 84% during Phase 1 and 76% during Phase 2.

During Phase 1 we examined general play structure. All variables were measured over the 3 min period. We measured the duration of each play activity (Table 1) and seven other variables as defined in Table 2.

The length of Phase 2 was variable, therefore variables were expressed as rates per minute, calculated over the interest duration (as defined in Table 2). There were six general variables measured during the whole phase (Table 3). The focal dog now had the option to either possess its own toy or to compete for its partner's. So, to assess the motivation to do each, whilst allowing for differences in the partner's behaviour, additional measurements were taken whenever two situations occurred — when the focal dog competed for a toy, and when it possessed a toy. The variables measured are listed in Table 4.

Table 3
General variables measured throughout whole of Phase 2

Variable	Description
Interest duration	as defined in Table 2
Competition frequency	as defined in Table 2
Proportion win	proportion of total competitions following which focal dog maintains possession of the object
Duration both object interest	time focal dog shows interest in both objects
Duration same object interest	time focal dog shows interest in same object as does partner

Table 4
Variables measured during Phase 2: (a) whenever focal dog competed for same object as their play partner, (b) whenever focal dog possessed object.

Variable	Description
(a) Competing for object	
Mean win time	Mean duration of competitions following which focal dog maintains possession
Mean lose time	Mean durations of competitions following which focal dog loses possession
Maximum competition	Maximum duration of a single competition for an object
Proportion interest loss	Proportion of competitions ended by focal dog losing interest in object
Proportion deflection	Proportion of competitions ended by focal dog deviating to other object
(b) Possessing object	
Mean competition start latency	Mean time before focal dog approaches partner and initiates a competition
Mean interest loss latency	Mean time before focal dog loses interest in both objects
Proportion interest loss	Proportion of possessions ended by focal dog losing interest in object
Proportion competition start	Proportion of possessions ended by focal dog approaching partner and initiating competition
Maximum possession	Maximum duration of sole possession

4.2. Statistical analysis

All variables showed dependence between means and variances, and were therefore transformed. Duration, frequency and latency variables were transformed using $\log(x+1)$ and proportional variables via $\arcsin(\sqrt{x})$. We explored the effect of partner type (condition) on the composition of interested time to see whether the 11 object-oriented activities were differentially affected by condition. We used a Repeated Measures Multi-factor ANOVA (SPSS-PC v7.0) and examined the interaction between condition and activity. A significant interaction would suggest that the activities were affected differently. All remaining variables were analysed using Repeated Measures two-way ANOVAs. For each factor, *F*-ratios were calculated using the corresponding between-subjects mean square as the error term.

4.3. Results

4.3.1. Phase 1

Partner type had different effects upon the 11 play activities ($F_{(10,110)} = 2.8,\ P < 0.001$). The focal dog spent significantly more time performing tug object ($F_{(1,11)} = 8.8,\ P < 0.05$), watch object ($F_{(1,11)} = 6.8,\ P < 0.05$), chase object ($F_{(1,11)} = 11.2,\ P < 0.01$), run chased ($F_{(1,11)} = 18.8,\ P < 0.01$) and show object ($F_{(1,11)} = 17.6,\ P < 0.01$) when playing with a person than another dog. The other six play activities did not differ significantly. The total interest duration ($F_{(1,11)} = 2.4,\ P > 0.1$) was not significantly affected by partner type, but several of the other behavioural variables were (Table 5). Dogs displayed higher competition, show object and presentation frequencies and higher

Table 5
Behavioural variables significantly affected by partner type ($P < 0.1$) during Phase 1. F = main effect F-ratio, E = direction of effect, D = dog partner, H = human partner

Behavioural variable	$F_{(1,11)}$	P	E
Competition frequency	16.5	< 0.005	H > D
Show object frequency	20.3	< 0.005	H > D
Presentation frequency	19.1	< 0.005	H > D
Give-up proportion	6.5	< 0.025	H > D
Proportion time shake	3.3	< 0.1	D > H

give-up proportions when playing with a person than when playing with another dog. However, the proportion of competition time spent shaking the toy was higher when the play partner was a dog (significant only at $P < 0.1$).

4.3.2. Phase 2

During phase two, three of the variables were significantly affected by partner type (Table 6). When playing with a person, dogs exhibited higher competition frequencies and longer durations of both object interest. The maximum single object possession duration was longer during intraspecific trials than during dog–human trials.

4.4. Discussion

We have shown that although the total interest in the object did not vary when the focal dog played with a person or another dog, other aspects of their behaviour did. We therefore reject the initial hypothesis and conclude that intra- and interspecific play are not homogeneous in structure.

The composition of play was different. During dog–human play activities such as show object, tug object, chase object and run chased figured more prominently. These are all interactive activities whilst more solitary activities such as chew and hold object, were not significantly affected by partner type.

During Phase 1, dogs engaged in more competitions when playing with a human. They more frequently showed and presented the toy to a person than to a dog. These

Table 6
Behavioural variables significantly affected by play partner type ($P < 0.1$) during Phase 2. df = degrees of freedom; this varies due to the absence of some behavioural patterns in some subjects. Other abbreviations as in Table 5.

Behavioural variable	df	F	P	E
Competition frequency	1,10	11.2	< 0.01	H > D
Duration both object interest	1,11	6.4	< 0.05	H > D
Mean competition start latency	1,7	5.3	< 0.1	D > H
Proportion competition start	1,10	4.7	< 0.1	H > D
Maximum possession	1,10	5.5	< 0.05	D > H

differences suggest that the dogs were keener to instigate play with a person. During interspecific play, a larger proportion of competitions were ended by the dog giving up, but with another dog, more of the competition time was spent shaking the object (significant only at $P < 0.1$). Lateral shaking is generally more vigorous than tugging (Rogerson, personal communication) and so these two differences suggest that winning possession of the object was more important during intraspecific play.

In Phase 2, we observed more competitions and longer durations of interest in both objects during interspecific play. Maximum possession durations were longer during dog–dog play. When playing with a person, a dog was also more likely and quicker (although significant only at $P < 0.1$) to leave the object it possessed and start competing with its partner. We suggest these findings indicate that during intraspecific play dogs are more strongly motivated to possess the object and are thus more competitive. Contrastingly, during interspecific play, interactions with the person are of greater importance.

These differences can be interpreted by considering hunting behaviour. Biben (1982) performed a cross-species comparison of the hunting behaviour and object play of carnivores. She found that the more cooperative the hunting behaviour of a species, the more sharing and less competition that occurred during their object play. For example there is much sharing during the play of the group-hunting bushdogs, *Speothos venaticus*, whilst solitary crab-eating foxes, *Cerdocyon thous*, compete for and defend objects. Domestic dogs often defend food items from conspecifics (Scott and Fuller, 1965), feral dogs seldom hunt cooperatively (Nesbitt, 1975; Boitani et al., 1995; Macdonald and Carr, 1995) and dingos (*Canis familiaris dingo*) mainly hunt alone (Corbett and Nesome, 1975). According to the ideas of Biben (1982) we would expect intraspecific dog play to be competitive, with little sharing of play items. This appears to be the case in the present study.

Dogs also hunt interspecifically with humans. For hundreds of years domestic dogs (especially retrieving breeds) have been selected to hunt with humans. They share and even surrender their prey to people. If hunting behaviour and play are under similar motivation, as Biben (1982) and Hall and Bradshaw (1998) suggest for other species, we would expect dog–human play to involve more sharing and to be less competitive than dog–dog play. Our results support these predictions.

This study does have limitations. The subjects all belong to a single population of Labrador Retrievers and we cannot assume that these findings will be universal, since breeds of dog vary widely in their behaviour (Hart and Hart, 1985; Bradshaw et al., 1996). Labradors have been selected for their ability to retrieve and it would be interesting to compare play behaviour in breeds which have been selected for different purposes. Subjects were observed playing with familiar dogs and people, with which they had stable relationships. Repetition using unfamiliar or young animals may give different results.

5. General discussion

We have shown that having many opportunities to engage in intraspecific play does not reduce the performance of interspecific play by dogs, as has previously been claimed

(Whitney, 1989; Rogerson, 1992; Askew, 1996). This suggests that, under normal conditions, the motivation to play with humans is not satisfied by dog–dog play. We have also shown that the structure of dog–human object-oriented play is different to its dog–dog counterpart: specifically the relative motivations to possess an object and to interact with the partner differ. We suggest that, taken together, these findings indicate that the two categories are not homogeneous.

There are several possible implications of this dichotomy. Dog–human games are frequently claimed to have effects upon the relationship between the players. Consistently allowing a dog to win games is alleged to result in the dog perceiving itself as stronger than its owner, leading to subsequent conflict and behavioural problems (McBride, 1995). This idea is based on extrapolation of intraspecific behaviours, particularly those of the wolf. Winning possession of toys is described as simulating the winning of the battle for the best meat at the end of a pack hunt (Appleby, 1997, p. 182), which can have consequences for the social hierarchy. This idea assumes that play is a contest and the goal is to possess the toy. Although this was the case during dog–dog play, we saw no evidence for it during dog–human play. Since dogs react differently to human and dog play partners, we see no reason to assume that the consequences of dog–human games are the same as dog–dog games. Decreased competitiveness may mean that the outcome of dog–human games is less likely to affect the players' relationship than has been suggested by some authors.

Hediger (1964, p. 166) claims that the ''humanizing tendency of man corresponds to a zoomorphizing tendency of the animal''. However, we have shown that dogs do not ''zoomorphize'' when playing, but react differently to dog and human play partners. Whether other elements of dog social behaviour are homogeneous when interacting with conspecifics and humans remains to be seen. We suggest that in the future care should be taken when extrapolating from dog–dog to dog–human interactions.

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