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Influence of group housing on social competence and adoption rate of dogs in a shelter

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Abstract

Social skills are the key for successful communication and an interactive life. Since dogs were bred for different purposes across the world, and widely fulfil the function of pets, they had to adapt to the human lifestyle, which created various behavioural problems, intra and interspecies. This pilot study intends to clarify if dog group housing in shelters can enhance the development of individual social skills and therefore create a better quality of life, subsequently leading to a higher adoption rate. In this study, a total of 20 group housed dogs were filmed in their daily routine, during 28 consecutive days at the HTV shelter in Hamburg, Germany, over the month of February. Each dog was filmed for three times three minutes per day, in a predefined order. Six focus dogs were chosen from the initial 20, namely those that were present during most of the filming, and their behaviours in dyadic interactions were evaluated according to an ethogram. Later on three dog-dog and three dog-human temperament test situation were performed with the six focus dogs and, conversely, with six single housed dogs, in order to evaluate if there was a difference in the displayed behaviours regarding the type of housing. There was a statistically significant correlation between the number of interactions in the group (dog-dog and dog-human) and their length ($p<0.001$ for both), the shorter the interactions the more interactions happened that day, at the same time there was a negative relationship between the number of interactions and the periods of sleep or resting ($p<0.001$), the more time was spent sleeping, the less interactions happened per day and the shorter each interaction was, either with dogs or with humans. The behaviours shown most by the dogs were behaviours from the group of social approach behavior, second came behaviours for de-escalation. Aggressive behavior was observed only very rarely. There was a positive linear correlation between the number of dyadic interactions started or stopped by an individual focus dog ($p<0.001$), the more a dog started interactions, the more the same dog stopped them, also the more different partners one dog had, the lower was the time spent with each of them ($p=0.003$). During the temperament test situations there was a statistical significance between the different groups of housing ($p<0.005$) just for one situation (person stumbling) and one behaviours (de-escalation). Overall the finding suggest that there is an advantage for dogs to be group housed in a shelter compared to be single housed, since it is beneficial in terms of development and/or improvement of individual social skills and competences for dog-dog and dog-human interaction, increasing stress tolerance levels and enhancing the overall quality of life for sheltered dogs.

Keywords: Dogs social skills, Shelter dogs, Shelter group housing, Communication between dogs, Dog welfare.

Resumo

Competências sociais são a chave para uma comunicação bem sucedida e uma vida interactiva. Cães foram seleccionados para variados fins nas várias partes do mundo, cumprindo hoje, largamente, a função de animais de companhia, tendo para isso que que se adaptar ao estilo de vida dos humanos, o que criou diversos problemas comportamentais, intra e interespécies. Este estudo pioneiro visa clarificar se cães alojados em grupo beneficiarão ao nível do desenvolvimento the competências sociais individuais promovendo uma melhor qualidade de vida, emaior número de adopções. Neste estudo, um total de 20 cães alojados em grupo foram filmados nas as suas rotinas diárias, durante 28 dias consecutivos no canil HTV em Hamburgo, Alemanha, durante o mês de Fevereiro, cada cão foi filmado três vezes três minutos diariamente. Com auxilio de um etograma, os comportamentos diádicos apresentados por seis cães foco, sendo estes os que estiveram presentes na maior dos dias. Posteriormente, três situações cão-cão e três cão-humano de um teste de temperamento foram executadas, com os seis cães foco e com seis cães alojados individualmente, com o intuito de avaliar se haveria diferenças nos comportamentos exibidos relativamente aos alojamentos. Houve uma correlação significativa estatisticmente entre o numero de interações no grupo (cão-cão e cão-humano) e a sua duração ($p<0.001$ para ambos), quanto mais curta a interação mais interações ocorreram, ao mesmo tempo houve uma relação negativa entre o numero the interações e os periodos de dormir ou descanso ($p<0.001$), quanto mais tempo era despendido a dormir ou descansar, menos as interações por dia e mais curtas estas se tornavam, tanto entre cães como com humanos. Os comportamentos mais exibidos pelos cães foram comportamentos de abordagem social, seguidos de comportamentos para alívio de conflito, sendo que os comportamentos agressivos foram raramente observado. Houve uma correlação linear positiva entre o numero de interações diádicas iniciadas e terminadas pelo cão foco ($p<0.001$), quanto mais interações o cão iniciava, mais interações o mesmo cão terminava, igualmente quanto mais parceiros diferentes um cão tivesse, menos era o tempo com cada um ($p=0.003$). Durante as situações do teste de temperamento houve uma significância estatística entre os diferentes grupos de alojamento ($p<0.005$) apenas numa situação (humano tropeça) e num comportamento (comportamento para alívio de conflito). No geral os resultados sugerem que o alojamento em grupo traz vantagens em comparação com o alojamento individual, pois é benefico em termos de desenvolvimento e/ou de melhoria das competências sociais em interações entre cães e com humanos, aumentando os niveis de tolerância ao stress e da qualidade de vida para cães de canil.

Palavras-chave: Competências sociais em cães, cães de canil, alojamento em grupo no canil, comunicação entre cães, bem-estar de cães.

Introdução

Competências sociais são a chave para uma correcta comunicação e uma vida interactiva. Cães como animais de companhia foram seleccionados mundialmente e criados para diferentes propósitos, tiveram que se adaptar ao estilo de vida dos humanos, o que criou diversos problemas comportamentais, intra e interespécies. Este estudo pioneiro visa vir a clarificar se cães alojados em grupo em canis pode aumentar o desenvolvimento de competências sociais individuais e por esse motivo criar uma melhor qualidade de vida, levando a aumentos nas taxas de adoção.

Neste estudo, foram filmadas as rotinas diárias de 20 cães no total, durante 28 dias consecutivos. Estas filmagens ocorreram durante o mês de Fevereiro de 2016 e foram conseguidas no alojamento de grupo do canil HTV (Hamburger Tierschutzverein) em Hamburgo, Alemanha. Cada cão foi filmado durante três minutos, três vezes e no final foram avaliados, com auxilio de um etograma, os comportamnetos apresentados por seis cães foco, escolhidos por terem estado presentes na maioria dos dias. Após os 28 dias de filmagens, três situações cão-cão e três cão-humano de um teste de temperamento foram executadas, com os seis cães foco e com seis cães alojados individualmente, com o intuito de avaliar se há diferenças nos comportamentos exibidos relativamente aos diferentes alojamentos, como consequência de desenvolvimento das competências sociais.

O estudo compreende os seguintes tópicos:

1. Evolução da ligação entre cães e humanos

Historicamente, o cão doméstico, *Canis familiaris*, tem vivido em conjunto com os seres humanos desde à 15 000 anos (Clutton-Brock, 1995) ou de acordo com estudos mitocondriais de ADN, a mais e 135 000 anos (Vila, 1997; vonHoldt, et al., 2010). Desde o inicio, esta convivência tem trazido vantagens para ambas as partes: para os cães foi providenciado abrigo e comida, para os humanos tutores estes animais desenvolveram toda uma gama de tarefas, desde caça até á guarda, abrangendo também o pastoreio ou proteção de

rebanhos, assim como a simples tarefa de fazer companhia ao seu tutor, ser humano.(Bradshaw, 2011; Herre & Röhrs, 1990; K. L. Overall, 2013; Serpell, 1995).

Evidências de cães com diferentes morfologias, que provavelmente surgiram através das diferentes tarefas a que foram sujeitos, remontam até a cerca de 15 000 anos (Pang et al., 2009) e na arte antiga dos Egipcios e Chineses é possivel encontrar representações de cães com fenótipos similares envolvidos em tarefas associadas desde à 3500 anos (K. L. Overall, 2013).

Hoje em dia, a principal função da maioria dos cães é ganhar aptidão para fazer companhia aos humanos, como membro da familia, amigo ou mesmo como substituição de descendentes, com o intuito de satisfazer as necessidades de atenção dos tutores, suporte emocional e fazer-lhes companhia (Gebhardt-henrich, 2002; King, Marston, & Bennett, 2012). Escolher um cão pela sua aparência, sem tomar em consideração as caracteristcas da raça, tais como os requisitos para exercicio fisico e a necessidade para estimulos mentais, leva ao aumento de falhas na associação cão-tutor, provocando consequentemente problemas comportamentais (Marder & Duxbury, 2008).

A proximidade da relação dos cães com humanos faz com que a falta de conhecimentos sobre comportamento e comunicação dos cães seja particularmente perigosa, pois interpretações errôneas dos sinais comunicativos podem facilmente levar à negligência do bem-estar, ao desenvolvimento de problemas comportamentais, ao perigo para os seres humanos e envolventes e consequentemente, até mesmo à eutanásia do animal (Miklósi, 2007).

2. Comportamento do Cão

A interpretação do comportamento canino e dos métodos de treino de acordo com os diferentes extremos, como Lupomorfismo de um lado e babymorfismo do outro, são a origem de muitos problemas na relação dos cães com os humanos (Miklósi, 2007). Embora a genética, em certa medida, determine em que forma o indivíduo interage com o ambiente, estabelecendo um elenco de predisposições, a interação também é amplamente determinada pelas experiências e feedbacks a que o cão está sujeito, isto é: aprendizagem. Consequentemente, o indivíduo desenvolve-se com base numa interacção contínua entre a composição genética e o ambiente, muitas vezes referida como “nature and nurture” (Abrantes, 2001; Bradley, 2011). Ao considerar a ontogenia do cão, o termo socialização é inevitável, pois este é o processo através do qual o indivíduo adquire as competências sociais

necessárias pela exposição ao ambiente social e seus membros. No caso do cão, isso inclui necessariamente contato com seres humanos também (Miklósi, 2007). Um dos aspectos mais importantes na vida social é a comunicação, esta tem a mesma função que todos os outros comportamentos que o cão desmonstra, servindo: para aumentar e manter a aptidão biológica (Schöning, 2006; Tschanz, 1993).

2.1. Comportamento e Aptidão Biológica

O comportamento social do cão foi influenciado pela humanidade ao longo da domesticação, e a seleção foi feita para aumentar a tendência natural de interagir com os seres humanos (Serpell, 1995). No reino animal, a capacidade de interagir com os seres humanos e de interpretar o comportamento humano é incomparável mesmo para os macacos (Hare & Tomasello, 2005). De acordo com Bräuer et al (2006) os cães são mais rápidos a interpretar algumas sugestões visuais tais como apontar do que mesmo os chimpanzés, sendo muito sensíveis ao foco da atenção dos seres humanos (Miklósi, et al., 2003; Schwab & Huber, 2006). Os cães mostram naturalmente uma exposição vasta de comportamentos comunicativos perante os seres humanos, e no caso dos cães que foram negados da atenção humana, tais como os cães do abrigo, são ainda mais dirigidos socialmente a olhar e interagir com seres humanos, do que cães de estimação (Duranton & Gaunet, 2016) usando sinais comunicativos que eles não usam com congêneres (Gácsi, McGreevy, Kara, & Miklósi, 2009). Os cães usam seres humanos (predominantemente o proprietário) como um sujeito de referenciamento social (Merola, Prato-Previde, & Marshall-Pescini, 2012), e se eles não sabem como abordar ou resolver um problema, dirigem-se para estes mesmos seres humanos, o que não acontece no caso dos lobos (Miklosi et al., 2003). Uma compreensão completa da forma como os cães comunicam e se comportam é a base de qualquer trabalho em conjunto com treino e/ou modificação comportamental, sendo importante para o bem-estar do cão. O termo "aptidão biológica" resume os três objetivos biológicos principais subjacentes a qualquer manifestação de comportamento, que são:

a. Reprodução,
b. Prevenção de Danos e
c. Acesso a recursos e aumento de bem-estar em geral (Schöning, 2006; Tschanz, 1993).

2.2 Comportamento Social e Comunicação

O termo "comportamento social" abrange todos os comportamentos dirigidos a uma mesma espécie ou parceiro inter-espécies (Schöning, 2006). Os comportamentos sociais são usados como uma ferramenta de comunicação e compreendem a reciprocidade entre a emissão de um sinal por um indivíduo e a resposta do receptor, que afeta o seu comportamento pelo comportamento demosntrado pelo primeiro indivíduo. É, em suma, uma dualidade comunicativa. (Manning y Dawkins, 1998, Schöning, 2006). A importância da comunicação num nível ritualizado é reduzir o mal-entendido e portanto, a quantidade potencialmente letal de encontros agressivos, que são uma ameaça à homeostase do indivíduo e/ou do grupo (Schöning, 2006; Wrubel, Moon-Fanelli, Maranda, & Dodman, 2011) Inclui comportamentos socio-positivos, bem como comportamentos socio-negativos, sendo que comportamentos sócio-positivos (por exemplo, submissão ativa) visam reduzir a distância entre dois indivíduos, enquanto que comportamentos socio-negativos (por exemplo, ameaças) visam aumentar a distância. Na comunicação social, os cães confiam na comunicação visual (sinais ópticos como imitação ou postura corporal), (Fukuzawa et al. 2005; Miklósi, 2007), a comunicação funciona melhor, o quanto melhor ambos os parceiros foram socializados e aprenderam a entender e exibir esses sinais. Assim, na comunicação, esses sinais informam o outro parceiro sobre o estado emocional, a motivação e a prontidão para iniciar certos comportamentos (Feddersen-Petersen & Ohl, 1995; Mittmann, 2002). Feddersen-Petersen denominou o termo "comportamento expressivo" ("Ausdrucksverhalten") para esta categoria de comportamentos.

Para cada espécie, o reportório comportamental completo é mostrado num assim chamado etograma, ou seja uma lista de comportamentos individuais ou comportamentos agrupados para uma entidade individual, de acordo com sua função e objetivo. Os comportamentos a partir do etograma do cão podem, por si só, ser agregados em certos grupos, tais como, por exemplo o grupo de comportamento reprodutivo, o grupo de comportamento de abordagem social ou o grupo de comportamento imponente.

Os problemas na relação cão-humano ocorrem mais frequentemente, porque os seres humanos interpretam o comportamento do cão erradamente e/ou de uma perspectiva antropomórfica (Overall, 2013). Eles têm especialmente dificuldades em interpretar sinais menos óbvios e discretos com precisão e, embora talvez interpretando corretamente, a responder corretamente. Isso novamente pode ser mal interpretado pelo cão e um conflito pode facilmente iniciar e levar ao stress em ambos os lados. Se ocorrer uma mordida numa

relação cão-humano, geralmente resulta em resultados nefastos para ambos, sendo que o cão que é muitas vezes abandonado ou mesmo abatido, enquanto o humano sofre de dor física. Quando a relação entre cães e humanos é destruída ou perturbada, muitas pessoas recorrem a um abrigo para deixar os seus animais de estimação.

3. Alojamento de Cão no Canil

Em termos de habitação, os cães podem ser alojados num abrigo que basicamente pode ter quatro tipos principais de instalações: i) pequenas jaulas individuais, apropriadas para animais doentes/feridos que necessitam de monitorização rigorosa; ii) canil único, útil para cães que não podem ser alojados com outros cães; iii) recintos maiores para alojamentos individuais, emparelhados ou em grupo; iv) recintos indoor/outdoor, semelhante ao anterior, mas com uma parte interior e uma exterior. Ao longo das últimas décadas, o conceito de bem-estar animal mudou: tradicionalmente tem sido visto principalmente em termos do corpo e do ambiente físico (abrigo, alimentação, etc.), com base na premissa de que se um animal está em boa saúde física e a produzir/reproduzir bem, o seu bem-estar deve ser adequado (Broom, 1991; Hewson, 2003). Recentemente, tem sido sugerido que o foco não deve estar apenas em evitar dano e desconforto, mas também dar valor a comportamentos típicos da espécie, experiências positivas, recursos e atividades prazerosas (Starling, Branson, Cody, Starling, & McGreevy, 2014). Até recentemente, o padrão global de ambiente de canil num abrigo, era de habitação única, com apenas contato auditivo com outros cães e contato com seres humanos limitado à limpeza diária, sendo a principal razão para este tipo de habitação é o medo de lutas entre cães (Mertens & Unshelm, 1996; Salman et al., 1998). Hoje em dia o abrigo de cães está a mudar para o abrigo de grupo, sendo que o exercício, o acto de brincar e a socialização são igualmente considerados (Loveridge, 1998; Ottesen, Weber, Gürtler, & Mikkelsen, 2004; Taylor & Mills, 2007).

3.1 Stress no Canil

Quando um cão é deixado num canil, o ambiente novo e desconhecido (por exemplo, pessoas, cheiros, sons e outros animais), além do sofrimento causado por ser separado do proprietário, em alguns casos, pode induzir o stress (Stephen & Ledger, 2005). O tipo de confinamento adicionalmente pode comprometer o bem-estar do cão. Quando as estas condições são prolongadas, o stress crónico surge (Hennessy, Davis, Williams, Mellott, & Douglas, 1997), o que pode levar a mudanças comportamentais, tais como comportamentos

repetitivos (estereotipias ou comportamentos compulsivos obsessivos) (Denham, Bradshaw, & Rooney, 2014; Miller & Janeczko, 2015). O stress também tem um efeito na diminuição do sistema imunitário, portanto, aumentando o risco de infecção, que é sempre uma preocupação num ambiente denso, como abrigos (Miller & Janeczko, 2015).

Esforços para reduzir o stress já estão descritos na literatura (exemplos como, habitação adequada e princípios de criação são explicados mais adiante no enriquecimento ambiental). As estratégias incluem a manipulação positiva (o maneio brusco por parte dos tratadores deve ser evitado a todo o custo), redução de ruído, evitando a colocação aleatória com outros animais e proporcionando conforto e enriquecimento ambiental nos seus compartimentos primários (Wells, 2004). Circunstâncias consideradas adversas pelo animal podem levar a uma "resposta de luta ou fuga" (em paralelo, surgem reações de stress: aumento da freqüência cardíaca e respiratória, pressão arterial elevada, pupilas dilatadas) (McEwen, 2000; Rushen, 2000). Os animais stressados não só são mais propensos a ficar doentes, mas quando doentes, desenvolvem sinais clínicos graves, permanecendo doentes por períodos mais longos e tendo uma resposta diminuída ao tratamento (Gourkow & Fraser, 2006). A genética, as experiências passadas, o ambiente, o temperamento e a aprendizagem do animal são fatores que influenciam a maneira como o cão reage e percebe os fatores que causam stress (Tynes, Sinn, & Koch, 2015). As mudanças comportamentais provocadas pelo stress podem ter um impacto negativo sobre o bem-estar e diminuir a hipótese de um animal ser adotado. Em paralelo pode aumentar o perigo colocado por estes cães, sendo que os animais muito stressados podem reagir inesperada e/ou agressivamente ao maneio (Miller & Janeczko, 2015). Entre os factores de stress mais importantes em cães de canil são por exemplo: novas rotinas diárias, cheiros estranhos, sons, pessoas e outros cães - muitas vezes resultando em falta de controlo do ambiente e, portanto, imprevisibilidade e medo (Belpedio, 2010; Hiby, Rooney, & Bradshaw, 2006). Quando o tempo no canil é prolongado, a falta de interação social com animais da mesma espécie e seres humanos é um fator importante que deve ser levado em consideração como um gatilho de frustração e stress (efeito de longo prazo) (Stephen & Ledger, 2005). Alguns indicadores comportamentais comuns de stress agudo em cães de abrigo incluem baixa postura corporal, lambedura das comissuras labiais, bocejo e aumento da inquietação (Beerda B. , et al., 1998). Indicador comportamental de stress crónico pode ser baixa postura corporal, aumento de auto-grooming (limpeza excessiva através de lambedura pela parte do cão), levantamento da pata, vocalizações, comportamento

repetitivo, e coprofagia (Beerda B. , et al., 1999). O Stephen and Ledger (2005) resume os comportamentos associados com o os problemas no bem-estar em cães de canil.

A prevalência de comportamentos associados à frustração, como estimulação, saltos contra a parede e roer a cama, aumentou quando os cães viviam num ambiente que não lhes permitia realizar comportamentos específicos para a espécie (Stephen & Ledger, 2005).

3.2 Alojamento em Grupo

O alojamento em grupo para cães oferece diversas oportunidades de enriquecimento ambiental e enriquecimento social. É necessário um planeamento cuidadoso para assegurar que os efeitos positivos do alojamento em grupo superem os possíveis negativos como, por exemplo, stress, lutas e transmissão de doenças, portanto o alojamento em grupo não é apropriado para todos os animais. Exemplos do que pode ser feito para diminuir os riscos incluem: vacinação e controlo parasitário de todos os cães, avaliação comportamental para garantir compatibilidades entre eles, e esterilização/castração antes da colocação com outros (F.D. McMillan, 2013).

A ideia de que manter cão em grupos lhes oferece a oportunidade de satisfazer uma necessidade biológica de exercício físico e de contato social com a mesma espécie e que isso tem um efeito positivo sobre o bem-estar, tem sido discutida por vários autores (Hubrecht, Serpell, & Poole, 1992; Salman et al., 1998; Sonderegger & Turner, 1996). Esta tendência é ainda mais apoiada por evidências que sugerem que os cães alojados individualmente mostram um risco aumentado de patologias comportamentais tais como estereotipias (por exemplo, estimulação, auto-grooming excessivo ou vocalizações) especialmente quando vivem em isolamento por períodos prolongados e/ou desde a idade precoce (B Beerda et al., 1999; Cafazzo et al., 2014; Hubrecht et al., 1992). Cães alojados em compartimentos maiores com outros cães mostraram quase ausência completa de estereotipias (Hubrecht et al., 1992) (Hubrecht et al 1992; Hubrecht 1993; Mertens & Unshelm 1996). Um estudo comparativo de cães alojados individualmente e agrupados em dois abrigos na Alemanha descobriu que os cães alojados em grupo eram mais ativos, menos agressivos, eram mais rápidos a serem cães de companhia e apresentavam menos problemas de comportamento na nova casa, além de que mais de 90% dos conflitos foram resolvidos apenas através de comportamentos ritualizados e sem ameaças sérias (Mertens & Unshelm, 1996).

Equilibrar o número de machos e fêmeas, bem como evitar a presença de fêmeas no cio e de machos não castrados, também pode reduzir o conflito potencial e encontros agressivos (Mertens & Unshelm, 1996; Sonderegger & Turner, 1996).

Conflitos podem surgir quando os cães competem por comida e podem ser reduzidos com alimentos ad libitum ou alimentação em grupo diretamente no chão, sob supervisão (Pettijohn, Davis, & Scott, 1980). Alguns estudos sugerem uma influência do tamanho do grupo sobre a agressão, com grupos maiores (mais de 50 indivíduos) ou grupos com alto retorno de cães com alto grau de agressão, talvez por causa da impossibilidade de formar hierarquias de qualquer tipo neste tipo de ambiente (Mertens & Unshelm, 1996; Sonderegger & Turner, 1996). Grupos pequenos com hierarquias estáveis devem, portanto, também mostrar baixas taxas de agressões (Taylor & Mills, 2007). Nos estudos de Mertens e Unshelm (1996) e de Sonderegger e Turner (1996) verificou-se que, mesmo vivendo fora e em conjunto com outros cães, os animais alojados em grupo tinham mais oportunidades de contato cão-humano, a presença humana nos grupos maiores foi mais constante e mais longa, o que também levou a um maior foco perante os seres humanos. Isso leva a supor que o enriquecimento ambiental não deve incluir apenas o contato cão-cão, mas também o contato cão-humano, já que os cães parecem ter desenvolvido uma atenção seletiva e exclusiva, tendo uma tendência de ligação com os seres humanos (Miklosi et al., 2003).

4. Enriquecimento Ambiental

Alojamento em grupo é uma forma de enriquecimento ambiental e como um grupo de cães foi investigado neste estudo, é importante esclarecer o conceito e enumerar os outros tipos de enriquecimento ambiental.

Quando se fala em cães de grupo ou de habitação única, e o seu efeito sobre o bem-estar, é impossível não se deparar com o termo Enriquecimento Ambiental, como referido anteriormente. O enriquecimento ambiental permite, independentemente da espécie a que se aplica, aos animais em cativeiro melhorar a sua saúde física, comportamental e psicológica (Young, 2003). Enriquecimento ambiental é um "conceito que descreve como o ambiente de animais em cativeiro pode ser alterado para beneficiar os seus habitantes" (Carlstead & Shepherdson, 1994). As Diretrizes para Padrões de Cuidados em Abrigos de Animais, pela ASV, define a importância do enriquecimento como equivalentemente importante como nutrição e cuidados veterinários; não é opcional. O enriquecimento permite a redução do stress, promove a estimulação física e mental, encoraja os comportamentos típicos das

espécies e permite que os animais tenham mais controlo sobre o seu ambiente, contribuindo para o bem-estar geral (Newbury et al., 2010). O enriquecimento pode ser dividido em duas categorias principais: animado (contato com outros animais e seres humanos), que também pode ser chamado de "enriquecimento social"; E inanimado (habitação, alimentação, brinquedos e enriquecimento sensorial), que também pode ser chamado de enriquecimento ambiental (D. Wells, 2004).

As necessidades individuais devem sempre ser levadas em consideração, pois nem todas as estratégias são apropriadas para cada cão.

4.1 Enriquecimento Social e Animado

Contato com outros cães: é prejudicial ao bem-estar, abrigar uma espécie altamente social como o cão, em total isolamento dos membros da sua espécie (Miklósi, 2007; K. L. Overall, 2013). É aconselhável abrigar cães em pares ou grupos. O mero fato de descartar canis de uma forma que permita que os cães vejam outros da mesma espécie, pode já ser benéfico (Ottesen et al., 2004; D. L. Wells & Hepper, 1998). No entanto, isso nem sempre é possível para todos os abrigos, e para alguns animais não é aconselhável. Outras estratégias para promover a interação social com outros cães incluem caminhadas e brincadeiras entre cães (Sadler, 2014; D. Wells, 2004).

Já em 1992, um estudo de Hubrecht et al mostrou que o alojamento dos cães em grupos estava associado a alta atividade, comportamento social e investigação, juntamente com baixos níveis de comportamento repetitivo (estereotipias associadas ao stress e ao pobre bem-estar), enquanto os cães alojados sozinhos estavam mais inativos. O alojamento em grupo proporciona um ambiente social complexo, enquanto o alojamento individual foi associado a mais passividade e comportamentos repetitivos não-sociais. A impressão dada foi que os cães alojados sozinhos passaram grande parte do seu tempo a tentar aumentar os estimulos sensoriais investigando o chão, presumivelmente em busca de algum nível de estimulação mental (Hubrecht et al., 1992).

Taylor e Mills (2007) descobriram que os cachorros que foram alojados juntos exibiram comportamentos menos perturbados, e foram mais silenciosos durante grande parte do dia (Taylor & Mills, 2007).

Por outro lado, cães socialmente competentes têm maiores oportunidades de obter acesso a recursos como manipulação, playgroups, passeios e envolvimento em relações humanas, que por sua vez pode levar a taxas de adoção mais rápidas como a maioria dos

adotantes à procura de cães de companhia são atraídos por cães que se apresentam de uma forma amigável e sociável com outros cães, além de pessoas (Luescher & Tyson Medlock, 2009; Protopopova, Brandifino, & Wynne, 2016; Emily Weiss, Miller, Mohan-Gibbons, & Vela, 2012).

4.1.1. Contacto com humanos:

Não só o isolamento social de outros cães, mas também a falta de interação com os seres humanos são um fator que contribui para o stress num ambiente de canil. Os seres humanos são um recurso importante que pode e deve ser usado para melhorar o bem-estar geral (Coppinger & Zuccotti, 1999; Coppola, Grandin, & Enns, 2006). A importância da interação social humana com cães de canil tem sido evidenciada em vários estudos, que sublinham a importância da interação cão-humano positiva (Belpedio, 2010; Coppola et al., 2006; Menor-Campos et al, 2011) É importante levar em conta as características individuais do cão, tais como experiências anteriores, socialização, personalidade e até genética, a fim de assegurar uma experiência positiva ao invés de stressante (Franklin D McMillan, 2002). O estudo realizado por Menor-Campos et al. (2011) demonstraram que um protocolo de 25 minutos de exercício, brincadeiras e contato humano foi útil na redução do stress em cães de canil.

As estratégias incluem: preparação e maneio por tratadores e voluntários; Brincadeiras entre cães e tratadores/voluntários; Passeio do Cão e sessões de treino com métodos de reforço positivo (D. Wells, 2004)

4.2 Enriquecimento Ambiental e Inanimado

Embora nem todos os cães mostrem interesse ou tenham aprendido a usar brinquedos, a evidência mostrou que a sua mera presença no recinto primário é vista pelo público (e pelos possíveis adotantes) como um elemento desejável que pode aumentar as hipóteses de adoção (Graham, Wells, & Hepper, 2005; Luescher & Tyson Medlock, 2009). Há uma abundância de brinquedos disponíveis no mercado, incluindo bolas, brinquedos de roer e brinquedos que permitem o enriquecimento alimentar, tais como kongs® (K. L. Overall, 2013; Santos et al., 2013)

Os recintos em que os cães são alojados devem incluir uma variedade de espaços, plataformas elevadas, que permitem aos cães uma melhor vigilância do ambiente, além de fornecer lugares de repouso (sub ou sob solo); Lugares para esconder, que permitam aos

animais ter algum controlo no ambiente; Áreas funcionais separadas (zona de descanso longe das zonas de eliminação) (Moesta, McCune, Deacon, & Kruger, 2015; D. Wells, 2004).

O enriquecimento sensorial também pode ser do tipo auditivo, incluindo a redução de ruído e a adição de sons como música ou conversa calma (Brayley & Montrose, 2016; Kogan, Schoenfeld-Tacher, & Simon, 2012); Ou pode ser olfativo, com a adição de novos cheiros ou fragrâncias calmantes (Graham et al., 2005) ou a feromona (DAP), que foi anunciada com propriedades calmantes em cães, embora mais pesquisas sejam necessárias para chegar a mais conclusões dos seus benefícios para cães de canil (Moesta et al., 2015).

5. Este Estudo

O objetivo principal deste estudo pioneiro foi observar o comportamento individual de cães agrupados num abrigo, especialmente nas interações sociais entre cães. A pergunta geral era: O alojamento em grupo de cães num abrigo é benéfico em termos do desenvolvimento de competências sociais individuais, melhorando a qualidade de vida e bem-estar gerais assim como o aumento da taxa de adoção?

A melhoria das competências sociais pode prevenir problemas de comportamento após a adoção e, em geral, aumentar a taxa de adoções bem sucedidas. Além disso, como foi sugerido que o alojamento em grupo pode ser uma causa de stress para os cães, reduzindo assim a sua qualidade de vida, este estudo deve trazer alguma introspecção sobre este assunto.

Um grande argumento, além de muito trabalho para o tratador, contra o alojamento de grupo é o medo de que os cães podem envolver-se em encontros agressivos e lutas com alguma frequência. Por isso, procurou-se interações positivas e negativas entre os cães: Para avaliar as habilidades sociais individuais ao nível geral de stress, analisou-se a interação cão-cão no período de observação, determinando se foi caracterizada por interação social positiva entre cães ou por interações de conflito. Aqui "interação de conflito" está não só para a ocorrência de comportamento agressivo, mas também quando o comportamento imponente foi demonstrado por um ou ambos os cães intervenientes. Paralelamente, considerou-se o número de comportamentos de submissão, medo e stress mostrados por cada cão. Os seguintes parâmetros foram observados durante as interações cão-cão:

- número de interações sociais, número de parceiros, duração de cada interação social; Quem iniciou cada interação e quem terminou. Se os cães individuais preferiam os parceiros sociais ou não.

- quais dos elementos comportamentais foram mostrados por cada cão, e se os cães mostraram variação individual no uso desses elementos. Elementos como comportamentos de medo e stress podem ser indicativos do temperamento de um cão, permitindo que o pessoal do abrigo agrupe os cães de forma mais eficiente.

- se os cães diferem na sua interacção com os seres humanos e na quantidade de tempo que passam a dormir/descansar;

Finalmente, após o período de observação, os cães foram testados em seis situações padronizadas e o seu comportamento foi comparado ao comportamento de seis cães mantidos em alojamento individual no abrigo. A questão era saber se os cães alojados no grupo diferiam no seu comportamento dos cães alojados individualmente, especialmente em termos de competência social.

Material e Métodos

1. Informação dos cães

Seis cães foram observados em relação ao seu comportamento social, num grupo de cães que consistia em 20 cães no total. Os cães viviam em grupo num abrigo da Sociedade de Hamburgo para a Prevenção da Crueldade contra os Animais (Hamburger Tierschutzverein von 1841 eV., Süderstraße 399, 20537 Hamburgo, Alemanha (HTV)). A Tabela 1 compreende a informação relevante para estes seis cães.

Table 1 - Informações de cada um dos seis cães foco.

Cão	Raça	Idade	Sexo	Origem	Razão para estar no canil	Tempo de alojamento no canil
Cão 1	Pator Alemão	5 anos	Fêmea (esterilizada)	Encontrada	Negligência	2 anos
Cão 2	SRD	2 anos	Macho (castrado)	Roménia	Agressivo perante outros cães	1 ano
Cão 3	SRD	1 ano	Macho (castrado)	Roménia	Tutor tinha demasiados cães	1 ano

Cão 4	X Rottweiler	5 anos	Macho (castrado)	Sem informação	Agressivo perante humanos e tutor	1 ano
Cão 5	SRD	2 anos	Macho (castrado)	Roménia	Privado	4 anos
Cão 6	X Staffordshire-Rottweiler-Pastor alemão	> 9 anos	Macho (castrado)	De outro canil	Privado	4 anos

Para avaliar os comportamentos demonstrados por cada cão, os animais foram filmados todos os dias (ver compilação de dados). A maioria dos cães permaneceu no grupo de habitação durante 24 horas sete dias por semana, no entanto, em alguns dias, cães individuais sairam por períodos mais ou menos curtos (visitas aos veterinários, passeios á rua, etc) ou mesmo durante a noite (levado para casa por um voluntário ou tratador). Alguns cães pertenciam aos tratadores do abrigo, unindo-se ao grupo de forma irregular. Apenas seis cães (Cão 1 - Cão 6) estavam presentes regularmente durante as sessões de vídeo, por essa razão, apenas os dados destes seis cães foram avaliados neste estudo.

2. Compilação de Dados

Os dados foram reunidos por meio de gravação de vídeo, por 28 dias consecutivos, de 1 de Fevereiro de 2016 até 28 de Fevereiro de 2016. As filmagens foram realizadas por 2 pessoas diferentes com telemóveis: Vodafone Smart Prime 6 e Samsung A5; Estas duas pessoas foram equipadas com roupas do abrigo, e foram introduzidas aos cães, com a ajuda e supervisão dos tratadores três dias consecutivos antes de iniciar as filmagens, para que os cães se habituassem e não se distraíssem do seu comportamento normal de rotina.

Os cães foram filmados de acordo com "Focal animal´s behaviour sampling" (Martin & Bateson, 1996), cada cão três vezes durante três minutos, por dia. A gravação ocorreu de manhã após a alimentação e antes de iniciarem os passeios diários. Dependendo do número de cães por dia, a gravação do vídeo foi dividido entre as duas pessoas e os cães atribuídos foram filmados consistentemente pela mesma pessoa, durante a sua permanência no grupo. A ordem dos cães foi sempre a mesma, mais especificamente dos seis cães estudados foi Cão 1 e Cão 3

primeiro, Cão 5 e Cão 4 segundo e Cão 6 e Cão 2 de seguida, respectivamente, para cada pessoa.

3. Instalações e Rotinas diárias

O recinto tinha cerca de 500 m^2. O solo era 30% de relva, 50% de terra e 20% de cimento. A área com relva tinha um grande pneu para enriquecimento ambiental e uma única plataforma redonda, de cerca de 1 metro de diâmetro, com 1 metro de altura. Telhas foram usadas para cobrir 50% da área total. A entrada principal do recinto era equipada com portas duplas, onde eram armazenados todos os equipamentos para as caminhadas, como trelas, coleiras e açaimes. No lado direito do recinto havia outra porta dupla e no lado esquerdo havia uma entrada de porta única que raramente era usada.

No recinto foram instaladas 16 casotas (3x2m, 6m2), 12 casotas no terreno e 4 numa plataforma coberta, a cerca de 1,50 metros acima do solo com três rampas de acesso, permitindo o acesso livre para o espaço sob a plataforma. Quase todas as casotas tinham toalhas à entrada para maior isolamento térmico. Em dias muito frios (temperaturas abaixo de zero e neve) as casotas eram preenchidas com palha extra para mais isolamento.

Os cães eram alimentados pela manhã, às 8 horas durante a semana e às 7 horas no fim de semana. Geralmente, um trilho de alimentação de ração seca e alguns alimentos húmidos adicionados era feito no chão de cimento e todos os cães comiam diretamente dele, com exceção do Cão 4 que foi alimentado separadamente devido à sua persistente agressão alimentar, assim como os cães 5 e 6 que foram alimentados com alimentos que o proprietário trazia de casa. Como a variação dos alimentos dependia das doações, que incluíam peixes, rúmen, carne picada e alimentos enlatados, às vezes (dependendo da solidez do alimento) a alimentação era em tigelas individuais que eram removidos quando terminavam. Houve acesso irrestrito a 8 tigelas de água permanentemente cheias que eram colocadas perto da entrada principal, penduradas na cerca a 10 cm acima do solo, 2 no lado direito da entrada, 4 no lado esquerdo e outras 2 na outra entrada de porta dupla.

Às 10 horas da manhã, os cães eram levados para as suas caminhadas diárias com voluntários seleccionados durante cerca de 1 hora, repetidas no final do dia. Dois tratadores do sexo masculino, entre 25-30 anos de idade, eram responsáveis pelos cães. Um deles era responsável por alimentar, limpar, cuidar e interagir socialmente com os animais em alojamento de grupo, enquanto o outro cuidava de outros animais no abrigo. Os seus deveres alternavam de dia para dia. Durante as sessões de vídeo, um deles, dependendo da sua

programação, entrava no grupo para procedimentos de limpeza e manutenção, permanecendo cerca de 20 minutos. Se algum dos cães tivesse problemas de saúde, precisasse de ir ao veterinário residente, ou de ser levado para conhecer potenciais adotantes, eles também eram removidos do grupo pelos tratadores.

4. Etograma e Amostragem de Dados

O comportamento dos cães nas interações sociais foi analisado seguindo um etograma amplamente descrito por Schöning 2006.

O tempo de sono e repouso durante o período de observação foi contado também.

As interações com seres humanos também foram avaliadas, se houvesse algumas, em termos de quantas vezes e por quanto tempo elas ocorreriam. Essas interações foram registadas, independentemente em relação a quem elas foram demonstradas: pessoal do abrigo, as duas pessoas da filmagem ou os visitantes ou potenciais novos proprietários. As interações com os seres humanos consistiam em: aproximar-se, seguir ativamente, cheirar o humano, lamber as mãos do humano, fixar o humano com os olhos, ladrar, tentar brincar e encostar-se ao humano estando em pé ou sentado (este último comportamento poderia ser combinado com qualquer um dos descritos acima).

Os vídeos foram transformados em dados mp4 num PC e cada vídeo dos 6 cães foco foi assistido, em câmera lenta, 1-2 vezes, dependendo da complexidade das interações. Quando havia dúvidas, os vídeos eram assistidos pela terceira vez pelo supervisor. Em geral, o supervisor controlava aleatoriamente os dados derivados dos vídeos.

Os dados foram colocados num arquivo excel contendo os seguintes conteúdos:

- Número do cão foco;
- Data da observação;
- Número de interações com outros cães por amostra, por dia;
- Duração geral das interações;
- Duração media das interações individuais com outros cães;
- Quantas vezes o cão foco iniciou a interação em relação às vezes que os outros cães iniciaram;
- Quantas vezes o cão foco parou a interação em relação às vezes que os outros cães pararam;
- Quantas vezes durante todas as interações, o cão foco demonstrou comportamentos do etograma;

- Número de interações com humanos, duração destas no geral e média de duração de interações;
- Segundos por dia em que o cão permaneceu a dormir ou em repouso;
- Número de parceiros por amostra, tempo e o número individual desses cães.

5. Teste de Temperamento Final

Finalmente os seis cães foco foram testados em três situações cão-humano e três situações cão-cão, retirados de um teste standard em: (http://*www.ml.niedersachsen.de/download/2815; http://www.ml.niedersachsen.de/themen/tiergesundheit_tierschutz/tierschutz/mit-dem-zentralen-register-und-dem-sachkundenachweis-sind-ab-01072013-alle-regelungen-des-hundegesetzes-in-kraft-93854.html)*; o qual é praticado na Alemanha nos últimos 15 anos para avaliar os cães no "German Dangerous Dogs Acts" e tem sido validado pelas seguintes referências: Böttjer, 2003, Bruns, 2003, Mittmann, 2002, Schöning, 2006).

As situações de teste estão descritas na tabela seguinte. Além da situação "sozinho", cada cão de foco esteve sempre com trela e foi conduzido pelo seu tratador. Na situação "sozinho" o cão foi fixado à vedação e ficou na ausência do tratador.

Tabela 2 – Situações do Teste

Situação Cão-Cão	Situações Cão-Humano
Na vedação: O cão foco é abordado por outro cão atrás de uma vedação.	Abordar/acariciar: o humano aproxima-se do cão de uma forma amigável, não-confrontativa, conversa com o cão e tenta acariciá-lo.
Passar à trela: dois cães (macho e fêmea) são passeados um após o outro pelo cão foco. São passeados duas vezes cada e na segunda vez o tratador finge tropeçar.	Tropeçar: o humano passa pelo cão a uma distância de 1,5 metros e tropeça mesmo em frente ao cão.
(Sozinho) um cão do mesmo sexo que o cão foco passa por este.	Fixar: o humano fica de pé, silenciosamente em frente ao cão (1,5m de distância) e fixa o olhar nele.

Para comparação, seis cães alojados individualmente no canil, foram sujeitos às mesmas situações de teste. A seguinte tabela contem a informação em relação a esses cães.

Tabela 3 – Informação dos cães alojados individualmente.

Cão	Raça	Idade	Sexo	Origem	Razão para estar no canil	Tempo de alojamento no canil
Cão 21	Jack russel	> 9 anos	Macho (castrado)	Sem informação	Agressivo perante desconhecidos	4 anos
Cão 22	Jack russel	8 anos	Macho	Criador	Agressivo perante humanos e tutor	1 ano
Cão 23	SRD	> 9 anos	Macho (castrado)	Sem informação	Tutor já não o quis mais	1 ano
Cão 24	Kangal	2 anos	Macho (castrado)	Sem informação	Apreendido pela polícia	1 ano
Cão 25	Pit Bull	2 anos	Macho (castrado)	Sem informação	Agressivo perante outros cães	2 anos
Cão 26	SRD	> 9 anos	Macho (castrado)	Sem informação	Negligência	1 ano

Os testes foram realizados num relvado, cada cão foi guiado por um tratador.

A amostragem dos dados seguiu o procedimento mencionado anteriormente: Os cães foram registados em cada situação e os comportamentos demonstrados em cada situação de teste foram contados e listados num arquivo excel.

Análise Estatística

Para a análise dos dados, utilizou-se o software estatístico SPSS versão 20. Em relação à análise descritiva, foram calculadas medidas de tendência central como a média e medidas de dispersão estatística como o desvio padrão para as variáveis contínuas e para as variáveis categóricas. Em relação às estatísticas inferenciais, tanto o coeficiente de Spearman como o coeficiente de Pearson foram utilizados para demonstrar a relação entre duas variáveis contínuas, a relação entre uma variável contínua e uma variável categórica foi utilizada pelo teste t ou o teste paramétrico alternativo, Mann-Whitney, quando a normalidade não foi assumida . O qui-quadrado e o teste exato de Fisher foram utilizados para analisar a relação de variáveis categóricas. Todas as estatísticas inferenciais usaram um nível de significância de 5%.

Resultados

Foram analisadas 703 interações diádicas cão-cão e 303 interações diádicas cão-humano.

A. Avaliação do número de interações cão-cão, duração destas e duração média de cada cão foco; comparação com o tempo de sono ou repouso, durante o período de observação de 28 dias.

O cão 3 mostrou o maior número médio de interações por dia com 6,29 e a segunda maior duração média de interação de 100,64 segundos.

O número médio de interações por dia foi de 4,19 por cão, com uma duração total média de 64,81 segundos de interações por três vezes num periodo de três minutos de observação por dia e uma média de duração de 15,52 segundos por interação.

O cão número 4 apresentou o maior tempo médio de duração com 39,69 segundos (desvio padrão (s) = 48,61), enquanto o cão número 2 apresentou a menor duração média de interação e o menor número de interações por dia em paralelo.

Cão 3 foi o que teve o maior número médio de interações e passou menos tempo a dormir ou em repouso com uma média de 41,96 segundos por dia.

O Cão 4 teve uma média de 66,54 segundos por dia de sono ou de repouso e teve em paralelo o maior duração média de interações.

O cão 2 teve o menor número de interações e o tempo gasto a interagir, teve o maior tempo médio de sono ou repouso, com 234 segundos (s = 177,91) por dia.

Houve uma correlação estatisticamente significativa entre o número de interações cão-cão e a duração dessas interações por dia (speerman rho = 746, p <0,001). Quanto menor a interação, mais interações ocorreram por dia.

Houve uma relação negativa entre a quantidade de interações e os períodos de sono ou repouso (Pearson r negativa = 0,335, p <0,001), mas não houve relação significativa entre a duração média das interações e o tempo de repouso ou sono (Pearson r = 0,006 , P = 0,937).

B. Avaliação do número de interações cão-humano, duração destas e duração média das interações, para cada cão durante os 28 dias e a comparação com o tempo de sono ou repouso.

O cão número 3 apresentou o maior número de interações com seres humanos (média de 3,04 por dia (s = 1,79) e uma duração média de interações de 54,75 segundos por dia (s =

58,97), quase cinco vezes maior que a média dos outros cães, embora ele não tivesse a maior duração média de interação no contato cão-humano, paralelamente, ele passava menos tempo por dia a dormir ou em repouso com apenas 41,96 (s = 78,66).

Houve uma correlação estatisticamente significativa entre o número de interações com humanos e o tempo que elas duraram (speerman rho = 0,840, p <0,001). Quanto menor a interação, mais interações ocorrem por dia.

Houve uma relação negativa entre o número de interações e os períodos de sono ou repouso (negativa de Pearson r = 0,335, p <0,001) e também houve uma tendência para uma relação negativa entre a duração média das interações e o tempo gasto a dormir ou em repouso (negativo Pearson r = -0,206, p = 0,007). Quanto mais tempo foi gasto a dormir, menos interações aconteciam por dia e mais curta era cada interação.

C. Avaliação de qual cão iniciou e/ou parou durante as interações cão-cão, ao longo dos 28 dias.

Os cães foco começaram uma interação mais frequentemente do que os outros cães. (Cão foco iniciou:2,25 s=2,39;) outro cão iniciou: (x=1,99, s=2,07). "Iniciar" é definido aqui como "o cão aproximou-se do parceiro de interação e começou a interação".

O mesmo se aplica para o número de interações interrompidas pelo cão de foco, no entanto a diferença é 1,7 vezes maior (=cão foco parou uma interação mais frequentemente do que ele começou). "Parar" é definido aqui como "o cão afastou-se do parceiro e a interação terminou".

Devido à falta de normalidade dos dados, utilizou-se a abordagem não paramétrica. O teste de Mann-Whitney sugeriu que não havia diferenças estatisticamente significativas para o número médio de interações que foram iniciadas pelo cão foco e que foram iniciadas por um dos outros cães (p=0,545).

Porém, houve diferença estatisticamente significativa entre o número de interações que foram interrompidas pelos cães foco e que foram interrompidas por um dos outros cães (p <0,001).

Cão 1 iniciou as interações 100 vezes durante os 28 dias, e foi de longe o que interrompeu mais interações, exatamente 121 vezes. Cão 3 teve quase os mesmos resultados que o cão 1, começando 99 vezes, mas parando apenas em 54 vezes.

O cão 1 iniciou interacções significativamente mais frequentemente do que o cão 2 e o cão 6 (ambos p=0,001). O cão 1 iniciou as interacções ligeiramente mais frequentemente do

que o cão 4 (p=0,007). O cão 3 iniciou interacções significativamente mais frequentemente do que o cão 2 e o cão 6 (ambos p=0,001). Não houve diferença significativa no início de uma interação entre o cão 1, 3 e 5.

O cão 1 parou as interacções significativamente mais frequentemente do que o cão 2 (p=0,001). O cão 1 parou as interacções com mais frequência do que o cão 4 e 6 (p=0,004, 0,018 e 0,002). O cão 3 interrompeu significativamente mais interações e com mais frequência que o cão 2 (p=0,009).

Houve uma correlação linear positiva entre o número de interações iniciadas pelo cão foco e as que ele parou (r=0,771, p<0,001): quanto mais um cão começou a interagir, mais ele as interrompeu também.

D. Avaliação dos comportamentos, demonstrados pelos seis cães foco nas interações, durante os 28 dias.

No total, em todas as 703 díades, os seguintes comportamentos foram exibidos por todos os seis cães foco:

- O comportamento de abordagem social foi mais acentuado, 628 vezes (28,1%); (Social approach behaviour);
- Comportamento para alivio do conflito, 425 vezes (19%); (de-escalation behaviour);
- O comportamento impostor foi exibido 267 vezes (11,9%); (Imposing behaviour);
- Tentativa de fuga da situação 258 vezes (11,6%); (Flight/Leave);
- As ameaças foram demonstradas 148 vezes (6,6%); (Threats);
- O comportamento de brincadeira ocorreu 81 vezes (3,6%); (Play behaviour);
- O medo foi recorrido 80 vezes (3,6%); (Fear)
- Submissão passiva foi 24 vezes (1,1%); (Passive Submission)
- Submissão ativa foi mostrada 15 vezes (0,7%); (Active Submission);
- Comportamento ofensivo inibido também 15 vezes (0,7%); (Inhibited offensive behaviour);
- O menos mostrado foi comportamento ofensivo desinibido com apenas quatro vezes (0,2%) (Uninhibited offensive behaviour)

E. Número de parceiros que interagiram, para cada cão durante os 28 dias.

Uma vez que o número médio de parceiros por período de observação na maior parte dos 28 dias, para todos os seis cães foco, foi de três, foi dado como "até três parceiros em três minutos" ou "mais de três parceiros".

Cão número 4 teve o maior número de até 3 parceiros. Cão número 3 teve o maior número de mais de 3 parceiros. Quanto mais parceiros diferentes um cão tinha, menor o tempo gasto com cada um deles (Teste de Mann-Whitney, $p=0,003$).

F. Comparação das situações de teste de temperamento, entre os cães alojados em grupo e os cães alojados individualmente.

As situações de teste foram realizadas com os seis cães foco do grupo e, consequentemente, com seis cães que estavam alojados individualmente. Não houve diferença significativa nos comportamentos demonstrados entre os de grupo e os cães alojados individualmente. A única exceção foi o comportamento para alivio do conflito na situação de tropeço cão-humano ($p<0,05$), o que foi demonstrado mais pelos cães alojados individualmnte.

No entanto, cada situação de teste foi avaliada para os comportamentos mostrados e alguns resultados merecem ser destacados, apesar de não serem estatisticamente significativos:

Situação da vedação:

Cinco cães de cada grupo mostraram comportamentos de abordagem social, mas apenas um dos cães alojados em grupo apresentou comportamentos imponentes enquanto isso foi demonstrado por cinco dos cães alojados individualmente. Nenhum dos cães alojados no grupo apresentou ameaças, enquanto quatro cães de alojamento individual o fizeram. Os comportamentos para alívio de conflito foram quase iguais entre os dois grupos (seis cães alojados em grupo versus cinco cães alojados individualmente). Mais cães alojados em grupo mostraram comportamento de fuga: quatro versus três cães alojados individualmente

Confrontação do cão em isolamento:

Todos os doze cães mostraram comportamentos de abordagem social, enquanto cinco dos seis cães alojados em grupo e apenas um dos cães alojados individualmente demonstraram comportamento imponente. As ameaças foram demonstradas por dois do grupo e por um dos cães alojados individualmente e um de cada grupo tentou fugir da situação.

Comportamento para alívio de conflito foi mostrado por cinco do grupo e todos os seis cães alojados individualmente.

Cães de ambos os sexos passam:

Esta foi a única situação de teste com cães foram em que submissão passiva foi demonstrada (por dois dos alojados em grupo e por um único cão alojado individualmente). Três cães de cada tipo de alojamento tentaram deixar a situação e quase todos, com a exceção de um cão alojado em grupo, mostraram comportamentos para alívio de conflito. Um macho dos cães alojados em grupo mostrou comportamento ofensivo inibido em relação ao dummy-dog feminino, sendo a única vez em que isso aconteceu durante os testes com outros cães. Um cão de cada grupo mostrou comportamento de brincadeira. O comportamento imponente novamente foi mostrado mais frequentemente pelo grupo (em comparação com um dos cães alojados individualmente),

Nesta situação o tratador fingiu uma vez ter tropeçado, foi quando quatro dos cães alojados em grupo tentaram deixar a situação em comparação com dois da do alojamento individual.

A pessoa tenta acariciar o cão:

Embora cinco cães de cada grupo exibissem comportamentos de abordagem social, foi a única situação em que o comportamento ofensivo desinibido foi mostrado por um cão de cada tipo de habitação e o comportamento ofensivo inibido foi usado por um cão do alojamento individual. A submissão passiva foi exibida por dois do grupo e um dos cães alojados individualmente e o stress foi mostrado por dois cães do grupo contra cinco cães do alojamento individual. Um cão do alojamento de grupo também exibiu comportamentos de medo, sendo o único cão e a única vez que isso aconteceu durante os testes com os seres humanos.

A pessoa olha fixamente para o cão:

Comportamentos de abordagem social foram mostrados mais nesta situação, por todos os seis cães do grupo em comparação com cinco dos cães alojados individualmente. Foi a única situação cão-humano onde três cães para o grupo habitação tentou fugir.

Pessoa tropeça:

Esta foi a única situação de teste cão-humano em que nenhum cão do grupo mostrou submissão passiva em comparação com as outras duas situações. Três cães de cada grupo exibiram comportamentos imponentes. Nesta situação particular houve uma significância

estatística ($p < 0,05$) para comportamento para alívio de conflito, que não foi demonstrado por nenhum dos cães alojados em grupo e por outro lado por cinco dos alojados individualmente.

Discussão

A pergunta geral para este estudo pioneiro foi: O alojamento em grupo de cães num abrigo é benéfico em termos de desenvolvimento de commpetências sociais, melhorando a qualidade de vida e bem-estar gerais para cães de canil? Para responder a esta pergunta, foram observados e avaliados os comportamentos individuais e as interacções sociais dos cães alojados num grupo e no final estes cães foram comparados com cães alojados individualmente, durante uma amostra de um teste de temperamento.

Até agora não existe nenhum estudo onde os cães foram monitorizados em grupo num abrigo por um período longo em condições de "vida real de abrigo". Teria sido injusto, por exemplo, reduzir o enriquecimento já praticado para os cães, como por exemplo caminhadas ou ir para casa com alguém do abrigo durante a noite, apenas para obter um período de quatro semanas sem perturbações na filmagem. Portanto, apenas uma subpopulação de todos os cães observados foi avaliada, isso significa que os resultados não podem ser facilmente extrapolados e generalizados para abrigos em grupo e precisam de ser interpretados com algum cuidado. Devido a este fato, uma abordagem predominantemente descritiva foi usada para a análise dos dados.

Até agora não existe uma literatura de referência, onde os níveis de atividade de cães que vivem em grupo num abrigo e os que vivem isoladamente são comparados. Todos os cães aqui observados mostraram uma certa atividade social (interações cão-cão) ao longo dos períodos de observação, com alguns cães sendo mais ativos (isto é, maior número de interações diádicas) do que os outros. Também foram observadas diferenças entre os cães na duração média das interações diádicas, os cães mais ativos apresentaram menos fases de sono ou de repouso e tiveram interações diádicas menores. As razões para tais diferenças no nível de atividade entre cães mantidos num abrigo podem ser múltiplas.

Uma razão para os diferentes níveis de atividade social entre os cães pode ser o tempo gasto na interação com os seres humanos. Neste estudo também foi observada uma diferença na quantidade de interações, e a duração de interação entre cães. Sabe-se que, em condições de canil, alguns cães são negativamente afetados pela falta de contato social com os seres humanos, o que pode resultar em afeiçoamentos rápidos e excessivos, mesmo em cães adultos, logo que existam seres humanos presentes (Gácsi, Topál, Miklósi, Dóka, & Csányi,

2001). Olhando explicitamente para a ligação a seres humanos quando avaliados cães em grupo num canil no futuro, será importante em termos de avaliação, por exemplo onde e com quem colocar um cão. Cão 6, por exemplo, tinha um baixo número de interacções e cada interacção durou bastante tempo quando comparado com os outros cães. Este fato pode estar relacionado a longos períodos de abordagem e tentativas de comunicação com seres humanos e pode ser um sinal de que o contato com humanos pode ser um ponto importante para o cão 6. (Shiverdecker, Schiml, & Hennessy, 2013). Um resumo disto seriam protocolos para o contato humano e exercício de modo a melhorar o bem-estar dos cães de canil, como já tinha sido afirmado por outros autores (Menor-Campos, Molleda-Carbonell, & López-Rodríguez, 2011). No entanto, para alguns cães de canil, interações com seres humanos podem ser stressantes e criar problemas comportamentais, que interferem com as suas possibilidades de adoção. Assim, restringindo as interações com seres humanos desconhecidos, pode melhorar o bem-estar ao longo de períodos curtos, diminuindo o stress relacionado com níveis de atividade e comportamentos repetitivos (Hewison, Wright, Zulch, & Ellis, 2014).

Diferenças na atividade social (cão-cão e cão-humano) podem ser devido à idade e stress. O cão 3 apresentou os maiores níveis de atividade durante o período de observação, ele foi o que demonstrou a maioria das interações tanto com outros cães como também com os seres humanos. Uma razão poderia ter sido a sua juventude (um ano de idade sendo o cão mais novo no grupo) e o fato de que a maturação social ainda não estava terminada. Cães jovens imaturos são conhecidos por mostrar taxas mais elevadas de comportamentos sócio-positivos especialmente perante cães mais velhos (Feddersen-Petersen & Ohl, 1995; Miklósi, 2007).

A idade não foi avaliada como um fator na estatística devido ao pequeno tamanho da amostra no entanto vale a pena discutir aqui. Cão 6, por exemplo, como o cão mais velho (> 9 anos), teve o segundo nível de atividade mais baixo. Alterações nos níveis de atividade, como comportamentos exploratórios e também interações sociais podem ser associadas ao stress do canil, mas a idade avançada ou síndrome de disfunção cognitiva relacionada à idade também é um fator na diminuição da atividade espontânea (Rosado, et al., 2012; Michel & Brown, 2014). Uetake, Yang, Endo, & Tanaka (2016) mostrou que os cães idosos se podem adaptar a novos ambientes, o que leva a uma redução do stress, assim como a atividade física pode desempenhar um papel para a redução do stress e bem-estar. No caso do HTV, passeios regulares foram realizados e está provado que isso melhora a atividade física global (Rhodes,

Murray, Temple, Tuokko, & Higgins, 2012) e consequentemente tem resultados positivos em cães sedentários ou doentes (Huang & Lien, 2017).

Para obter uma melhor visão geral do contexto em que os cães exibiram quaisquer comportamentos, foi avaliado qual o cão que começou ou interrompeu uma interação diádica. Com esta informação os níveis de atividade de cada cão e os comportamentos durante as interações podem ser melhor avaliados, pois há uma diferença se um comportamento foi iniciado voluntariamente pelo cão foco ou se foi induzido por outro cão. Mesmo que haja uma diferença entre o número médio de interações que foram iniciadas pelo cão foco em oposição àqueles iniciados pelos outros cães, não foi estatisticamente significativa. No entanto havia uma diferença significativa no cão que parou uma interação, não só o cão foco parou interações mais frequentemente, como também houve uma diferença entre os cães foco. Por exemplo: cão 1 iniciou e parou interações significativamente mais frequentemente do que outros cães. Novamente, outras investigações são necessárias para avaliar se a idade, sexo, competência social e preferências para se comunicar com os seres humanos podem desempenhar um papel aqui.

A grande questão deste estudo foi se o alojamento em grupo de cães num abrigo será benéfico em termos do desenvolvimento de competências sociais individuais. Portanto, foram analisados comportamentos individuais e grupos comportamentais, respectivamente, mostrados na interação.

De todos os comportamentos ou grupos comportamentais, o comportamento de abordagem social foi mostrado mais vezes pelos cães. Dado também que os comportamentos para alívio de conflito foram exibidos em segundo lugar, isso implica que a maioria das interações foram num contexto social-positivo ou quando atribuído como uma interação de conflito, foram resolvidos numa tensão de baixo nível.

Ao olhar para quais comportamentos foram mostrados significativamente, com mais frequência, juntos numa interação, o comportamento de fuga ou para sair da situação, foi significativamente mais exibido, juntamente com comportamentos de abordagem social, comportamentos imponentes, comportamentos de medo e, mais importante, comportamentos para alivio de conflito e stress. Isto sugere que nos conflitos entre grupos sociais, a decisão de recuar pode ser uma escolha mais rápida de resposta em conflitos entre gupos que causam medo e stress, de modo a evitar o ataque, sendo uma afirmação corroborada por outros estudos (Bonanni, Natoli, Cafazzo, & Valsecchi, 2011).

Comportamento de ataque (comportamento agressivo desinibido) foi, na verdade, o comportamento menos demonstrado e não teve qualquer correlação significativa com os outros comportamentos, mais uma vez sugerindo que as lutas são de fato um último recurso num grupo estável. É interessante salientar que todos os seis cães foco deste estudo foram castrados, Kuhne (2012) afirma que cães castrados têm uma atividade geral reduzida e a sua capacidade de se concentrar em alvos para atacar parece menor. A maioria dos cães foco eram sem raça definida, o que poderia ser um argumento que contradiz a alegação geral de que as raças indefinidas estão associadas a comportamentos problemáticos, como ser menos calmos e menos sociáveis em relação a outros cães (Turcsán, Miklósi, & Kubinyi, 2017) mas devido ao baixo número de cães neste estudo, esta é apenas uma suposição. O comportamento e as ameaças impostas normalmente precedem outros comportamentos ofensivos, mas podem estar associados a comportamentos agressivos em relação à proteção de recursos, em cães com níveis mais altos de impulsividade (Jacobs, Coe, Pearl, Widowski, & Niel, 2017). No periodo de observação alguns dos cães do grupo guardaram objectos que acidentalmente obtiveram, localizações (por exemplo, especificamente cão 2 quando se encontrava em cima da plataforma elevada da área do canil) ou mesmo pessoas que consideravam um recurso valioso. Estas situações não foram analisadas explicitamente na investigação porque não ocorreram frequentemente e eram inconsistentes entre os cães.

Alguns cães mostraram submissão ativa para um parceiro, embora em geral não foi mostrado com frequência, a suposição é que foi exibido quando os comportamentos para alívio de conflito eram insuficientes para resolver um conflito. Neste estudo a submissão ativa foi fortemente demonstrada juntamente com a submissão passiva, isso enfatiza ainda mais o fato de que a submissão ativa ou a submissão passiva eram uma espécie de "último recurso" quando outros comportamentos para alívio de conflito não funcionavam. Não foi observado um cronograma aqui, isto é, quais comportamentos estavam a precer quais, por isso poderia muito bem ser que quando a submissão ativa falhou, os cães mudaram para submissão passiva, especialmente o cão 3, que era um animal muito jovem, muitas vezes mostrou comportamentos deste grupo perante cães mais velhos (Zimen, 1971; Umlauf, 1993).

Outra ferramenta para resolver conflitos pode ser o comportamento de brincadeira (Feddersen-Petersen, 1994), de acordo com Lindsay (2001), é exibido como uma possibilidade para controlar e aliviar algumas situações agressivas, a fim de evitar confrontos intensos que culminam em lesões. O inverso também pode ocorrer, quando durante a brincadeira a situação fica descontrolada terminando agressivamente e mesmo com lutas

(Lindsay, 2001). Neste estudo, não foi encontrada correlação entre comportamentos de brincadeira e outros comportamentos.

Durante os 28 dias de filmagem, o grupo incluiu (em dias diferentes) um total de 20 cães, isto significa que em alguns dias houve uma gama mais ampla de parceiros a escolher para interações. O número de parceiros de cada um dos seis cães foco foi comparado com o tempo que passaram a interagir, o número médio de parceiros por observação foi de três, por isso foi dado como "até três parceiros em três minutos" ou "mais de três parceiros". Cão 4, por exemplo, foi o que teve o maior número de interações com três parceiros, e exibiu mais comportamentos ofensivos desinibidos em comparação com os outros cinco cães foco. Cão 3, por outro lado, teve o maior número de interações com mais de três parceiros, sendo o mais jovem, mais ativo, e mostrou a maior tendência para brincar e comportamentos submissos. No geral, isso pode sugerir que os comportamentos exibidos no período de observação podem ser dependentes do número de cães com os quais o cão de foco interagiu e a duração de cada interação.

Todos os comportamentos mencionados anteriormente foram analisados quando se comparou os cães de grupo e os cães alojados individualmente. As situações de teste eram de um teste de temperamento utilizado para a avaliação da agressividade dos cães mas estas situações de teste não diferem das situações de teste usadas para prever a adoptabilidade de um cão (Ledger & Baxter, 1997; Valsecchi, Barnard, Stefanini, & Normando, 2011). A vantagem de testar cães desta forma é que dá uma visão geral sobre o temperamento e padrões de comportamento, a fim de gerar uma melhor correspondência com um potencial tutor (Coppola, Grandin, & Enns, 2006; Valsecchi et al., 2011). Os testes de temperamento são realizados rotineiramente no abrigo HTV especificamente para aqueles cães que têm demonstrado problemas comportamentais ou tiveram incidentes relacionados com agressão contra pessoas ou outros cães. Nestes testes padronizados, os cães são conduzidos pelos seus tratadores, isto pode ter um efeito positivo em algumas circunstâncias, como uma menor taxa de demonstração de comportamentos agressivos, que já foi observado anteriormente enquanto o animal é acompanhado por alguém familiar, como o tratador (Kis, Klausz, Persa, Miklósi, & Gácsi, 2014, Howard & DiGennaro Reed, 2014). No entanto, no caso de um teste de agressão, os resultados são igualmente válidos e confiáveis quando comparados a um cão sob a direção de um proprietário (Schöning, personal communication).

Embora o tamanho da amostra tenha sido pequena, observaram-se algumas diferenças entre os dois tipos de alojamento. Os comportamentos de brincadeira não eram

frequentes e quando exibidos eram sempre por apenas um cão dos seis cães alojados individualmente. Comportamentos que indicam stress foram mostrados menos nos cães alojados em grupo, em comparação com os cães alojados individualmente. Interessante foi o fato de que numa situação cão-humano (tropeçar), cinco dos cães alojados individualmente demonstraram comportamento para alívio de conflito em comparação com nenhum dos cães alojados em grupo. A diferença significativa aqui poderia ser por os cães alojados individualmente serem/estarem mais stressados e/ou assustados pela pessoa que tropeça do que os cães alojados em grupo. O rótulo "single loged" não significa que esses cães foram mantidos em isolamento completo, eles tinham contato com os seres humanos (responsáveis/tratadores e voluntários) e também a um nível baixo com cães, por exemplo quando outros cães passeavam perto dos canis dos cães alojados individualmente. No entanto, a qualidade e a quantidade desses contatos são incomparáveis à qualidade e quantidade de contato entre os cães alojados em grupo.

Estes achados podem ser importantes, em relação a potenciais problemas que surjam após a adoção e também para o processo de decisão sobre que cão adotar, os cães de grupo podem representar menos problemas e os potenciais tutores podem obter melhores conselhos dos tratadores que tiveram a oportunidade de observar o comportamento social dos cães num contexto de grupo. (Weiss, Miller, Mohan-Gibbons, & Vela (2012) já mostrou que as informações obtidas por um funcionário do abrigo sobre a saúde física e comportamentos é mais valorizada pelos tutores e mais importante do que apenas olhando para o cão ou para uma descrição escrita.

Os resultados deste estudo sugerem que existe uma vantagem para os cães serem alojados em grupo num canil, em comparação com ser alojados individualmente, níveis de stress podem ser mais baixos no geral, uma vez que as interações diárias com outros cães é uma rotina e não uma exceção. Por exemplo, um dos cães alojados individualmente (Cão 25) foi abandonado no canil por ser agressivo contra outros cães, durante as situações de teste cão-cão, ele exibiu alguns comportamentos tensos e agressivos em paralelo com o stress. Como comparação o cão 2 (de grupo), que também foi abandonado por ser agressivo contra outros cães, nem no período de observação nem nas situações de teste demonstrou qualquer comportamento agressivo específico contra outros cães, nem comportamentos de stress.

Houve diferenças entre as situações de teste cão-cão e cão-humano que sugerem que as reações em relação aos seres humanos podem ser mais espontâneas do que as reações contra outros cães no geral, independentemente do tipo de alojamento, mas isso pode ser

dependente do passado individual de cada cão. Por exemplo, o cão 1 (alojado em grupo), que exibiu comportamentos ofensivos desinibidos perante o humano durante uma situação de teste, foi levado para o abrigo por razões de bem-estar (apreendido pelas autoridades depois de ser negligenciado). Cão 4 (alojado em grupo) foi abandonado por ser agressivo contra os seres humanos (incluindo proprietário), mas não apresentou qualquer comportamento agressivo em situações de teste com seres humanos. Os comportamentos agressivos exibidos ao viver com o tutor podem ter sido dependentes do contexto e ser vistos como um sinal de bem-estar diminuído.

Conclusões

Os resultados deste estudo, embora obtidos a partir de um pequeno tamanho de amostra, sugerem que, de fato o alojamento em grupo no canil é benéfico em termos de desenvolvimento e/ou melhoria de habilidades sociais individuais e competências em interações entre cão-cão e cão-humano. Níveis de tolerância ao stress podem ser melhorados, e no geral a habitação em grupo pode melhorar a qualidade de vida para cães de canil.

Os cães como animais ativos e sociais precisam de uma rotina diária que leve em consideração não apenas a necessidade de exercícios físicos, mas também a estimulação mental (Laser, 2008, Overall, 2013) esta deve incluir estímulos específicos e planos de treino para cada cão (Part, et al., 2014). É necessário mais investigação sobre este tópico para melhorar o bem-estar dos cães em canil e posteriormente, alcançar uma melhor taxa de adoção.

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List of abbreviations and symbols

% - percentage

CRO- Centros de Recolha Oficiais

DAP- dog appeasing pheromone

DGAV- Direcção Geral de Alimentação e Veterinária

DL- Decreto-Lei

DNA- *deoxyribonucleic acid*

e.g.- exempli grati (for example)

HTV- Hamburger Tierschutzverein

min- minutes

SPSS- Statistical Package for the Social Sciences

Introduction

6. Evolution of the bond between dogs and humans

Historically speaking, the domestic dog, *Canis familiaris*, has been living in close association with human kind for as long as 15,000 years (Clutton-Brock, 1995) or, according to studies of mitochondrial DNA, even as long as 135.000 years (Vila, 1997; vonHoldt, et al., 2010). From the dawn of this partnership, living together brought both parties great advantages: for dogs it meant shelter and food , for their human owners these animals performed a whole range of tasks, from hunting to guarding, over herding or protecting the flock up to the simple function of being a lap warmer (Bradshaw, 2011; Herre & Röhrs, 1990; K. L. Overall, 2013; Serpell, 1995).

Evidence of dogs of different morphologies who were likely to have engaged in different tasks dates back about 15.000 years (Pang et al., 2009) and in ancient Egyptian and Chinese art we can find representations of dogs with similar phenotypes engaging in related tasks for as long as 3500 years (K. L. Overall, 2013)

Nowadays the main function of most dogs is its suitability as a human companion, a member of the family, friend, or even child-surrogate that must satisfy the owners need for attention, emotional support and companionship (Gebhardt-henrich, 2002; King, Marston, & Bennett, 2012). Choosing a dog for the specific way it looks, not taking into consideration the characteristics of the breed, such as the exercise requirements or the need for mental stimulation leads to increased chances of mismatches and consequently behavior problems (Marder & Duxbury, 2008).

The closeness of the human-dog relation makes lack of knowledge about dog behavior and communication particularly hazardous, as misinterpretations of communicative signals can easily lead to welfare neglect, the development of behavior problems, danger for humans and conspecifics, and, consequently the relinquishment or even euthanasia of the animal (Miklósi, 2007).

7. Dog behaviour

The interpretation of dog behavior and training methods according to different extremes such as Lupomorfism on one hand and babymorfism on the other are at the origin of many problems in the human-dog relationship (Miklósi, 2007). While genetics do to some extent determine in which way the individual interacts with the environment, by laying down a cast of predispositions, the interaction is also widely determined by the experiences and

feedbacks it is subject to, this is: learning. Consequently, the individual develops based on a continuous interaction between genetic make-up and environment, often referred to as "nature and nurture"(Abrantes, 2001; Bradley, 2011). When considering dog ontogeny, the term socialization is unavoidable, as this is the process through which an individual acquires the necessary social competences: vie exposure to a social environment and its members. In the case of the dog, necessarily this includes contact to humans also (Miklósi, 2007). One of the most important aspects in social life is communication. Communication has the same function as all other behaviors the dog engages in: to increase and maintain biological fitness (Schöning, 2006; Tschanz, 1993).

6.1. Behavior and Biological Fitness

The social behavior of the dog has been influenced by mankind over the course of domestication, and a selection has been made to increase the natural tendency of interacting with humans (Serpell, 1995). In the animal kingdom, the capacity of interacting with humans and interpreting human behavioure is unparalleled even by great apes (Hare & Tomasello, 2005). According to Bräuer et al (2006) dogs are quicker to interpret some visual cues such as pointing as even chimpanzees and they are very sensitive to humans' attention focus (Miklósi, et al., 2003; Schwab & Huber, 2006). Dogs naturally direct a vast display of communicative behaviours at humans, and in the case of dogs deprived of human attention, such as shelter dogs, they are even more socially driven to gaze at and interact with humans than pet dogs (Duranton & Gaunet, 2016) using communicative signals they do not use with conspecifics (Gácsi, McGreevy, Kara, & Miklósi, 2009). Dogs use humans (predominantly the owner) as a subject of social referencing (Merola, Prato-Previde, & Marshall-Pescini, 2012), and if they do not know how to approach or solve a problem they turn to humans, which does not happen in the case of wolves (Miklosi et al., 2003). A thorough understanding of the way dogs communicate and behave is the basis of any working together, training and/or behavioral modification and is consequently important for the dog's welfare.

The term "biological fitness" sums up the three major biological goals subjacent to any manifestation of behaviour, which are:

d. Reproduction,
e. Avoidance of harm and
f. Access to resources and gain well-being in general (Schöning, 2006; Tschanz, 1993).

4.2 Social behavior and Communication

The term “Social behaviour" covers all behaviours directed to a same species or inter-species partner (Schöning, 2006). Social behaviours are used as a communication tool and they comprise the reciprocity between the issuing of a signal by one individual, and the response from the receiver who was affected in his behavior by the behavior of the first individual. It is, in short, a communicative duality. (Manning y Dawkins, 1998, Schöning, 2006). The importance of communication on a ritualized level is to reduce misunderstanding, and thus the amount of potentially lethal or at least physically endangering aggressive encounters which are a threat to homeostasis of the individual and/or the group (Schöning, 2006; Wrubel, Moon-Fanelli, Maranda, & Dodman, 2011) It includes socio-positive behaviours as well as socio-negative behaviours, socio-positive behaviours (e.g. active submission or face-licking) aim at reducing the distance between two individuals whereas socio-negative behaviours (e.g. threats) aim at increasing the distance.

In social communication, dogs rely on visual communication (optical signals like mimic or body posture), (Fukuzawa et al. 2005; Miklósi, 2007). Communication runs the better and more accurate, the better both partners have been socialized and have learned to understand and display these signals. Thus in communication these signals inform the other partner about the emotional state, the motivation, and the readiness to engage in certain behaviours (Feddersen-Petersen & Ohl, 1995; Mittmann, 2002). Feddersen-Petersen coined the term “expressive behaviour” (“*Ausdrucksverhalten*”) for this category of behaviours.

For each species the complete behavioural repertoire is sampled in a so-called ethogram, e.g. a list of single behaviours or behaviours grouped to an individual entity, according to its function and goal. The behaviours from the ethogram of the dog can itself be aggregated into certain groups like e.g. the group of reproductive behavior, the group of social approach behavior or the group of imposing behavior. A list of the groups of social behavior used in this paper is given in the Material & Methods chapter.

Problems in the dog-human relationship most often occur because humans do not interpret dog behavior correctly, or because they do interpret it from an anthropomorphic perspective (Overall, 2013). They have especial difficulties in interpreting less obvious, discreet signs accurately and also, though maybe interpreting the dog correctly, responding adequately. The response to a certain behavior might be misunderstood by the dog and a conflict might easily escalate and lead to stress on both sides. If biting occurs in a dog-human

relationship it usually results in fatal outcomes for both the dog, which is often relinquished or even put down, and the human, who besides physical pain may suffer emotional disturbance.

When the relationship between dogs and humans is destroyed or troubled, many people resort to a shelter to leave their pets.

8. Shelter dog housing

In terms of housing, dogs can be accommodated in a shelter in basically four main types of facilities: i) small, single cages, appropriate for ill/injured animals who need close monitoring; ii) single enriched kennels, useful for dogs who cannot be housed with other dogs,); iii) larger enclosures for single, paired or group housing; iv) indoor/outdoor runs, similar to the previous type, but with an indoor and an outdoor part.

Over the last decades the concept of animal welfare has shifted: traditionally it has been seen chiefly in terms of the body and the physical environment (shelter, feed, etc.) focusing on the premise that if an animal is in good physical health and producing/reproducing well, its welfare must be adequate (Broom, 1991; Hewson, 2003). Recently, it has been suggested that the focus should not only lie on avoiding harm and discomfort, but also on place value species typic behaviours, positive experiences, resources and pleasurable activities (Starling, Branson, Cody, Starling, & McGreevy, 2014). Until recently, the global standard kennel environment in a shelter was one of single housing with only auditory contact with other dogs and contact with humans limited to daily cleaning. The main reason for this type of housing being the fear of fights between dogs (Mertens & Unshelm, 1996; Salman et al., 1998). Nowadays the focus in housing shelter dogs, even if they have to be kenneled, is shifting towards group housing and exercise, play and socialization are equally considered (Loveridge, 1998; Ottesen, Weber, Gürtler, & Mikkelsen, 2004; Taylor & Mills, 2007).

4.1 Stress when being kenneled

When a dog is left in a shelter, the new and unfamiliar environment (e.g. people, smells, sounds and other animals), in addition to the distress caused by being apart from the owner in some cases, can induce stress (Stephen & Ledger, 2005). The type of confinement additionally can compromise dog's welfare. When the conditions are prolonged, chronic stress arises (Hennessy, Davis, Williams, Mellott, & Douglas, 1997) which can lead to behavioural changes such as repetitive behaviours (stereotypy or obsessive compulsive

behaviours) or even biting due to a higher tendency to get active (Denham, Bradshaw, & Rooney, 2014; Miller & Janeczko, 2015). Stress also has an effect in decreasing immune status, therefore increasing the risk of infection, which is always a concern in a dense environment such as shelters (Miller & Janeczko, 2015).

Efforts to reduce stress are already described in the literature (examples like e.g. proper housing and husbandry principles are explained on environmental enrichment further on). Strategies include positive handling (rough handling by staff should be avoided by all means), noise reduction, avoiding random placing with other animals and providing comfort and environmental enrichment in their primary enclosures (Wells, 2004).Circumstances perceived to be adverse by the animal can lead to a "fight or flight response" (in parallel vegetative stress-reaction arise: increased heart and respiratory rate, elevated blood pressure, dilated pupils) (McEwen, 2000; Rushen, 2000). Stressed animals are not only more likely to become ill, but when ill, develop severe clinical signs, remain ill for longer periods, and have a decreased positive response to treatment (Gourkow & Fraser, 2006). Genetics, past experiences, the environment, the animal's temperament and learning are factors that influence the way the individual dog reacts to, and perceives stressors (Tynes, Sinn, & Koch, 2015). The behavioural changes brought about by stress can have a negative impact on welfare and decrease an animal´s chance of being adopted. In parallel it can increase de danger posed by these dogs, as highly stressed animals may react unexpectedly and/or aggressively to handling (Miller & Janeczko, 2015). Among the most important stressors in kenneled dogs are e.g. new daily routines, unfamiliar smells, sounds, people and other dogs – often resulting in lack of control of the environment, and therefore, unpredictability and fear (Belpedio, 2010; Hiby, Rooney, & Bradshaw, 2006). When kenneling is prolonged the lack of social interaction with both conspecifics and humans is an important factor to take into consideration as a trigger of frustration and stress (long term effect) (Stephen & Ledger, 2005). Some common behavioural indicators of acute stress in shelter dogs include low body posture, oral behaviors (such as lip licks), yawning, and increased restlessness (Beerda B. , et al., 1998). Behavioural indicator of chronic stress can be lowered body posture, increased auto-grooming, paw lifting, vocalizing, repetitive behavior, and coprophagy (Beerda B. , et al., 1999). The following ethogram (Table 1) by Stephen and Ledger (2005) summarizes those behaviours associated with poor welfare in kenneled dogs:

Table 1- Ethogram of behaviours associated with poor welfare in kenneled dogs (adapted from Stephen & Ledger, 2005)

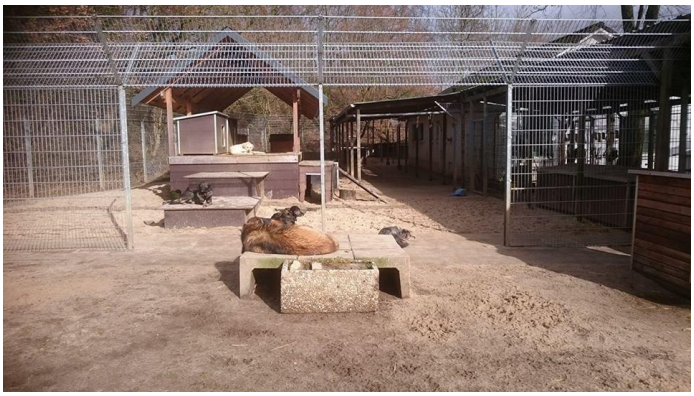
Behaviours	Description
Repetitive pace	Dog repeatedly (>2) paces around kennel in a fixed route.
Wall bouncing	Dog repeatedly (>3) jumps up kennel wall from side to side.
Tail-chasing	Dog chases tail repeatedly (>3) for reasons other than discomfort or grooming.
Circling	Dog walks around in small circles repeatedly.
Play bouncing	Dog repeatedly displays the play bow posture (>3) and may bark repeatedly.
Chewing bedding	Dog chews its own bedding.
Chewing bars	Dog repeatedly chews and bites at the wire of the kennel (>20 sec.).
Self-licking	Dog licks or chews its own body repeatedly (>5 minutes per session).
Polydipsia	Dog drinks large volumes of water in excess of what its normal.
Panting	Dog pants for reasons other than physical exertion or warm ambient temperatures (only recorded if temperature is < 26º).
Lack of appetite	Dog does not eat more than 50% of the food that is presented.
Excessive vocalization	Dog barks for prolonged periods (>1 min) in the visual and auditory absence of people and other dogs.
Listless	Dog is withdrawn and unresponsive to commands.
Escape attempt	Dog attempts to escape kennel in a forceful manner whenever the kennel door is opened and closed.
Hiding	Dog is obscured from the view of kennel staff behind its bed or other kennel furniture for prolonged periods when not asleep (>2 min); may be accompanied by a low posture and trembling.

The prevalence of behaviors associated with frustration, such as pacing, wall bouncing and bedding chewing, increased when dogs lived in an environment which did not allow them to perform species-specific behaviours (Stephen & Ledger, 2005).

4.2 Group housing

Group housing for dogs (Figure 1) provides diverse opportunities for environmental enrichment, and social enrichment. Careful planning is necessary to assure that the positive effects of group housing outweigh possible negative ones as e.g. stress, fighting and disease transmission. Group housing is not appropriate for all animals. Examples of what can be done in order to decrease the risks include: vaccination and parasite control of all dogs, behavioural evaluation to ensure compatibilities between them, and spaying/neutering before placement with others (F.D. McMillan, 2013).

Figure 1 – Group housing in HTV Shelter (original).



The idea that keeping dogs in groups offers them the opportunity to satisfy a biological need for physical exercise and for social contact with conspecifics and that this has a positive effect on welfare has been discussed by several authors (Hubrecht, Serpell, & Poole, 1992; Salman et al., 1998; Sonderegger & Turner, 1996). This tendency is further backed by evidence suggesting that singly housed dogs show increased risk of behavioural pathologies such as stereotypies (e.g. pacing, excessive auto-grooming or vocalizations) especially when living in isolation for extended periods and/or since early age (B Beerda et al., 1999; Cafazzo et al., 2014; Hubrecht et al., 1992). Dogs housed in larger enclosures with conspecifics showed almost complete absence of stereotypies (Hubrecht et al., 1992) (Hubrecht et al 1992; Hubrecht 1993; Mertens & Unshelm 1996). A comparative study of single and grouped housed dogs in two shelters in Germany found that group-housed dogs were more active, less aggressive, were quicker to be re-homed and showed less behaviour problems in the new home, besides finding that over 90% of conflicts were solved only through ritualized behaviours and without serious threats(Mertens & Unshelm, 1996).

Balancing the numbers of males and females, as well as avoiding the presence of females on heat, and neutering males, may also reduce conflict potential and aggressive encounters (Mertens & Unshelm, 1996; Sonderegger & Turner, 1996).

Conflicts may arise when dogs compete for food and may be reduced with ad libitum food or group feeding directly on the ground, under supervision (Pettijohn, Davis, & Scott, 1980). Some studies suggest an influence of group size on aggression, with larger groups (over 50 individuals) or groups with high turn-over of dogs ranking high in aggression, maybe because of the impossibility of forming hierarchies of any type in this kind of environment (Mertens & Unshelm, 1996; Sonderegger & Turner, 1996). Small groups with stable hierarchies should therefore also show low rates of aggressive encounters (Taylor & Mills, 2007). Pair housing may be seen as a compromise to group housing since no difference in time spent active or interacting with the other dogs has been observed between pair or group housing (Hubrecht et al., 1992; Taylor & Mills, 2007). In the studies of both Mertens and Unshelm (1996) and Sonderegger and Turner (1996) it was found that even though living outside and together with conspecifics, the animals housed in group housing had more opportunities for dog-human contact as well, as the human presence in the larger pens was more constant and longer, which also led to increased focus on humans. This leads us to assume that environmental enrichment should not only include dog-dog contact but also dog-human contact, as dogs appear to have developed a unique selective attention and attachment tendency towards humans (Miklosi et al., 2003).

9. Environmental Enrichment

Group housing is a form of environmental enrichment and as a group of dogs was investigated in this study, it is important to clarify the concept and enumerate the other types of environmental enrichment.

When talking about group or single housing dogs, and its effect on welfare it is impossible to not come across the term Environmental Enrichment, as has happened above. Environmental enrichment allows, independent of the species it is applied to, captive animals to improve their physical, behavioural and psychological health (Young, 2003). Environmental enrichment is a "concept which describes how the environment of captive animals can be changed in order to benefit its inhabitants" (Carlstead & Shepherdson, 1994). *The Guidelines for Standards of Care in Animal Shelters*, by the ASV, which created a Task Force to review and research the available studies and publications on the different subjects

concerning shelter medicine defines the importance of enrichment as equivalently important as nutrition and veterinary care, and by no means optional. Enrichment allows stress-reduction, promotes physical and mental stimulation, encourages species typical behaviours and allows animals to have more control over their environment, contributing to overall welfare (Newbury et al., 2010). Enrichment can be divided into two main categories: animate (contact with other animals and humans), which can also be called "social enrichment"; and inanimate (housing, feeding, toys and sensory enrichment), which can also be called environmental enrichment (D. Wells, 2004).

Individual needs should always be taken into consideration, as not all strategies are appropriate for every dog.

5.1 Animate Enrichment / Social enrichment

Contact with conspecifics: it is detrimental to welfare, housing a highly social species such as the dog, in total isolation from members of its species (Miklósi, 2007; K. L. Overall, 2013). It is advisable housing dogs in pairs or groups. The mere fact of disposing kennels in a way that allows dogs to see their conspecifics may already be beneficial (Ottesen et al., 2004; D. L. Wells & Hepper, 1998). However, this is not always possible for all shelters, and for some animals it is not advisable. Other strategies to promote social interaction with conspecifics include dog walks and play (Sadler, 2014; D. Wells, 2004).

As early as 1992, a study by Hubrecht et al showed that housing the dogs in groups was associated with high activity, social behaviour and investigation, together with low levels of repetitive behavior (stereotypies being associated to stress and poor welfare), while dogs housed alone were more inactive. Group housing provides a complex social environment, and overall pen size tends to be larger, while single housing was associated with more passivity and non-social repetitive behaviour. The impression given was that single housed dogs spent much of their time trying to increase sensory input by investigating the floor, presumably in search of some level of mental stimulation (Hubrecht et al., 1992).

Taylor and Mills (2007) found that puppies which were housed together exhibited less disturbed behaviors, and were quieter for greater portions of the day (Taylor & Mills, 2007).

On the other hand, socially competent dogs have higher chances of getting access to resources such as handling, playgroups, walks and engagement in human relationships, which in turn can lead to quicker adoption rates as most adopters looking for companion dogs are

attracted to dogs which present themselves in a friendly and sociable manner with conspecifics, besides with people (Luescher & Tyson Medlock, 2009; Protopopova, Brandifino, & Wynne, 2016; Emily Weiss, Miller, Mohan-Gibbons, & Vela, 2012).

8.1.1. Contact with Humans:

Not only social isolation from conspecifics, but also lack of interaction with humans are a contributing factor for the stress experienced in a kennel environment. Humans are an important resource which can and should be used to improve general welfare(Coppinger & Zuccotti, 1999; Coppola, Grandin, & Enns, 2006). The importance of social human interaction with shelter dogs has been evidenced in several studies, which underline the importance of positive human-dog interaction (Belpedio, 2010; Coppola et al., 2006; Menor-Campos et al, 2011) It is important to take into account the individual characteristics of the dog, such as previous experiences, socialization, personality and even genetics in order to assure a positive rather than stressful experience (Franklin D McMillan, 2002). The study conducted by Menor-Campos et al. (2011) demonstrated that a 25 minute protocol of exercise, play and human contact was helpful in reducing stress in shelter dogs.

Strategies include: grooming and handling by staff and volunteers; play between dogs and staff/volunteers; dog walking; training sessions with positive reinforcement methods, and spending quiet time with the dogs (D. Wells, 2004)

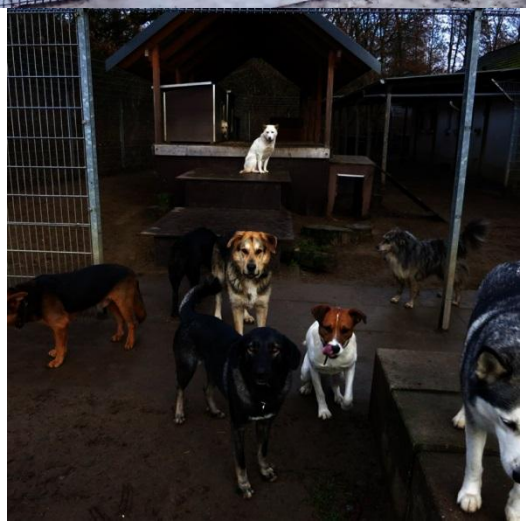
Figure 2 – Exercise and play area for dogs in the HTV Shelter (original).

5.2 Inanimate Enrichment / Environmental Enrichment

Although not all dogs show interest or have even learnt how to use toys, evidence has shown that their mere presence in the primary enclosure is seen by the public (and prospective adopters) as a desirable element, and may increase the chances of adoption(Graham, Wells, & Hepper, 2005; Luescher & Tyson Medlock, 2009). There are plenty of toys available on the market, including balls, chew toys, and toys which allow feeding enrichment such as kongs® (K. L. Overall, 2013; Santos et al., 2013)

The enclosures in which dogs are housed should include a variety of spaces, raised platforms, which allow dogs a better surveillance of the environment, besides providing rest places (on or under); places to hide, which allow animals to have some control of the environment; separate functional areas (sleeping apart from eliminating) (Moesta, McCune, Deacon, & Kruger, 2015; D. Wells, 2004).

Figure 3 and 4 – Group-housed enclosure in the HTV Shelter (original).



Sensory enrichment can also be of the auditive type including both noise reduction and the addition of sounds such as music or calm talking (Brayley & Montrose, 2016; Kogan,

Schoenfeld-Tacher, & Simon, 2012); or it can be olfactory such as adding interesting new smells or calming fragrances (Graham et al., 2005) or the dog appeasing pheromone (DAP) , which has been advertised for calming properties in dogs, although more research needs to be conducted to reach more conclusions on its benefits for shelter dogs (Moesta et al., 2015).

10. Shelter dogs in Portugal

In Portugal, the DGAV (Direcção Geral de Alimentação e Veterinária), a branch of the Ministry of Agriculture is the highest entity responsible for matters regarding veterinary medicine and welfare. Of the various laws regulating the protection of companion animals, "Decreto-Lei 276/2001" and "Decreto-Lei 315/2003", are the two that lay down the norms for detention, housing, handling, surgical interventions, seizure and euthanasia. "Decreto-Lei 260/2012" lays down the norms for municipal and private shelters/capture centers (DGAV, 2016). Article 19 of "Decreto-Lei 260/2012" defines that it is the local council's responsibility to decide upon the seizure and eventual euthanasia of companion animals, if public health is in jeopardy for any reason. Animals are taken to so called "Centros de Recolha Oficiais" (CRO), which are official capture centers, they are to be held for a period of eight days. If no one claims the animal during this period, the veterinarian in charge decides upon its destination: adoption, transfer to other facilities (e.g. private shelters) or euthanasia (DL 260/2012). Licensing of both (official and private) facilities is the responsibility DGAV. There are approximately 136 licensed CROs but still many councils do not have one. As for private shelters, approximately 38 shelters are licensed but not all are re-homing centers, some are multiple dog households (DGAV, 2016). Data concerning the numbers of unwanted pets in Portugal is scarce and incomplete, Table 2 gives us the intakes and adoptions in CROs but there is no available information about the proportion of stray animals, animals relinquished by the owners, or of those taken in and managed by private shelters.

Table 2 - Data concerning animals housed in CRO and respective outcomes.

Year	Dogs housed in CRO	Dogs returned to owners	Adopted dogs	Euthanized dogs
2013	23.632	1.724	8.407	11.837
2014	24.579	1.786	8.768	11.978

Recently, two new laws on animal welfare have been approved: the criminalization of animal cruelty (Law 69/2014), and even more recently (August 2016) the prohibition of euthanasia as population control measure in CROs. These centers will no longer be allowed to euthanize animals for economic reasons, overpopulation and or/space constraints. The councils have two years to prepare before the law is effective (Law 27/2016).

11. This Study

The main goal of this pilot study was to observe the individual behaviour of dogs group-housed in a shelter, especially the social interactions between dogs. The overall question was: Is group housing of dogs in a shelter beneficial in terms of the development of individual social skills, and will it enhance the overall quality of life for sheltered dogs?

Improving social skills could prevent behaviour problems after adoption, and, in general, increase the rate of successful adoptions. Furthermore, as it has been suggested that group housing might be a cause of stress for dogs, thus reducing their quality of life, this pilot study should bring some insight on this matter.

One big argument, besides too much work for the staff, against group housing is the fear that the dogs might engage in aggressive encounters on a regular basis. Therefore it was looked for positive and negative interactions between the dogs: To evaluate individual social skills and overall stress level, dog-dog-interaction in the observing period was analyzed, determining if it was characterized by positive social interaction between dogs, or by conflict interaction. Here "conflict interaction" stands not only for the occurrence of aggressive behavior, but also when imposing behaviour was shown by one or both dogs interacting. In parallel the number of submissive, fear and stress behaviours shown by individual dogs was considered.

The following parameters were looked at when observing dog-dog interaction:

- number of social interactions, number of partners, length of each social interaction; who started each interaction and who ended it. If individual dogs had preferred social partners or not.

- which behavioural elements were shown by each dog, and did the dogs show individual variation in the use of these elements. Elements such as fear- and stress behaviours could be indicative of the temperament of a dog, allowing shelter personnel to more efficiently group dogs together.

- if dogs differed in their interaction with humans and in the amount of time spent sleeping/resting; if there could be a correlation to the amount of fear-/stress behaviour shown. Finally, after the observation period, the dogs were tested in six standardized situations and their behaviour was compared to the behaviour of six dogs kept in single housings in the shelter. The question was whether the group housed dogs differed in their behaviour from the single housed dogs, especially in terms of social competence.

Material and Methods

6. Dogs Information

Six dogs were observed regarding their social behavior, in a group of dogs which consisted altogether of 20 dogs. The dogs lived as a group in a shelter of the Hamburg Society for the Prevention of Cruelty to Animals (Hamburger Tierschutzverein von 1841 e.V., Süderstraße 399, 20537 Hamburg, Germany (HTV)). Table 3 comprises the relevant information for these six dogs. The complete data of the other 14 dogs is displayed in the Appendix 1 (Table A).

Table 3 - Overview about the information from each one of the six focus dogs.

Dog	Breed	Age	Sex	Origin	Reason for being in the shelter	Length of stay in the Shelter
Dog 1	German shepherd	5 Years	Female (neutered)	Found	Neglect	2 Years
Dog 2	Mongrel	2 Years	Male (neutered)	Romania	Aggressive against other dogs	1 Year
Dog 3	Mongrel	1 Year	Male (neutered)	Romania	Owner had too many dogs	1 Year
Dog 4	Rottweiler mix	5 Years	Male (neutered)	Unknown	Aggressive against humans and owner	1 Year
Dog 5	Mongrel	2 Years	Male (neutered)	Romania	Private	4 Years
Dog 6	Staffordshire-Rottweiler-German shepherd mix	> 9 Years	Male (neutered)	Other shelter	Private	4 Years

To evaluate the behaviors shown by each dog, the animals were filmed every day (see Data collection). Most of the dogs stayed in group housing on a 24/7 basis, however, on some days, individual dogs were left for longer or shorter periods (visit to the vets, walking) or even overnight (taken home by a dog-walker or staff). Some dogs belonged to shelter staff,

joining the group on an irregular basis. Only six dogs (Dog 1 - Dog 6) were present regularly throughout the video sessions. For that reason, only the data from these six dogs was evaluated in this study. Table B (Appendix 1) gives an overview of the complete data of each one of the dogs in the group housing, irrespectively being permanently in the group or not (frequency). Stated is their absence/presence during the video sessions, reasons for leaving the group and if or when the dog re-entered the group after leaving.

7. Data collection

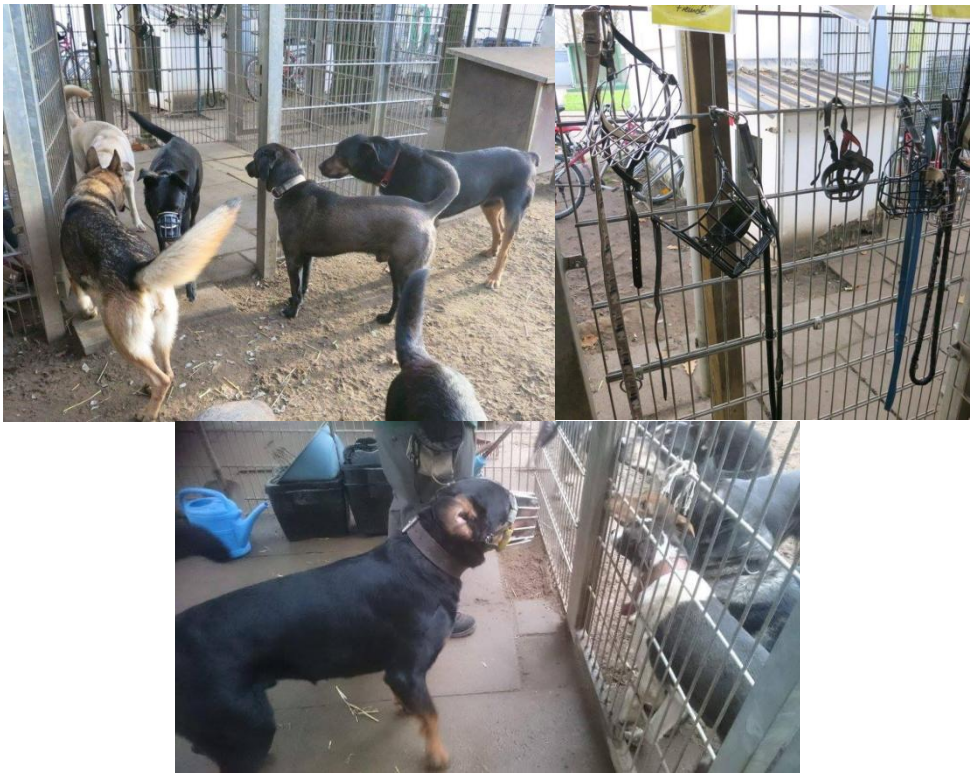
The data was collected through video recording, for 28 consecutive days, from February 1st, 2016 until February 28th, 2016. The videoing was done by 2 different people with mobile phones: Vodafone Smart Prime 6 and Samsung A5; they were equipped with clothes from the shelter, and were introduced to the dogs, with help and supervision of the caretakers three days in a row before the videoing started, so the dogs would get used to them and not be distracted in their normal behavior and routine.

The dogs were filmed according to the "Focal animal´s behaviour sampling" (Martin & Bateson, 1996), each dog three times for three minutes per day. Recording took place in the morning after feeding and before the daily walks started. Depending on the number of dogs each day, video recording was split between the two people and the attributed dogs were consistently filmed by the same person during their stay in the group. The order of dogs was always the same, more specifically from the 6 studied dogs it was Dog 1 and Dog 3 first, Dog 5 and Dog 4 second and Dog 6 and Dog 2 next, respectively, for each person.

8. Facilities and Daily Routines

The enclosure was about 500 m^2. The ground was 30% grass, 50% bare soil and 20% concrete. The area with grass had a big tire for environmental enrichment and a single round platform, about 1 meter in diameter, of 1 meter height. Roof tiles were used to cover 50% of the total area. The main entrance to the enclosure was equipped with double doors with a gate function, were all the equipment for the walks, such as collars, leashes and muzzles, were stored (Figures 5, 6 and 7). At the right side of the kennel was another double door with a gate function entrance and on the left side was a single door entrance that was rarely used.

Figure 5, 6 and 7 – Double doors with a gate function (left and below) with equipment storage (right), (all original).



In the enclosure, altogether 16 smaller (3x2 m; 6 m^2) wooden kennels were placed, 12 kennels stood on the ground and 4 kennels stood on a covered platform, about 1,50 meters above the ground with 3 access ramps, allowing free access to the space under the platform. Almost all kennels had towels over the entrance for increased thermal insulation. On very cold days (below zero temperatures and snow) the kennels were filled with extra straw for more insulation.

The dogs were fed in the morning, at 8 am during the week and at 7 am in the weekend. Generally, a feeding track of kibble (Figures 8 and 9) and some added moist food was spilled on the concrete floor and all dogs ate directly from it, with the exception of Dog 4 who was fed separately due to his persistent food aggression, and Dogs 5 and 6 which were fed with food that their owner brought from home. As food variation was dependent on donations, it included fish, rumen, meat mince and canned food; therefore sometimes (depending on the solidity of the food) feeding was in individual bowls that were removed when finished. There was unrestricted access to 8 permanently filled water bowls that were placed near the main entrance, hanging on the fence at 10 cm above the ground, 2 at the right side of the entrance, 4 at the left side and another 2 at the other double door entrance.

Figures 8 and 9 – Feeding track (left) and feeding in bowls (right) in the group-housed enclosure of the HTV Shelter (both original).

At 10 AM the dogs were taken for their daily walks with selected volunteers for about 1 hour, repeated at the end of the day. Two male caretakers, between 25-30 years of age, were responsible for the dogs. One of them was responsible for feeding, cleaning, caretaking and socially interacting with the animals in group housing, while the other was looking after other shelter animals. Their duties alternated from day to day. During the video sessions one of them, depending on their schedule, entered the group for cleaning and husbandry procedures, remaining around 20 minutes. If any of the dogs had medical issues, needed to be taken to the resident veterinarian, or taken out to meet potential adopters, they were also removed from the group by the caretakers.

To avoid fights and/or trauma through inappropriate ingestion there were no toys in the enclosure.

9. Ethogram and Data sampling

The behaviour of the dogs in social interactions was analyzed following an ethogram extensively described in a review by Schöning 2006 .The following behaviours and behaviour groups were looked at:

Table 4 – Overview of each behaviours, their description and examples.

Group	Name	Description and examples of behaviour
A	Social Approach Behaviour	These behaviours aim at "decreasing the distance between individuals". Showing them peaceful or socializing intentions and/or aims to end or reduce its counterpart's agonistic tendencies

		(Gattermann, 1993). They can be used in a conflict situation as de-escalation ease, according to Schenkel (1947) and Feddersen-Petersen & Ohl (1995). Behaviours for social approach comprise e.g.: nose nudge, muzzle nuge, sniffing, following, rubbing, circling, pushing, licking, jumping at and muzzle holding.
B	Active submission	Active submission belongs to the group of social approach behavior. It is a complex behavior which fulfills a certain purpose (from friendly greeting to de-escalation) (see Schöning 2006), therefore it is looked at here separately. Active submission comprises behaviours that reduce distance between the two animals communicating, often performed by young dogs towards older ones, but can also be shown the other way round (Feddersen-Petersen & Ohl, 1995) like e.g.: muzzle nudge, licking intention = licking the other mouth, pawing, avoiding eye contact, round back, small body posture, which can be shown all in parallel.
C	Imposing behaviour	Behaviors included in this category lack the intention for attack and are firm and predictable (Umlauf, 1993). There is no longstanding approach or body contact between the dogs. Typical elements are: placing paw or head on back, mounting, raised body posture and/or tail, showing neck and T-position, making oneself bigger through piloerection (Klaus Immelmann et al., 1996; (Scho□ning & Ro□hrs, 2013).
D	Passive submission	Used for de-escalation of a conflict. Differently from the behaviours described above under the name “active submission”, in this case the dog showing this behaviour does not actively approach the partner, on the contrary he tries to increase the distance between them in space and time by freezing. Passive submission can be a reaction to imposing or threatening or offensive behaviours, reflecting that the dog is in a state of fear and stress (Zimen, 1971; Umlauf, 1993). A typical mimic would be this: Flat smooth face, ears backwards, eyes wide open, long mouth-gap (submissive grin), eyes avoid contact with the other dog.

		Possible additional signs: licking of own snout, large pupils (Feddersen-Petersen, 1988). Posture: avoiding eye contact, rolling onto the back, with submissive grin and ears flat at the back, usually with tucked in tail and spread hind legs (Feddersen-Petersen & Ohl, 1995).The other dog may be standing over or close to the side (Schenkel, 1967).
E	Threatening behaviour	Shown in a conflict to increase distance in space and time from an opponent. Shown when stressed and/or under fear, e.g. when the dog is in a conflict situation Depending on the situation and the emotional state of the dog, threats can be shown more offensive or defensive. Threats do not imply intent to harm, but minor injuries may result from bodily contact arisen from it.. threatening behavior comprises e.g.: defending while lying on the back, snapping, growling, wrinkled nose, raised hackles, baring teeth, raised hair, barking, lurking, biting over the muzzle, chattering with teeth, bite-threatening, standing over the opponent and chasing. (Schoning, 2006, Zimen, 1971).
F	Inhibited Offensive Behaviour	Behaviours from this group express the intent to fight but with some caution, mostly accompanied with the flight/leaving behaviour. Examples are: mugging, wrestling and pressing the other dog down.
G	Uninhibited Offensive Behaviour	It consists in behaviours shown during a fight, without limits and with the intention to hurt, which comprise e.g.: biting once or multiple times and/or bite-shaking, attacking and trying to wound the other dog by fighting, focused on specific body areas (Rottenberg, 2000).
H	Flight behaviour	Flight (leaving the opponent slowly or quickly) also aims at increasing distance to an opponent in time and/or space.
I	Behaviours for De-escalation	For De-escalation of a conflict dogs can show avoidance behavior or displacement behavior of any kind (e.g. autogrooming, digging)
J	Play behaviour	Play behaviuour is an opportunity to train muscles, motoric capacities and social roles without the seriousness of an

		antagonistic encounter (Overall, 2013) and therefore it's important for the development of communication and impulse and aggression control (Feddersen-Petersen & Ohl, 1995; Klaus Immelmann et al., 1996). They occur in a friendly encounter or even as a resort to end and avoid unsafe situations (de-escalation of conflicts). These behaviours comprise e.g.: bowing, playful biting and/or fighting, along with a play face that consists of: wide open eyes with a direct focus on the other dog, expressive and partly relaxed face and a variable mouth position, while the corners are mostly relaxed.
K	Behaviours to indicate stress	Besides a typical "facial expression of fear", dogs can show that they are in a stressful state through a wide range of mimics and behaviours. The range comprises vegetative reactions, e.g. drooling, letting urine or feces; vocalization like e.g. whining; behaviours like lip licking, panting, penis erection, piloerection, wagging and barking, yawning.
L	Behaviours to indicate fear	Typical signs of fear or anxiety are a crouched or low body posture, ears flattened back, eyes small (blinking) or wide open, avoiding eye contact, flat face with long mouth gap; tail low, can be tucked under the body (see for example Overall, 2013)

The time of sleeping and resting during the observation period was counted too.

Interactions with humans were also evaluated, if they occurred, in terms of how often and for how long they took place. These interactions were registered, regardless to whom they were shown: shelter staff, the two person filming and visitors or potential new owners. Interactions with humans comprised: approaching, actively following, sniffing at the human, licking the hands of the human, fixing the human with the eyes, barking, attempt to play and leaning against the human while standing or sitting (this last behaviour could be combined with any of the above).

The videos were transformed into mp4 data on a PC and each video of the six focus dogs was watched, in slow motion, one or two times, depending on the complexity of the interactions. When there were doubts, the videos were watched a third time by the supervisor. In general the supervisor controlled at random for the data derived from the videos.

Data was sampled in an excel file containing the following contents:

- Number of the focus dog;
- Date of observation;
- Number of interactions with other dogs per sampling per day;
- Length of interaction per day in general;
- Average length of single interactions with another dog;
- How many times did the focus dog start the interaction and how many times the other dog;
- How many times did the focus dog stop the interaction and how many times the other dog;
- How many times during all interactions did the focus dog show behaviours from the following ethogram groups and behaviors: Social Approach Behaviour, Active Submission, Imposing Behaviour, Passive Submission, Threats, Inhibited Offensive Behaviour, Uninhibited Offensive Behaviour, Flight/Leaving, Behaviour for De-escalation, Play Behaviour, Stress Behaviour and Fear;
- Number of interaction with humans, length of combined interactions and average length of single interactions;
- Seconds per day and sampling time, the dog spent sleeping or resting;
- Number of dog-partners per sampling time and the individual number of these dogs.

10. Final Temperament Tests

Finally the 6 focus dogs were tested in three human-dog and three dog-dog test situations, derived from a standard temperament test for aggression (http://*www.ml.niedersachsen.de/download/2815; http://www.ml.niedersachsen.de/themen/tiergesundheit_tierschutz/tierschutz/mit-dem-zentralen-register-und-dem-sachkundenachweis-sind-ab-01072013-alle-regelungen-des-hundegesetzes-in-kraft-93854.html)*; which has been practiced in Germany for the last 15 years to evaluate dogs in the course of German Dangerous Dogs Acts and has been validated (references: Böttjer, 2003, Bruns, 2003, Mittmann, 2002, Schöning, 2006).

The test situations are described in table 5. Apart from the situation “alone” each focus dog is always on leash and led by its handler. In the situation “alone” the dog is fixed to a pole and without its handler.

Table 5 – Test situations

Dog-dog Situation	Dog-Human Situation
At fence: The focus dog is approached by another dog behind a fence.	Approaching/petting: the human approaches the dog in a friendly, non-confrontational way, talks to the dog and tries to stroke it
Walking on leash: two dogs (male and female) are walked one after the other past the focus dog. They are walked past two times each and when walked past the second time, the handler of the test-dog stumbles.	Stumbling: the human walks past the dog in 1.5 m distance and stumbles when being right in front of the dog
(Alone) a dog of the same sex as the focus is walked past	Starring: the human stands silently in front of the dog (distance 1.5 m) and stares at the dog

For comparison, six single housed dogs (Figure 10) from the shelter underwent the same test. Table 6 gives an overview over these dogs.

Figure 10 – Single-housing enclosure in the HTV Shelter (original).

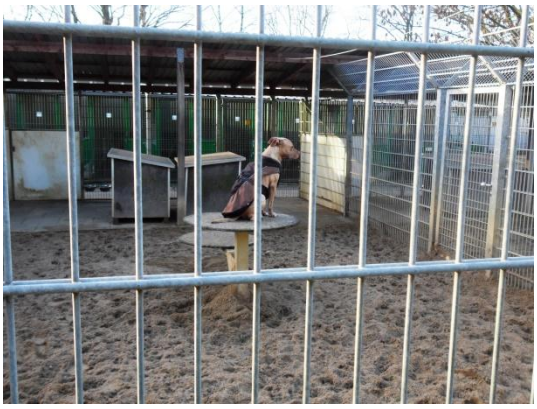


Table 6 – Overview of information from the single-housed dogs.

Dog	Breed	Age	Sex	Origin	Reason for being in the shelter	Length of stay in the Shelter
Dog 21	Jack russel	> 9 Years	Male (neutered)	Unknown	Aggressive against stranger	4 Years

Dog 22	Jack russel	8 Years	Male	Breeder	Aggressive against humans and owner	1 Year
Dog 23	Mongrel	> 9 Years	Male (neutered)	Unknown	Owner didn´t wanted anymore	1 Year
Dog 24	Kangal	2 Years	Male (neutered)	Unknown	Seized by the Police	1 Year
Dog 25	Pit Bull	2 Years	Male (neutered)	Unknown	Aggressive against other dogs	2 Years
Dog 26	Mongrel	> 9 Years	Male (neutered)	Unknown	Neglect	1 Year

The tests were done in an open grassy area, each dog was held by one handler.

Data sampling followed the procedure mentioned before: The dogs were recorded in each situation and the behaviours shown in each test-situation were counted and listed in an excel file.

Statistical analysis and Results

For the data analysis, the statistical software SPSS version 20 was used. Regarding descriptive analysis, measures of central tendency such as means and measures of statistical dispersion such as standard deviation were calculated for continuous variables and frequencies and percentages for categorical variables. Regarding inferential statistics, both Spearmen's and Pearson's coefficient were accessed the relation between two continuous variables, the relation between one continuous variable and a categorical variable was accessed by t-test or an alternative parametric test, Mann-Whitney, when normality was not assumed. Chi-square and Fisher's exact test were used to analyze the relationship of categorical variables. All inferential statistics used a level of significance of 5%.

Altogether 703 dyadic interactions dog-dog and 303 dyadic interactions dog-human were analysed.

G. Evaluation of the dog-dog interaction number, length and average length for each focus dog and the comparison with the time spent sleeping or resting, during the 28 days observation period.

Dog 3 showed the highest mean number of interactions per day with 6.29, and the second high mean interaction length of 100.64 seconds.

The average number of interactions per day was 4.19 per dog, with a mean total duration of 64.81 seconds of interactions per three times three minutes observation period per day and a mean average duration of 15.52 seconds per interaction.

Dog number 4 showed the highest mean duration time with 39.69 seconds (standard deviation (s) = 48.61) whilst dog number 2 showed the lowest mean interaction duration and the lowest number of interactions per day in parallel.

The following table describes the number of interactions of the six focus dogs living in group-housing towards other dogs, over the 28 days period.

Table 7 – Mean number of interactions, length of the interactions and average length of each single interaction, for each dog during the 28 days of filming.

		Interaction Number		Interaction Length		Average Interaction Length	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Dog	1	6.07	3.55	68.89	68	9.9	6.19
	2	2.21	2.56	11.86	14.4	4.18	7.08
	3	6.29	3.65	100.64	77.71	15.96	10.34
	4	4.18	3.26	126.86	123.03	39.69	48.61
	5	3.86	4.26	65.93	90.09	19.37	34.64
	6	2.5	2.63	14.68	17.24	4.05	5.68

Dog 3 was the one with the highest mean number of interactions and spent the lowest time sleeping or resting with a mean of 41.96 seconds per day.

Dog 4 spent a mean of 66.54 seconds per day sleeping or resting and had in parallel the highest mean average interaction length.

Dog 2 had the least number of interactions and time spent interacting, and had the highest mean time sleeping or resting, with 234 seconds (s=177.91) per day.

Table 8 – Mean time the six focus dogs spent sleeping or resting.

		Sleeping/Resting	
		Mean	Standard Deviation
Dog	1	96.64	107.36
	2	234	177.91
	3	41.96	78.66
	4	66.54	74.16
	5	109.54	119.77
	6	122.96	101.15

There was statistically significant correlation between the number of dog-dog interactions and the interaction length per day (spearman rho=746, $p < 0.001$). The shorter a single interaction, the more interactions happened per day.

There was a negative relationship between interaction numbers and periods of sleep or resting (negative Pearson r=0.335, $p<0.001$) but there was no significant relationship between the average duration of interactions and the time spent sleeping or resting (negative Pearson r=0.006, p=0.937).

H. Evaluation of the dog-human interaction number, length and average length of interactions, for each dog during the 28 days and the comparison with the time spent sleeping or resting.

Dog number 3 had the highest number of interactions with humans (average of 3.04 per day (s=1.79), and a mean duration of interactions of 54.75 seconds per day (s=58.97), which was almost five times higher than the average of the other focus dogs, though he did not had the highest average interaction length in dog-human contact. In parallel he spent the least time per day sleeping or resting with only 41.96 (s=78.66) (see Graph H in Appendix 2).

The following table describes the mean number of interactions, total duration and average duration of each encounter with humans, and the mean time they spent sleeping or resting.

Table 9 - Mean number of the interactions with humans, mean length of those interactions, average length and the time spent sleeping or resting, for each dog during the 28 days of filming.

		Interaction with Human		How Long		Average		Sleeping/Resting	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Dog	1	1.96	2.59	18.29	26.7	8.96	16.65	96.64	107.36
	2	1.75	1.84	19.32	22.67	8.63	12.82	234,00	177.91
	3	3.04	1.79	54.75	58.97	16.07	15.26	41.96	78.66
	4	1.61	1.62	27.04	40,00	12.21	16.04	66.54	74.16
	5	1.04	1.32	10.61	18.69	6.14	9.28	109.54	119.77
	6	1.43	1.32	44.32	67.82	21.47	34.34	122.96	101.15

There was a statistically significant correlation between the number of interactions with humans and how long they lasted (spearman rho=0.840, $p<0.001$). The shorter a single interaction, the more interactions happened per day. (see, Graph G in Appendix 2)

There was a negative relationship between interaction numbers and periods of sleep or resting (negative Pearson r=0.335, $p<0.001$) and there also was a trend for a negative relationship between the average duration of interactions and the time spent sleeping or resting (negative Pearson r=-0.206, p=0.007), presented in the Graph I in Appendix 2. The more time was spent sleeping, the less interactions happened per day and the shorter each interaction was.

Each chart, of the overall activity from the six focus dogs, can be viewed in the Appendix 2.

I. Evaluation of which dog started and/or stopped during the dog-dog interactions, over the 28 days.

The Focus dogs started an interaction slightly more often than did the other dogs. (focus dog started: 2.25 s=2.39;) other dog started: (x=1.99, s=2.07). “Starting” is defined here as “the dog approached the interaction partner and started interaction”.

The same applied for the number of interactions stopped by the focus dog, however the difference is 1.7 times higher (= focus dog stopped an interaction more often than he started it). “Stopping” is defined here as “the dog went away from the partner and the interaction finished”.

Because of the lack of normality of the data, non-parametric approached were used. The Mann-Whitney test suggested that there were no statistically significant differences for

the mean number of interactions that were started by the focus dog and that were started by one of the other dogs (p=0.545).

But there was a statistically significant difference between the number of interactions that were stopped by the focus dogs and that were stopped by one of the other dogs ($p < 0.001$) described in table 10 and illustrated in the followed charter (Graph 1).

Dog 1 started interactions 100 times during the 28 days, and was by far the one to stop interactions the most, exactly 121 times. Dog 3 had nearly the same results than dog 1, starting 99 times but stopping just in 54 times.

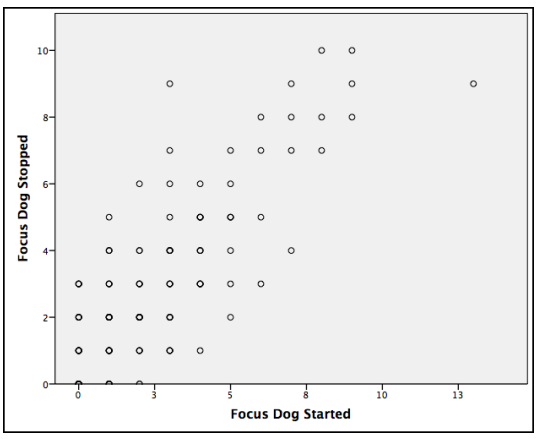
Dog 1 started interactions significantly more often than dog 2 and dog 6 (both p=0.001). Dog 1 started interactions slightly more often than dog 4 (p=0.007). Dog 3 started interactions significantly more often than dog 2 and dog 6 (both p=0.001). There was no significant difference in starting an interaction between dog 1, 3 and 5.

Dog 1 stopped interactions significantly more often than dog 2 (p=0.001). Dog 1 stopped interactions more often than dog 4, and 6 (p=0.004, 0.018 and 0.002). Dog 3 stopped interactions significantly more often than dog 2 (p=0.009).

Table 10 - Number of interactions started and stopped by focus dogs or others.

		Mean	Std. Deviation
Number of interactions started	by focus dog	2.25	2.39
	by other dogs	1.99	2.07
Number of interactions stopped	by focus dog	1.52	1.76
	by other dogs	2.64	2.45

Graph 1 – Scatterplot presenting the connection between the focus dog that started and stopped interactions.



There is a positive linear correlation, between the number of interactions started by the focus dog and the ones he stopped ($r=0.771$, $p<0.001$): the more a dog started interactions, the more he stopped them also.

J. Evaluation of the behaviour, the six focus dogs showed while interacting, during the 28 days.

Altogether over all 703 dyads the following behaviours were displayed by all six focus dogs:

- Social approach behaviour was shown the most, 628 times (28.1%);
- Behaviour for de-escalation, 425 times (19%);
- Stress, 321 times (12.4%)
- Imposing behaviour was displayed 267 times (11.9%);
- Attempt to flight or leave the situation 258 times (11.6%);
- Threats were shown 148 times (6.6%);
- Play behaviour occurred 81 times (3.6%);
- Fear was resorted 80 times (3.6%);
- Passive submission was 24 times (1.1%);
- Active submission was shown 15 times (0.7%);
- Inhibited offensive behaviour also 15 times (0.7%);
- The least shown was uninhibited offensive behaviour with just four times (0.2%).

In descending order of quantity, those were the behaviours displayed by each of the six focus dogs:

Dog 1 showed social approach behaviour ($x=5.36$, $s=3.6$), followed by behaviour for de-escalation ($x=4.18$, $s=2.91$), flight or leaving ($x=3.25$, $s=2.46$), stress ($x=3.21$, $s=2.33$), imposing ($x=2.64$, $s=2.48$), threats ($x=1.75$, $s=1.6$), fear ($x=1.36$, $s=1.25$) passive submission ($x=0.11$, $s=0.31$), play behaviour ($x=0.5$, $s=1.14$) and active submission ($x=0.04$, $s=0.19$), while inhibited and uninhibited offensive behaviours weren't shown at all;

Dog 2 displayed social approach behaviour ($x=1.93$, $s=2.52$), de-escalation behaviour ($x=1.24$, $s=1.58$), stress ($x=1.14$, $s=1.65$), imposing ($x=0.89$, $s=1.29$), flight or leaving ($x=0.79$, $s=1.17$), threats ($x=0.32$, $s=0.72$), play behaviour ($x=0.11$, $s=0.42$) and fear ($x=0.07$, $s=0.26$), while active and passive submission and both offensive behaviours weren't shown at all.

Dog 3 resorted the most to social approach behaviour (x=5.82, s=3.92), de-escalation behaviour (x=3.93, s=2.91), flight or leaving (x=2.5, s=1.75), stress (x=2.29, s=2.07), play behaviour (x=1.96, s=2.44), imposing (x=1.89, s=1.77), fear (x=1.25, s=1.35), passive submission (x=0.71, s=1.18), active submission (x=0.5, s=1.11), threats (x=0.46, s=1.07) and inhibited offensive behaviour (x=0.18, s=0.48), while uninhibited offensive behaviour wasn't shown.

Dog 4 showed social approach behaviour (x=3.64, s=3.41), de-escalation behaviour (x=2.86, s=2.55), imposing (x=2.32, s=1.89), stress (x=1.89, s=1.81), threats (x=1.46, s=1.35), flight or leaving (x=1.11, s=1.03), inhibited offensive behaviour (x=0.14, s=0.45), uninhibited offensive behaviour (x=0.07, s=0.38), play behaviour (x=0.07, s=0.26) and fear (x=0.11, s=0.42), while active and passive submission weren't displayed at all.

Dog 5 appealed to social approach behaviour (x=3.25, s=4.01), de-escalation behaviour (x=2, s=1.94), imposing (x=1.25, s=2.2), stress (x=1.11, s=1.62), threats (x=0.93, s=1.72), flight or leaving (x=0.82, s=0.98), play behaviour (x=0.25, s=0.52), inhibited offensive behaviour (x=0.18, s=0.55), passive submission and uninhibited offensive behaviour (x=0.04, s=0.19) and fear (x=0.07, s=0.38), while active submission wasn't shown.

Dog 6 showed social approach behaviour (x=2.43, s=2.63), de-escalation behaviour (x=0.96, s=1.53), flight or leaving (x=0.75, s=1.17), stress (x=0.57, s=1.1), imposing (x=0.54, s=0.96), threats (x=0.36, s=0.68), inhibited and uninhibited offensive behaviours (x=0.04, s=0.19), while active and passive submission and play behaviour weren't shown.

Dog 1 followed by dog 3 were the ones that displayed the most behaviours in comparison with the other four focus dogs and dogs 6 and 2 were the most inactive. Social approach behaviour was displayed by all dogs as the highest, followed by de-escalation behaviour, active submission was only displayed by dog 1 and 3 as well as passive submission were dog 5 is also included. Threats, imposing, flight or leaving the situation and stress were shown by all dogs regularly. Play behaviour and fear were shown by all with exception for dog 6 and even with a low tendency, just dog 1 and 2 were the ones that didn't resorted to the offensive behaviours, including dog 3 in the uninhibited offensive behaviours.

Table 11 – Overview of the behaviours showed by each one of the six focus dogs during the 28 days.

	Social Approach Behaviour		Active Submission		Imposing Behaviour		Passive Submission		Threats		Inhibited Offensive Behaviour	
Dog	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
1	5,36	3,6	0,04	0,19	2,64	2,48	0,11	0,31	1,75	1,6	0	0
2	1,93	2,52	0	0	0,89	1,29	0	0	0,32	0,72	0	0
3	5,82	3,92	0,5	1,11	1,89	1,77	0,71	1,18	0,46	1,07	0,18	0,48
4	3,64	3,41	0	0	2,32	1,89	0	0	1,46	1,35	0,14	0,45
5	3,25	4,01	0	0	1,25	2,2	0,04	0,19	0,93	1,72	0,18	0,55
6	2,43	2,63	0	0	0,54	0,96	0	0	0,36	0,68	0,04	0,19

	Uninhibited Offensive Behaviour		Flight/Leaving		Behaviour for De-escalation		Play Behaviour		Stress Behaviour		Fear	
Dog	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
1	0	0	3,25	2,46	4,18	2,91	0,5	1,14	3,21	2,33	1,36	1,25
2	0	0	0,79	1,17	1,25	1,58	0,11	0,42	1,14	1,65	0,07	0,26
3	0	0	2,5	1,75	3,93	2,91	1,96	2,44	2,29	2,07	1,25	1,35
4	0,07	0,38	1,11	1,03	2,86	2,55	0,07	0,26	1,89	1,81	0,11	0,42
5	0,04	0,19	0,82	0,98	2	1,94	0,25	0,52	1,11	1,62	0,07	0,38
6	0,04	0,19	0,75	1,17	0,96	1,53	0	0	0,57	1,1	0	0

The mean number of the behaviours shown the most were marked in blue.

Dogs which showed a high amount of social approach behaviour showed also a high amount of flight or leaving behaviour (rho=0.639), and of de-escalation behaviours (rho=0.735),

Dogs which showed active submission, showed passive submission regularly also (rho=6.09).

When dogs showed imposing behaviour, they also showed significantly often threatening behaviour (rho=0.623), flight or leaving behaviour (rho=0.608), behaviour for de-escalation (rho=0.734) and display of stress (rho=0.730): However when showing threatening behaviour, dogs showed stress display significantly in a high amount also (rho=0.647).

When dogs showed flight or leaving behaviour, apart from the correlations mentioned above, they showed significantly often fear behaviour (rho=0.624), behaviour for de-escalation (rho=0.812) and stress (rho=0.736), which also was correlated to behaviour for de-escalation (rho=0.794).

Inhibited and uninhibited offensive behaviours and play behaviour were shown rarely and were not significantly correlated to any other behaviour.

The table below (table 12) presents the Spearman's correlation (rho) between different interactions types. Although many statistical significant relationships were found only the highest correlations were marked in red. They were also proved to be statistically significant with Pearson's correlation.

Table 12 - Spearman's correlation (rho) between all the behaviours.

		Social Approach Behaviour	Active Submission	Imposing Behaviour	Passive Submission	Threats	Inhibited Offensive Behaviour	Uninhibited Offensive Behaviour	Flight/Leaving	Behaviour for De-escalation	Play Behaviour	Stress Behaviour	Fear
Social Approach Behaviour	r	1.000	.262**	.572**	.239**	.257**	.086	.159*	.639**	.735**	.443**	.578**	.347**
	p-value	.	.001	.000	.002	.001	.270	.040	.000	.000	.000	.000	.000
	n	168	168	168	168	168	168	168	168	168	168	168	168
Active Submission	r	.262**	1.000	.167*	.609**	.028	.174*	-.028	.316**	.303**	.387**	.295**	.412**
	p-value	.001	.	.030	.000	.722	.024	.718	.000	.000	.000	.000	.000
	n	168	168	168	168	168	168	168	168	168	168	168	168
Imposing Behaviour	r	.572**	.167*	1.000	.162*	.623**	.195*	.207**	.608**	.734**	.312**	.730**	.309**
	p-value	.000	.030	.	.036	.000	.011	.007	.000	.000	.000	.000	.000
	n	168	168	168	168	168	168	168	168	168	168	168	168
Passive Submission	r	.239**	.609**	.162*	1.000	-.029	.096	-.041	.241**	.248**	.352**	.188*	.435**
	p-value	.002	.000	.036	.	.710	.215	.601	.002	.001	.000	.015	.000
	n	168	168	168	168	168	168	168	168	168	168	168	168
Threats	r	.257**	.028	.623**	-.029	1.000	.286**	.169*	.484**	.494**	-.002	.647**	.274**
	p-value	.001	.722	.000	.710	.	.000	.029	.000	.000	.977	.000	.000
	n	168	168	168	168	168	168	168	168	168	168	168	168
Inhibited Offensive Behaviour	r	.086	.174*	.195*	.096	.286**	1.000	.508**	.244**	.147	-.065	.239**	.201**
	p-value	.270	.024	.011	.215	.000	.	.000	.001	.057	.403	.002	.009
	n	168	168	168	168	168	168	168	168	168	168	168	168
Uninhibited Offensive Behaviour	r	.159*	-.028	.207**	-.041	.169*	.508**	1.000	.171*	.143	-.067	.169*	.031
	p-value	.040	.718	.007	.601	.029	.000	.	.027	.065	.385	.028	.687
	n	168	168	168	168	168	168	168	168	168	168	168	168
Flight/Leaving	r	.639**	.316**	.608**	.241**	.484**	.244**	.171*	1.000	**.812****	.330**	**.736****	**.624****
	p-value	.000	.000	.000	.002	.000	.001	.027	.	.000	.000	.000	.000
	n	168	168	168	168	168	168	168	168	168	168	168	168
Behaviour for De-escalatior	r	.735**	.303**	.734**	.248**	.494**	.147	.143	.812**	1.000	.453**	.794**	.452**
	p-value	.000	.000	.000	.001	.000	.057	.065	.000	.	.000	.000	.000
	n	168	168	168	168	168	168	168	168	168	168	168	168
Play Behaviour	r	.443**	.387**	.312**	.352**	-.002	-.065	-.067	.330**	.453**	1.000	.293**	.349**
	p-value	.000	.000	.000	.000	.977	.403	.385	.000	.000	.	.000	.000
	n	168	168	168	168	168	168	168	168	168	168	168	168
Stress Behaviour	r	.578**	.295**	.730**	.188*	.647**	.239**	.169*	.736**	.794**	.293**	1.000	.476**
	p-value	.000	.000	.000	.015	.000	.002	.028	.000	.000	.000	.	.000
	n	168	168	168	168	168	168	168	168	168	168	168	168
Fear	r	.347**	.412**	.309**	.435**	.274**	.201**	.031	.624**	.452**	.349**	.476**	1.000
	p-value	.000	.000	.000	.000	.000	.009	.687	.000	.000	.000	.000	.
	n	168	168	168	168	168	168	168	168	168	168	168	168

Statistical significant correlations were flagged with * or ** depending if they were significant at a level of 0.005 or 0.001.

K. Number of partners that interacted, for each dog during the 28 days.

Since the average number of partners per observation period on most of the 28 days, for all the six focus dogs, was three it was given as “up to three partners within three minutes” or “more than three partners”.

Dog number 4 had the highest number of up to 3 partners. Dog number 3 had the highest number of more than 3 partners. The more different partners one dog had, the lower was the time spent with each of them (Mann-Whitney Test, p=0.003).

Table 13 - Length of interactions, the number of interactions with up to 3 partners or with more than 3 partners and the total number of interactions.

		Length	1 to 3 partners	Length / Partner Ratio	more than 3	Length / Partner Ratio	Total interactions
Dog	1	69	18	3,8	10	0,4	28
	2	12	12	1,0	6	0,2	18
	3	101	15	6,7	13	0,5	28
	4	127	20	6,4	6	1,1	26
	5	66	16	4,1	5	0,8	21
	6	15	14	1,1	4	0,3	18

L. Comparison of the temperament test situations, between the group housed and the single housed dogs. (see tables in Appendix 2)

The test situations were performed with the six focus dogs from the group housing and accordingly with six dogs that where single housed. There was no significant difference in which behaviours were shown between the group housed and the single housed dogs. The only exception was behaviour for de-escalation in the dog-human stumbling situation ($p<0.05$), which was shown more by the single-housed dogs.

Nevertheless each test-situation was evaluated for the behaviours shown and some results are worth mentioning, despite being not statistically significant:

Situation at the fence:

Five dogs of each group showed social approach behaviours but just one of the group housed dogs showed imposing behaviours while this was shown by five of the single housed dogs. None of the group housed dogs showed threats while four single-housed dogs did. Behaviours for de-escalation were nearly equal between the two groups (six group-housed dogs versus five the single housed dogs). More group housed dogs showed flight behaviour: four vs. three single housed dogs

Dog confrontation in isolation:

All twelve dogs showed social approach behaviours, while five of the six group housed dogs and only by one of the single housed showed imposing behaviour. Threats were shown by two of the group housed and by one of the single housed dogs and one of each group tried to leave. Behaviour for de-escalation was shown by five from the group housed and all six single housed dogs.

Dogs of both genders walking by:

This was the only test-situation with dogs were passive submission was shown (by two group housed dogs and one single housed dog). Three dogs of each type of housing tried to leave the situation and almost all, with the exception of one group housed dog, showed de-escalation behaviours. One male of the group housed dogs showed inhibited offensive

behaviour towards the female dummy-dog, being the only time this happened during the tests with other dogs. One dog of each group showed play behaviour. Imposing behaviour again was shown more often by the group housed (compared to one from the single housed dogs),

In this walking by situation the caretaker once faked stumbling, following this, four of the group housed dogs tried to leave the situation compared to two from the single housing.

Person tries to stroke the dog:

Although five dogs of each group displayed social approach behaviours, it was the only situation where uninhibited offensive behaviour was shown by one dog of each housing type and inhibited offensive behaviour by one dog of the single housing. Passive submission was displayed by two of the group housed and one of the single housed dogs and stress was shown by two dogs of the group housing against five dogs of the single housing. One group housed dog also displayed fear behaviours, being the only dog and only time that this happened during the tests with humans.

Person stares at the dog:

Social approach behaviours were shown most here, by all six dogs from the group housing compared to five of the single housed dogs. It was the only dog-human situation where three dogs for the group housing attempted to flight or leave

Person stumbles:

This was the only test situation dog-human were no dog from the group housing showed passive submission in comparison with the other two situations,. Three dogs of each group exhibited imposing behaviours. In this particular situation was a statistical significance ($p<0.05$) for de-escalation behaviours, shown by none of the group housed dogs and on the other hand by five of the single housed.

Discussion

The overall question for this pilot study was: Is group housing of dogs in a shelter beneficial in terms of the development of individual social skills, and will it enhance the overall quality of life for sheltered dogs? For answering these questions, the individual behaviours and social interactions of dogs housed in a group were observed and evaluated and finally these dogs were compared to single housed dogs during a short temperament test.

So far no study exists where dogs have been monitored in a group in a shelter for a longer period under "real shelter life" conditions. It would have been unacceptable for welfare reasons to reduce already practiced enrichment for the dogs like e.g. walks or going home with the staff over night, in order to get an uninterrupted four week period of filming. The fluctuation in the group arising from this real-life environment accounts for the necessity of choosing a subpopulation for evaluation. The reduction of the initial number of course influences the power of the study to draw conclusions, this meaning that the results cannot easily be extrapolated and generalized to group housing as such and need to be interpreted with some caution. Due to this fact, a predominantly descriptive approach was taken for data analysis.

All group housed dogs observed here showed a certain amount of social activity (dog-dog encounters) over the observation periods, with some dogs being more active (i.e. higher number of dyadic interaction) than the others. Also, differences between dogs in the average length of dyadic interactions were observed. More active dogs showed less sleeping or resting phases, and had altogether shorter dyadic interactions. The reason for such differences in activity level between dogs kept in a shelter can be manifold.

One reason for the different social activity levels between dogs could be the time spent interacting with humans. In this study differences in the amount of interactions, and interaction length between dogs in their contact with humans became clear. It is known that in shelter conditions, some dogs are negatively affected by the lack of social contact with humans, which can result in excessive and fast forming attachments, even in adult dogs, as soon as humans are present (Gácsi, Topál, Miklósi, Dóka, & Csányi, 2001). Specifically looking for attachment to humans when observing a group of dogs in a shelter in the future, could be important in terms of evaluation e.g. where and with whom to place a dog. Dog 6 for example had a low number of interactions but each interaction lasted quite long when compared to the other dogs. This fact could be related to long periods of approach and attempts to communicate with humans and can be a sign that contact with humans might be

quite an important point for dog 6. (Shiverdecker, Schiml, & Hennessy, 2013). A conclusion to bear in mind when following this line of thought would be that protocols for human contact and exercise can improve the welfare of shelter dogs, as it had already been stated by others (Menor-Campos, Molleda-Carbonell, & López-Rodríguez, 2011). However, for some kenneled dogs, interactions with humans can be stressful and create behavioral problems, which interfere with their adoption possibilities. So restricting interactions with unfamiliar humans, can also improve welfare over short term periods, lowering stress related activity levels and repetitive behaviours (Hewison, Wright, Zulch, & Ellis, 2014).

Differences in social activity (dog-dog and dog-human) may be due to age and stress. Dog 3 had the highest activity levels during the observation period. He was the one that showed the most interactions both with conspecifics and also with humans. A reason could have been his youth (one year old and the youngest dog in the group) and the fact that social maturation was not finished yet. Young, immature dogs are known to show higher rates of socio-positive behaviours especially towards older dogs (Feddersen-Petersen & Ohl, 1995; Miklósi, 2007).

Age was not evaluated as a factor in the statistics due to the small sample size. But nevertheless it is worth mentioning: Dog 6 for example, as the oldest dog (> 9 years), had the second lowest activity level. Changes in activity levels, like exploratory behaviours, and also social interactions can be associated to kennel stress, but, old age, or age-related cognitive dysfunction syndrome is also a factor in spontaneous activity decrease, (Rosado, et al., 2012; Michel & Brown, 2014). Uetake, Yang, Endo, & Tanaka (2016) showed that elderly dogs can adapt well to new environments, which then leads to reduced stress. Also physical activity might play a role for stress reduction and well-being. In the case of the HTV, regular walks were provided and it has been proven that this improves physical activity overall (Rhodes, Murray, Temple, Tuokko, & Higgins, 2012) and accordingly has positive outcomes on sedentary or sick dogs (Huang & Lien, 2017).

To get a better overall picture of the context the dogs displayed any behaviours in, it was evaluated which dog started or stopped a dyadic interaction. Considering this information aided the evaluation of both the activity levels of each dog and the behaviours during the interactions, since it makes a difference if a behaviour was voluntarily started by the focus dog or if it was induced by another dog. Even though there is a difference between the mean number of interactions that were started by the focus dog in opposition to those started by the other dogs, it was not statistically significant. There was a significant difference between

which dog stopped an interaction, though. Not only did the focus dogs stop interactions more often, there also was a difference amongst the focus dogs. E.g. did dog 1 start and stop interactions significantly more often than other dogs. Again further investigations are necessary to evaluate whether age, sex, social competence and preferences to communicate with humans might play a role here.

To assess whether group housing of dogs in a shelter will be beneficial in terms of the development of individual social skills, we looked at individual behaviours and behavioural groups shown during interaction.

Of all behaviours or behavioural groups, social approach behavior was shown the most by the dogs. Given that behaviours for de-escalation were shown second most often, this implies that the majority of interactions either went on in a social-positive context or during a so called conflict interaction, and that they were solved on a low-level escalation. This is further strengthened by the fact that imposing behaviours and behaviours for flight and leaving the interaction show up third and fourth, on the display scale.

When looking at which behaviours were shown significantly more often together in an interaction, behavior for flight or leaving the situation, was significantly often shown together with behaviours of social approach, imposing behaviours, fear behaviours and, most importantly, behaviours for de-escalation and stress. This suggests that in conflicts among social groups, the decision to retreat may be a quicker choice of response in intergroup conflicts that cause fear and stress, in order to avoid escalation and getting attacked, a finding corroborated by other studies (Bonanni, Natoli, Cafazzo, & Valsecchi, 2011).

Attack behavior (uninhibited aggressive behavior) was, in fact, the least shown behaviour, and didn´t have any significant correlation with the other behaviours, once more suggesting that open fights are in fact a last resort in a stable group. It is interesting to point out that all six focus dogs from this study were neutered. Kuhne (2012) states that neutered dogs have a reduced general activity and their ability to concentrate on targets to attack seems lower. Most of the focus dogs were mongrels, which could be an argument contradicting the general claim that mixed-breeds are associated with problematic behaviour, such as being less calm and less sociable towards other dogs (Turcsán, Miklósi, & Kubinyi, 2017). But due to the low number of dogs in this study, this is only an assumption. Imposing behavior and threats normally precede other offensive behaviours but they can be associated with aggressive behaviours concerning resource guarding, in dogs with higher levels of impulsivity (Jacobs, Coe, Pearl, Widowski, & Niel, 2017). In the observation period some of the dogs of

the group guarded objects they accidentally obtained, locations (e.g. specifically dog 2 when on top of the elevated platform of the kennel area) or even people they regarded as a valuable resource. These situations were not looked at explicitly in the investigation because they did not occur often and were inconsistent among the dogs.

Some dogs showed active submission towards a partner, though in general it was not shown often. The assumption is that it was shown when behaviours for de-escalation were insufficient to solve a conflict. In this study active submission was strongly shown together with passive submission. This further stresses the point that active submission or passive submission were a sort of "last resort" when other behaviours for de-escalation did not work. The behaviours were not analyzed in a realistic chronologic order - i.e. which behaviours were preceding which - , therefore it could well be that when active submission failed, the dogs changed to passive submission. Especially dog 3, which was a quite young animal, often showed behaviours from this group towards older dogs, Zimen (1971) and Umlauf (1993) had already observed this fact.

Another tool to solve conflicts can be play behaviour (Feddersen-Petersen, 1994). According to Lindsy (2001) it is shown as a possibility to control and ease some aggressive situations, in order to avoid intense confrontations that culminate in injuries. The reverse may also occur, when during play the situation gets uncontrolled ending aggressively and even with fights (Lindsay, 2001). In this study, no correlation between play behaviours and other behaviours could be found.

Over the 28 days of filming, the group comprised (on different days) a total of 20 dogs. This means that on some days there was a wider range of partners to choose for interactions. The number of partners of each of the six focus dogs was compared with the time they spend interacting. The average number of partners per observation was three, so it was given as "up to three partners within three minutes" or "more than three partners". Dog 4, for example, was the one with the highest number of interactions with up to three partners, and showed the most uninhibited offensive behaviours in comparison to the other five focus dogs. Dog 3, on the other hand, had the highest number of interactions with more than three partners, being the youngest, most active one, and showed the highest tendency for play and submissive behaviours. Overall this may suggest that the behaviours displayed in the observation period can be dependent on the number of dogs the focus dog interacted with and the length of each interaction.

So far no reference literature exists, where the activity levels of dogs living in a group in a shelter and those living singly are compared. All the previous mentioned behaviours were looked at when comparing group and single housed dogs. The test situations came from a temperament test used for the evaluation of aggressiveness and dangerousness of dogs. But these test situations do not differ from test situations used to predict a dog's adoptability (Ledger & Baxter, 1997; Valsecchi, Barnard, Stefanini, & Normando, 2011). The advantage of testing dogs this way is that it gives an overview on temperament and behavior patterns, in order to generate a better match with a potential owner (Coppola, Grandin, & Enns, 2006; Valsecchi et al., 2011). Temperament tests are performed on a routinely basis at the HTV shelter specifically on those dogs that have shown behavioral problems or had incidents related to aggression against people or other dogs. In these standardized tests, the dogs are led by their caretakers. Being led by a familiar person may have a positive effect on the dog in some circumstances. A lower rate of aggressive behaviours in unfamiliar situations had been reported when the animal is accompanied by someone familiar, like the caretaker (Kis, Klausz, Persa, Miklósi, & Gácsi, 2014, Howard & DiGennaro Reed, 2014). Nevertheless, in the case of an aggression test, the results are equally valid and reliable when compared to a dog led by an owner (Schöning, personal communication).

Although the sample size was small, some differences between the two types of housing were noticed. Play behaviour was not frequent and when shown it was exhibited always by just one dog of the six single housed dogs. Behaviours that indicate stress where shown less in the group housed dogs compared to the single housed dogs, though the difference was not statistically significant. The fact that in one dog-human situation (the tester stumbling), five of the single housed dogs showed behaviour for de-escalation compared to none of the group housed dogs is a curious finding. The significant difference here could be an indication that single housed dogs were more stressed and/or frightened by the stumbling person than the group housed dogs. The label "single housed" does not mean that those dogs were kept in complete isolation. They had contact to humans (care takers and dog-walkers) and also, on a more sporadic level, to other dogs, for example, when other dogs were walked past the kennels of the single housed dogs. Nevertheless the quality and quantity of such contacts was far from quality and quantity of social contact for the group housed dogs.

These differences can be a hint that with regard to potential problems arising after adoption, and also for the decision process which dog to adopt, dogs from group housing might pose less problems. Additionally potential owners might get better advice from staff

which had the opportunity to observe the social behavior of the dogs in a group context. Weiss, Miller, Mohan-Gibbons, & Vela (2012) already showed that information obtained from a staff member of the shelter about physical health and behaviours is most valued by owners and more important than just looking at the dog and some written description on their own.

The results of this study suggest that there is an advantage for dogs to be group housed in a shelter compared to be single housed. Stress levels might be lower in general, since the daily interactions with other dogs is a routine and not an exception.

For example one of the single housed dogs (Dog 25) was relinquished to the shelter for being aggressive against other dogs. During the dog-dog test situations he displayed some tense and aggressive behaviours in parallel with stress. As a comparison dog 2 (from group housing) which was also relinquished for being aggressive against other dogs did neither in the observation period nor in the test situations display any specific aggressive behaviours towards other dogs, and did not show a lot of stress behaviour either.

There were differences between the dog-dog and dog-human test situations which suggest that reactions towards humans might be more spontaneous than reactions against other dogs in general, regardless of the housing type. But this can be dependent on the individual background of the dogs. For example, dog 1 (group housed), which displayed uninhibited offensive behaviours towards the tester during one test situation, was brought to the shelter for welfare reasons (seized by the authorities after being neglected). Dog 4 (group housed) was relinquished for being aggressive against humans (including owner), but did not display any aggressive behaviours in test situations with humans. Aggressive behaviours when living with the owner could well have been context specific and a sign of diminished welfare also.

Conclusions

The results of this study, although gained from a small sample size, suggest that in fact living in a group in a shelter is beneficial in terms of the development and/or improvement of individual social skills and competences for dog-dog and dog-human interaction. Stress tolerance levels might be improved, and, altogether, group housing will enhance the overall quality of life for sheltered dogs.

Dogs as active and social animals require a daily routine that takes into consideration not only their need for physical exercise but also mental stimulation (Laser, 2008; Overall, 2013) and should include specific stimuli and training schedules for each dog (Part, et al., 2014).

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Appendix 1

Information about all 20 dogs that were in the group housed enclosure, during the 28 days of filming.

Table A - Overview about each dog's information

Dog	Breed	Age	Sex	Origin	Reason for being in the shelter	Length of stay in the Shelter
Dog 1	German shepherd	5 Years	Female (neutered)	Found	Neglect	2 Years
Dog 2	Mongrel	2 Years	Male (neutered)	Romania	Aggressive against other dogs	1 Year
Dog 3	Mongrel	1 Year	Male (neutered)	Romania	Owner had too much dogs	1 Year
Dog 4	Rottweiler mix	5 Years	Male (neutered)	Unknown	Aggressive against humans and owner	1 Year
Dog 5	Mongrel	2 Years	Male (neutered)	Romania	Private	4 Years
Dog 6	Staffordshire-Rottweiler-German shepherd mix	> 9 Years	Male (neutered)	Other shelter	Private	4 Years
Dog 7	German shepherd mix	2 Years	Male	Unknown	Hunting behavior	2 Years
Dog 8	Husky-Bernese mountain mix	2 Years	Male	Unknown	Aggressive against children	< 1 Month

			(neutered)			
Dog 9	Brandlbracke	2 Years	Male	Unknown	Neglect	< 1 Month
Dog 10	Mongrel	2 Years	Male	Unknown	Seized by the Police	1 Year
Dog 11	Shepherd-Chowchow mix	8 Years	Male (neutered)	Breeder	Aggressive against humans and owner	< 1 Month
Dog 12	Mongrel	2 Years	Female (neutered)	Romania	Aggressive against humans and owner	< 1 Month
Dog 13	German shepherd mix	2 Years	Female (neutered)	Unknown	Seized by the Police	< 1 Month
Dog 14	German shepherd mix	2 Years	Female (neutered)	Unknown	Seized by the Police	< 1 Month
Dog 15	Shepherd mix	5 Years	Female (neutered)	Holland	Aggressive against humans and owner	3 Years
Dog 16	Labrador mix	5 Years	Male (neutered)	Unknown	Aggressive against humans and owner	2 Years
Dog 17	American-Staffordshire Pit Bull terrier mix	2 Years	Male (neutered)	Unknown	Seized by the Police	1 Year
Dog 18	Caucasian Ovcharka	> 9 Years	Male	Unknown	Owner didn´t wanted anymore	< 1 Month
Dog	German shepherd	5 Years	Male	Unknown	Owner didn´t wanted	< 1 Month

19					anymore	
Dog 20	Labrador mix	5 Years	Male (neutered)	Unknown	Other Shelter	3 Years

Table **B** - Overview about each dogs permanence in the group housing.

Dog	**Day entered the group**	**Total of days in the Group during the 28 days of filming**	**Frequency**	**Left or staid during the video sessions**	**Reason for the exit**	**Re-entered the group during the video sessions**
Dog 1	Was already in	28	Permanent	Never left	---	---
Dog 2	Entered at the 3rd day of filming	26	Permanent	Never left	---	---
Dog 3	Entered at the 1st day of filming	28	Depending on the weather	Left at the 1st of February	Went for a walk with a potential owner	Yes at the 2nd of February
				Left at the 10th of February	Went to the Vet	Yes at the 11th of February
Dog 4	Entered at the 2nd day of filming	27	Permanent	Never left	---	---

Dog 5	Was already in	24	Sleeps at home	Left at the 13-14th and 27-28th of February	Owners day off	Yes
Dog 6	Was already in	24	Sleeps at home	Left at the 1st of February	Went to the Vet	Yes at the 2nd of February
				Left at the 13-14th and 27-28th of February	Owners day off	Yes
				Left at the 20th of February	Went to the Vet	Yes at the 21st of February
Dog 7	Was already in	2	Permanent	Left at the 2nd of February	Transfer in another Shelter	No
Dog 8	Entered at the 1st day of filming	4	Permanent	Left at the 4th of February	Illness	No
Dog 9	Entered at the 3rd day of filming	1	Sleeps inside	Left at the 3rd of February	Harassed by another dog	No
Dog 10	Entered at the 2nd day of filming	8	Sleeps inside	Left at the 9th of February	Illness	No

Dog 11	Entered at the 5th day of filming	24	Permanent	Never left	---	---
Dog 12	Entered at the 5th day of filming	23	Permanent	Left at the 20th of February	Went to the Vet/on a walk with potential owners	Yes at the 22nd of February
Dog 13	Entered at the 5th day of filming	2	Permanent	Left at the 6th of February	Adopted	No
Dog 14	Entered at the 5th day of filming	7	Permanent	Left at the 11th of February	Adopted	No
Dog 15	Entered at the 1st day of filming	18	Sleeps inside and is sometimes single housed	Left at the 2nd of February	Went to the Vet/on a walk with potential owners/another type of housing (single)	Yes at the 5th of February
				Left at the 7th of February	Went to the Vet/on a walk with potential owners/another type of housing (single)	Yes at the 10th of February
				Left at the 10th of February	Went to the Vet/on a walk with potential owners/another type of housing (single)	Yes at the 12th of February

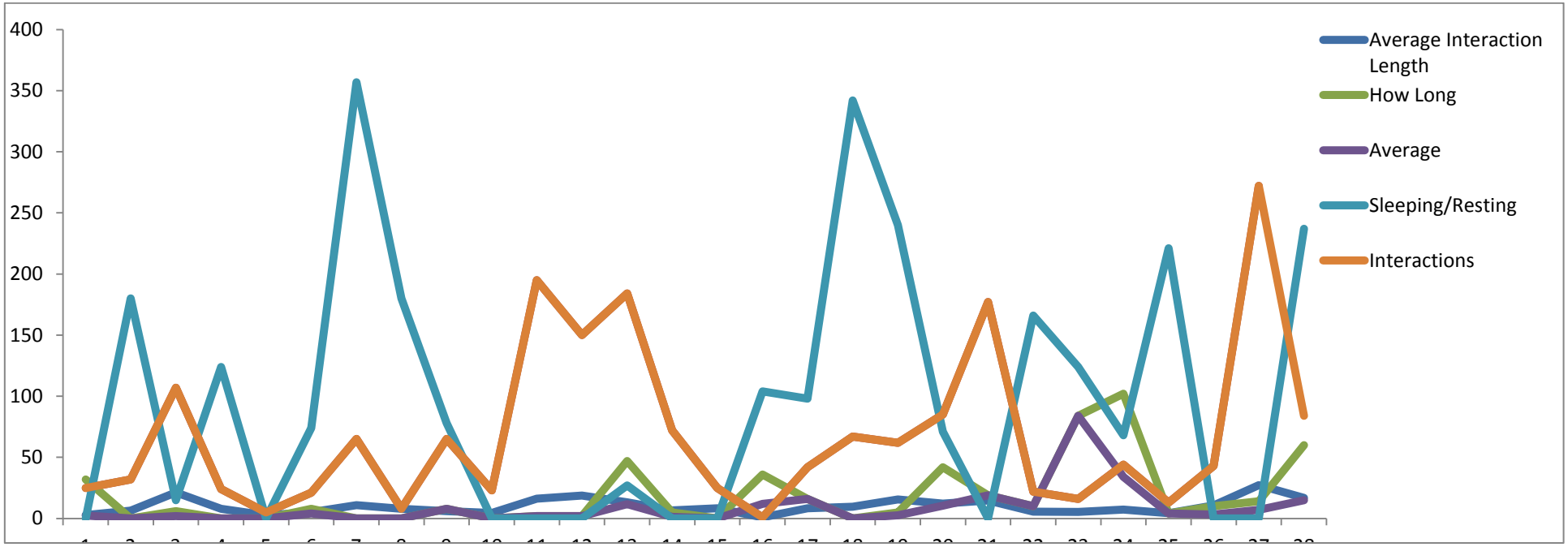
				Left at the 15th of February	Went to the Vet/on a walk with potential owners/another type of housing (single)	Yes at the 19th of February
				Left at the 20th of February	Went to the Vet/on a walk with potential owners/another type of housing (single)	Yes at the 22nd of February
				Left at the 22nd of February	Went to the Vet/on a walk with potential owners/another type of housing (single)	Yes at the 24th of February
Dog 16	Entered at the 12th day of filming	2	Sleeps inside	Left at the 13th of February	Other type of Housing	No
Dog 17	Entered at the 12th day of filming	2	Sleeps inside	Left at the 13th of February	Other type of Housing	No
Dog 18	Entered at the 19th day of filming	7	Sleeps inside	Left at the 25th of February	Harassed by another dog	No
Dog 19	Entered at the 22nd day of filming	6	Sleeps inside	Left at the 23rd of February	Illness	Yes at the 25th of February

Dog 20	Entered at the 24th day of filming	1	Sleeps inside	Left at the 24th of February	Illness	No

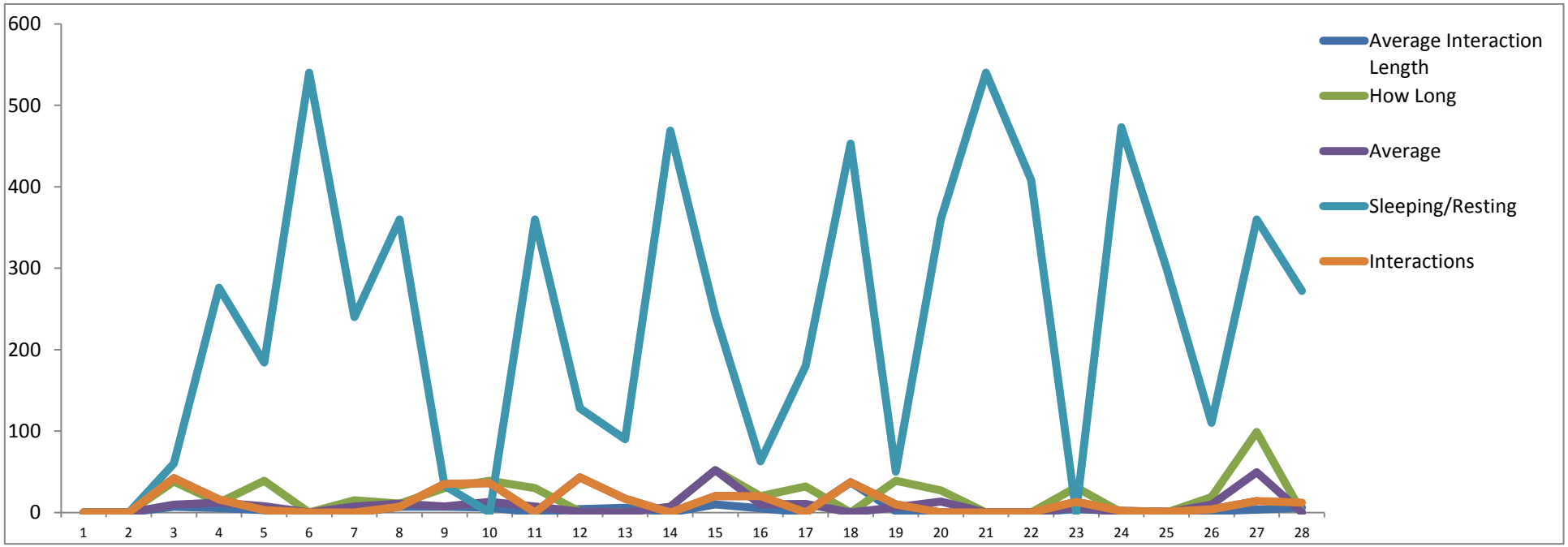
Appendix 2

9.1Activity levels from each one of the six focus dogs, during the 28 days.

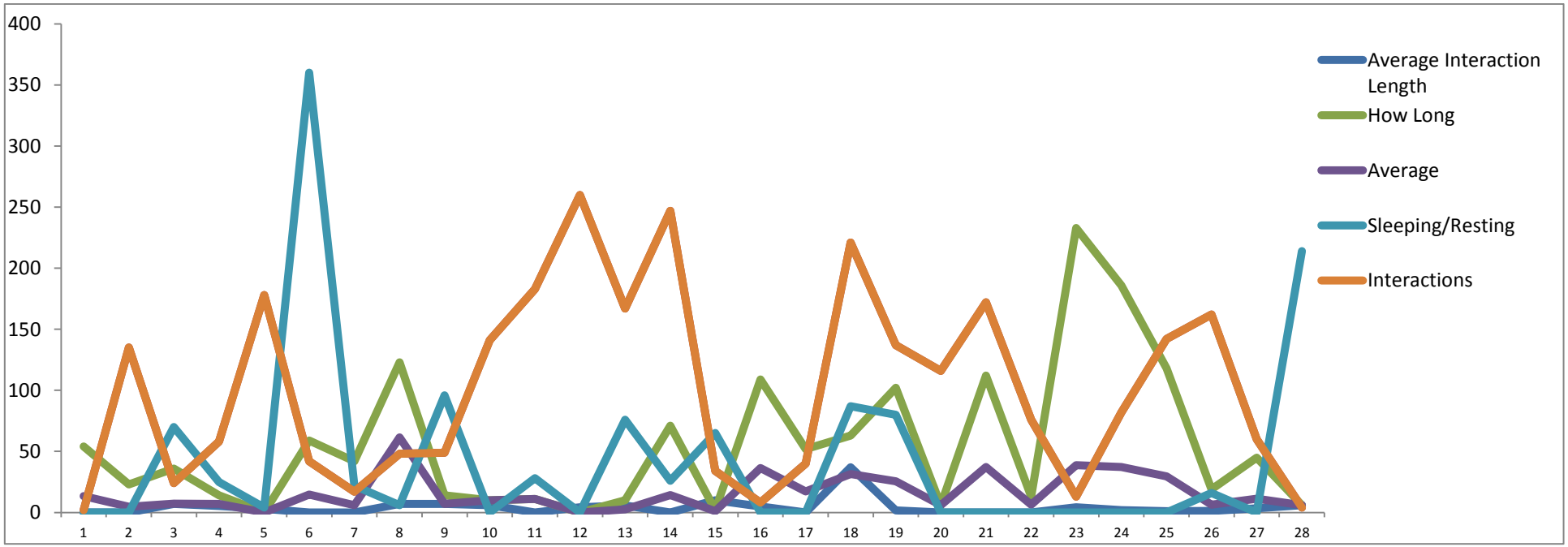
Graphic A – Regarding dog 1: Number of interactions with other dogs (Interactions - orange), average interactions length with other dogs (Average Interaction Length - dark blue). Time in seconds, spend interacting with humans (How long – green), average between the number of interactions with humans and the interactions length with humans (Average – purple) and time spend sleeping or resting (Sleeping/resting – blue), during the 28 days of filming.



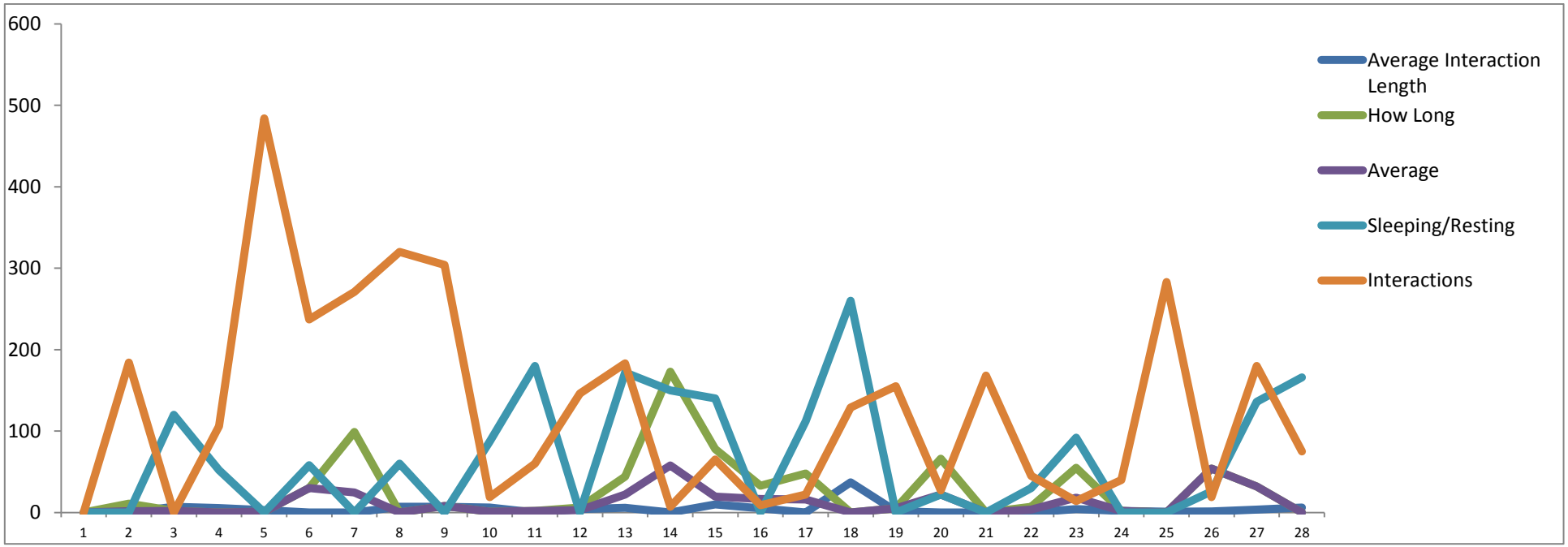
Graphic B – Regarding dog 2: Number of interactions with other dogs (Interactions - orange), average interactions length with other dogs (Average Interaction Length - dark blue). Time in seconds, spend interacting with humans (How long – green), average between the number of interactions with humans and the interactions length with humans (Average – purple) and time spend sleeping or resting (Sleeping/resting – blue), during the 28 days of filming.



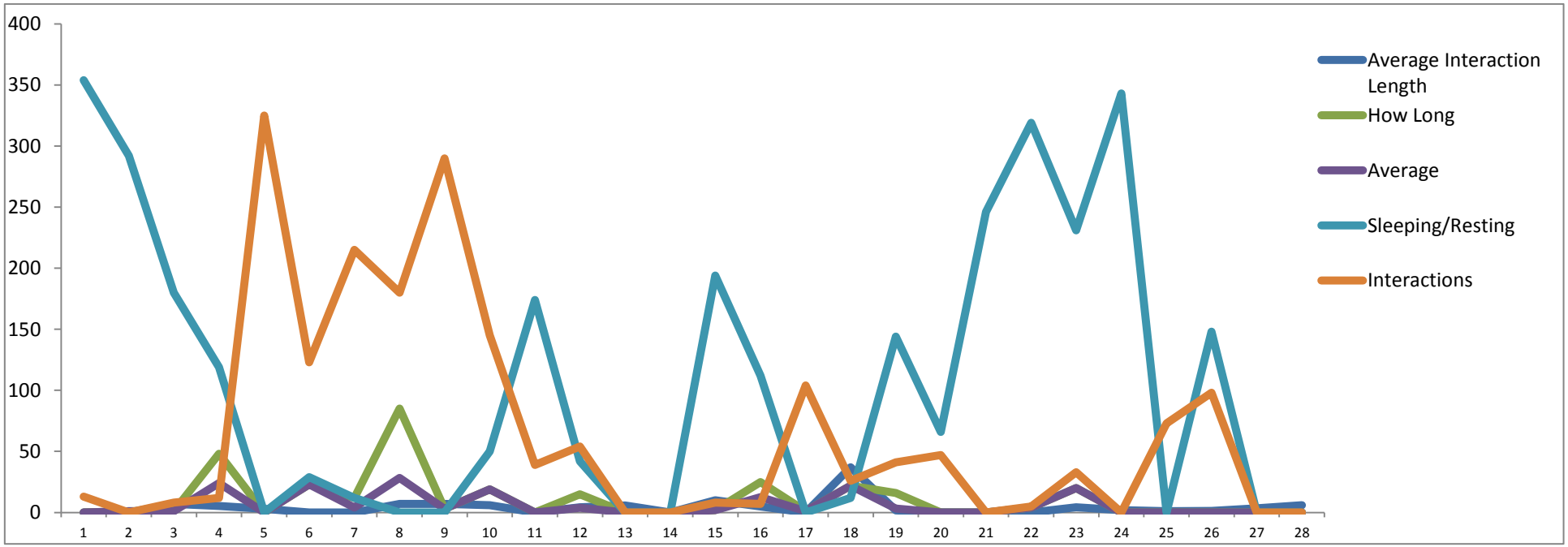
Graphic C – Regarding dog 3: Number of interactions with other dogs (Interactions - orange), average interactions length with other dogs (Average Interaction Length - dark blue). Time in seconds, spend interacting with humans (How long – green), average between the number of interactions with humans and the interactions length with humans (Average – purple) and time spend sleeping or resting (Sleeping/resting – blue), during the 28 days of filming.



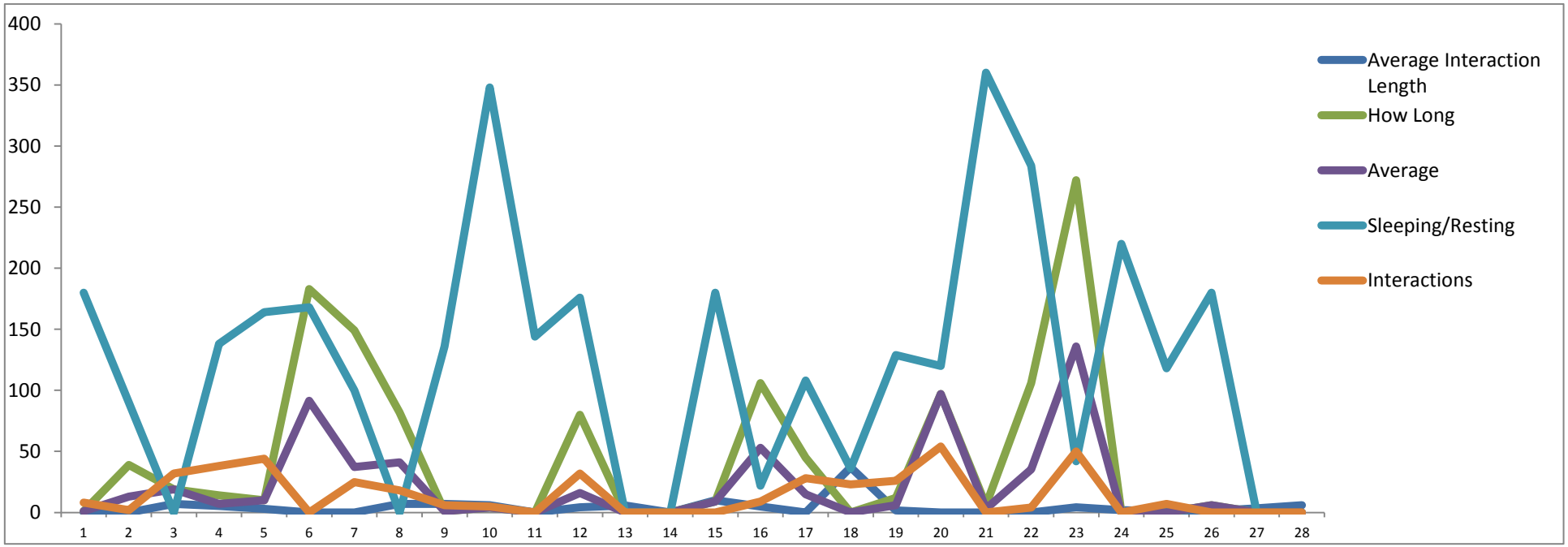
Graphic D – Regarding dog 4: Number of interactions with other dogs (Interactions - orange), average interactions length with other dogs (Average Interaction Length - dark blue). Time in seconds, spend interacting with humans (How long – green), average between the number of interactions with humans and the interactions length with humans (Average – purple) and time spend sleeping or resting (Sleeping/resting – blue), during the 28 days of filming.



Graphic E – Regarding dog 5: Number of interactions with other dogs (Interactions - orange), average interactions length with other dogs (Average Interaction Length - dark blue). Time in seconds, spend interacting with humans (How long – green), average between the number of interactions with humans and the interactions length with humans (Average – purple) and time spend sleeping or resting (Sleeping/resting – blue), during the 28 days of filming.

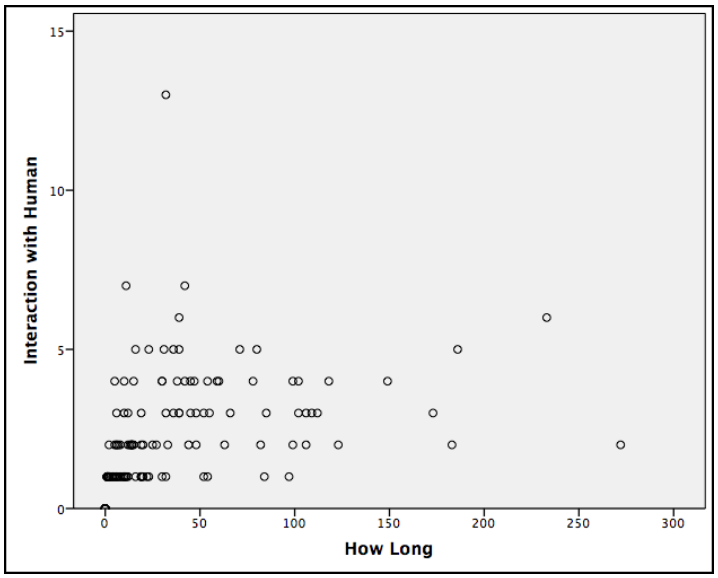


Graphic F – Regarding dog 6: Number of interactions with other dogs (Interactions - orange), average interactions length with other dogs (Average Interaction Length - dark blue). Time in seconds, spend interacting with humans (How long – green), average between the number of interactions with humans and the interactions length with humans (Average – purple) and time spend sleeping or resting (Sleeping/resting – blue), during the 28 days of filming.

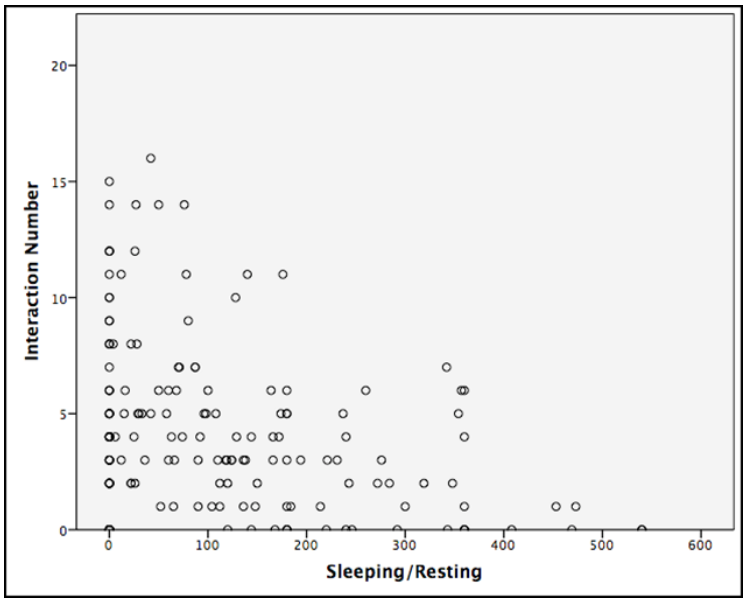


9.2 Evaluation of the dog-human interaction number, length and average length of interactions, for each dog during the 28 days and the comparison with the time spent sleeping or resting.

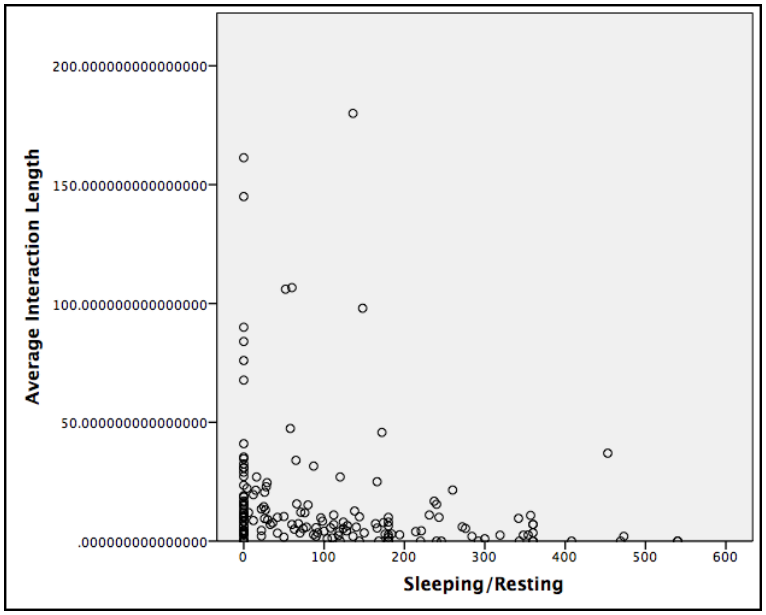
Graph G – Scatterplot of the correlation between the number of interactions with humans and how long they lasted.



Graph H - Scatterplot presenting the relation between the number of interactions and the time spent sleeping or resting.



Graph I – Scatterplot of the link between the average duration of interactions and the time spent sleeping or resting.



9.3 Test situations:

a) At the Fence - Confrontation between the focus dog with another dog behind a fence.

The table below summarizes the various behaviours shown by the focus dogs (all focus dogs combined) behind a fence, and the differences between group and single housed dogs (reaction of six single housed dogs combined). The Fishers exact test accesses if there is a relationship between displaying certain behaviours and the type of housing.

At the fence		Did not show this behaviour	Displayed behaviour	p-value (Fishers Exact Test)
Social Approach Behaviour	Group Housed	1	5	0.999
	Single Housed	1	5	
Active Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Imposing Behaviour	Group Housed	5	1	0.080
	Single Housed	1	5	
Passive Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Threats	Group Housed	6	0	0.060
	Single Housed	2	4	
Inhibited Offensive Behaviour	Group Housed	6	0	0.990
	Single Housed	6	0	
Uninhibited Offensive Behaviour	Group Housed	6	0	0.99
	Single Housed	6	0	
Flight/Leaving	Group Housed	2	4	0.567
	Single Housed	4	2	
Behaviour for De-escalation	Group Housed	0	6	0.990
	Single Housed	1	5	
Play Behaviour	Group Housed	6	0	0.990
	Single Housed	5	1	
Stress Behaviour	Group Housed	3	3	0.545
	Single Housed	1	5	
Fear	Group Housed	6	0	0.990
	Single Housed	6	0	

There was no significant relationship between behaviour and type of housing shown by the dogs behind a fence

b) Alone - The dog got isolated from the caretakers or handlers, was tied up to a fence and a dog of the same sex walked by.

The table below summarizes the various behaviours shown by the focus dogs (all focus dogs combined) when alone and a same sex dog walked by, and the differences between group and single housed dogs (reaction of six single housed dogs combined). The Fishers exact test accesses if there is a relationship between displaying certain behaviours and the type of housing.

Alone (same sex dog walking on the leash)		Did not show this behaviour	Displayed behaviour	p-value (Fishers Exact Test)
Social Approach Behaviour	Group Housed	0	6	0.990
	Single Housed	0	6	
Active Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Imposing Behaviour	Group Housed	1	5	0.080
	Single Housed	5	1	
Passive Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Threats	Group Housed	4	2	0.990
	Single Housed	5	1	
Inhibited Offensive Behavio	Group Housed	6	0	0.990
	Single Housed	6	0	
Uninhibited Offensive Beha	Group Housed	6	0	0.990
	Single Housed	6	0	
Flight/Leaving	Group Housed	5	1	0.990
	Single Housed	5	1	
Behaviour for De-escalation	Group Housed	1	5	0.990
	Single Housed	0	6	
Play Behaviour	Group Housed	6	0	0.990
	Single Housed	6	0	
Stress Behaviour	Group Housed	3	3	0.545
	Single Housed	1	5	
Fear	Group Housed	6	0	0.990
	Single Housed	5	1	

There was no significant relationship between behaviour and type of housing for dogs who are alone while a same sex dog walked by

c) Female walking on leash – A female dog walked by.

The table below summarizes the various behaviours shown by the focus dogs (all focus dogs combined) when a female dog walked by and the differences between group and single housed dogs (reaction of six single housed dogs combined). The Fishers exact test accesses if there is a relationship between displaying certain behaviours and the type of housing.

Female walking on leash		Did not show this behaviour	Displayed behaviour	p-value (Fishers Exact Test)
Social Approach Behaviour	Group Housed	2	4	0.990
	Single Housed	1	5	
Active Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Imposing Behaviour	Group Housed	2	4	0.990
	Single Housed	2	4	
Passive Submission	Group Housed	4	2	0.990
	Single Housed	5	1	
Threats	Group Housed	5	1	0.990
	Single Housed	5	1	
Inhibited Offensive Behavio	Group Housed	5	1	0.990
	Single Housed	6	0	
Uninhibited Offensive Beha	Group Housed	6	0	0.990
	Single Housed	6	0	
Flight/Leaving	Group Housed	3	3	0.990
	Single Housed	3	3	
Behaviour for De-escalatior	Group Housed	1	5	0.990
	Single Housed	0	6	
Play Behaviour	Group Housed	5	1	0.990
	Single Housed	5	1	
Stress Behaviour	Group Housed	2	4	0.455
	Single Housed	0	6	
Fear	Group Housed	5	1	0.990
	Single Housed	5	1	

There was no significant relationship between behaviour and type of housing for dogs when a female dog walked by

d) Male walking on leash – A male dog walked by.

The table below summarizes the various behaviours shown by the focus dogs (all focus dogs combined) when a male dog walked by and the differences between group and single housed dogs (reaction of six single housed dogs combined). The Fishers exact test accesses if there is a relationship between displaying certain behaviours and the type of housing.

Male walking on leash		Did not show this behaviour	Displayed behaviour	p-value (Fishers Exact Test)
Social Approach Behaviour	Group Housed	1	5	0.303
	Single Housed	3	3	
Active Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Imposing Behaviour	Group Housed	2	4	0.242
	Single Housed	5	1	
Passive Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Threats	Group Housed	5	1	0.990
	Single Housed	5	1	
Inhibited Offensive Behavio	Group Housed	6	0	0.990
	Single Housed	6	0	
Uninhibited Offensive Beha	Group Housed	6	0	0.990
	Single Housed	6	0	
Flight/Leaving	Group Housed	2	4	0.621
	Single Housed	3	3	
Behaviour for De-escalatior	Group Housed	2	4	0.990
	Single Housed	1	5	
Play Behaviour	Group Housed	6	0	0.990
	Single Housed	5	1	
Stress Behaviour	Group Housed	5	1	0.080
	Single Housed	1	5	
Fear	Group Housed	6	0	0.990
	Single Housed	6	0	

There was no significant relationship between behaviour and type of housing for dogs when a male dog walked by

e) Same sex dog walking on leash (stumbling) – A same sex dog walks by and the caretaker stumbles on the way.

The table below summarizes the various behaviours shown by the focus dogs (all focus dogs combined) when a same sex dog walks by and there is a tumble shown by the caretaker and the differences between group and single housed dogs (reaction of six single housed dogs combined). The Fishers exact test accesses if there is a relationship between displaying certain behaviours and the type of housing.

Same sex dog walking on leash (Stumbling)		Did not show this behaviour	Displayed behaviour	p-value (Fishers Exact Test)
Social Approach Behaviour	Group Housed	2	4	0.990
	Single Housed	2	4	
Active Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Imposing Behaviour	Group Housed	4	2	0.990
	Single Housed	4	2	
Passive Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Threats	Group Housed	5	1	0.990
	Single Housed	5	1	
Inhibited Offensive Behavio	Group Housed	6	0	0.990
	Single Housed	6	0	
Uninhibited Offensive Beha	Group Housed	6	0	0.990
	Single Housed	6	0	
Flight/Leaving	Group Housed	2	4	0.567
	Single Housed	4	2	
Behaviour for De-escalation	Group Housed	2	4	0.990
	Single Housed	1	5	
Play Behaviour	Group Housed	6	0	0.990
	Single Housed	5	1	
Stress Behaviour	Group Housed	0	6	0.990
	Single Housed	1	5	
Fear	Group Housed	5	1	0.990
	Single Housed	4	2	

There was no significant relationship between behaviour and type of housing for dogs when a same sex dog walked by while the caretaker stumbled).

Test situations with humans

a) **Approaching/petting -** A person approaches the dog while talking to him/her and tries to stroke the dog.

The table below summarizes the various behaviours shown by the focus dogs (all focus dogs combined) when approached by a human with the attempt to stroke and the differences between group and single housed dogs (reaction of six single housed dogs combined). The Fishers exact test accesses if there is a relationship between displaying certain behaviours and the type of housing.

Approaching/petting		Did not show this behaviour	Displayed behaviour	p-value (Fishers Exact Test)
Social Approach Behaviour	Group Housed	1	5	0.990
	Single Housed	1	5	
Active Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Imposing Behaviour	Group Housed	4	2	0.621
	Single Housed	3	3	
Passive Submission	Group Housed	4	2	0.990
	Single Housed	5	1	
Threats	Group Housed	5	1	0.990
	Single Housed	5	1	
Inhibited Offensive Behavio	Group Housed	6	0	0.990
	Single Housed	5	1	
Uninhibited Offensive Beha	Group Housed	5	1	0.990
	Single Housed	5	1	
Flight/Leaving	Group Housed	5	1	0.990
	Single Housed	5	1	
Behaviour for De-escalation	Group Housed	3	3	0.990
	Single Housed	2	4	
Play Behaviour	Group Housed	6	0	0.990
	Single Housed	6	0	
Stress Behaviour	Group Housed	6	2	0.242
	Single Housed	1	5	
Fear	Group Housed	5	1	0.990
	Single Housed	6	0	

There was no significant relationship between behaviour and type of housing for dogs shown when approached by a human with the attempt to stroke

b) **Staring -** A person approaches the dog silently from the front and stares at him/her.

The table below summarizes the various behaviours shown by the focus dogs (all focus dogs combined) when approached by a person who stares at him/her and the differences between group and single housed dogs (reaction of six single housed dogs combined). The Fishers exact test accesses if there is a relationship between displaying certain behaviours and the type of housing.

Staring		Did not show this behaviour	Displayed behaviour	p-value (Fishers Exact Test)
Social Approach Behaviour	Group Housed	0	6	0.990
	Single Housed	1	5	
Active Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Imposing Behaviour	Group Housed	4	2	0.990
	Single Housed	5	1	
Passive Submission	Group Housed	5	1	0.990
	Single Housed	6	0	
Threats	Group Housed	4	2	0.990
	Single Housed	4	2	
Inhibited Offensive Behavio	Group Housed	6	0	0.990
	Single Housed	6	0	
Uninhibited Offensive Beha	Group Housed	6	0	0.990
	Single Housed	6	0	
Flight/Leaving	Group Housed	3	3	0.545
	Single Housed	5	1	
Behaviour for De-escalation	Group Housed	0	6	0.990
	Single Housed	0	6	
Play Behaviour	Group Housed	5	1	0.990
	Single Housed	5	1	
Stress Behaviour	Group Housed	2	4	0.990
	Single Housed	2	4	
Fear	Group Housed	6	0	0.990
	Single Housed	6	0	

There was no significant relationship between behaviour and type of housing for dogs when approached by a person who stares at him/her

c) **Stumbling -** A person stumbles, while passing in front of the dog at 1.5 meters distance.

The table below summarizes the various behaviours shown by the focus dogs (all focus dogs combined) when a person passes in front of the dog and stumbles and the differences between group and single housed dogs (reaction of six single housed dogs combined). The Fishers exact test accesses if there is a relationship between displaying certain behaviours and the type of housing.

Stumbling		Did not show this behaviour	Displayed behaviour	p-value (Fishers Exact Test)
Social Approach Behaviour	Group Housed	1	5	0.990
	Single Housed	2	4	
Active Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Imposing Behaviour	Group Housed	3	3	0.990
	Single Housed	3	3	
Passive Submission	Group Housed	6	0	0.990
	Single Housed	6	0	
Threats	Group Housed	4	2	0.990
	Single Housed	5	1	
Inhibited Offensive Behavio	Group Housed	6	0	0.990
	Single Housed	6	0	
Uninhibited Offensive Beha	Group Housed	6	0	0.990
	Single Housed	6	0	
Flight/Leaving	Group Housed	6	0	0.990
	Single Housed	6	0	
Behaviour for De-escalation	Group Housed	6	0	0.015
	Single Housed	1	5	
Play Behaviour	Group Housed	6	0	0.990
	Single Housed	6	0	
Stress Behaviour	Group Housed	2	4	0.990
	Single Housed	1	5	
Fear	Group Housed	6	0	0.990
	Single Housed	6	0	

There was a significant relationship between behaviour for de-escalation and type of housing for dogs when a person passes in front of the dog and stumbles ($p < 0.05$)