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Animal appeal: features underlying children's attraction to animals

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“*A tadpole is not simply an unformed frog, and we should endeavor to understand the experiences and needs of children within the social and cognitive environment to which they are uniquely adapted. If interactions with animals are as attractive and important to children as they appear to be, then it is the height of adult arrogance to assume that child-animal relations are somehow irrelevant to normal development*”

James Serpell, 1999, Animals in Children's Lives, p.92

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ABSTRACT

A growing body of evidence suggests that interacting with animals, owning a pet, as well as animal-based educational programs, have several benefits on children’s emotional and social development. In the context of the Biophilia framework it has been stated that humans possess a predisposition to be attracted by other species and several studies have shown animals to be powerful stimuli able to elicit positive responses, such an increase in attention, social behaviours and positive affect, even in children with social impairments. However, while research efforts have been dedicated to empirically confirm human ‘biophilic’ (and/or ‘biophobic’) predisposition and its emergence during development, very little attention has been paid to the identification of specific animal characteristics underpinning distinct behavioural responses in humans, particularly in children. The perception of certain similarities to human beings, the predictability of the behaviour, as well as the infantile appearance, appear to be the best candidates to form positive attitudes towards animals and to evoke affiliative responses, such as nurturing behaviour. However, previous research, including analyses on human attraction to certain animal features, did not consider children younger than 6 years. **The general aim** of the work presented in this thesis was to analyze both attitudes (i.e. preferences) and behavioural responses (i.e. gaze behaviour) towards animal stimuli presenting differential morphological characteristics (different animal species and animals with specific facial features) in 3-6 years old children, a population usually not addressed in the literature. In particular, in **Chapter 2**, we report about the impact of species’ philogenetic closeness to humans and domesticity in animal-related attitudes forming, while in **Chapter 3** we show the effect of the presence of an infantile facial configuration (i.e. baby schema) on children’s perception of some animals, specifically of the most common pet animals (dogs and cats). Both these studies relied on the assessment of children’s explicit preferences for photographic stimuli depicting animals. **Chapter 4** describes research in which a standardized set of stimuli and eye-tracking technologies were employed as a tool to deepen our knowledge of human perception of animals and to evidence the basic mechanism underlying motivation and preference. Both indirect (i.e. cuteness rating) and direct (i.e. visual attention) measures of preference show that the incentive salience of infantile traits might be a causal factor behind human attraction to animals, especially pets. However, the appeal of infantile features only partially explains why some animals have a powerful hold over human perception. Analyses of the effects of factors such as gender, age, pet ownership - described in **Chapter 2, 3 and 4** - highlight the importance of human individual factors in modulating preferences towards animals and attitudes’ forming. **Results are discussed** considering the impact of this knowledge for different disciplines, such as environmental psychology, education and animal welfare, as well as for therapeutic and recreational programs.

CHAPTER 1

Cirulli F., **Borgi M.**, Berry A., Francia N., Alleva E. (2011). Animal-Assisted-Interventions as innovative tools for mental health. *Ann Ist Super Sanità*, 47(4): 341-348.

Berry A., **Borgi M.**, Francia N., Alleva E., Cirulli F. (2013). Use of assistance and therapy dogs for children with Autism Spectrum Disorders: a critical review of the current evidence, *J Altern Complement Med*, 19(2): 73-80.

1. GENERAL INTRODUCTION

1.1. THE ANIMAL APPEAL: FEATURES UNDERLYING HUMAN ATTRACTION TO ANIMALS

It has been hypothesized that humans exhibit a natural interest and attraction to other species and their activities (the so-called *Biophilia Hypothesis*, Wilson, 1984). In the context of Wilson' theory (1984), the human need and propensity to focus on and to affiliate with animals ('Biophilia'), as well as its counterpart (negative attitudes towards some animals, or 'Biophobia'), have been depicted as biological tendencies (Wilson, 1984; Kellert, 1993a). Although the existence of a genetic predisposition to be attracted by different aspects of the natural world, including animals, has so far had limited empirical support, Biophilia theory may represent a valuable framework for investigating the human affiliation with animals and to chart ontogenetic course (Kahn, 1997).

A general proneness towards animals seems to emerge from early childhood onward: infants as young as 4 months show an overall preference (i.e., look more and show more positive emotional responses) for animal over inanimate stimuli (DeLoache et al., 2011; Lobue et al., 2012). Even in subjects with a deficit in the social domain (i.e. children diagnosed with autism spectrum disorders, ASD) such a preference for animal forms has been shown (Celani, 2002; Prothmann et al., 2009), as well as an increase in social behaviours in the presence of animals compared to toys (O'Haire et al., 2013).

Human proneness towards animals and love for them is confirmed by the observation of the willingness to take care of - and to invest resources on - pets in an ever-increasing numbers of people all around the world (Serpell, 1996; Herzog, 2011). At an early age children come to care for a wide range of animals and it was also shown that the vast majority of children, if they do not already own a pet, express a desire to have one (Salomon, 1981; Kidd and Kidd, 1985; Pagani et al., 2007). For many people relationships with animals present several similarities with the bonds they form with other human beings. Many owners feel that their pet is a member of the family and treat it as such (e.g. speak to it) (Serpell, 1996; Wells, 2009).

Why animals constitute such an attractive stimulus for humans is not clear. In general terms, their biological characteristics such as motion or sensory properties, as well as human perception of their ability to perceive, learn and think, makes them particularly appealing in comparison with inanimate stimuli. Some authors have stated that the affinity of people for pets may come from animal's multisensory characteristic and from the simple and interpretable pattern of movements characterizing animals such as dogs that might facilitate the engagement of people (especially in the case of children with ASD) in structurally simple social actions that do not require the interpretation of verbal cues and are highly repeatable and predictable (Redefer and Goodman, 1989; Sams et al., 2006; Solomon, 2010).

However, despite the common practice of pet-keeping in western societies and the widespread human attitude to develop intense, close relationships with animals, little is known about how humans (both typical and atypical population) perceive animals. While research efforts have been dedicated to empirically confirm human ‘biophilic’ (or ‘biophobic’) predisposition and its emergence during development, very little attention has been paid to the identification of specific animal characteristics able to influence our attraction to animals (and ultimately our affiliative response towards them). More research is thus needed to explore animal features and traits underpinning distinct behavioural responses in humans, particularly in children.

Preliminary studies aimed to compare children’s behaviour towards robotic, stuffed and real animals suggest that differences in animal features (such as their animacy, size, texture and speed movements) can impact upon children’s emotional response and their willingness to engage in social interactions (Kerepesi et al., 2006; Ribi et al., 2008; Howard and Vick, 2010). Unique behavioural responses to each type of animal were observed in kindergarten children interacting with a live tarantula, a cockatiel, a rabbit, and a dog, with differential reactions to each animal being independent of the ages and genders of the children (Nielson and Delude, 1989).

Nonetheless, the existence of a huge amount of different and variegated animal forms makes difficult to assess how the general appearance (and/or some specific morphological characteristics) of animals is able to elicit distinct behavioural responses in children. Hence, where behavioural information is either unavailable or inaccessible, it is necessary to rely on more easily measured correlates of behaviour, such as attitudes and preferences.

Like most other human attitudes, the reason why people like some animals while disliking others is an extremely complex issue, involving a multitude of evolutionary, psychological and cultural aspects (Serpell, 2004). It is evident that the enormous variance in people’s attitudes towards animals depends on a range of factors, including intercultural differences and individual human attributes, such as gender, age, educational level, exposure to animals, pet ownership (Kellert, 1980; Serpell, 2004).

However, even not considering this variance, people’s proneness towards and consideration of animal species greatly vary depending on some attributes intrinsic to the animal itself (Serpell, 2004). Animal physical appearance was shown to be a salient factor underlying human attitudes towards some species. Among others, animal attributes that have been most consistently shown to affect human preferences and attitudes are anthropomorphic features, large size, neotenic (juvenile) traits, shape, and color (Serpell, 2004).

In the next two sections, the analysis of the influence of some of these factors will be deepened through the exploration of those animal attributes that are the best candidates to explain human attraction to some species and animals' ability to evoke social responses and positive affect (and their counterpart, i.e. negative attitudes). In particular, the effect of animal similarity to humans and species' utility on animal-related attitudes in humans will be explored, as well as the effect of animal infant-like traits on human preferences for and attraction to some species such as dogs and cats.

1.1.1. Similarity to humans and utility

The modalities with which humans perceive and respond to animals are consequence of different interacting variables. Serpell (2004) summarized the results of several investigations regarding this topic proposing a motivational framework based on two primary dimensions: affection and sympathy (i.e. people's affective and emotional responses to non-human species), and utility (i.e. people's perception of the species' instrumental value). Animals (mostly domestic) that are recognized as useful or beneficial to humans are generally regarded more positively than species that are less useful, or damaging or that pose threats or health hazards. For example, humans tend to avoid predators that may pose a serious threat to them and in general fear-relevant animals or animals that are associated with diseases, such as invertebrates or mice (but see exceptions, Serpell, 1996; Serpell, 2004; Herzog, 2011).

However, considerations on why some animals evoke sympathy and affect, while other do not, are complex and should take into account the large influence of both physical and behavioural characteristics of the various species on human perception. A substantial body of literature on attitudes and likeness of non-human species has shown that people are particularly attracted to animals that they perceived as more human-like: species close phylogenetically to humans (e.g. apes, monkeys) or that are physically, behaviorally or cognitively similar to them (e.g. penguins, dogs, dolphins, charismatic megafauna) tend to be preferred, evoke more positive affect, as well as higher concern in term of welfare and conservation (Driscoll, 1992 ; Kellert, 1993b; Plous, 1993; Gunnthorsdottir, 2001; Serpell, 2004; Knight, 2008). By contrast, humans show negative attitudes towards animals considered phylogenetically distant or dissimilar (e.g. reptiles, fishes, invertebrates) (Kellert, 1993b; Bjerke et al., 1998; Woods, 2000; Bjerke and Ostdahl, 2004; Prokop et al., 2010; Wagler, 2010). People's knowledge of species can influence attitudes, however scientific considerations appear relatively much less important than anthropomorphic (phylogenetic) and anthropocentric (utilitarian) factors in determining human attitudes towards animals (Martín-López et al., 2007).

The examination of the different factors influencing human propensity to affiliate with some species has attracted the attention of researchers from different disciplines, in particular the empirically-established fact that some animals are favored while other are disfavored, is a matter of concern to the field of animal welfare, as well as to conservation biology (Plous, 1993; Czech et al., 1998; Gunnthorsdottir, 2001; Serpell, 2004; Tisdell et al., 2005; Kaltenborn et al., 2006; Tisdell et al., 2006; Martín-López et al., 2007; Knight, 2008; Batt, 2009). This interest has led to a great number of reports on human species' preferences and willingness to support some animals (in terms of conservation and/or animal use) from many countries. Most of these analyses are focused only on adult subjects. Hence, whether the foundations for attitudes towards animals are laid during early childhood and to what degree preferences and attitudes typology change with age and experience is still largely unknown.

Previous studies have shown that in children and adolescents a preference for familiar species (such as domestic animals) over wild species is already present, as well as a negative orientation towards invertebrates and fear-relevant animals (Bjerke et al., 1998; Prokop and Tunnicliffe, 2008; Randler et al., 2012). Girls show to be less favourably inclined than boys to animals associated with fear and disgust and in general to animals that may pose a threat, danger, or disease to them (Prokop and Tunnicliffe, 2010; Randler et al., 2012). Moreover, girls appear to be more pet-oriented, while boys show a greater preference for wild animals than girls (Bjerke et al., 1998).

In general terms, it seems that interest in animals and the liking of animal species is reduced with increasing age (Bjerke et al., 1998; Bjerke et al., 2001; Pagani et al., 2007; Prokop and Kubiatko, 2008; Prokop and Tunnicliffe, 2008). However, it should be taken into account that most of this information refers to attitudes and species preferences shown by children and adolescent ranging in age from 9 to 15 years. The vast majority of studies on attitudes to animals and the liking of different species do not consider children younger than 6 years. In fact, attitude assessment typically relies on the use of the questionnaire survey (e.g. level of agreement or disagreement with attitude statements on Likert rating scales or open-ended interviews) and these approaches are not easy to apply in developmental studies, especially when participants are very young. Indeed, in-depth examinations of attitudes towards animals in very young children are needed since they may evidence specific trends and help elucidating the trajectories of attitudes' forming.

1.1.1. Baby schema and the 'Cute effect'

In the literature it is claimed that humans tend to prefer animals that they perceived as aesthetically appealing or 'cute' (Gould, 1979; Woods, 2000; Gunnthorsdottir, 2001; Stokes, 2007; Knight, 2008; Archer and Monton, 2011; Herzog, 2011; Lišková and Frynta, 2013). Cuteness is often used as a measure indicative of attractiveness to a stimulus commonly associated with infancy and youth. The term was conceptualized in the Konrad Lorenz's notion of *Kindchenschema* (or *baby schema*) and first described by the ethologist as a set of facial features (i.e. large head and a round face, a high and protruding forehead, large eyes, and a small nose and mouth) able to trigger an innate releasing mechanism for caregiving and affective orientation towards infants (Lorenz, 1943). More recently, several empirical studies have shown that faces with these traits are commonly perceived as cute and attractive and are consistently preferred to those with a less infantile facial configuration (Fullard and Reiling, 1976; Sternglanz et al., 1977; Hildebrandt and Fitzgerald, 1979; Alley, 1981; Sanefuji et al., 2007; Glocker et al., 2009a; Lobmaier et al., 2010; Luo et al., 2011; Little, 2012).

The concept of cuteness not only encompasses the processing of specific morphological features, but also involves a positive/affectionate behavioural response. Increased attention and willingness to care, positive affect and protective behaviour, as well as decreased likelihood of aggression towards the infant, characterize the so-called *baby schema response* or *cute response* (Lorenz, 1943; Alley, 1983; Brosch et al., 2007; Glocker et al., 2009a; Sherman et al., 2009; Nittono et al., 2012). Recent findings on the neural basis of the baby schema response, and its extension beyond the mother-infant relationship context, may explain why we feel the urge to care for anything that resembles a baby. Using functional magnetic resonance imaging, it has been found that the baby schema activates a key structure of the mesocorticolimbic system mediating reward processing, suggesting its role in providing motivational drive to caretaking behaviour (Glocker et al., 2009b). In species whose young completely depend on their caregivers for sustenance and protection, such response has a clear adaptive value, contributing to enhance offspring chances of survival (Lorenz, 1943) and helping mothers to focus on newborns and modulating attachment (Sprengelmeyer et al., 2009).

It is well known that some animals, such as the most common pet species (i.e., dogs and cats), exhibit both morphological and behavioural infantile characteristics, which have been retained into adulthood as a by-product of the domestication process (*neoteny*, Lorenz, 1943; Belyaev, 1979; Clutton-Brock, 1981; Frank and Frank, 1982; Hare et al., 2005). Infantile characteristics have also been emphasized during human selection of certain breeds for aesthetic reasons (e.g. lapdogs) and it has been hypothesized that such features might form the basis of our attraction to animals, especially pets. Both morphological and behavioural neoteny may combine to elicit emotional/affiliative responses towards pets (cute response) and may bear some part of the responsibility for our motivational drive to pet-keeping and pet-caretaking (Archer, 1997). This idea has gained weight in the light of some evidence that the bond between pets and their owners shares striking similarities to the relationship between human parents and their children (e.g. the language used to talk to animals mimics the so-called *motherese* or *baby talk* and dogs seem to view their owners as a secure base, Hirsh-Pasek and Treiman, 1982; Horn et al., 2013).

The idea that the human response to infantile features is not restricted to conspecifics, but can also be elicited by heterospecifics was first proposed by Lorenz and was subsequently demonstrated by several empirical studies which have shown the generalization of the cute response to real animals (Archer and Monton, 2011; Little, 2012), representations of animals such as cartoon characters (e.g. Mickey Mouse, Gould, 1979) and stuffed/toy animals (e.g. Teddy bear, Hinde and Barden, 1985; Archer and Monton, 2011). Infantile features present in images of young animals and in those of infant-like adults are able to affect both adults and children's preferences for those images and their perceived cuteness (Lorenz, 1943; Fullard and Reiling, 1976; Maestripieri and Pelka, 2002; Sanefuji et al., 2007; Archer and Monton, 2011; Little, 2012). Gender and familiarity with animals may modulate such a response, as was shown in Archer and Monton's study (2011) in which women showed higher preference scores for pets with infantile features than men, and pet owners rated pet faces as more attractive than non-pet owners, regardless of whether the faces had infant features. In this study a species-specific preference was also shown, specifically in adult cat owners (Archer and Monton, 2011).

However analyses on the emergence of a cute response during development and its extension to human-animal context are scarce. Previous assessments of age effects on preference for human and animal infantile stimuli produced conflicting results (Fullard and Reiling, 1976; Feldman et al., 1977; Maestripieri and Pelka, 2002) and most studies that involved children as participants used stimuli not objectively quantified according to the baby schema content. Moreover, to our knowledge, no attempts have been made to analyze the response to both animate and inanimate infantile stimuli in children younger than 5 years.

In sum, the literature reviewed so far highlights the scarce knowledge about the emergence of animal-related attitudes in early childhood. In particular, little attention has been paid to the exploration of which animal characteristics affect young children's perception of diverse species. This calls for further research to assess the mechanisms underlying children's attraction to different animal forms.

Greater knowledge on early attitudes towards animals has implications for promoting interest towards animals and for building educational interventions addressed to young children. This is particularly important in the light of the mounting evidence that contacts with animals may affect children's wellbeing and impact upon developmental trajectories (Endenburg and van Lith, 2011; McCardle et al., 2011) and by the growing employment of different animals in educational and therapeutic contexts.

1.2. ANIMALS IN CHILDREN'S LIVES

In contemporary societies, non-human animals play a salient role in children's lives. Throughout childhood, almost all infants and children play with animal-like toys, their clothes, bedrooms, and classrooms are all decorated with representations of animals, they read fairytales and look at cartoons and films in which the central characters often have animal features (Serpell, 1999). Children have also several opportunities to encounter and to have contacts with real animals. In Western societies the number of household pets have increase dramatically in recent years, including the number of non-traditional pets (e.g. USA and Italy, APPMA, 2013; Eurispes, 2013). In addition to animals in their homes, children may come in contact with animals and receive information about them in a variety of public settings, including schools, zoos, aquaria, and science museums (Serpell, 1999).

Despite the prominent role that animals play in children's lives, the analysis of how children relate to animals, their attitudes towards them and the effect of contacts with animals on their development are relatively new area for scientific inquiry. To date, there are two main area of research: a body of studies investigating the impact of contact with animals on the development of children, and those examining the potential use of animals (especially dogs and horses) in therapeutic interventions.

In the next two sections we describe the current state of the art about the influence of animals, especially pets, on children development. The aim is to highlight the importance of exploring the child-animal relationship since very early developmental stages, in particular for the impact that this information might have for the development of animal-based education programs and for child therapy (Melson, 2002).

1.2.1. Bond and benefits

There is an increasing agreement on the positive influence of companion animals on children's emotional and social development (Melson, 2003; Endenburg and van Lith, 2011). Many parents report that pets can be valuable tools with which to educate their children (Endenburg and Baarda, 1995). This general belief was repeatedly confirmed by psychological testing that has shown that growing up with pet animals may have a beneficial effect on the development of self-esteem, self-competence, and autonomy, can encourage caring attitudes and behaviour, promote the development of moral reciprocity and enhance empathy and sense of responsibility (Melson and Fogel, 1989; Endenburg and Baarda, 1995; Van Houtte and Jarvis, 1995; Serpell, 1999; Vidović et al., 1999; Daly and Morton, 2006; Endenburg and van Lith, 2011).

Research has also shown that children who have a positive attitude towards companion animals are more empathic than those who have a negative, or less positive, attitude (Daly and Morton, 2006). Ability to perceive animal's need seems to have a transfer effect to empathy with people (Melson and Fogel, 1989; Ascione, 1992; Ascione and Weber, 1996; Paul, 2000), thus growing up with animals (especially the formation of a bond with them) may promote the development of social intelligence (Kidd and Kidd, 1987; Poresky et al., 1987;

Poresky, 1990; Melson et al., 1991; Poresky, 1996; Vidović et al., 1999). As stated by Filiatre et al. (1986) pet's behaviour *'could contribute to the acquisition by the child of a more structured and more socially efficient behavioral repertoire'* (Filiatre et al., 1986), and the ability of dogs to trigger prosocial behaviours was also observed in children with a social deficit (i.e. children with autism, Grandgeorge et al., 2012).

The role of animals as a source of support is an important aspect in children's emotional development. Covert and colleagues found that many of the children in their study said that they turned to their pets when they were upset (Covert et al., 1985) and many children report emotional bonds with their pets which represent one of the most important relationship in their lives (Melson, 2011). Melson writes that a pet's *"animate, responsive proximity makes children feel less alone in a way that toys and games, television or video, even interactive media, cannot"* (Melson, 2001, p. 59). Animals, especially pets, may thus be an important part of children's lives thanks to their ability to provide support, comfort and companionship, to constitute a source of non-judgmental and positive affection, ultimately increasing their psychological well-being (Beck and Katcher, 1984; Bryant, 1990; McNicholas and Collis, 2000; Knight and Edwards, 2008).

Animals may also increase or strengthen children's social networks, as was shown in Paul and Serpell's study (1996) in which dog-owning children reported experiencing more visits from their friends and engaging in more leisure activities, compared with non-dog owning children (Paul and Serpell, 1996). Animals may promote social integration also in educational environments as was shown in a study by Kotrschal and Ortbauer (2003) in which the introduction of a dog in the classroom had the effect of decreasing behavioural extremes in children, such as aggressiveness, hyperactivity and withdrawal (Kotrschal and Ortbauer, 2003).

While the analysis of the influence of companion animals on the social and emotional development of children has attracted a relatively high interest from researchers, fewer studies have explored the influence of animals on their cognitive development. This is surprising since children's 'biophilic' predisposition to be attracted by other animals (and their activities) has the potential to affect different domains associated with cognition, learning and language development. Attraction and curiosity about other species may be exploited in order to enhance the efficacy of both educational and therapeutic interventions, since children are more likely to be attentive and to have increased motivational levels if animals are involved (Melson and Fogel, 1989; Limond et al., 1997; Martin and Farnum, 2002; Esteves and Stokes, 2008; Friesen, 2010). Since attention is one of the key aspects of the learning process, interacting with animals, either by owning a pet or through animal-based educational programs, has the potential to represent an easy mean for promoting children emotional and cognitive development, for counteracting individual child behavioural problems (e.g. learning disabilities, aggressiveness and attention deficit disorders) and for helping social integration (Hergovich et al., 2002; Kotrschal and Ortbauer, 2003; Endenburg and van Lith, 2011). For example, Gee and colleagues found that the presence of a dog in a classroom can provide many positive benefits for children, including enhanced motor skills, better ability to follow instructions and improved memory (Gee et al., 2007; Gee et al., 2009; Gee et al., 2010a; Gee et al., 2010b; Gee et al., 2012). However, more research is needed to find out whether companion animals can also influence other aspects of cognitive development, such as language. It has been suggested that *'companion animal ownership may facilitate language acquisition and enhance verbal skills in children. This would occur as a result of the companion animal functioning both as a patient recipient of the young child's babble and as an attractive verbal stimulus, eliciting communication from the child in the form of praise, orders, encouragement, and punishment'* (Endenburg and van Lith, 2011). Further research in this area should thus be encouraged.

1.2.2. Exploiting the animal appeal in Animal Assisted Interventions

The forms and manifestation of human's bond with companion animals has led to an extensive use of animals in various therapeutic/activity programs (also known as Animal-Assisted Interventions, AAI), with the implication that this bond is part of what helps patients to achieve therapeutic gains (Friedmann and Son, 2009; Grandgeorge and Hausberger, 2011).

There is a growing body of evidence showing that a close relationship with a pet animal is associated with significant health effects in people. The most cited outcomes include reduced stress, lowered heart rate and blood pressure, reduced loneliness and isolation, increased social interaction and connection, and increased socio-emotional functioning (for a review see Friedmann and Son, 2009; Wells, 2009). Although in different studies the relationship between owning a pet and health may be explained by an indirect effect such as the association between dog ownership and the number/duration of recreational walks (Serpell, 1991; Anderson et al., 1992; Dembicki and Anderson, 1996), more direct effects of human-animal contacts have been reported, albeit only investigated in the short term (Friedmann et al., 1983; Katcher et al., 1983; DeSchriver and Riddick, 1990; Allen et al., 2002; Odendaal and Meintjes, 2003; Friedmann et al., 2007).

In the context of the Biophilia framework it has been stated that humans possess a predisposition to be attracted by the activities of other animals (Wilson, 1984) and attention to animals alone is thought to be sufficient to explain some of the benefits of animal assisted interventions, since things that tend to focus and absorb people's attention in non-threatening ways are also known to exert a calming or de-arousing influence (Katcher et al., 1983; DeSchriver and Riddick, 1990). The presence of an animal, or even the mere observation of animals (DeSchriver and Riddick, 1990), can buffer physiological and psychological responses to stress and anxiety: as an example, a transient decrease in blood pressure and heart rate and in cortisol levels has been observed both in adults and children in the presence of a companion dog as well as while interacting with friendly but unknown dogs (Friedmann et al., 1983; Allen et al., 2002; Odendaal and Meintjes, 2003; Friedmann et al., 2007). Animals can indeed have a profound calming effect and the general assumption underlying animal-assisted educational and therapeutic interventions addressed to children is the non-judgmental and non-threatening nature of the companion animal's support which can promote a climate of "safety" for the child and contribute to a positive perception of a situation (Parish-Plass, 2008; Endenburg and van Lith, 2011). Animals may help children to cope with mildly stressful activities (e.g. visit to the doctor's office or reading aloud) and also with a major, stressful experience like hospitalization, with measurable physiological effects such as decrease in blood pressure and heart rate (Friedmann et al., 1983; Nagengast et al., 1997; Havener et al., 2001; Bouchard et al., 2004; Tsai et al., 2010).

Since children are less anxious when they interact with animals they are also more willing to engage with peers and adults: an increase in responsiveness, alertness and willingness to communicate has been observed when a dog was introduced in the classroom or in therapeutic environments (Limond et al., 1997; Hergovich et al., 2002; Kotrschal and Ortbauer, 2003; Esteves and Stokes, 2008). Emotional availability to participate in the therapy practice was enhanced by the presence of a dog during AAI in children who had previously experienced psychological and/or physical abuse and have been separated from their families (Parish-Plass, 2008). The presence of an animal, particularly a dog, is able to act as an "ice-breaker": it catalyzes communication and enhances opportunities for social exchange and shared interests which, in turn, can promote a feeling of social integration (McNicholas and Collis, 2000; Knight and Edwards, 2008), an aspect particularly important for children with atypical development and with physical disabilities which may experience social discrimination (Limond et al., 1997; Esteves and Stokes, 2008).

1.2.2.1. The case of children with Autism Spectrum Disorder

Autism spectrum disorders (ASD) are characterized by deficits in social reciprocity and communication, and by unusually restricted, repetitive behaviours (Kolvin, 1971). In particular, a diagnosis of autism implies impairments in 3 behavioural domains: 1) social interaction; 2) language, communication, and imaginative play; and 3) restricted range of interests and activities (World Health Organization, 1993; American Psychiatric Association, 1994). It has been estimated that Pervasive Developmental Disorders (that include autism, Asperger syndrome and atypical autism) affect one child in about 150 children (Fombonne, 2009), although several factors may lead to an underestimation of the prevalence (Lord, 2011).

Despite the large number of therapeutic approaches for the management of infantile autism (Rogers and Vismara, 2008; Reichow, 2011), at present, neither proven therapies nor preventive measures exist for the universal treatment of infantile autism. Therefore, further research and the development of individualized therapies for the ASD population appear imperative.

In the light of the growing body of evidence showing the potential of interactions with animals to benefit people, including those with disabilities, some studies have specifically focused on the role of child-animal relationship in the ASD population (for a comprehensive review see O'Haire, 2013). These approaches are based on the assumption that the emotional aspects of the relationship with an animal (particularly a dog) might represent an effective tool to dampen withdrawal of children with ASD by targeting some of the core symptoms of this disorder.

Although the first reports on the beneficial effects of dogs with severely withdrawn children date back to the ‘60s with the experience of Boris Levinson (Serpell, 1996), a systematic review of the literature reveals that it was only from 2000 that this field of research has been receiving growing attention, as reflected in the increasing amount of studies published. In the late ‘80s, Redefer and Goodman (Redefer and Goodman, 1989) were pioneers in the scientific approach of the effects of interaction with dogs on children with autism. Authors observed that, following the introduction of a friendly dog into a therapeutic session, seriously withdrawn children with ASD showed a sharp increase in the frequency of both verbal and non verbal social behaviours; this increase was directed towards the dog and the therapist and was paralleled by a decrease in children's withdrawal. This general improvement could still be observed 1 month after dog exposure (follow up), although in a smaller proportion. However, Martin and Farnum’s study (2002) represents the first important attempt to perform a thorough analysis of the effects of AAI with a dog through the comparison with behavioural changes resulting from the exposure to different stimuli (ball/stuffed dog). These authors found that children were less distracted, exhibited a more playful mood and were more aware of their social environment when in the presence of the therapy dog. Furthermore verbal interactions were stimulated by the presence of the animal: children were more likely to talk to the dog, engaging the therapist in discussions regarding the animal, and speaking less about topics unrelated to the therapeutic protocol during the dog condition (Martin and Farnum, 2002).

Similar results were obtained by Sams and colleagues who found that the incorporation of animals (i.e. lamas, dogs and rabbits) in a school-based occupational therapy program was able to encourage language use and social interaction in children with ASD, particularly in comparison to occupational therapy using standard techniques (Sams et al., 2006).

The efficacy of dogs’ presence in increasing the engagement and decreasing negative behavioural patterns (such as aggressive and obsessive manifestations) was also confirmed in a very recent case-study by Silva and colleagues. In particular, physical and verbal aggressiveness, as well as self-absorption, were significantly reduced while smiles, visual contacts and affectionate behaviours were increased (Silva et al., 2011).

Intervention programs with horses, mostly involving mounted riding activities, have shown similar outcomes as those obtained by interaction with dogs, and are increasingly recognized as a promising practice (Umbarger, 2007; O'Haire, 2013). Both therapeutic horseback riding and educational interventions involving horses have shown their potential to increase social responsiveness and interactions, as well as communication in ASD children, ultimately improving the quality of life of these subjects and their families (Bass et al., 2009; Keino et al., 2009; Taylor et al., 2009; Memishevikj and Hodzhikj, 2010; Kern et al., 2011; Gabriels et al., 2012).

Overall, results from these intervention programs are encouraging, since the interaction of children affected by ASD with both dogs and horses was able to promote verbal and non-verbal behaviours, directed both towards the dog and the therapist. In this context, it is important to stress that language impairment is one of the most pervasive symptoms characterizing children with ASD early during postnatal life and thus being able to act upon such a domain is a main challenge of current behavioural therapies. Taken together, these studies have shown that intervention strategies based on exploiting the emotional aspects of the relationship with a dog can overcome the inability of children affected by ASD to relate and interact with others by targeting some of the core symptoms of this disorder. In fact, some authors have suggested that being able to gain access to pets, or to talk about them, might represent a strong drive for children with ASD to increase social interactions with the therapist (Sams et al., 2006).

The simple and interpretable pattern of movements that characterizes dogs, might facilitate the engagement of children with ASD in structurally simple social actions that do not require the interpretation of verbal cues and are highly repeatable and predictable (e.g. throw, fetch and retrieve play, walking the dog on a leash, giving a hand command) (Redefer and Goodman, 1989; Sams et al., 2006; Solomon, 2010). Sams and colleagues suggest that acquiring the ability to interpret and respond to the social and behavioural cues of dogs may provide a bridge towards learning to interpret the more subtle behaviour of human beings (Sams et al., 2006). It has also been suggested that dogs, representing a powerful multisensory stimulus - strong and clear sounds, a vivid visual impression, a special smell and an innovation to touch - might target the low sensory and affective arousal levels characterizing children with ASD (Redefer and Goodman, 1989).

In this context it is worth noticing that the Denver Model, a therapeutic intervention that integrates applied behaviour analysis with developmental and relationship-based approaches (Rogers et al., 1986; Smith et al., 2008), involves the use of ‘sensory social routines’ i.e. *‘repeated dyadic interactions, based on pleasurable activities, that have strong sensory, movement, and social* *foundations'* (Rogers, 1998). Thus, animals appear good candidates to assist therapists in building such pleasurable dyadic interactions.

Overall, these evidence suggest that interacting with animals, owning a pet as well as animal-based educational programs have a great potentiality for counteracting child behavioural problems (e.g. learning disabilities, aggressiveness and attention deficit) and for aiding social integration, although further research is required to confirm that animals are positive casual agents in children social and cognitive development. In this context it appears of particular importance to investigate children's perception of animals starting from the very early developmental stages, by analyzing specific characteristics of different species able to evoke positive responses and relevant for promoting positive attitudes towards animals. The future challenge is to unravel the spontaneous behaviour (attitudes) both in typical and atypical developing children and to explore the implications of this information for educators and children's therapists (Prothmann et al., 2005).

1.3. RATIONALE AND OBJECTIVES

1.3.1. Current state of the art and statement of the problem

The literature reviewed so far support the pedagogical common sense that animal contact benefits child development, but the mechanisms that lie behind the effects observed remain not clear. In the context of the Biophilia framework it has been stated that humans possess a predisposition to be attracted by other species and attention to animals alone is thought to be sufficient to explain some of the benefits of contacts with animals. Experimental evidence of a human tendency to be attracted by other species is accumulating, showing animals as powerful stimulus able to elicit positive responses, such an increase in attention, social behaviours and positive affect even in children with social impairments. However, while research efforts have been dedicated to empirically confirm human 'biophilic' (and/or 'biophobic') predisposition and its emergence during development, very little attention has been paid to the identification of specific characteristics of the animals underpinning distinct behavioural responses in humans, particularly in children. Notwithstanding the evidence on the impact of animal interactions upon children's wellbeing and attitudes, information on which specific characteristics of the animals are able to attract and engage children is largely unknown and we have limited understanding of how animal features combine with children's individual attributes to elicit differential responses.

The perception of certain similarities with human beings, the predictability of the behaviour, as well as the infantile appearance, appear to be the best candidates to form positive attitudes towards animals and to evoke positive responses such as nurturing behaviour. However, the vast majority of previous studies on attitudes to animals and previous analyses on human attraction to certain animal features (e.g. baby schema) did not consider children younger than 6 years. Indeed, in-depth examinations of how very young children perceive animals and respond to them is needed since they may evidence specific trends and help elucidating the trajectories of attitudes and preferences' forming. **The general aim** of the work presented in this thesis was to analyze both attitudes (i.e. preferences) and behavioural responses (i.e. visual attention) towards animal stimuli presenting differential morphological characteristics (different animal species and animals with specific facial features, i.e. baby schema) in 3-6 years old children, a population usually not addressed in the literature. We propose that this analysis may provide information on how children perceive animals and a platform for further examination of the impact of animals on children socio-emotional and cognitive development.

1.3.2. Rationale of the studies

I. Investigate explicit preferences for a variety of different animal species, ranging from mammals to invertebrates, in children aged 3-6- years old. We aimed at assessing the effect of taxonomic closeness (a measure of similarity to humans) and domesticity (a measure of familiarity and utility) on children's preference forming, as well as the emergence of gender-based attitudes towards animals.

II. Analyse the effects of specific facial features on 3-6 years old children's explicit preferences for animals. In particular we aimed at assessing how the presence of infantile traits (i.e. *Facial index*) affects children's preference for the most common companion animals (i.e. dogs and cats). Moreover, whether a gender-biased tendency to preferentially attend baby-like stimuli (including animals) is already present in children and how this tendency combines with experiential factors (i.e. age and pet ownerships) was also assessed.

III. Study the effect of an infantile facial configuration (i.e. *baby schema*) on children's perception of human and pet animals, using both indirect (i.e. cuteness rating) and direct (i.e. gaze behaviour) measures. We aimed at exploring whether infantile features affect visual attention to animal stimuli in children and whether both cuteness perception and gaze are sensitive to cues specifically related to infant-like traits.

1.3.3. Experimental approach and outline of the thesis

In **Chapter 2** and **Chapter 3** we report two studies aimed at assessing 3-6 years old children explicit preferences for photographic animal stimuli. Both these studies used an experimental paradigm - a *forced-choice task* (Fisher et al., 1992) - in which two photographic stimuli are simultaneously presented and participants are allowed to choose one, since it is well suited to evaluate preferences in young children (Schanding et al., 2009). In fact, attitude assessment typically relies on the use of the questionnaire survey (e.g. level of agreement or disagreement with attitude statements on Likert rating scales or open-ended interviews) and these approaches are not easy to apply in developmental studies, especially when participants are very young. Although the concept of human attitude is complex, the analysis of explicit preferences may be a good indicator of underlying negative and positive attitudes (Woods, 2000) and may help addressing young subjects (e.g. kindergarten children). Moreover, the use of visual aids (e.g. pictures, drawings, videos) is a valid instrument to assess perception of animals and may help in eliciting and maintaining respondents' attention (Martín-López et al., 2007). When viewing photographs, not only the information extracted from the image influences participants' responses, but pictures also generate reminiscences of past experiences and previous knowledge of the subject depicted (Martín-López et al., 2007).

Chapter 2 describes a study aimed at assessing children's preferences for a variety of different animal species, ranging from mammals to invertebrates. In particular the effect of taxon **-** as indicative of both phylogenetic closeness and bio-behavioural similarity to humans (Batt, 2009) **-** on preference scores was measured. Children's preferences for domestic over wild species were also analyzed. Since gender is recognized as one of the most important demographic variable affecting attitudes and behaviour toward animals (Herzog, 2007), gender effects on participants' responses were also assessed. Data were analyzed in order to highlight general inclinations as well as children's favour or disfavour for some individual species that did not follow average preferences.

Chapter 3 describes a study in which, using the same methodology (*forced-choice task*, Fisher et al., 1992), we analyzed children's preferences for faces of the most common companion animals (i.e. dogs and cats) with presence (or absence) of infant features and the generalization of this response to an inanimate object, a teddy bear. Pictures employed had been independently validated in adults and classified on the basis of an objective index of one aspect of the baby schema (i.e., *Facial index*, Archer and Monton, 2011). Children's preferences for different species (dogs and cats) and for animal over non–animal stimuli were also obtained and the effects of sex, age, and pet ownership analyzed.

The analysis of children preferences for infantile pet dogs carried out in the study described in **Chapter 3** confirms the notion that the infantile appearance in the most common pets (and its appeal for humans) may be one of the driving forces behind human attraction to these species and indicates an early emergence of such a predisposition. There are, nonetheless, some limitations to the generalization of these findings. First, the original set of pictures had been classified only on the basis of the *Facial Index*, which gives one objective aspect of the baby schema while it does not measure other characteristics such as large eyes (Archer and Monton, 2011). Moreover, pictures depicted different subjects and had different backgrounds (as well as colour and expression). Hence the interpretation of outcomes is limited by the impossibility to dissociate the response to a specific stimulus (humans vs. animals) from the response to its facial configuration (i.e. baby schema). Second, when asked for overt preferences, participants might only report socially desirable and appropriate responses, as evidenced in traditional self-report measures (e.g., ratings, questionnaires, interviews). Direct preference assessments (such as preferential looking) represent a more reliable and sensitive measure of the observer's preferences (Fleming et al., 2010) and may shed light on the cognitive mechanisms underlying attraction to different stimuli.

Chapter 4 describes a procedure adopted in order to create a standardized set of stimuli with objectively quantified and parametrically manipulated baby schema content that retained all the characteristics of the individual portrait. We followed Glocker et al.'s procedure – originally developed to modify human infant faces (Glocker et al., 2009a) - and were the first to apply it also to faces of human adults as well as adult and young animals. Images obtained were used to systematically investigate the effects of the baby schema on children's and adults' perception of human and animal faces, using both indirect (i.e. cuteness rating) and direct (i.e. gaze behaviour) measures. The pattern of eye movements is a susceptible index of our attention, motivation and preference and can be modulated by cognitive demands and characteristics of the observed scenes (Henderson, 2003; Isaacowitz, 2006). Eye-tracking is a technique used to determine eye movement and eye-fixation patterns of a person. It measures either the point of gaze ("where the subject is looking") and the sequence in which the eyes are shifting from one location to another. In this study eye-tracking technologies were employed in order to explore whether infantile features affect visual attention to animal stimuli in children and whether both cuteness perception and gaze are sensitive to cues specifically related to infant-like characteristics. The role of factors such as age, gender, and experience/familiarity with animals in modulating both cuteness processing and behavioural response to infantile stimuli is still not clear (Maestripieri and Pelka, 2002; Archer and Monton, 2011). Hence the effects of gender and pet ownership were assessed and, for comparative purposes, cuteness judgement in a sample of adult participants was collected through a web-based questionnaire.

All data are discussed in **Chapter 5**.

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CHAPTER 2

2. ATTITUDES TOWARDS ANIMALS IN KINDERGARTEN CHILDREN: SPECIES PREFERENCES

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ABSTRACT

Human attitudes towards animals are influenced by both animal traits (e.g. similarity to humans, aesthetic quality, size) and individual human attributes (e.g. gender, age, educational level, cultural factors). Although the examination of children's interest in animals and their preference for different species may evidence specific trends and help to elucidate the trajectories of attitude's forming, the vast majority of research has not considered children younger than 6 years. The present study was aimed at assessing preference for a variety of animal species in a sample of 3-6 year-old Italian children, using a *forced-choice task* and visual aids (images of the animals). Pictures of 48 animal species, ranging from mammals to invertebrates, were presented to children. Two photographic stimuli were simultaneously displayed and participants were asked to indicate their preferences. Results show children's propensity for higher order of species and for domestic over wild animals. Apart from some exceptions, our analysis shows that invertebrates are the most disliked group of species among kindergarten children. Gender effects emerge very early during development showing higher negative and fear-related attitudes in girls. Results are discussed taking into account different factors that may affect children's preference for various animal species, i.e. similarity to humans and aesthetical appeal. Greater knowledge on early attitudes towards animals has implications for promoting interest towards animals and for building educational interventions addressed to kindergarten children. This is particularly important in the light of the growing use of different animals in educational and therapeutic contexts, as well as for the animal welfare perspective.

Keywords: animals, attitudes, children, gender.

2.1. INTRODUCTION

Due to the extraordinarily prominent position that animals occupy in human lives from childhood to adulthood (Serpell, 1999), and in consideration of the increasing number of household pets in Western societies, including non-traditional pets (e.g. USA and Italy, (APPMA, 2013; Eurispes, 2013), the examination of human attitudes towards animals, and the analysis of the different factors influencing them, has attracted the attention of researchers from different disciplines. First, the self-evident and empirically-established fact that humans have different attitudes towards animals, that some animals are favored while other are disfavored, are a matter of concern to the field of animal welfare, as well as to conservation biology (Plous, 1993; Czech et al., 1998; Serpell, 2004; Tisdell et al., 2005; Kaltenborn et al., 2006; Tisdell et al., 2006; Martín-López et al., 2007; Knight, 2008; Batt, 2009). In addition, the analysis of why not all animals are equal "in the eyes of the beholder" has implications for the management of tourism and recreational facilities (zoos and other venues), and can be used as a valuable tool to improve educational programs and address misconceptions (Woods, 2000). Last but not least, attitudes towards animals have attracted the attention of the psychology field, especially as a consequence of the mounting evidence that contacts with animals may affect children's wellbeing and impact upon developmental trajectories (Endenburg and van Lith, 2011; McCardle et al., 2011).

In consideration of its impact on different disciplines, several studies, mostly based on questionnaires and interviews, have tried to characterize and describe the different dimensions of human attitude towards animals. Human attitude has been defined as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly and Chaiken, 1993, p.1). The results of research surveys have demonstrated that there is an enormous variance in people's attitudes towards animals, which depends on a range of factors, some intrinsic to the animal itself (i.e. animal attributes), others extrinsic (i.e. individual human attributes and cultural factors) (Serpell, 2004).

Perception of some animal traits (shape, size, behavior, facial features) seems to form the basis for people's initial evaluation of different species and attitude discriminations. In the literature it is claimed that humans prefer (and show greater concern for) animals that are more human-like, i.e. species phylogenetically close to humans or physically, behaviorally or cognitively similar to them, such as primates, dolphins, dogs, charismatic megafauna (Driscoll, 1992 ; Kellert, 1993b; Plous, 1993; Gunnthorsdottir, 2001; Serpell, 2004; Knight, 2008). Humans also tend to prefer animals that they perceived as aesthetically appealing or 'cute' (Gould, 1979; Woods, 2000; Gunnthorsdottir, 2001; Stokes, 2007; Knight, 2008; Archer and Monton, 2011; Herzog, 2011; Borgi and Cirulli, 2013; Lišková and Frynta, 2013). Moreover animals that are recognized as useful or beneficial to humans are generally regarded more positively than species that are less useful, or damaging or that pose threats or health hazards (but see exceptions, Serpell, 1996; Serpell, 2004; Herzog, 2011).

However, there are large individual differences in human attitudes that are partially independent of the animal's intrinsic attributes (Serpell, 2004). Several studies have shown that people's attitudes towards the same animal group and their species preference largely vary according to gender, age, level of education, knowledge and exposure to animals (e.g. pet ownership) (Driscoll, 1992 ; Bjerke et al., 1998a; Bjerke et al., 2003; Serpell, 2004; Serpell, 2005; Herzog, 2007). While these investigations have emphasized the effect of experience and cultural factors on people's views of animals, some authors have depicted the human need and propensity to affiliate with other living creatures (the 'Biophilia') and its counterpart (negative attitudes towards some animals, or 'Biophobia'), as biological tendencies (Wilson, 1984; Kellert, 1993a). In any case, it is still not clear whether the foundations for attitudes towards animals are laid during early childhood and to what degree preferences and attitudes typology change with age and experience (Kellert and Westervelt, 1984; Paul and Serpell, 1993; Schenk et al., 1994).

Previous studies have shown that in children and adolescents a preference for familiar species (such as domestic animals) over wild species is already present, as well as a negative orientation towards invertebrates and fear-relevant animals (Bjerke et al., 1998b; Prokop and Tunnicliffe, 2008; Randler et al., 2012). Girls show to be less favorably inclined than boys to animals associated with fear and disgust and in general to animals that may pose a threat, danger, or disease to them (Prokop and Tunnicliffe, 2010; Randler et al., 2012). Moreover, girls appear to be more pet-oriented, while boys show a greater preference for wild animals than girls (Bjerke et al., 1998b). Experience with animals gathered during this stage of development (i.e. pet ownership, participation in animal-related activities) may affect attitudes and appreciation of animals both in children and adolescents (Kellert and Westervelt, 1984; Bjerke et al., 1998a, 1998b; Bjerke et al., 2001; Prokop and Tunnicliffe, 2010; Randler et al., 2012).

In general terms, it seems that interest in animals is reduced with increasing age (Bjerke et al., 1998b; Bjerke et al., 2001; Pagani et al., 2007; Prokop and Kubiatko, 2008; Prokop and Tunnicliffe, 2008). However, it should be taken into account that most of these information refer to attitudes and species preferences shown by children and adolescent ranging in age from 9 to 15 years. The vast majority of studies on attitudes to animals and the liking of different species do not consider children younger than 6 years. Attitude assessment typically relies on the use of the questionnaire survey (e.g. level of agreement or disagreement with attitude statements on Likert rating scales or open-ended interviews) and these approaches are not easy to apply in developmental studies, especially when participants are very young. Indeed, in-depth examinations of attitudes towards animals in very young children are needed since they may evidence specific trends and help elucidating the trajectories of attitudes' forming.

The present study was aimed at assessing preference for a variety of different animal species, ranging from mammals to invertebrates, in a sample of 3-6 year-old Italian children. We used an experimental paradigm - a *forced-choice task* (Fisher et al., 1992) - in which two photographic stimuli are simultaneously presented and participants are allowed to choose one, since it is well suited to evaluate preferences in young children (Schanding et al., 2009; Borgi and Cirulli, 2013). Although the concept of human attitude is complex, the analysis of explicit preferences may be a good indicator of underlying negative and positive attitudes (Woods, 2000) and may help to address young subjects (e.g. kindergarten children). Moreover, the use of visual aids (e.g. pictures, drawings, videos) is a valid instrument to assess perception of animals and may help in eliciting and maintaining respondents' attention (Martín-López et al., 2007). When viewing photographs, not only the information extracted from the image influences participants' responses, but pictures also generate reminiscences of past experiences and previous knowledge of the subject depicted (Martín-López et al., 2007).

In the present study children were presented with color photographs illustrating a wide range of species and their preferences were recorded. We aimed at assessing whether species' similarity to humans is able to affect participants' preferences for some animal species. In particular the effect of taxon - as indicative of both phylogenetical closeness and bio-behavioural similarity to humans (Batt, 2009) - on preference scores was measured. Moreover we analysed children preferences for domestic (i.e. companion and farm animals, the latter including both mammals and birds) over wild species. Since gender is recognized as on of the most important demographic variable affecting attitudes and behavior toward animals (Herzog, 2007), gender effects on participants' responses were also assessed. Data were analysed in order to highlight general inclinations as well as children's favor or disfavor for some individual species that did not follow average preferences.

2.2. METHODS

2.2.1. Participants

Participants were 282 children, half girls and half boys, recruited in 4 public kindergartens in Ladispoli (Rome, Italy). Children's age ranged from 3.2 to 6.6 years (M_{age}=56 months). Exclusion criteria consisted of certified developmental disability, visual impairment, or an unwillingness to participate spontaneously. Information letters were sent out first to schools to inform them about our study and to ask for their participation. As soon as consent was obtained by those settings, parents received a letter that included information about the study and a consent form. Written consent was obtained from parents on behalf of the children enrolled in the study. Before testing, children were also asked to give their assent and they were aware that they could withdraw at any time during testing. Parents of participating children filled in a questionnaire comprising children's demographic information, presence of animals at home, frequency of child's exposure to animals and representations of animals (in zoos, cartoons, books, movies, documentaries, television programs) as well as possible animal-related problems (phobia, accidents, allergies). The authors, as well as the teachers, distributed the questionnaires to parents. Questionnaires were returned to schools in a closed envelope to guarantee privacy. The details of the participants were rendered anonymous and treated confidentially.

2.2.2. Stimuli

2.2.2.1 Species selection. Forty-eight animal species were selected in order to represent as wide a range of species as feasible (Table 1). We included species from six broad taxonomic groups (Mammals, Birds, Reptiles, Amphibians, Fishes and Invertebrates). The selection was intended to include a representative from each significant, recognizable group of species, e.g. mammals included a rodent, a bat, a monkey, an ape, an ungulate, a marine mammal, a marsupial, and large carnivores (wolf, lion, bear). Species selection was partially based on species catalogue created by Batt (2009) taking into account the biobehavioural similarity between animal species and humans, formed on the basis of multidimensional analyses of data regarding the natural history, behaviour and physiology of a wide range of taxonomic groups (e.g. size, weight and lifespan, reproductive strategy, parental investment and social organization, Batt 2009). Differently from Batt (2009), we also included domestic animals, since one of the purposes of our study was to assess possible effects of familiarity on children's preferences. In particular we included the most common companion animals (i.e. dog and cat) and farm animals (i.e. horse, donkey, pig, sheep, cow, rabbit, chicken, duck). Hence, in comparison with Batt's study, our species' selection included an unbalanced number of mammals (which represent the majority of companion and farm animals).

Table 1. Animal species depicted in photographic stimuli (common names)

Mammals	Birds	Reptiles	Amphibians	Fishes	Invertebrates
Dog*	Chicken*	Snake	Newt	Shark	Bee
Cat*	Duck*	Lizard	Frog	Trout	Beetle
Horse*	Ostrich	Alligator			Mosquito
Donkey*	Parrot	Turtle			Butterfly
Pig*	Eagle owl				Spider
Sheep*	Sparrow				Crab
Cow*					Millipede
Rabbit*					Earthworm
Deer					Jellyfish
Hippopotamus					Snail
Wolf					Octopus
Lion					Scorpion
Bear					
Bat					
Dolphin					
Elephant					
Kangaroo					
Monkey					
Ape (Chimpanzee)					
Mouse					
Sea lion					
Hedgehog					

*Domestic animals

2.2.2.2 Images selection. Stimuli consisted in 48 colour photographs portraying 48 different animal species as listed in Table 1. Images were obtained from Thinkstock/Getty Images (www.thinkstockphotos.it, courtesy of Gioacchino Altamura). Pictures selection was made on the basis of image quality (300 dpi), uniform background (white), presence of the entire structure of the animal (head, body and tail), and neutral facial expression (see Figure 1 for examples). Moreover, when having the possibility to choose between different pictures as representative of a given recognizable animal, we selected species/or images with a prevalence of brown, dark yellow and grey colors (e.g. the monarch butterfly was chosen among many species of butterflies). The parrot, whose image presented bright colors (green, red, blue and white), was the only exception.

Fig. 1. Examples of stimuli presented to participants. From the top (left): vervet monkey, chicken, cat, spider, rattlesnake, sheep, mouse, lion, eagle owl, turtle, monarch butterfly and snail. Photos: Thinckstock/GettyImages.

2.2.2.3 Images matching. Pictures were scaled to have the same height (width was enlarged or reduced proportionally). Two pictures were matched and placed centrally at the extreme left or right side of a 15.4''screen (Power Point presentation). We created 47 sets of stimuli, each consisted of 24 different pairs of pictures, to obtain every possible pairs between animals (i.e. a particular picture was paired with any other picture), with the constraint that each picture couldn't be present in the same set for more than 1 time. Moreover, 47 reversal sets were created in order to counterbalance left-right position of each picture in a pair across sets. Pictures pairing was counterbalanced across participants and within gender groups [each set was presented three times, (47+47R)*3=282 children]. Serial position (order of presentation within sets) was randomized across subjects (through the use of a true random number generator website).

2.2.3. Procedure

Participants were tested during school hours in a dedicated familiar room. One experimenter tested all children. Each child followed the experimenter after being asked if he/she would like to leave the classroom to go to play with a laptop. Only in those cases when children were not comfortable to follow the experimenter, the teacher was asked to help take the child outside the classroom and the test started when the child was ready. Each child was tested individually. He/she was asked to sit in front of a monitor and the experimenter sat next to him/her. A set of stimuli was presented to each child. Children were asked to choose between two different animals displayed simultaneously (24 trials = 24 choices). Once each pair of images was presented, the experimenter asked "*Which one do you like more?*" (if the child did not answer, the experimenter asked again "*Which one do you prefer?*") and preferences were collected in a check-sheet. Both verbal and non-verbal (i.e., pointing gesture) responses were accepted. The total testing time for each child did not exceed 10 minutes. The study took place from November 2011 to May 2012. Testing sessions occurred in the morning (from 9am to 1pm).

2.2.4. Data analysis and Statistics

Since a particular picture of an animal was paired with any other picture, preferences for each of the 48 images were computed and shown as the total number of preferences obtained (number of choices). Greater preference was attributed to stimuli that were selected on a higher number of trials. As an exploratory data analysis for organizing observed preferences in homogeneous classes, we carried out a hierarchical cluster analysis using Ward's method applying squared Euclidean distance as the similarity measure. Cluster analysis was followed by Kruskal-Wallis test and Mann-Whitney tests to assess the effect of the Taxon (Mammals, Birds, Amphibians, Reptiles, and Invertebrates) and Domesticity (domestic vs. wild animals) on children's preferences for different images. Chi-square goodness-of-fit tests were conducted to assess the effect of participant's gender on their preferences. Data were analyzed using SPSS 20 (Armonk, NY: IBM Corp.). Significance levels were set at $p<0.05$.

Questionnaires were returned at the end of the study. Since not all parents filled the questionnaire, it was not possible to counterbalance pictures pairing within pet owners and non-owners groups. Hence the role of this variable (as well as the effects of animal-related problems and exposure to animals) on children preferences was not statistically determined. Information obtained from questionnaires was qualitatively described.

2.3. RESULTS

2.3.1. Questionnaires

Questionnaires were returned from 170 of 282 parents enrolled (completion rate of 60.3%). Among 170 respondents, 34 were dog owners, 13 cat owners, 11 owned both dogs and cats and 22 owned others animals (mostly turtles, birds, rabbits, and other small mammals). The 76.5% of the respondents indicated an urban residence area, 23.5% a rural residence area. Only 18 parents stated that their child presented fear of some animals (the most frequent is the fear of dogs, followed by fear of spider and snake), 12 reported that their child has had a minor accident involving dogs (mostly dog bites), 6 reported allergic reactions to animals in their child. Parents were also asked to report the frequency of their child's exposure to animals and representations of animals: 32.4% of parents stated that their child *sometimes* looked at cartoons, movies, documentaries, television programs and read books about animals, while 67.6% stated that their child did it *often*. Moreover, 10.6% stated that their child was *never* exposed to real animals (wild animals or animals in captivity, i.e. in zoos), 8.2% *seldom*, 57.1% *sometimes*, 24.1% *often*.

2.3.2. Preferences

Animal species were ranked by number of preferences received and species composition in various fractions (clusters) of the ranking was determined by cluster analysis and shown in a dendrogram (Figure 2).

The dendrogram shows two major clusters of animals: the first (Cluster A, higher number of preferences) having four sub-clusters, the second (Cluster B, lower number of preferences) having two sub-clusters. Starting at the top of the dendrogram, group A-1 includes the frog, snail, monkey, deer, lizard, alligator, and snake; group A-2 includes the hippopotamus, chicken, cow, sparrow, sheep, bear, chimpanzee, ostrich, and pig. A third sub-group within Cluster A (A-3) includes the horse, dolphin, dog, mouse, parrot, rabbit, and butterfly. The fourth group (A-4) includes the elephant, turtle, cat, lion, donkey, kangaroo, sea lion, shark, wolf, hedgehog, eagle owl, duck and trout. Moving down the dendrogram, the next major cluster (Cluster B) also split into two sub-clusters. The first of these (B-1) includes the millipede, jellyfish, bat, crab, newt, and octopus; the second (B-2) includes the bee, scorpion, spider, earthworm, beetle and mosquito.

Preference scores for each species, from the most to the least preferred, are shown in Table 2 (split in clusters). Species ranking composition by taxon and domesticity is also illustrated. Results show that all the mammals (with the exception of the bat), birds, reptiles and fishes and the companion and farm animals were the most preferred (chosen) species (grouped together in Cluster A). Cluster A includes also two invertebrates, the butterfly (in subgroup A-3, i.e. species which received the highest number of preferences) and the snail (subgroup A-1). All the invertebrates are grouped in Cluster B (species least preferred) which includes also a mammal (the bat). Amphibians were split in two clusters (frog in Cluster A and newt in Cluster B).

Since cluster analysis showed a clear organization of children's preferences into groups that mostly correspond to taxonomic categories, we then assessed the effect of those categories on preference scores, by mean of a non-parametric analysis of variance. As observed during testing sessions, the newt was not recognized by children (who believed it being a lizard, see also Ballouard et al., 2011). For this reason and since Amphibians had only two representatives which were split in two different clusters Amphibians and Reptiles were merged in one category (Herptiles). Fishes were excluded from this data analysis due to the scarce number (two) of their representatives.

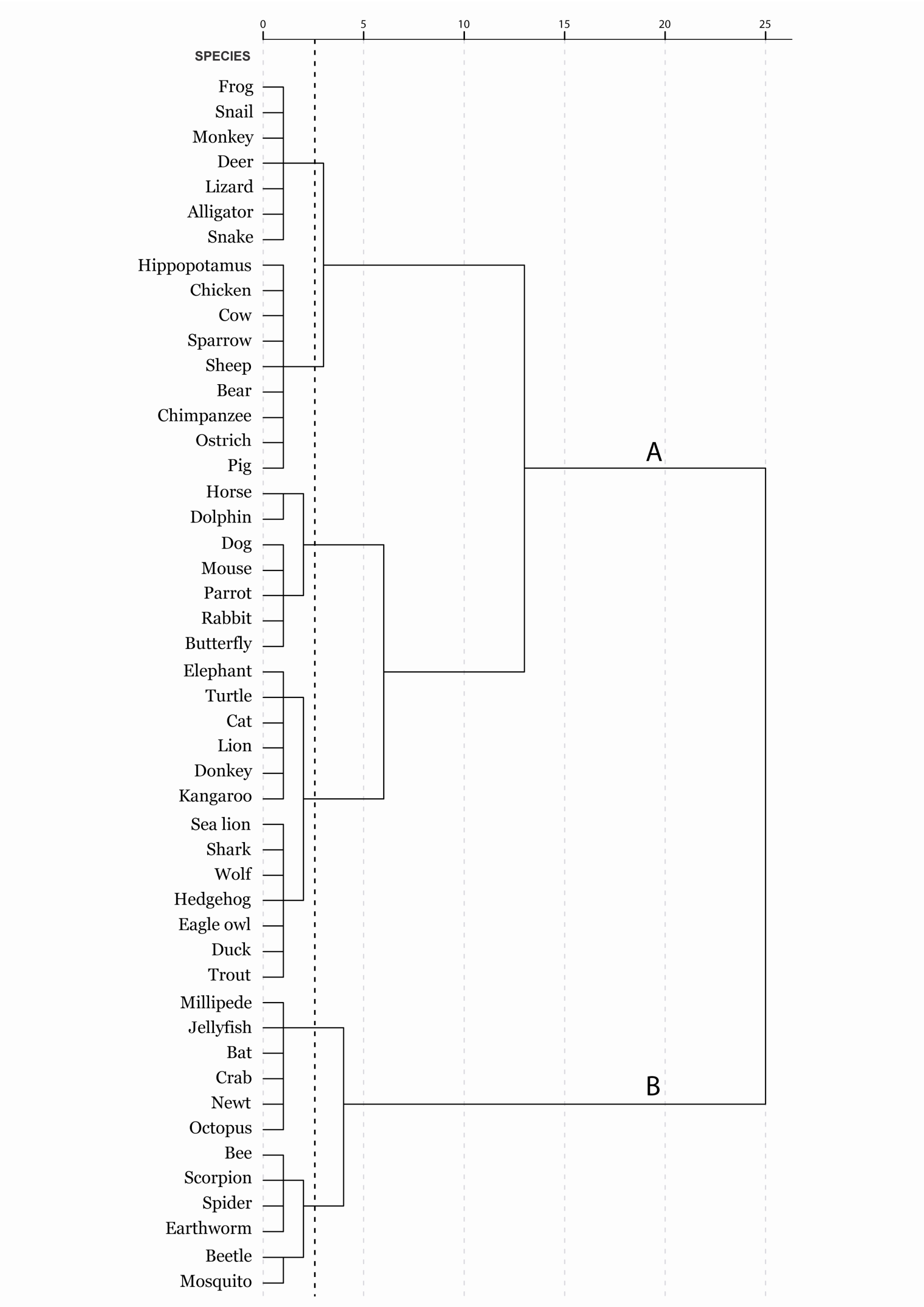

Fig. 2. Dendrogram of cluster analysis. Dendrogram of the 48 species from children's preferences obtained by cluster analysis. The number of clusters is calculated starting from the pruning line (black vertical dotted line). For description of clusters see the text.

Table 2. Children preferences for animal species (split in clusters) from the most to the least preferred [*Domestic animals]

Species	Cluster	Preferences	Taxa and Domesticity
Dolphin	A3	211	**Mammals.**
Horse*		206	**Companion and Farm animals**.
Butterfly		200	Birds (parrot), Invertebrates (butterfly).
Rabbit*		194	
Mouse		190	
Dog*		189	
Parrot		187	
Elephant	A4	181	**Mammals, Birds, Fishes.**
Turtle		180	**Companion and Farm animals.**
Lion		175	Reptiles (turtle)
Cat*		174	
Donkey*		171	
Kangaroo		168	
Wolf		164	
Sea lion		163	
Shark		163	
Trout		159	
Duck*		156	
Hedgehog		154	
Eagle owl		154	
Pig*	A2	150	**Mammals, Birds.**
Bear		147	**Farm animals.**
Chimpanzee		147	
Ostrich		146	
Cow*		144	
Sparrow		144	
Sheep*		143	
Hippopotamus		142	
Chicken*		142	
Deer	A1	137	**Mammals, Reptiles.**
Frog		133	Invertebrates (snail), Amphibians (frog).
Snail		133	
Monkey		132	
Lizard		123	
Alligator		123	
Snake		119	
Crab	B1	109	**Invertebrates.**
Bat		108	Mammals (bat), Amphibians (newt).
Octopus		103	
Newt		101	
Jellyfish		96	
Millipede		92	
Bee	B2	80	**Invertebrates.**
Scorpion		79	
Earthworm		76	
Spider		74	
Beetle		60	
Mosquito		46	

Kruskal-Wallis test shows an effect of Taxon on children preferences ($H_{(3)}$=21.237, p<0.000). In particular, Mann-Whitney tests (with a Bonferroni correction applied, resulting in a significance level set at p<0.0083) show a statistically significant difference between Mammals and Invertebrates (U=23.000 p=0.000) and between Birds and Invertebrates (U=6.000 p=0.005). No other significant differences were found (all p>0.01) (Figure 3).

A significant difference in preferences given to domestic and wild animals was also found (Mann-Whitney test, U=100.000, p<0.022).

Finally, a series of chi-square goodness-of-fit tests (for each image) were conducted to determine whether the distribution of preferences for gender differed from what expected by chance (null hypothesis of equal distribution: 50% of preferences given by boys, 50% given by girls for each species). Boys and girls gave unbalanced preferences for some images. In particular the probability of choosing butterfly, ostrich, hedgehog and sea lion was higher in girls, while the probability of choosing scorpion, octopus, crab, spider, beetle, bee, shark, newt, alligator and snake was higher in boys (see Table 3 and Figure 4, only significant results shown).

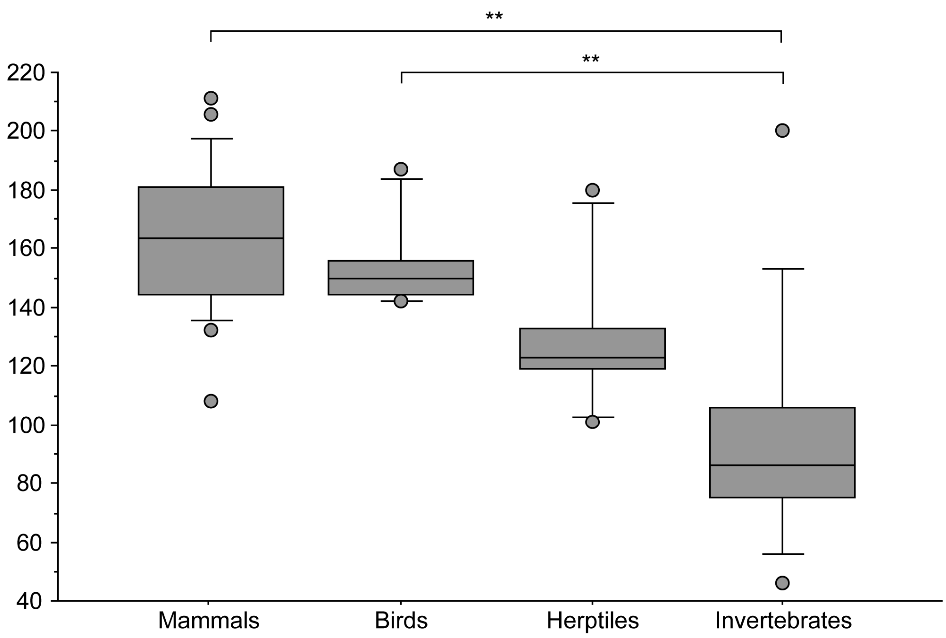

Fig. 3. Distribution of preference among taxa. Box plots show: 25^{th}-75^{th} percentile (box), median (horizontal line in the box), minimum and maximum (whiskers), outliers (individual points); **p<0.0083, Mann-Whitney tests with Bonferroni correction applied.

Table 3. Gender effect on children's preferences (Chi square goodness-of-fit tests)

Animals	$\chi^2_{(1)}$	p
Scorpion	4.472	0.034
Octopus	4.390	0.036
Crab	3.945	0.047
Spider	3.706	0.054
Butterfly	16.463	0.000
Beetle	6.188	0.013
Bee	9.331	0.002
Shark	6.050	0.014
Newt	13.067	0.000
Alligator	9.680	0.002
Snake	10.595	0.001
Ostrich	5.734	0.017
Hedgehog	6.068	0.014
Sea lion	13.785	0.000

Only significant effects are shown

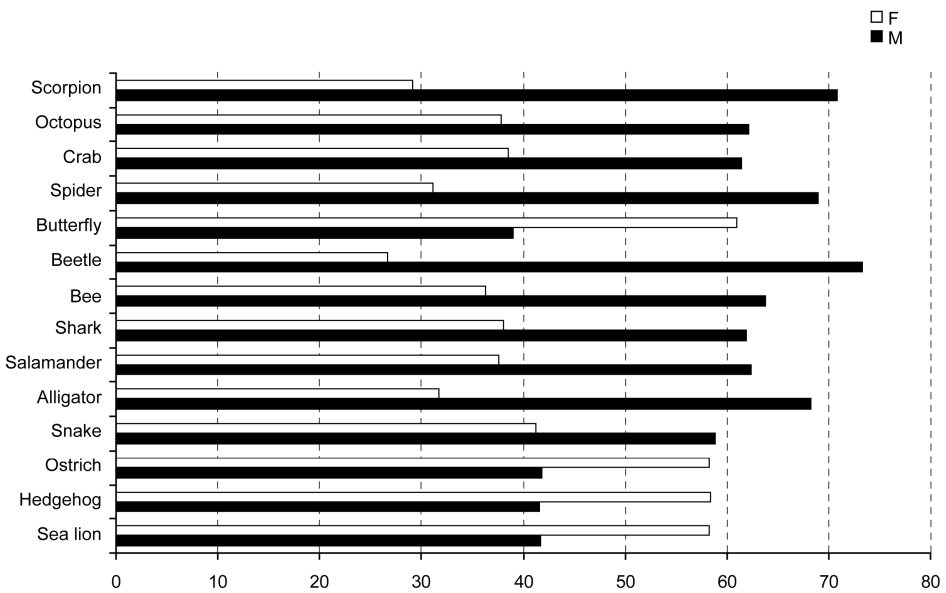

Fig. 4. Percentage (%) of preferences given by girls and boys for some images. Chi-square goodness-of-fit tests against the null hypothesis of equal distribution (50%), all $p<0.05$.

2.4 DISCUSSION

The analysis of children's preferences for a variety of animal species carried out in the present study shows an early emergence of children's propensity for higher order of species and for domestic over wild animals, as well as an unbalanced and gender-based distribution of preferences for some species, mostly for animals reported to induce disgust/fear response in humans.

A substantial body of literature on human attitudes and likeness of some species has shown that animals that appear and/or behave similarly to humans tend to be preferred, evoke more positive affect, as well as higher concern in term of welfare and conservation (Driscoll, 1992 ; Kellert, 1993b; Plous, 1993; Czech et al., 1998; Gunnthorsdottir, 2001; Serpell, 2004; Tisdell et al., 2005, 2006; Martín-López et al., 2007; Knight, 2008; Batt, 2009). Overall preferences shown by kindergarten children in our sample are in line with this 'Similarity Principle' (Tisdell et al., 2006) and suggest an early emergence of such a predisposition. Cluster analysis shows mammals ranking highly and dominating the top fractions of animals preferred by children in the hierarchical list, followed by birds and fishes, while reptiles received a moderate number of preferences (that placed them at the bottom of Cluster A). Invertebrates appear in the lowest category of the hierarchical scale (Cluster B), a result in line with the general trend to view them negatively observed in previous studies (Kellert, 1993b; Bjerke et al., 1998b; Woods, 2000; Bjerke and Ostdahl, 2004; Prokop et al., 2010; Wagler, 2010).

However, there were many exceptions that did not follow the 'Similarity Principle'. Although being an invertebrate, the butterfly was one of the favorite animals for children in our sample, second only to the dolphin and the horse. Among invertebrates, also the snail received a relative higher number of preferences in comparison to the other members of its taxonomic group. A similar response was observed when children gave preferences for the turtle in comparison with the other reptiles.

Similarity to humans (in particular phylogenetic closeness) is only one of the animal attributes explaining the enormous variance in people's attitudes towards animals (Serpell, 2004). The high rank of the butterfly, snail and turtle may be explained by their aesthetic appeal, as well as by children's exposure to their anthropomorphized representations (drawings placed on the wall in the classrooms or in children's exercise books; personal observation) that may have outweighed other factors (Kellert, 1993b; Serpell, 1996; Czech et al., 1998; Bjerke and Ostdahl, 2004; Batt, 2009; Wagler, 2010). Animal physical appearance or aesthetic quality were indicated as important factors underlying human greater appreciation and willingness to support some species or animal groups (Gunnthorsdottir, 2001; Serpell, 2004; Knight, 2008). Among others, animal attributes that have been most consistently shown to affect human preferences and attitudes are large size, neotenic (juvenile) features, shape, and color (Ward et al., 1998; Serpell, 2004; Stokes, 2007; Borgi and Cirulli, 2013; Lišková and Frynta, 2013). Previous results indicate that human aesthetic preferences discriminate finely among species and may be based on minor features, such as color (Stokes, 2007; Lišková and Frynta, 2013). Consistent with Stokes's observation, the parrot (whose image was the only one with bright colors, see *Images selection*) was highly preferred by children, in particular it was the only bird present in the highest-ranked sub-cluster. In the literature it is also claimed that animals represented as highly anthropomorphized, or that are perceived as infantile and cute, evoke positive affect (Gould, 1979; Kellert and Westervelt, 1984; Lawrence, 1986; Woods, 2000; Gunnthorsdottir, 2001; Serpell, 2002; Herzog, 2011) and are consistently preferred both by adult and children (Archer and Monton, 2011; Borgi and Cirulli, 2013). Moreover, it shouldn't be underestimated that, in comparison with most of their invertebrate and reptile counterparts (e.g. spider, scorpion, mosquito, snake, alligator), butterfly, snail and turtle may be perceived as non-threatening animals (e.g. slow locomotion), a reason that might explain their popularity (Tisdell et al., 2006).

Consistent with this interpretation, although in the opposite direction, is the observed low rank of the bat in the preference list. Bat was the only mammal present in cluster B (least favored animals). Bats are controversial and unpopular animals, well known from mythology and movies that have contributed to make them targets of irrational fear: a scarce level of knowledge and false beliefs about bats are the principal factors behind their unpopularity (Prokop and Tunnicliffe, 2008; Prokop et al., 2009a). Even if it is very improbable that children at that age have had direct contacts with bats (Prokop and Tunnicliffe, 2008), a negative attitude towards these animals seems to emerge very early during development.

Consistently with fear-based attitudes towards some animals, in the current study snake was confirmed to be one of the most unpopular animals (lowest rank in Cluster A). The dislike and fear of snakes seem to be a cross-cultural trait; they rank lowest on the preference scale in reports from many countries (Arrindell, 2000; Woods, 2000; Öhman and Mineka, 2003; Kaltenborn et al., 2006; Martín-López et al., 2007; Pagani et al., 2007; Batt, 2009). Fear/disgust for some animals is biological significant in evolutionary terms since it may prevent transmission of diseases or injuries (e.g. being bitten or attacked). However it should be taken into account that, similarly to bats, snakes might be the target of incorrect assumptions about their danger and thus of public prejudices (Kaltenborn et al., 2006; Pagani et al., 2007; Prokop et al., 2009b).

Results from the present study clearly confirm gender differences in animal species preferences that may partly be mediated by a higher level of fear/disgust of less popular animals among females relative to males observed both in older children and adults (Kellert and Westervelt, 1984; Davey, 1994; Bjerke et al., 2003; Røskaft et al., 2003; Bjerke and Ostdahl, 2004; Prokop and Tunnicliffe, 2008; Prokop et al., 2009b; Prokop and Tunnicliffe, 2010; Randler et al., 2012).

Our results extend the current knowledge about gender-based attitudes towards animals to younger children (3-6 years old), showing that, in comparison with girls of the same age, kindergarten boys indicate a higher appreciation of fear relevant animals, such as alligator, snake, and shark, and biting and stinging invertebrates (e.g. scorpion, spider, beetle, bee). Girls showed a greater preference for the butterfly, ostrich, hedgehog and sea lion, that seems to confirm a more aesthetically oriented attitude to animals observed in females (Kellert and Westervelt, 1984), including their higher sensitivity to infantile characteristics (Archer and Monton, 2011; Borgi and Cirulli, 2013). However, differently from previous research on older children, girls in our study were not more pet-oriented than boys and the gender did not effect the probability of choosing either farm or companion animals (Kellert, 1985; Bjerke et al., 1998b). Our results show that domestic animals were frequently chosen by both boys and girls and, in general terms, received a relative higher number of preferences than wild species. In line with what previously observed in children and adults, dogs was confirmed to be the favorite companion animals, followed by the cat; the horse was the top-ranked species among domestics, followed by the rabbit (Bjerke et al., 1998b; Woods, 2000; Borgi and Cirulli, 2013).

One of the most unexpected results of the current study is the high number of preferences given to the mouse image by both boys and girls in our sample of participants. Together with snakes and spiders, mice are usually ranked among the most fear-relevant animals, as they evoke relatively little affection or concern, they are considered serious crop pests and responsible for spreading diseases (Arrindell, 2000; Bjerke et al., 2003; Bjerke and Ostdahl, 2004; Serpell, 2004; Kaltenborn et al., 2006; Pagani et al., 2007). In our study, the mouse was ranked among the top-preferred animals (at the same level of the dog in the hierarchical list). One reason explaining this ‘mouse paradox’ (Randler et al., 2012) may be the employment of visual aids in our study that contrast with most of the assessment tools used to explore human attitudes towards animals in previous research. The presentation of a picture depicting a mouse may have positively influenced children’s responses, by emphasizing visual information (e.g. similarity to humans and cuteness perception) at the same time minimizing the cultural-based “bad reputation” of mice. Moreover, it should not be underestimated the widely use of the anthropomorphized and neotenic (juvenile) representations of the mouse in children’s books and films (Mickey Mouse, the popular Ratatouille released in 2007, and the Italian ‘Topo Gigio’), that may have contributed to make this animal particularly popular among children (Gould, 1979). Future studies should address this possibility by exploring attitudes to mice in a sample more representative of the different stage of developments (infants, children, adolescent, and adults) and the effect of exposure to positive, ‘cute’ representations of this species.

2.4.1. Conclusions

In sum, our results suggest that, children as young as 3 years show a propensity for higher order of species and for aesthetically appealing and familiar (mostly domestic) animals. Gender effects emerge very early during development showing higher negative and probably fear-related and disgust-related attitudes in girls. Apart from some exceptions, and not considering the observed higher appreciation of invertebrates in boys, these animals are confirmed to be the most disliked group of species since early stages of development.

The variations in the size and characteristics of sample populations (e.g. participants' age and nationality), the use of a widely varying methodologies, as well as the diversity of research focus, make extremely difficult a comparison among studies (Kellert and Westervelt, 1984). Although it is not easy to arrive at a comprehensive understanding of how different variables influence children's perception of animals, our analysis of species preferences in kindergarten children - a population usually not addressed in the literature - represents a further step towards a more in-depth exploration of the development course of attitudes to a wide range of animals. Although limited to the Italian population, the results presented here are based on a large sample size, which allows generalization. Moreover, we believe that an explorative analysis of Italian children's attitudes to animals is fundamental for cross-cultural comparisons and also in consideration of the important role that animals play in Italian youths' lives (Pagani et al., 2007).

Far from being a comprehensive exploration of the variety of children's attitudes, knowledge and behaviors towards animals, the analysis of relative preferences for some images appeared a good indicator to explore likeness of a wide range of species in young children. The experimental procedure (i.e., forced-choice task) resulted to be well suited for assessing preferences in our sample of participants, all of whom completed the testing session and appeared to enjoy it. Moreover, although the use of images (as well as drawing and videos) may be subject to a bias due to authors' image selection (e.g. pictures might be highly or poorly representative of each category), at the other hand the employment of visual aids appeared to be extremely useful to both sustain attention in very young participants and extract information on children's visual perception of animals.

2.4.2. Future perspectives

Knowledge of animals may influence humans' beliefs and behavior toward them, thus building positive attitudes toward animals is one of the main aims of biology teachers and environmental education programs (Iozzi, 1989). Observation of animals in nature, contacts with animals (e.g. handling), as well as information on biology of the living organisms, are able to increase appreciation of animals among children and youths and may change attitude typologies (Morgan and Gramann, 1989; Lindemann-Matthies, 2005; Prokop et al., 2009a; Randler et al., 2012).

Results from our study strongly suggest that these programs should be directed at children before they enter primary school, since most of the negative attitudes observed in children and adolescent (as well as in adults) emerge earlier. Interest in less popular animals such as snakes, bats, spider or insects, should be encouraged very early in children, especially in girls, since negative attitudes to these animals may became highly resistant to change (Bjerke et al., 2003; Prokop and Tunnicliffe, 2008; Prokop et al., 2009a; Prokop et al., 2009b). By anthropomorphizing and neotenizing selected animal species, educational programs may successfully make some animals appear cuter than they usually appear and thus attract children's attention (but see Lawrence, 1986; Grauerholz, 2007). However, while aesthetic quality may influence children's initial evaluation of different species and attitude discriminations, a better knowledge of bio-behavioral attributes of some animals, as well as direct contact with animals (e.g. observation and handling, monitoring local animal population) appear the relevant factors that may have a strong impact on children attitudes forming and to help children lay aside prejudices against specific animals (Kellert, 1985; Ballouard et al., 2011).

Although complex, there is a correspondence between attitudes and actual behavior (Glasman and Albarracin, 2006). Hence building positive attitudes to animals from childhood is of primary importance for its impact on animal welfare, and for the development of a healthy and safe relation between children and animals. The widely-supported notion that interaction with an animal has a beneficial influence on children's social-emotional and cognitive development and the mounting evidence of the valuable role of animals as adjuncts in therapeutic programs (Cirulli et al., 2011; Endenburg and van Lith, 2011; McCardle et al., 2011) call for further research exploring the multi-faceted ways in which children perceive animals and relate to them.

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CHAPTER 3

3. CHILDREN'S PREFERENCES FOR INFANTILE FEATURES IN DOGS AND CATS

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ABSTRACT

A number of authors suggest that children exhibit a natural interest towards animals and different intervention programs have shown the presence of an animal being able to increase children's attentiveness and motivation levels. Nonetheless, few research efforts have been devoted to the identification of specific animal characteristics able to attract and engage children. It has been hypothesised that the presence of infantile features in the most common pets (and their appeal for humans) is involved in our motivational drive to pet-keeping and pet-caretaking. This study was aimed at assessing children's preference for faces of pets with presence (or absence) of infant features and the generalization of this response to an inanimate object, a teddy bear. Children (n = 272) aged 3 to 6 years participated in the study and were tested on a forced-choice task, using paired photographic stimuli. Children's preferences for different species (dogs and cats) and for animal over non–animal stimuli were also obtained and the effects of sex, age, and pet ownership analyzed. Overall, children showed a preference for more infantile cats but no differences were found when they were asked to choose between dog faces. Moreover, children showed a preference for animal over non-animal stimuli and for dogs over cats. Factors such as sex, age, and familiarity with animals (i.e. ownership) were able to modulate their responses. Results and their implications for the child-animal bond are discussed.

Keywords: baby schema, children, pets, forced-choice task.

3.1. INTRODUCTION

As first suggested by ethologist Konrad Lorenz, the mechanisms through which human adults become attracted to infants of their own species involve a response to a specific configuration of facial and bodily features, commonly found both in human and animal infants and defined as *Kindchenschema* (*baby schema*) (Lorenz, 1943). A large head and a round face, a high and protruding forehead, large and low-lying eyes, bulging cheeks, and a small nose and mouth are some of the components of the quality referred to in the literature as *babyness* which is perceived as attractive and cute by humans (Alley, 1981; Berry and McArthur, 1985; Fullard and Reiling, 1976; Glocker et al., 2009a; Hildebrandt and Fitzgerald, 1979; Little, 2012; Lobmaier et al., 2010; Lorenz, 1943; Luo et al., 2011; Sternglan et al., 1977). Together with behavioural traits, such morphological characteristics combine to elicit the following responses from adults: increased attention, positive affect, and protective behaviour as well as decreased likelihood of aggression towards the infant (Alley, 1983a, b; Brosch et al., 2007; Glocker et al., 2009a; Lorenz, 1943; Sternglanz et al., 1977).

Several empirical studies have employed the use of pictures/drawing to analyse the appeal of baby schema for humans. In these studies, both children and adults have shown to consistently prefer images depicting subjects of baby-like appearance, particularly pictures of infant over those of adults (Berman, 1976; Berman et al., 1975; Fullard and Reiling, 1976; Luo et al., 2011; Sanefuji et al., 2007; Sternglanz et al., 1977).

Lorenz (1943) hypothesized that the human response to infantile features is not restricted to conspecifics, but can also be elicited by heterospecifics and a number of studies have demonstrated the generalization of the human attraction to infant-like stimuli, including animals (Archer and Monton, 2011; Fullard and Reiling, 1976; Little, 2012; Maestripieri and Pelka, 2002; Sanefuji et al., 2007), comic characters (Gould, 1979), and objects (Archer and Monton, 2011; Hinde and Barden, 1985; Miesler et al., 2011). Recent findings on the neural basis of the baby schema response, and its extension beyond the mother-infant relationship context, may explain why we feel the urge to care for anything that resembles a baby. Using functional magnetic resonance imaging, it has been found that the baby schema activates a key structure of the mesocorticolimbic system mediating reward processing, suggesting its role in providing motivational drive to caretaking behaviour (Glocker et al., 2009b).

It is well known that some animals, such as the most common pet species (i.e., dogs and cats), exhibit both morphological and behavioural infantile characteristics (*neotenic features*), which may have been retained into adulthood as a by-product of the domestication process (Clutton-Brock, 1981; Frank and Frank, 1982; Hare and Tomasello, 2005; Lorenz, 1943; Morey, 1994; Price, 1999). Infantile characteristics have also been emphasized during human selection of certain breeds for aesthetic reasons (e.g., lapdogs) and it has been hypothesized that such features (and their appeal for humans) combine to elicit emotional/affiliative responses towards pets and are involved in our motivational drive to pet-keeping and pet-caretaking (Archer, 1997; Archer and Monton, 2011). Previous studies have shown that infantile features present in images of young animals and in those of infant-like adults are able to affect both adults and children's preferences for those images and their perceived cuteness (Archer and Monton, 2011; Fullard and Reiling, 1976; Little, 2012; Maestripieri and Pelka, 2002; Sanefuji et al., 2007). Sex and familiarity with animals may modulate such a response, as was shown in Archer and Monton's (2011) study in which women showed higher preference scores for pets with infant features than men, and pet owners rated pet faces as more attractive than non-pet owners, regardless of whether the faces had infant features (Archer and Monton, 2011). Analyses of age effect on preference for human and animal infantile stimuli produced conflicting results (Feldman et al., 1977; Fullard and Reiling, 1976; Maestripieri and Pelka, 2002) and most previous studies that involved children as participants used stimuli not objectively quantified according to the baby schema content. Moreover, to our knowledge, no attempts have been made to analyze the response to both animate and inanimate infantile stimuli in children younger than 5 years.

The present study was aimed at assessing 3-6 year-old children's preference for infantile features using responses to a set of images depicting human babies, dogs, cats, and teddy bears. These pictures had been independently validated in adults and classified on the basis of an objective index of one aspect of the baby schema (i.e., *Facial index*, Archer and Monton, 2011). We used an experimental paradigm - a forced-choice task (Fisher et al., 1992) - in which two stimuli are simultaneously presented and participants are allowed to choose one since it is well suited to evaluate explicit preferences in young children (Schanding et al., 2009). We assessed children's preference for faces of pets with presence (or absence) of infantile features and the generalization of this response to an inanimate object, a teddy bear. Children's preferences for different species (dogs and cats) and for animal over non – animal (i.e. human and inanimate) stimuli were also obtained, and the effects of sex, age and presence of animals at home analyzed because these variables are likely to moderate preferences for infant features.

Following earlier findings on human adults' reaction to baby-like stimuli, we would expect a general preference for faces with infantile features over those without, girls to show greater preferences for infantile stimuli than boys, and pet owners to show greater preferences for pet faces than non-owners (Alley, 1983a, b; Archer and Monton, 2011; Feldman et al., 1977; Fullard and Reiling, 1976; Glocker et al., 2009a; Lobmaier et al., 2010). Owning cats or dogs may influence preferences, both for cat or dog faces with infant features and for cat or dog faces in general. A species-specific preference was shown in adult cat owners in Archer and Monton's study (2011). Moreover, previous studies have shown an overall preference (i.e., look more and show more positive emotional responses) for animal over inanimate stimuli in infants as young as 4 months (DeLoache et al., 2011), and different authors have suggested that children exhibit a natural interest in, and are particularly attracted to animals (Kahn, 1997; Kellert, 1985). According to this assumption, we would also expect a general preference for animal over non animal stimuli.

We therefore compared children's preferences either for particular classes of photographs, or preferences shown by different categories of participants, according to demographic information (sex and age) and information on presence of animals at home collected through teachers' and parents' collaboration.

3.2. METHODS

3.2.1. Participants

Participants were 272 children recruited in a public kindergarten in Ladispoli (Rome, Italy). Children's age ranged from 2.9 to 6.3 years (M_{age}=53 months). The gender distribution was close to even with 50.4% (n=137) girls and 49.6% (n=135) boys. All children, with the exception of 10, had Italian nationality; 34% of children had one parent with a different nationality (mostly Rumanian and Polish). Exclusion criteria consisted of certified developmental disability, visual impairment, or an unwillingness to participate spontaneously. Parents of participating children gave written informed consent and filled in a questionnaire comprising children's demographic information and presence of animals at home. The authors, as well as the teachers, distributed the questionnaires to parents. Questionnaires were returned to school in a closed envelope to guarantee privacy.

3.2.2. Photographic stimuli

Eighteen colour photographs (originals courtesy Prof. Archer, University of Central Lancashire; Archer and Monton, 2011) served as stimuli (Figure 1). They portrayed frontal shots of the face of dogs, cats, babies and teddy bears, reduced or enlarged so that they were equal in size. They comprised two each of the following categories: (a) puppy, (b) adult dog with infant features, (c) adult dog without infant features, (d) kitten, (e) adult cat with infant features, (f) adult cat without infant features, (g) teddy bear with infant features, (h) teddy bear without infant features, and (i) human infant. Pictures of young individuals (human infants, puppies, kittens) and those of adult pets and teddy bears with infant features (for simplicity hereafter all called *Infantile* stimuli) had a relatively higher Facial Index (i.e., a measurement of the centre of the eye to the crown of the head divided by the centre of the eye to the base of the chin) than those of adult pets and teddy bears without infant features (for simplicity hereafter all called *Non Infantile* stimuli) (Archer and Monton, 2011).

Figure 1. Photographs used: (in order): 1–2) human infants; (3–4) puppies; (5–6) kittens; (7–8) adult dogs with infant features; (9–10) adult cats with infant features; (11–12) adult dogs without infant features; (13–14) adult cats without infant features; (15–16) teddy bears with infant features; (17–18) teddy bears without infant features. From "Preferences for Infant Facial Features in Pet Dogs and Cats", J. Archer and S. Monton, 2011, *Ethology, 117, 217–226.* Copyright (2011) by Wiley. Reprinted with permission.

Pictures were matched in order to have different comparisons, as shown in Table 1. In the *Infantile Condition*, two pictures (Infantile vs. Non Infantile) of the same subject (dog or cat or teddy bear) were matched (Comparisons 2-3; 5-

6; 7). Moreover we compared children's preferences for young animals (i.e., puppies and kittens) with preferences shown for adult dogs and cats with infantile features (both Infantile stimuli; Comparisons 1 and 4). In the *Interspecies Condition* two pictures of different subjects (both of them Infantile or Non Infantile) were matched: dogs vs. cats and animal vs. non-animal (i.e. human infants and teddy bears) stimuli (Comparisons 8-16).

Table 1. Criteria for stimuli matching

Infantile Condition		
Subject	Category	Comparisons
Cat	CK: kitten CW: adult cats with infant features CO: adult cats without infant features	1. CK-CW 2. CK-CO 3. CW-CO
Dog	DP: puppies DW: adult dogs with infant features DO: adult dogs without infant features	4. DP-DW 5. DP-DO 6. DW-DO
Teddy bear	TW: teddy bears with infant features TO: teddy bears without infant features	7. TW-TO
Interspecies Condition		
Subject	Category	Comparisons
Dog vs. Cat	DP: puppies CK: kitten	8. DP-CK
	DW: adult dogs with infant features CW: adult cats with infant features	9. DW-CW
	DO: adult dogs without infant features CO: adult cats without infant features	10. DO-CO
Human vs. Animal	H: human infants DP: puppies	11. H-DP
	H: human infants CK: kittens	12. H-CK
Teddy bear vs. Animal	TW: teddy bears with infant features DW: adult dogs with infant features	13. TW-DW
	TO: teddy bears without infant features DO: adult dogs without infant features	14. TO-DO
	TW: teddy bears with infant features CW: adult cats with infant features	15. TW-CW
	TO: teddy bears without infant features CO: adult cats without infant features	16. TO-CO

CK=kittens; CW=adult cats with infant features; CO=adult cats without infant features; DP=puppies; DW=adult dogs with infant features; DO=adult dogs without infant features; TW=teddy bears with infant features; TO=teddy bears without infant features.

3.2.3. Procedure

Participants were tested during school hours in a dedicated familiar room. One experimenter tested all children. Each child followed the experimenter after being asked if he/she would like to leave the classroom to go to play with a laptop. Only in those cases when children were not comfortable to follow the experimenter, the teacher was asked to help take the child outside the classroom and the test started when the child was ready. Each child was tested individually. He/she was asked to sit in front of a monitor (screen size: 15.4'') and the experimenter sat next to him/her. Pairs of stimuli (16 different comparisons shown in Table 1) were presented in sequence. Since each category is represented in the original study (Archer and Monton, 2011) with 2 different pictures, 4 pairs of pictures were possible for each comparison. Picture pairing and left-right position of each picture was counterbalanced between subjects, with the constraint that each child could not be presented with the same picture more than twice. Order of pairs' presentation (serial position) was randomized between subjects. Once each pair of images was presented, the experimenter asked "*Which one do you like more?*" (if the child did not answer, the experimenter asked again "*Which one do you prefer?*") and preferences were collected in a check-sheet. Both verbal and non-verbal (i.e., pointing gesture) responses were accepted (Figure 2). The study took place from November 2011 to May 2012. Testing sessions occurred in the morning (from 9am to 1pm).

3.2.4. Statistical Analysis

The data were analyzed using Stata/SE 12.1(StataCorp, College Station, Texas, USA). Since children were asked to choose between two photographs, there were only two possible outcomes. Children's preferences for one of the two images presented were recorded and stored as 0-1 data (0=not chosen, 1=chosen). Children's preferences were evaluated with the binomial probability test of the null hypothesis that the two outcomes have equal probabilities (the two images are equally chosen). When other variables were involved (i.e., age, sex, pet ownership; cat/dog ownership), logistic regression was used, a statistical method for analyzing a dataset in which there are one or more independent variables that may determine a dichotomous outcome. A p-value ≤ 0.05 was accepted as statistically significant.

Figure 2. Gestural (i.e. pointing) response during a testing session.

3.3. RESULTS

3.3.1. Preference for infant features

In the Infantile Condition, children's preferences for two pictures (Infantile vs. Non Infantile and young vs. adults with infantile features) of the same subject (dog or cat or teddy bear) were assessed (see Table 1).

In the case of cats, children showed a preference for kittens and for more infantile stimuli in every comparison. Pictures of kittens were preferred to those of adult cats with and without infant features (Binomial test, $p<0.0001$, $n=272$ for both comparisons) and children preferred adult cats with infant features to those without (Binomial test, $p<0.0001$, $n=272$). When children were asked to choose between two photographs portraying dogs, they did not show preferences either for puppies or for more infantile adult dog in any comparison (dog puppies vs. adult dogs with infant features: Binomial test, $p=0.3026$; dog puppies vs. adult dogs without infant features: Binomial test, $p=0.9516$; adult dogs with vs. adult dogs without infant features: Binomial test, $p=0.7618$, $n=272$). When presented with pictures of an inanimate object, children showed a preference for teddy bear faces with infant features over those without (Binomial test, $p<0.0001$, $n=272$).

3.3.2. Preference for dog vs. cat faces

In Interspecies Condition, preferences for pictures of dog vs. cat faces were assessed. Children showed a preference for dog faces in every comparison: Children preferred faces of puppies to faces of kittens (Binomial test, p=0.0003, n=272), faces of adult dogs to those of adult cats with infant features (Binomial test, p=0.0062, n=272), and faces of adult dogs to those of adult cats without infant features (Binomial test, p<0.0001, n=272) (Figure 3).

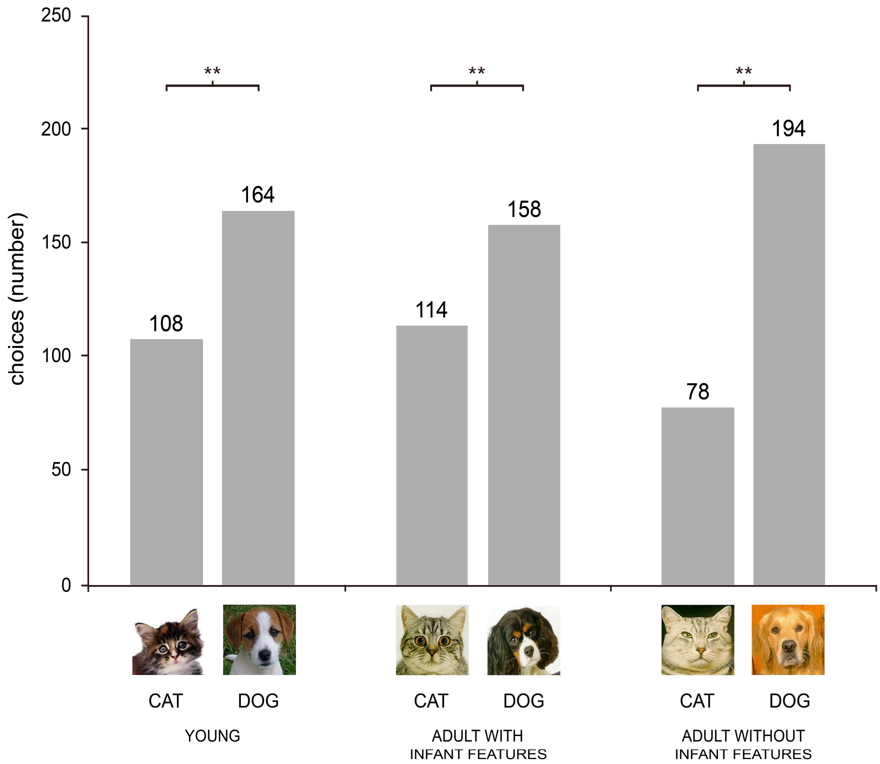

Figure 3. Interspecies Condition. Children preferences (number of choices = number of children) between dogs and cats. ** Binomial test, p<0.01. (n=272).

3.3.3. Preference for animal over non animal faces

In Interspecies Condition, children's preferences for pictures depicting animals over non-animal (i.e. human infants and teddy bears) images were assessed.

Children showed a preference both for faces of dog puppies (Binomial test, p<0.0001, n=272) and for faces of kittens (Binomial test, p<0.0001, n=272) over human infants (Figure 4).

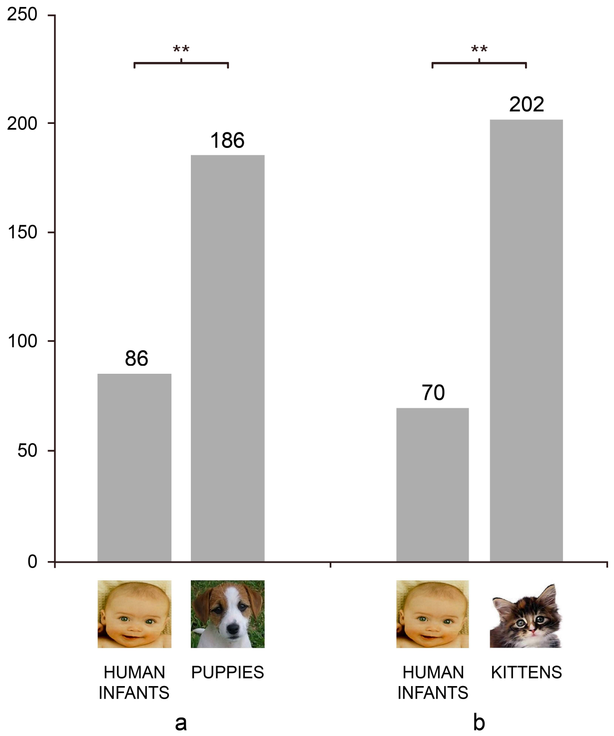

Figure 4. Interspecies Condition. Children preferences (number of choices = number of children) for human infants and puppies (a) and for human infants and kittens (b). ** Binomial test, $p<0.01$. ($n=272$).

When choosing between dogs and teddy bears, children showed a preference for faces of dogs (both with and without infant features) over those of teddy bears (Binomial test, $p<0.0001$ for both comparisons, $n=272$; Figure 5a). Moreover children preferred faces of cats to faces of teddy bears with infant features (Binomial test, $p<0.0001$, $n=272$), but no preference was shown when they were asked to choose between faces of cats and teddy bears without infant features (Binomial test, $p=0.7618$, $n=272$) (Figure 5b).

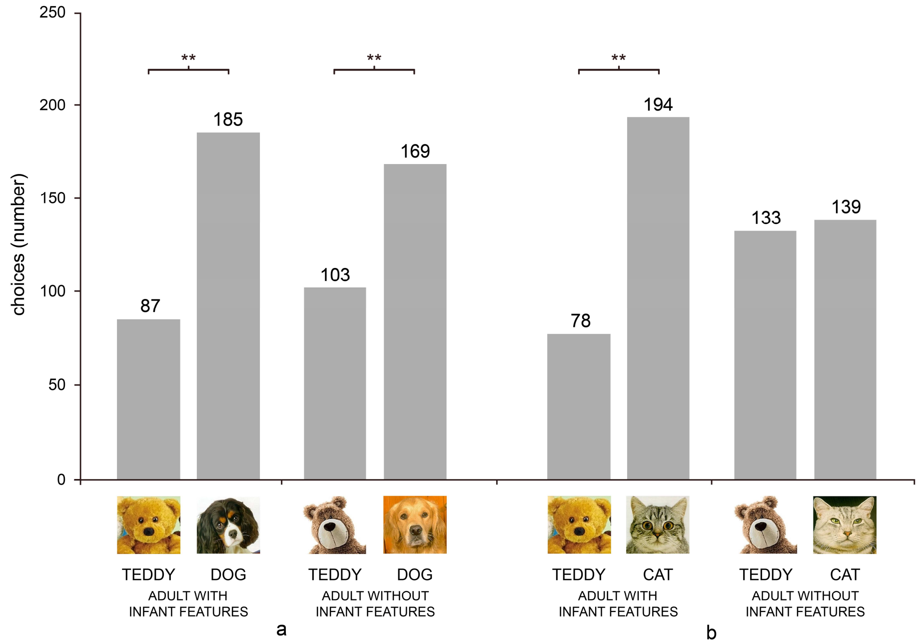

Figure 5. Interspecies Condition. Children preferences (number of choices = number of children) for teddy bears and dogs (a) and for teddy bears and cats (b). ** Binomial test, p<0.01. (n=272)

3.3.4. Effect of sex and age

We obtained demographic information (sex and date of birth) from all participants (n=272). In order to assess the effect of sex and age on children preferences for infantile features, for different species (dogs and cats) and for animal (over non-animal) stimuli, a two-predictor logistic model was fitted to the data. The two predictors were sex and age (above and below mean: Group 1 < 53 months, Group 2 > 53 months).[1]

3.3.4.1. Infantile Condition. Children's preference for images of more infantile cats was not affected by sex, but was negatively related to age for one comparison (Table 2a-c): The odds of a child choosing pictures of adult cats without infant features (over those with) was more likely to occur in Group 2 (Table 2c). When children were asked to choose between two dogs, the likelihood of choosing infantile dog pictures (both puppies and adult dogs with infant features over those without) was higher in girls than in boys and was not affected by age (Table 2d-f). No effect of sex and age was found on children's

[1] Group 1 (n=136): girls n=68, boys n=68; Group 2 (n=136): girls n=69, boys n=67)

preferences for teddy bears with infant features over those without (Table 2g). No interaction effects between sex and age were found.

Table 2. Logistic Regression Table. Effect of sex and age on children's preferences (Infantile Condition), n=272

Comparisons	Predictor	Odds Ratio	Std. Err	z	p>│z│	[95% Conf. Interval]	
a. CK (*vs.* CW)	Sex	1.475155	.6006605	0.95	0.340	.6641124	3.27667
	Age	1.514493	.6043171	1.04	0.298	.6928167	3.31067
	Sex*Age	.4019139	.2252605	-1.63	0.104	.1339863	1.20560
	constant	2.421053	.6602451	3.24	0.001	1.418643	4.13176
b. CK (vs. CO)	Sex	1.103909	.3923534	0.28	0.781	.5500446	2.21548
	Age	1.363248	.478982	0.88	0.378	.6847028	2.71423
	Sex*Age	2.255855	1.184895	1.55	0.121	.8057766	6.31549
	constant	1.241379	.3097497	0.87	0.386	.7612235	.024402
c. CW (*vs.* CO)	Sex	.6216006	.2216894	-1.33	0.182	.3089844	1.25050
	Age	**.3356643**	**.1239412**	**-2.96**	**0.003**	**.1627819**	**692156**
	Sex*Age	1.304562	.6928	0.50	0.617	.4607083	3.69405
	constant	1.03125	.2558519	0.12	0.901	.6341352	1.67705
d. DP (*vs.* DW)	Sex	1.09899	.3874592	0.27	0.789	.550674	2.19327
	Age	1.087236	.3748727	0.24	0.808	.5531392	2.13704
	Sex*Age	.9837043	.4788238	-0.03	0.973	.3789111	2.55382
	constant	1.03125	.2558519	0.12	0.901	.6341352	1.67705
e. DP (*vs.* DO)	**Sex**	**2.230415**	**.8131305**	**2.20**	**0.028**	**1.09161**	**4.55725**
	Age	1.868726	.66773	1.75	0.080	.9276747	3.76439
	Sex*Age	1.02633	.5155327	0.05	0.959	.3834622	2.74695
	constant	.4772727	.1265865	-2.79	0.005	.2837942	.802656
f. DW (*vs.* DO)	**Sex**	**2.192593**	**.7876996**	**2.19**	**0.029**	**1.084325**	**4.43359**
	Age	1.347368	.4717056	0.85	0.394	.6784	2.67600
	Sex*Age	.8704226	.4304558	-0.28	0.779	.3302022	2.29446
	constant	.625	.1593444	-1.84	0.065	.3791974	1.03013
g. TW (*vs.* TO)	Sex	1.72859	.6218639	1.52	0.128	.854025	3.49875
	Age	1.219941	.4216343	0.58	0.565	.6196522	2.40176
	Sex*Age	1.937889	1.017527	1.26	0.208	.6924504	5.42337
	constant	1.03125	.2558519	0.12	0.901	.6341352	1.67705

CK=kittens; CW=adult cats with infant features; CO=adult cats without infant features; DP=puppies; DW=adult dogs with infant features; DO=adult dogs without infant features; TW=teddy bears with infant features; TO=teddy bears without infant features.

3.3.4.2. Interspecies Condition. Sex and age had no effect on children's preferences for dogs (over cats) and for animal (over non-animal) stimuli.

3.3.5. Effect of having animals at home

We obtained information on the presence of animals at home from 162 of 272 children tested, whose parents filled out the questionnaires (completion rate of 59.5%). There were 57 dog and cat owners (*pet owners*), 22 *other animal owners* (most of them owned turtles, birds, rabbits and other small mammals) [2] and 83 *non-owners*. [3] Of the pet owners, 34 owned dogs, 12 owned cats, and 11 owned both dogs and cats.

3.3.5.1. Infantile Condition. In order to assess if having pets at home modulated children's preference for infantile characteristics present in the faces of pets, as well as in teddy bears, we analysed the effect of pet ownership (and its possible interaction effects with sex and age) using a logistic regression model with pet ownership, sex, and age as predictors. Having pets at home did not influence children's preferences for infantile features: neither effects of pet ownership nor interaction effects between pet ownership and sex and age were found (all $p > 0.05$). In order to investigate possible species-specific preferences for infantile features, a logistic regression was also performed with cat ownership and dog ownership entered as independent variables. No significant effects were found.

3.3.5.2. Interspecies Condition. One of our hypotheses was that owning cats or dogs may influence preferences not only for cat or dog faces with infantile features, but also for cat or dog faces in general. Our analyses showed a species-specific effect in children's preferences for different species (dogs and cats). Although overall, children preferred images of dogs over those of cats (see above), the likelihood of choosing images of cats was higher in children who had cats at home than in those who had not (Logistic regression, Predictor cat ownership: DW, adult dogs with infant features vs. CW, adult cats with infant features: odds ratio=0.305, Std. Err=0.1919, $z=-1.90$, $p=0.057$; DO, adult dogs without infant features vs. CO, adult cats without infant features: odds ratio=0.3349, Std. Err=0.1600, $z=-2.29$, $p=0.022$). No effect of dog ownership was found in children preference for dog over cat faces (all $p > 0.05$).

Neither cat ownership nor dog ownership influenced children's preferences for animal over non-animal (human and teddy bear) stimuli.

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[2] Respondents who owned both pets and other animal species where considered pet owners.

[3] Pet owners: M_{age}=53 months, 49.1% girls, 50.9% boys; Other animals owners and Non owners together: M_{age}=52 months, 47.1% girls, 52.9% boys

3.4. DISCUSSION

In this study, we analysed children preferences for photographic stimuli showing both inanimate and animate (humans and animals) subjects. Our working hypothesis was that children would show a general preference for faces with infantile features over those without. Moreover, we expected girls to show greater preferences for infantile stimuli than boys and pet owners to show greater preferences for pet faces than non-owners. Following earlier findings on children' reaction to animal stimuli, we also expected a general preference for animal over non-animal stimuli. To our knowledge this is the first study to analyze preferences for infantile features present in faces of pets (i.e., dogs and cats), as well as in inanimate objects (i.e., teddy bears) shown by children as young as 3 years. The experimental procedure (i.e., forced-choice task) appeared well suited for assessing preferences in young children, all of whom completed the testing session and appeared to enjoy it.

Results from this study partially support our initial hypotheses. Overall, children showed a preference for more infantile cats, and were able to discriminate the presence of infant features also in an inanimate stimulus, suggesting the generalization of children's response to an infantile configuration. These results are consistent with those obtained by Archer and Monton (2011) through the analysis of adults' preferences based on the same set of stimuli. By contrast, in our study, children showed no specific preferences for more infantile dogs. Together with preferences shown by children for dog over cat faces in every comparison and with the failure of dog ownership in predicting preferences, this result suggests that children are particularly attracted to dogs (and prefer them over cats), regardless of whether the dogs have infantile features and regardless of participants' familiarity with them. However, it should be taken into account that there is a strong sex effect found for dog preferential choices, indicating that girls are more likely to prefer infantile dogs than boys. In Archer and Monton's study (2011), women showed higher attractiveness scores for pets with infantile features than men. In our study, girls showed a higher preference for infantile traits than boys only when they had to choose between dogs (children's favourite species). By contrast, boys and girls equally preferred pictures of more infantile cats. Although data are still conflicted (Parsons et al., 2011), a number of behavioural studies have shown women to be more responsive to the baby schema: they not only tend to be more attracted to and prefer baby-like stimuli but they also appear more motivated to exhibit nurturing behaviour towards infants than men (Alley, 1983a,b; Berman, 1980; Feldman et al., 1977; Glocker et al., 2009a; Hildebrandt and Fitzgerald, 1979; Lobmaier et al., 2010; Maestripieri and Pelka, 2002; Sprengelmeyer et al., 2009; Sternglanz et al., 1977). Early attraction to infants might facilitate the acquisition of mothering skills prior to the onset of reproductive activity. However, further studies are needed to definitively answer the question as to whether a tendency towards nurturing behaviour is already present in children, particularly in girls, at an early stage of development (from 3 years of age), and if such predisposition could be extended to include the human-animal bond. Gender differences in cultural conditioning and experiences, such as exposure to media and toys, which encourage caring behaviours in girls, are well-known. The possibility that such factors may also influence our relationship with pets (especially when they are puppies or kittens) from an early stage of development remains unexplored (Melson and Fogel, 1996). It would also be important to assess whether girls' preference for infantile traits is caused by differences in the motivation to care for young animals, or by perceptual differences. In this context, the analysis of children's perception of cuteness as well as their responses when questioned about caretaking tasks - in which participants are asked to rate the extent of their motivation to take care of the subject in the picture – might help elucidate this issue and could be particularly useful (Glocker et al., 2009a).

Interestingly, when we analyzed the effect of age and familiarity with pet animals (i.e., pet-ownership) to explore the role of experience in modulating individual responses to stimuli presented, we found that pet ownership had no effect on children's preferences for infantile features present either in dogs or in cats; although, familiarity with a species was able to modulate species-specific preferences. In fact, overall children showed a preference for images of dogs over those of cats, but the likelihood of choosing images of cats (independently from infantile features) over those of dogs was higher in children who had cats at home than in those who did not. Moreover, the likelihood of a child choosing pictures of adult cats without infant features - which represented the least favourite stimulus and not preferred over an inanimate object (teddy bear) – was more likely in older children. These results seem to suggest that children learn to appreciate non-preferred animals through age and familiarity. However, this notion should be treated with caution, especially in consideration of the small number of cat owners enrolled in this study. Future studies should consider not only information on the presence/absence of animals at home, but also children's attachment to pets, which may better inform about the effects of growing with animals on children attitudes (Daly and Morton, 2009; Zasloff, 1996). Moreover, since home environment seems to impact children's perspectives, the effects of living with siblings (in particular infant siblings) should be taken into account in future studies.

Overall, children showed a preference for animal over non-animal (i.e., human and teddy bear) stimuli. In Archer and Monton's study (2011), when asked to rate photographs for their attractiveness, adult participants showed a preference for faces with infantile features but, differently from children in our study, they found photographs of puppies and kittens to be as attractive as those of human infants. It has been hypothesised that children exhibit a strong interest towards animals (Kahn, 1997; Kellert, 1985) and a greater attraction to animal stimuli has been shown in children as young as 4 months (DeLoache et al., 2011). Results from the present study seem to confirm this notion, and represent further evidence that there are not individual differences in children's strong preference for animals as a function of either sex/age or prior experience with animals (DeLoache et al., 2011). Nonetheless, more research is needed to investigate human preferences and attitudes towards animals and their change during development. In children, this consideration is of particular importance since the positive contribution of growing up with animals on emotional development, attentiveness, motivation levels, and sense of responsibility are well recognized (for a review see Cirulli et al., 2011 and Endenburg and van Lith, 2011). Nonetheless, few research efforts have been devoted to the identification of specific animal features able to attract and engage children. The analysis of specific animal characteristics able to elicit emotional/affiliative responses in children could ultimately help develop interventions for children with difficulty in the social/emotional domains by providing salient and emotionally relevant stimuli (Berry et al., 2013). This also may have implications for some of the questions raised about the inclusion of animals in Animal Assisted Interventions (AAI) (Marino, 2012).

Although results from the present study may represent a further step towards understanding those factors underlying human preference for other animal species and its development, a note of caution must be offered. The original set of pictures has been classified only on the basis of the Facial Index, which gives one objective aspect of the baby schema; it does not measure other characteristics such as large eyes (Archer and Monton, 2011). Moreover, pictures were subjectively selected by the authors, have different backgrounds (as well as colouration and expression), and the set was limited to two images per category, so that pictures might be not highly representative of each category. Although we used this set of images in order to compare and contrast our data with previous results, future studies should utilize stimuli with objectively quantified baby schema that retain all the characteristics of the portrait (Glocker et al., 2009a). This standardization could be of help in future systematic research of this subject. For example, comparative studies of different breeds of dogs in terms of their possession of baby facial features and its association with behavioural neoteny are lacking (Coppinger et al., 1987).

3.4.1. Conclusions and Future Prospects

Overall, the present study suggests that the ability to identify and prefer selected infantile features may emerge during early development. Preferences for baby schema appear to be species-specific and more pronounced in girls. Familiarity with an animal seems able to modulate preferences, particularly for less popular species (i.e., cats), a notion that underlines the importance of educational programs to promote child-animal relationships. Studies are currently in progress to better standardize stimuli and take into account other baby schema features (both morphological and behavioural). More research will also be needed to explore the possibility that factors such as experience and learning may influence our relationship with pets from an early stage of development. A major discrepancy between results obtained using measures of behavioural interest and those obtained using picture preference measures can occur (Berman, 1980). Therefore, both behavioural (direct observations) and questionnaire-based studies (to assess children's roles and responsibilities in caring for pets at home) as well as gender differences in attachment to pets should be encouraged to address this issue (Herzog, 2007).

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CHAPTER 4

4. WHY ARE WE ATTRACTED TO ANIMALS? EXPLORING THE BABY SCHEMA RESPONSE THROUGH EYE-TRACKING

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ABSTRACT

Pets (i.e. dogs and cats) exhibit both morphological and behavioural infantile characteristics. It has been hypothesized that the response to such features forms the basis of human attraction to these animals. The *baby schema* concept was originally proposed as a set of infantile traits eliciting caretaking behaviour. Several studies have demonstrated the baby schema's appeal for humans, in particular its effect on cuteness perception and, more recently, its role in modulating motivational and attentional processes.

However, it is unclear whether the response to the baby schema may be extended to the human-animal bond context and whether it depends on depicted species or pet-ownership experience. Furthermore, questions remain as to whether the cute response is constant and persistent or whether it changes with development. Following Glocker et al.'s procedure (2009) we parametrically manipulated the baby schema in images of humans, dogs and cats. We analysed responses of 3-6-year-old children, using both indirect (i.e. cuteness ratings) and direct (eye-tracking of looking behaviour) measures. For comparative purposes, ratings were also obtained by a sample of adults.

Overall, results show that the baby schema influences both cuteness perception and gaze allocation to specific facial features, an effect not simply limited to human faces. However, individual factors also affect attraction to animals: while in adults pet ownership influences their cuteness perception of different species, children show a general proneness towards animals, not mediated by experiential factors and only partially dependent by infantile features. Implications for the development of a safe and healthy relationship between children and animals are discussed as more in-depth knowledge of factors underlying children's attraction to animals may help interventions involving pets, at the same time minimizing risk factors (e.g. dog bites). This is particularly important in light of the growing employment of different animal species in educational and therapeutic contexts.

Keywords: attention, cats, children, dogs, eye-tracking, gender.

4.1. INTRODUCTION

It has been hypothesized that humans exhibit a natural interest and a predisposition to be attracted by other species (the so-called *Biophilia Hypothesis*, Kellert, 1993). A general proneness towards animals is observed in children from a very early stage of development (DeLoache et al., 2011; Lobue et al., 2012; Borgi and Cirulli, 2013). Children are more likely to be attentive and to have increased motivational levels in the presence of animals and this has led to the inclusion of different animal species both in educational and therapeutic interventions aimed at promoting healthy development in children (Cirulli et al., 2011; Endenburg and van Lith, 2011; Berry et al., 2013; O'Haire, 2013).

Despite recent interest of child psychology research in the Human-Animal-Interaction field (e.g. benefits of contacts with animals during development, dog bite prevention, links between animal and child abuse), attempts to identify factors underpinning distinct behavioural responses towards animals are still scarce. Preliminary studies analysing differences in children's behaviour towards robotic, stuffed and real animals suggest that animal features can impact upon children's emotional response and willingness to engage in social interactions (Kerepesi et al., 2006; Ribi et al., 2008; Howard and Vick, 2010). Even in subjects with a deficit in the social domain (i.e. autism spectrum disorder) a preference for animal over human and inanimate stimuli has been shown (Celani, 2002; Prothmann et al., 2009) as well as an increase in social behaviours in the presence of animals compared to toys (O'Haire et al., 2013). However, more studies are needed to identify specific animal attributes and traits influencing perception of and attraction to animals in children - and ultimately their affiliative response towards them.

Most common pet species (i.e. dogs and cats) exhibit both morphological and behavioural infantile characteristics which have been retained into adulthood as a by-product of the domestication process (*neoteny*, Lorenz, 1943; Belyaev, 1979). It has been hypothesized that such features might form the basis of our attraction to animals, especially pets (Archer, 1997). The term *baby schema* (*Kindchenschema*, Lorenz, 1943) refers to a set of facial features (i.e. large head and a round face, a high and protruding forehead, large eyes, and a small nose and mouth) commonly found both in human and animal infants. In classical ethology this specific configuration of features has been described as triggering an innate releasing mechanism for caregiving and affective orientation towards infants (Lorenz, 1943) and, more recently, its role in promoting human nurturing behaviour was demonstrated at the neurophysiologic level using neuroimaging (Glocker et al., 2009b).

Several empirical studies have employed the use of pictures/drawings to analyse the appeal of the baby schema for humans showing that faces with infantile traits are commonly perceived as cute and attractive and are consistently preferred to those with a less infantile facial configuration

(Sternglanz et al., 1977; Hildebrandt and Fitzgerald, 1979; Alley, 1981; Glocker et al., 2009a). Previous research has demonstrated the generalization of the response to infantile features to real animals (Archer and Monton, 2011; Little, 2012), representations of animals such as cartoon characters (e.g. Mickey Mouse, Gould, 1979) and stuffed/toy animals (e.g. Teddy bear Hinde and Barden, 1985; Archer and Monton, 2011).

The concept of cuteness not only encompasses the processing of specific morphological features, but also involves a positive/affectionate behavioural response. Increased attention and willingness to care, positive affect and protective behaviour, as well as decreased likelihood of aggression towards the infant, characterize the so-called *baby schema response* or *cute response* (Lorenz, 1943; Alley, 1983; Brosch et al., 2007; Glocker et al., 2009a; Sherman et al., 2009; Nittono et al., 2012).

Although the analyses of the emergence of a cute response during development have so far produced results not easily comparable (Fullard and Reiling, 1976; Maestripieri and Pelka, 2002; Sanefuji et al., 2007; Borgi and Cirulli, 2013), cuteness perception and preference for infantile features in animals (as well as the pseudo-nurturing behaviour towards animal-like toys such as teddy-bears) seem to emerge in children of both sexes between 3 and 6 years (Morris et al., 1995; Borgi and Cirulli, 2013). Children's positive response to the baby schema appears to be influenced by the viewed species, and gender and familiarity with animals (i.e. pet ownership) may modulate preference (Borgi and Cirulli, 2013).

There are, nonetheless, a range of limitations to the generalization of these finding. First, most of the previous studies have employed drastically simplified stimuli (line drawings and schematic faces) or stimuli not controlled for the individual facial differences unrelated to baby schema (e.g. colour, pose and expression). Hence the interpretation of outcomes is limited by the impossibility to dissociate the response to a specific stimulus (humans vs. animals; adult vs. young) from the response to its facial configuration (i.e. baby schema). Only recently Glocker and colleagues gave the first experimental evidence of baby schema effects in actual infant faces, by developing an effective procedure to create stimuli with objectively quantified and parametrically manipulated baby schema content that retained all the characteristic of the individual portrait (Glocker et al., 2009a).

Second, when asked for overt preferences, participants might only report socially desirable and appropriate responses, as evidenced in traditional self-report measures (e.g., ratings, questionnaires, interviews). Direct preference assessments (such as preferential looking) represent a more reliable and sensitive measure of the observer's preferences (Fleming et al., 2010) and may shed light on the cognitive mechanisms underlying attraction to different stimuli. In fact, although this aspect is still not extensively explored, the baby schema response seems to be anticipated by an attentional bias towards infantile stimuli. Previous studies have shown a visual prioritization (dotprobe task, Brosch et al., 2007) and a willingness to increase the viewing time to cute images (key-press task, Parsons et al., 2011; Hahn et al., 2013; Sprengelmeyer et al., 2013) in adult participants. In general, adults tend to look longer at infant than at adult faces and at cuter than at less cute infants (Hildebrandt and Fitzgerald, 1978; Power et al., 1982; Parsons et al., 2011; Cárdenas et al., 2013; Hahn et al., 2013; Sprengelmeyer et al., 2013). However, further studies are needed to determine whether this attentional bias is constant and persistent or whether it changes during development. In addition, questions remain as to whether this response may be detected when viewing images of non-human faces.

4.1.1. The present study

In this study we have systematically investigated the effects of the baby schema on children's and adults' perception of cuteness in humans and pets. We adapted Glocker et al.'s procedure – originally developed to modify human infant faces (Glocker et al., 2009a) - and are the first to apply it also to faces of human adults as well as adult and young animals. We created a photographic set of stimuli consisting of facial images of both humans and pets (i.e. dogs and cats), parametrically manipulated to produce two portraits of the same subject: one *high* in infantile features (round face, high forehead and big eyes, small nose and mouth) and one *low* in infantile features (narrow face, low forehead and small eyes, big nose and mouth). This procedure allows to disentangle the effects of degree of infantile features and age of displayed species. We assessed responses to the different categories of stimuli (humans vs. animals; adult vs. young) varying for the amount of baby schema (high vs. low infantile features), using both indirect (i.e. cuteness judgement) and direct (i.e. gaze behaviour) measures.

The goal of ***Experiment 1*** was to test the effect of the baby schema on children's perception of images presented to them. Stimuli were individually displayed and children were asked to rate pictures for cuteness. Eye-tracking was used to explore participants' fixation patterns towards displayed images (gaze distribution across key internal facial features, i.e. eyes, nose, and mouth). We predicted both cuteness ratings and gaze patterns to be sensitive to cues specifically related to infant-like characteristic, and are the first to test such an assumption in children.

In ***Experiment 2*** eye-tracking was used to assess children's preferential attention to one of two displayed images varying only for the degree of baby schema (side by-side pictures: high vs. low infantile).

Finally, for comparative purposes, a sample of university students was recruited to participate in ***Experiment 3*** in which we collected adults' cuteness judgements of the same set of stimuli as in Experiment 1, through a web-based questionnaire.

The role of factors such as age, gender, and experience/familiarity with animals in modulating both cuteness processing and behavioural response to infantile stimuli is still not clear (Maestripieri and Pelka, 2002; Archer and Monton, 2011; Borgi and Cirulli, 2013). The effects of gender and pet ownership were thus assessed in all experiments (in both children and adults' participants).

4.2. MATERIALS. STIMULUS CREATION

4.2.1. Overview

The stimuli were based on a set of 120 colour facial photographs (full frontal view, looking at camera, closed mouth and neutral facial expression) depicting 20 subjects for each of the following 6 categories: human adults, human infants, adult dogs, puppies, adult cats, kittens. Most of the images were obtained from Thinkstock/Getty Images (www.thinkstockphotos.it, courtesy of Gioacchino Altamura), some were collected on the World Wide Web. Following Glocker et al.'s method (Glocker et al., 2009a), pictures were modified to produce faces with parametrically manipulated baby schema that consisted of *high* and *low* infantile features for each portrait. In particular, in Glocker's study baby schema was operationalized using facial features that had previously been suggested to contribute to the baby schema response (and recognized as typical anatomical infant characteristics) such as face width, forehead length and eye, nose and mouth size. Baby schema content in each image was manipulated using the range of baby schema values (mean and standard deviation, SD) in a sample of unmanipulated images as a guide for the manipulation procedure which consisted in reducing or enlarging facial parameters (above or below the mean; with the range of manipulation depending on SD) to produce either *high* or *low* infantile features (Glocker et al., 2009a). In our study, the Glocker's method, originally developed to modified human infant faces, was for the first time applied also to faces of human adults and to those of adult and young animals (dogs and cats).

4.2.2. Stimulus creation procedure

Pictures were digitized at 72 dpi and were two-dimensionally rotated and scaled to a head length of 600 pixels. A coordinate system was superimposed on the faces so that the x-axis connected the inner corner of the eyes and the y-axis traversed the midline of the nose. Facial measurements were obtained by measuring distances between the following landmarks (see Figure 1): A (top of the head), B (bottom of the chin), C and D (outer edges of the face along the x-axis), E_1 and E_2 (inner corners of the eyes), F_1 and F_2 (outer corners of the eyes), O (nose base at the crossing of the x- and y-axis), H (below the tip of the nose), I and J (widest point on nose wing), K and L (outer edge of the mouth).

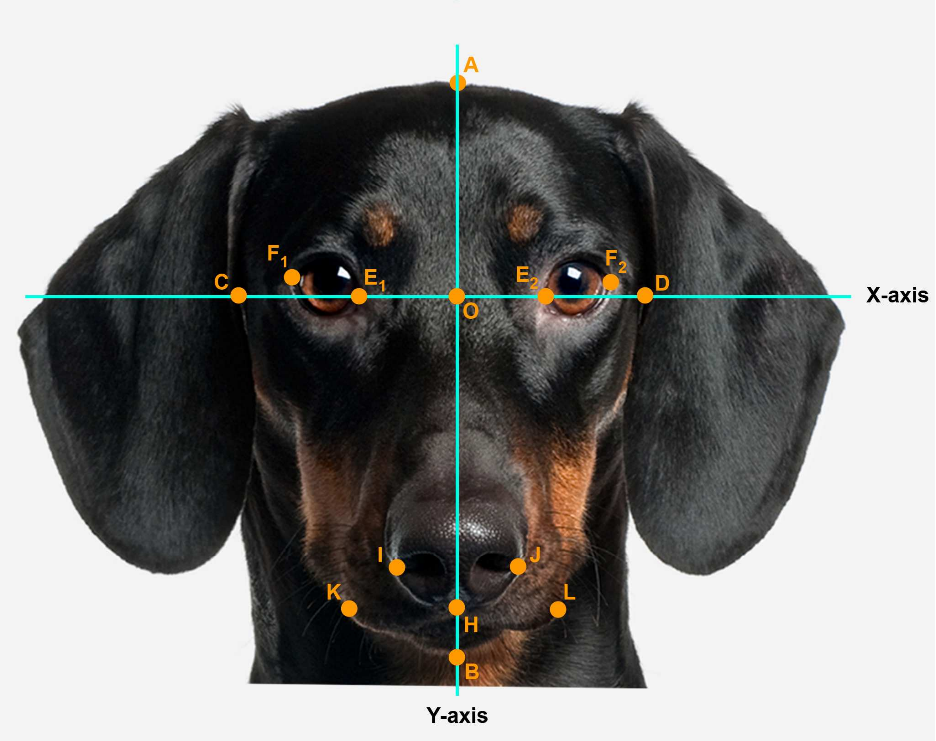

Figure 1. Facial landmark (example: portrait of an adult dog). Head length (AB, fixed, 600 pixels), face width (CD), forehead length (AO), eye width (EF, as the average calculated from the right, E_1F_1 and left E_2F_2 eye width), nose length (OH), nose width (IJ), mouth width (KL). Photo: Thinckstock/GettyImages (modified).

Table 1. Measurements taken (A) and baby schema facial parameters (B) in a sample of 20 unmanipulated images (mean and SD) (C).

Measurements (A)	Facial parameters (B)	Mean (SD) (C)						
		Human adult	Human adult	Human infant	Dog	Puppy	Cat	Kitten
AB= head length (fixed)	---------	600	600	600	600	600	600	600
CD= face width	CD	365.0 (16.0)	391.6 (23.5)	436.1 (66.5)	479.9 (91.0)	589.3 (44.4)	688.3 (48.4)	365.0 (16.0)
AO = forehead length	AO/AB	0.48 (0.02)	0.61 (0.03)	0.44 (0.06)	0.49 (0.05)	0.56 (0.03)	0.59 (0.05)	0.48 (0.02)
EF = eye width (average)	EF/CD	0.17 (0.01)	0.19 (0.01)	0.12 (0.03)	0.12 (0.02)	0.16 (0.01)	0.15 (0.01)	0.17 (0.01)
OH = nose length	OH/AB	0.21 (0.02)	0.14 (0.01)	0.42 (0.09)	0.34 (0.07)	0.29 (0.02)	0.23 (0.03)	0.21 (0.02)
IJ = nose width	IJ/CD	0.26 (0.02)	0.24 (0.02)	0.30 (0.04)	0.23 (0.06)	0.15 (0.02)	0.13 (0.01)	0.26 (0.02)
KL= mouth width	KL/CD	0.35 (0.02)	0.29 (0.04)	0.62 (0.16)	0.61 (0.14)	0.41 (0.07)	0.35 (0.06)	0.35 (0.02)

Using Adobe Photoshop ruler tool with pixel as unit, the following distances between landmarks were measured (Table 1, column a): head length (AB, fixed, 600 pixels), face width (CD), forehead length (AO), eye width (EF, as the average calculated from the right, E_1F_1 and left E_2F_2 eye width), nose length (OH), nose width (IJ), mouth width (KL).

The baby schema was captured by six facial parameters (Table 1, column b): CD as an absolute measure in pixels with reference to the head length of 600 pixels, and five proportion indices (relative size of one facial measure to another): AO/AB, EF/CD, OH/AB, IJ/CD, KL/CD.

The mean and standard deviation for each facial parameter was calculated from the sample of 20 unmanipulated images for each category (Table 1, column c). These values served as a guide for our manipulation (normalized mean values; z-scores) (Glocker et al., 2009a).

Using Adobe Photoshop we then manipulated these facial parameters to produce *high* (round face, high forehead and big eyes, small nose and mouth; CD, AO/AB and EF/CD > mean; OH/AB, IJ/CD and KL/CD < mean) and *low* (narrow face, low forehead and small eyes, big nose and mouth; CD, AO/AB and EF/CD < mean; OH/AB, IJ/CD and KL/CD > mean) infantile portraits of each subject. Photoshop resize tool on masked layers (which allow to modify a particular facial feature without affecting the others) was used to enlarge or reduce (in order) forehead length, nose length, face width, eye width, nose width and mouth width; clone stamp and healing brush tools were used to adjust sections of the picture which appeared unnaturally stretched.

To maintain normal facial appearance, the manipulation for each facial parameter was restricted to a z-score range of ± 2 standard deviations (Geldart et al., 1999; Glocker et al., 2009a). Since unmanipulated faces often combined high and low infantile features, only those parameters which needed an adjustment were manipulated (Glocker et al., 2009a).

Using this protocol, a sub-set of 24 pictures (4 different portraits for each category: human adults, human infants, adult dogs, puppies, adult cats, kittens) was manipulated. Pictures selection was made on the basis of image quality, uniform background, clarity of facial expression. This resulted in a set of 48 faces consisting of 24 *high* and 24 *low* infantile portraits. Images background was set to 5% grey. Brightness of the pictures was visually adjusted to appear similar between all pictures (see Figure 2 for examples).

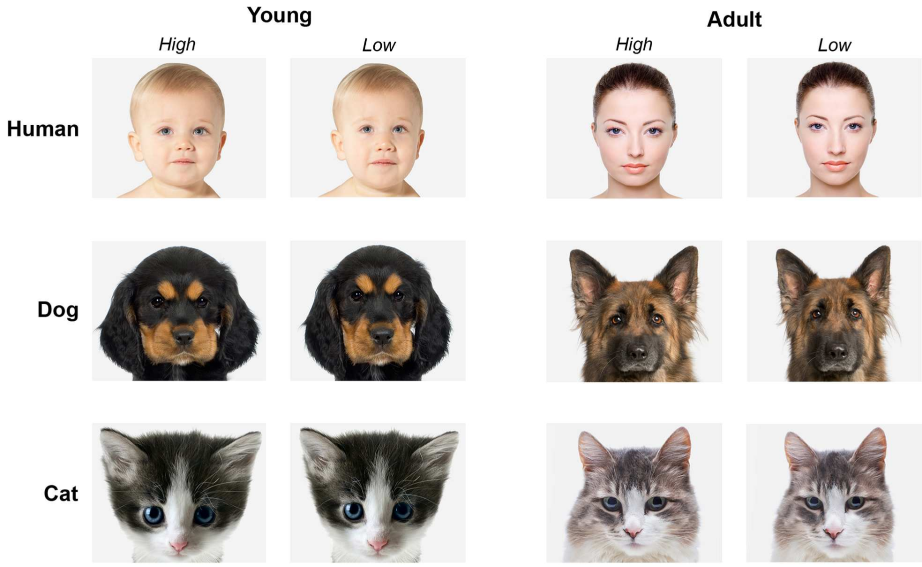

Figure 2. Examples of stimuli presented to participants. Young and adult faces of humans, dogs and cats. On the left the *high* infantile version, on the right the *low* infantile version of the same subject. Photos: Thinckstock/GettyImages (modified).

4.3. EXPERIMENT 1

4.3.1. Method

4.3.1.1. Participants

Thirty-two (16 male and 16 female) British children, ranging in age between 3 to 6 years (M=4.8, SD=1.0) participated in this experiment. Children were recruited in schools (four nursery schools and one primary school in Lincoln and Lincolnshire, UK). All children had normal or corrected-to-normal eyesight. Children would only be excluded if they had a certified developmental disability or were unwilling to participate spontaneously.

The study received approval by the Human Research Ethics Committee of the School of Psychology at the University of Lincoln and complies in all aspects with British Psychological Association Ethics guidelines. The procedures were as follows: information letters were sent out first to nurseries and schools to inform them about our study and to ask for their participation. As soon as consent was obtained by those settings, we complied with the settings preferences for gaining consent from parents. For nurseries, we sent out letters to parents via the nursery that included detailed information about the procedure. Parents then sent us a signed consent form back. Before testing, children were also asked to give their assent. If they did not want to take part, they were thanked and left to their usual nursery activities. For the school settings we tested in, and for one further nursery, we also sent out detailed information letters to parents via the teachers and the head of the nursery. In compliance with the school's and this nursery preferences and in line with British Psychological association guidelines, we then asked parents to inform us if they wanted to withdraw their child from the study. We also informed them that their decision not to opt out counted as giving consent. Children whose parents opted out of the study were not tested. Again, children who were allowed to take part were also asked to give their assent and were not tested if they did not want to take part. All children and all parents were aware that they could withdraw at any time, also after testing. Parents of participating children received a questionnaire comprising children's demographic information and presence of animals at home. Questionnaires were distributed by email or hand-delivered to parents. Fifteen of the participants were dog owners, 6 cat owners and 14 no owners. Data were collected between September and December 2012 during school hours.

4.3.1.2. Stimuli

Stimuli consisted of 24 images (4 different subjects per 6 face category - human adults, human infants, dogs, puppies, cats, kittens) which were displayed individually in the centre of the monitor (pictures dimension = 600 x 430 pixels). Two of the 4 images for each category showed *high* infantile and 2 *low* infantile faces (counterbalanced between participants). Order of picture presentation was randomized.

4.3.1.3. Apparatus

Participants' eye movements were tracked at a sample rate of 120 Hz using a Tobii T120 eye tracker (Tobii, Stockholm, Sweden), which is integrated into a 17" TFT monitor (pictures displayed with a resolution of 1024x768 pixels). The monitor was placed at a distance of approximately 70cm from the child. At this distance the eye-tracking device allows free head movement in a wide operating range (30 x 22 x 30 cm). Participants' eye movements were analyzed using the Lincoln Infant Lab Package software (Meints and Woodford, 2008): fixations (periods of relative gaze stability, (Henderson, 2003)) were extracted from the raw eye movement data, using dispersion threshold (maximum fixation radius = 1°) and duration threshold (minimum fixation duration = 100 ms) criteria (Salvucci and Goldberg, 2000).

4.3.1.4. AOIs analysis

We divided each picture presented into three Areas Of Interest (AOIs) corresponding to three key internal facial features: eyes, nose and mouth. Specifically, AOIs consisted of centered squares of different dimensions delimiting each possible facial feature and the immediate surrounding area (10 pixels were added in each direction - left, top, right, bottom - with the exception of the division line between the ‘mouth’ and ‘nose’ region: in this case the division line was the midline between the upper lip and the bottom of the nose). Each fixation was then characterised by its location among AOIs and the number of fixations (and associate viewing time) directed at each facial feature was normalized respectively to the total number of fixations and viewing time in that trial. As the same facial features across faces of different species and individuals vary in size, we adopted the criteria from Guo et al. (2010) that consist in subtracting the proportion of the area of each facial feature relative to the whole image from the proportion of fixations (or proportion of total viewing time) directed at that facial feature in a given trial (Guo et al., 2010). Any difference in fixation distribution from zero means that this particular facial feature attracted more or less fixations than predicted by a uniform looking strategy, thus negative values demonstrate less viewing than predicted by region size, and positive values demonstrate more viewing than predicted by region size (Dahl et al., 2009; Guo et al., 2010).

4.3.1.5. Procedure

Each child was tested individually. Children were asked if they would like to look at some pictures on a screen, and if they agreed, they were first familiarized with a quiet testing room for a few minutes. Before testing, the child’s vision was centred to the middle of the screen and the eye tracker was calibrated using 5 fixation points. After the calibration procedure, the experiment began with a short introduction in which children were instructed to look at the images and to rate how cute they found each picture on a 5-point scale, with 1 representing ‘not cute’ and 5 ‘very cute’ (a pictorial children-feasible scale was used, modified from (Ernst et al., 2000)). In order to assess whether children understood the notion of cuteness, we first asked them to provide us with some definition of the word ‘cute’ and only children who showed a clear understanding of the notion of ‘being cute’ were included in data analysis (the most common accepted definition children gave us were ‘pretty’, ‘nice’, ‘small’, ‘fluffy’, and ‘adorable’). The experimenter then explained the scale and asked the child to explain it back to her to check the child’s understanding. All children understood the scale and the task. Participants were then presented with a random sequence of the stimuli. Each trial showed the visual stimulus for 6 s (during this window eye position was recorded), then the rating scale appeared and after children gave us their rating of the picture, the next stimulus appeared. The onset of the image presentation was accompanied by a female voice auditory instruction to “look” delivered through a loudspeaker positioned centrally below the displayed pictures. The inter-trial interval varied depending on the time children needed for the rating. Two experimenters tested all children, one behind the screen, not visible to the children, controlling trials onset and monitoring children’s eyes through a laptop connected to the eye-tracker, the other sitting centrally behind the child encouraging him/her to keep their head still and collecting his/her responses.

Both verbal and non-verbal (i.e. pointing gesture) responses were accepted. Children were encouraged to accomplish the task and received a small gift and a sticker in return for participating in the study. The total testing time for each child did not exceed 10 minutes.

4.3.2. Results

4.3.2.1. Cuteness ratings

Scores given to the different categories of faces (human adult, infant, dog, puppy, cat and kitten) were averaged, separately for the modified *high* and *low* infantile versions, to give 12 mean scores for each participant (see Table 2). A mixed-model ANOVA was carried out with Species (human, dog and cat), Age (adult and young) and Baby schema (high and low) as within-subjects factors, and Gender and Pet ownership as between-subjects factors (a non-parametric analysis was performed prior to the ANOVA, showing similar results). A main effect of Species ($F_{(2,56)}$=8.968, p=0.000) was found: children rated images of animals as cuter than the images of humans (dog>human and cat>human, Tukey post-hoc tests, $p<0.05$), while there were no significant differences between dogs and cats (mean±SD humans 3.0±0.8, dogs 3.7±0.9, cats 3.7±0.8). Faces of young individuals were rated as cuter than those of adults (main effect of Age, $F_{(1,28)}$=7.522, p=0.011), but this effect was driven primarily by human stimuli: a significant interaction effect between Species and Age ($F_{(2,56)}$=3.657, p=0.032) showed that while human adults were rated as significantly less cute than human infants ($p<0.05$), no differences were found between adult and young animals ($p>0.05$, Figure 3). Human adults were also rated as less cute than adult animals ($p<0.01$), while images of human infants, puppies and kittens were rated as similarly cute ($p>0.05$). Facial modification for the degree of baby schema had a significant effect on children's cuteness judgements: as predicted, *high* infantile faces were rated as cuter than images of *low* infantile faces (main effect of Baby Schema, $F_{(1,28)}$=4.659, p=0.040) and this effect was independent of the species viewed (Species*Baby schema: $F_{(2,56)}$=0.069, p=0.9335). No main effects or interactions of gender or pet ownership were found.

Table 2. Cuteness ratings given by children. Averaged cuteness ratings (SD) for both *high* infantile and *low* infantile versions of each image category.

Human adult		Human infant		Dog		Puppy		Cat		Kitten	
High	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**
2.7 (1.3)	2.5 (1.0)	3.5 (1.1)	3.2 (1.2)	3.7 (1.2)	3.7 (1.1)	3.8 (1.1)	3.5 (1.2)	3.6 (1.2)	3.5 (1.1)	3.9 (1.0)	3.6 (1.1)

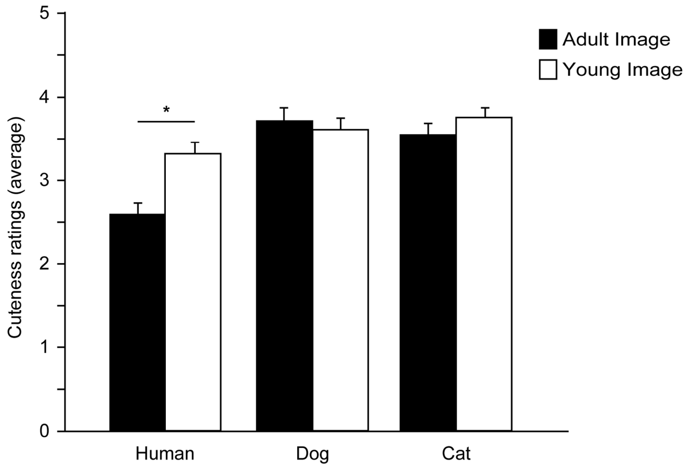

Figure 3. Cuteness ratings (children). Average cuteness ratings for adult and young faces of three species (human, dog and cat), given by children. ANOVA followed by Tukey post-hoc test, *p<0.05. All data are shown as mean and s.e.m.

4.3.2.2. Gaze allocation to stimuli

Participants dedicated on average 4.0 ± 1.1 s (mean ± SD) to explore images within a 6-second presentation time. We observed that an excessively short looking time in a trial was generally caused by momentary distraction (children looking elsewhere, i.e. looking at the experimenters or objects in the room). We therefore removed those trials with a total looking time shorter than 1 s (3.7% of the trials). Two mixed-model ANOVAs (dependent variables: number of fixations and viewing time) were carried out with Species (human, dog and cat), Age (adult and young) and Baby schema (high and low) as within-subjects factors, and Gender and Pet ownership as between-subjects factors. No effect of Species was observed: children allocated the same amount of fixations and associated viewing time ($F_{(2,50)}$=2.184, p=0.123) per image across human, dog and cat faces. Participants allocated more overall viewing time to images of young faces with the effect approaching significance ($F_{(1,25)}$=4.165, p=0.052), while showing no differences in the number of fixations ($F_{(1,25)}$=1.110, p=0.302). No effects were found for degree of baby schema (high vs. low) (fixations: $F_{(1,25)}$=0.148, p=0.703; viewing time: $F_{(1,25)}$=0.197, p=0.661). No effects of gender and pet ownership were found (all p>0.05).

4.3.2.3. Gaze allocation to AOIs

During face exploration children directed the majority of fixations (75% of overall fixations) and viewing time (78% of total face viewing time within a trial) at the predefined AOIs (eyes, nose and mouth). Number of fixations and viewing time directed at each AOI were expressed as proportion of total number of fixations and viewing time within whole faces (after subtracting the proportion of the area of each AOI relative to the whole image, (Guo et al., 2010)). Two mixed-model ANOVAs were carried out (see above) with AOI (eyes, nose, mouth) entered as additional within-subjects factor.

Highly significant main effects of AOI were found (fixations: $F_{(2,52)}$=118.305, p=0.000, viewing time: $F_{(2,52)}$=94.151, p=0.000). Tukey post-hoc tests (p<0.01) demonstrate that, irrespective of the face viewed (no main effects of Species or Age or Baby schema were found, all F<2.167, all p>0.05), the eyes attracted the highest proportion of fixations (46%) and the longest viewing time (47%), followed by the nose (fixation and viewing time 13%) and the mouth (fixation 6%, viewing time 7%). However, the significant interactions found between Species and AOI ($F_{(4,104)}$=11.871, p=0.000), Age and AOI ($F_{(2,52)}$=6.878, p=0.002) and Baby schema and AOI ($F_{(2,52)}$=6.133, p=0.004) showed that the amount of viewing time allocation to the same facial feature was species-dependent and was also sensitive to the degree of infant features. Specifically, Tukey post-hoc tests revealed that the eyes attracted a higher proportion of fixations and viewing times in dogs and cats than in human faces (p<0.05), while the mouth attracted a lower proportion of fixations and viewing times in dogs and cats than in human faces (p<0.01) (Figure 4). Moreover, children directed a significantly higher proportion of viewing time towards the eye region in images of *high* infantile individuals, in comparison with the eyes region in images of *low* infantile individuals (p<0.05). No effects of gender and pet ownership were found (all p>0.05).

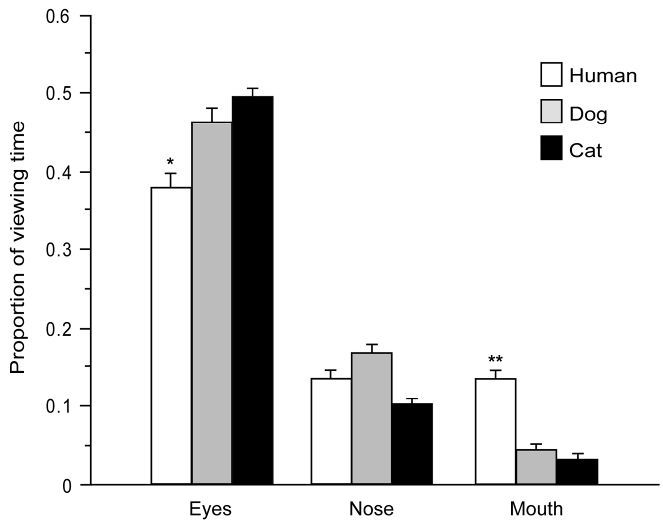

Figure 4. Species-specific gaze distribution among areas of interest. Proportion of viewing time directed at eyes, nose and mouth regions (AOIs) of different species (human, dog and cat faces). ANOVA followed by Tukey post-hoc test, **p<0.01 vs dog and cat; *p<0.05 vs dog and cat. All data are shown as mean and s.e.m.

4.4. EXPERIMENT 2

4.4.1. Method

4.4.1.1. Participants

Fifty (27 boys and 23 girls) British children, ranging in age between 3 to 6 years (M=4.5, SD=1.0) participated in this experiment. None of these children participated in Experiment 1. Children were recruited as described in Experiment 1. Exclusion criteria and recruitment, data collection and ethics procedures were also the same as in Experiment 1. Nineteen of the participants were dog owners, 11 cat owners and 24 no owners.

4.4.1.2. Stimuli

Stimuli were presented as two side by-side pictures, one showing a *high* infantile and the other a *low* infantile version of the same subject (total: 24 pairs of images). The size of each picture was 400 x 290 pixels, and the distance between the two images was 224 pixels. The order of presentation was randomized, and the presentation of the images was counterbalanced to appear on the left and right side of the screen equally often (given children's tendency for left gaze preference, Guo et al., 2009).

4.4.1.3. Apparatus

Same as in Experiment 1.

4.4.1.4. Procedure

Each child was tested individually in an Intermodal Preferential Looking (IPL) task (see Meints et al., 1999; Meints et al., 2002 for details on IPL procedure). Procedure and calibration was the same as in Experiment 1. After the calibration procedure, the experiment began with a short introduction in which children were instructed to look at the images. Each trial was started with a small red fixation point (FP) displayed on the centre of the monitor to attract the child's gaze to the centre of the screen (between the two images). Once the child's gaze was oriented towards the FP a visual stimulus was presented for 6 s and during this time window eye position was recorded. The onset of the image presentation was accompanied by a female auditory instruction to "look" delivered through a loudspeaker positioned centrally below the displayed pictures. Inter-trial intervals varied with the child's attention on the task because a new trial was not launched until children were attracted by the FP (minimum inter-stimulus interval 1 s). Two experimenters tested all children, similar to Experiment 1. Participants were encouraged to accomplish the task and received a small gift and a sticker in return for participating in the study. The total testing time for each child did not exceed 10 minutes.

4.4.2. Results

Within a 6-second presentation time, on average participants dedicated 4.2 ± 1.0 s (mean ± SD) to explore stimuli. As above, trials with a total looking time shorter than 1 s were removed (2.2% of the trials). Paired t-tests showed that, on average, children allocated significantly more viewing time to the *high* than the *low* infantile faces ($t_{(49)}$=2.298, p=0.026), but showed the same number of fixations ($t_{(49)}$=1.480, p=0.1451). We thus analysed proportion of viewing time allocated to the *high* infantile images, separately for each image category (human adult, infant, dog, puppy, cat and kitten); a significant bias towards the *high* version was calculated by means of one-sample t-tests against chance value (50%). Children's proportion of viewing time to the *high* infantile faces did not differ significantly from chance (human adult 51%, infant 51%, puppy 49%, cat 52%, and kitten 50%, all p>0.05), except during adult dog faces presentation: in this case children showed a mean preference of 54% for the *high* version, a value that was significantly different from chance ($t_{(49)}$=2.670, p=0.010). Neither effect of gender nor effect of pet ownership was shown on children's proportion of fixations and associated viewing time allocated to the *high* infantile images (independent t-test, all p>0.05).

4.5. EXPERIMENT 3

4.5.1. Method

4.5.1.1. Participants

Fifty-eight (48 female and 10 male) undergraduate students with a mean age of 21 years (age range=18-47 years, SD=5.9) participated in this experiment. They were recruited during a Psychology course (University of Lincoln, UK) and were asked to participate in a study involving voluntary completion of an anonymous, web-based questionnaire. Only participants with British nationality and who completed the questionnaire were included; participants who had children were excluded. Seventeen of the participants were dog owners, 20 cat owners and 26 no owners. Data were collected between April and May 2013.

4.5.1.2. Stimuli

Identical to Experiment 1.

4.5.1.3. Procedure

Participants were asked to complete an anonymous, web-based questionnaire created in Qualtrics (Qualtrics, Provo, UT). The questionnaire consisted of two sections: (1) a personal details section, comprising information on sex, age, nationality, parenthood, presence of animals at home; (2) a series of photographs to be rated for cuteness (pictures presented were the same as in Experiment 1).

4.5.2. Results

Averaged scores given to the different categories of faces are shown in Table 3. Data were analysed as in Experiment 1.

Table 3. Cuteness ratings given by adult participants. Averaged cuteness ratings (SD) for both *high* infantile and *low* infantile versions of each image category (n=32).

Human adult		Human infant		Dog		Puppy		Cat		Kitten	
High	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**
2.4 (0.9)	2.2 (0.7)	3.6 (1.1)	3.0 (1.1)	3.6 (0.9)	3.5 (0.9)	4.1 (0.9)	4.0 (0.9)	3.0 (1.0)	2.7 (1.0)	3.8 (0.8)	3.9 (0.9)

Highly significant main effects of Species ($F_{(2,108)}$=18.050, *p*=0.000) and Age ($F_{(1,54)}$=92.587, *p*=0.000) and a highly significant interaction effect between Species and Age ($F_{(2,108)}$=5.763, *p*=0.004) were found. In particular, when rating images of adult portraits, participants gave the highest score to dog faces, followed by the cat and then the human faces (Tukey post-hoc tests p<0.01), while images of puppies and kittens received a similar score (but higher than human infants, p<0.01). Faces of young individuals were rated as cuter than those of adults in all species viewed (all p<0.01) (Figure 5).

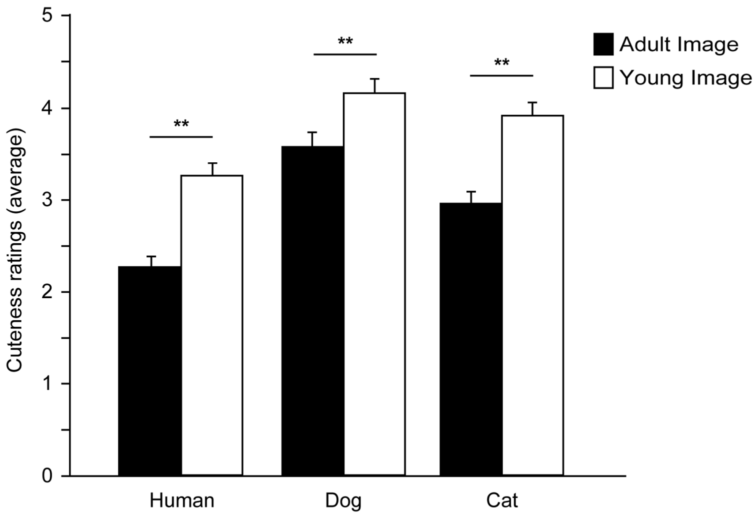

Figure 5. Cuteness ratings (adults). Average cuteness ratings for adult and young faces of three species (human, dog and cat), given by adult participants. Only the main effect of Age was highlighted here, for other effects see Results Section. ANOVA followed by Tukey post-hoc test, **p<0.01. All data are shown as mean and s.e.m.

By contrast, participants' cuteness scores given to images varying for the degree of baby schema depended on the species viewed as the significant interaction between Specie and Baby schema demonstrates ($F_{(2,108)}$=4.383, p=0.015). In particular, images of *high* infantile faces were rated as cuter than those of *low* infantile faces only in human stimuli (p<0.01), while participants found faces of high and low infantile animals (both dogs and cats) similarly cute (p>0.05).

No effect of gender was found (main effect and interaction effects, all p>0.05), while having animals at home influenced cuteness perception of different species. In particular, the ANOVA showed an effect of having cats at home on cuteness ratings: independent of the degree of infant features, cats were rated as cuter by cat-owners than non-owners. Cat-owners found cats and dogs equally cute, while non-owners showed higher ratings for dog faces (Species*Cat Ownership, $F_{(2,108)}$=4.180, p=0.018, Tukey post-hoc tests p<0.01, Figure 6).

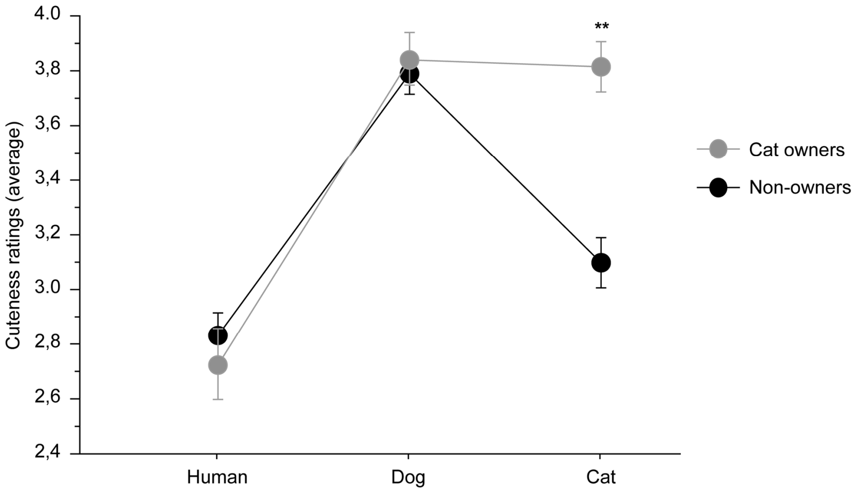

Figure 6. Cuteness ratings and cat ownership. Average cuteness ratings for three species given by (adult) cat owners and non-owners. ANOVA followed by Tukey post-hoc test, **p<0.01. All data are shown as mean and s.e.m.

4.6. DISCUSSION

In this study the effects of the baby schema on cuteness perception and visual preference were for the first time assessed in young children (3-6 years old) using a carefully controlled design in which stimuli (human and animal faces) were objectively quantified according to the baby schema content. The procedure used to modify facial configuration was originally developed by Glocker and colleagues and applied to faces of human infants. These researchers not only demonstrated that the baby schema affects cuteness perception and motivation for caretaking in adults (Glocker et al., 2009a), but they also suggested a neurophysiologic mechanism by which baby schema could promote human nurturing behaviour (Glocker et al., 2009b). By applying Glocker's procedure also to human adults and to faces of adult and young animals, we were able to dissociate the response to a specific stimulus (e.g. humans vs. animals) from the response to its facial configuration (i.e. high baby schema vs. low baby schema). In fact, the response to an image may be driven by its perceptual features (in this case relative dimensions of some facial features), but may also be affected by viewers' attitudes, motivation and preferences (e.g. interest in infants, preference for animals, attachment to animals, (Archer and Monton, 2011; Borgi and Cirulli, 2013; Cárdenas et al., 2013)).

4.6.1. Baby schema and cuteness ratings

Our results provide the first rigorous demonstration that the degree of baby schema drives cuteness perception in children: overall, faces with more infantile facial configurations (round face, high forehead and big eyes, small nose and mouth) were perceived as cuter than those with less infantile traits. However, our analysis shows that, when judging individual images for cuteness, participants do not simply respond to an infantile facial configuration. In fact, children rated images of animals as cuter than images of humans, independent of the degree of baby schema. Moreover, they gave similar cuteness scores to images of adult and young animals, while the age of the viewed subject did affect their ratings of human stimuli – adults stand out as the least cute. By contrast, adult participants showed a more differential appraisal for images of young animals (puppies and kittens), judging them as cuter than adult animals.

Children's general proneness towards animals was also independent of their familiarity/experience with them (i.e. pet ownership), a result in line with previous research on children's attitudes and preferences for animal stimuli (DeLoache et al., 2011; Lobue et al., 2012; Borgi and Cirulli, 2013). Differently from children, adult participants showed a more selective species-specific effect: they judged dogs as cuter than cats (this was true only for adult animals), regardless of differences in the baby schema, but their cuteness judgement was affected by their experience/familiarity with animals (pet ownership). In fact, although overall they perceived cats as less cute than dogs, this effect disappeared in cat-owners which gave higher cuteness ratings to both adult cats and kittens than non-owners. No gender effects were found either in children or in the sample of adult participants. Although data are still conflicted (Glocker et al., 2009a; Parsons et al., 2011), a number of studies have shown women to be more responsive to the baby schema then men (Sternglanz et al., 1977;

Hildebrandt and Fitzgerald, 1979; Sprengelmeyer et al., 2009; Lobmaier et al., 2010; Cárdenas et al., 2013). However, it should be taken into account that in our study the failure to detect differential responses between women and men may have been caused by the differences in number of men and women recruited or by the young age and childlessness of the participants – further research is needed to confirm if differences exist and for which groups.

4.6.2. Baby schema and face processing

The concept of cuteness not only encompasses the evaluation of specific morphological traits (i.e. cuteness ratings, preference, attractiveness), but also involves a positive/affectionate behavioural response (cute response), which appears to be anticipated by a visual prioritization of - and an attentional bias to - infantile stimuli. The pattern of eye movements is a susceptible index of our attention, motivation and preference and can be modulated by cognitive demands and characteristics of the observed scenes (Henderson, 2003; Isaacowitz, 2006). No studies to date have analysed whether cuteness perception of different faces involves a different gaze strategy (gaze distribution across key internal facial features, i.e. eyes, nose, and mouth). We predicted that while judging cuteness, gaze patterns would be sensitive to cues specifically related to infant-like characteristic (i.e. big eyes in baby schema) and for the first time we tested such an assumption in children by means of eye tracking. Our results show that, independently of the face viewed, children allocated the majority of fixations and longer viewing time to the eyes, followed by the nose and the mouth. This result is consistent with the evidence of a general oculomotor strategy employed by humans while exploring faces (both human and animals), at least for those sharing similar facial configurations (same components - eyes, mouth, and nose - within a similar spatial arrangement - the nose at the centre, the eyes above, and the mouth below) (Guo et al., 2010). Nonetheless, our results show that viewing time allocation to the same facial feature is species-dependent and is also sensitive to the degree of baby schema. In particular, after adjusting for the variance in size across different stimuli, we observed that the region of the eyes in high infantile faces attracted longer viewing times than in low infantile faces. The eyes contain critical information about face identity and emotional state (Emery, 2000), attention to the eyes may predict later social development (Wagner et al., 2013), and eye size may affect both aesthetic ratings of and visual preference for human faces (Geldart et al., 1999). Here we suggest that, more than other facial features, they may also be crucial for cuteness perception and associated attentional response.

Presentation of pictures of different species resulted in a differential distribution of fixations directed to specific face regions: the mouth region in human faces attracted significantly more fixations and longer viewing times than in dog and cat faces, similarly to what was observed in a sample of adults by Guo and colleagues (Guo et al., 2010). As in adults, children's differential gaze allocation to the mouth could indicate the precocious ability to extract relevant facial information from different species, in particular the importance of the mouth for human visuo-social communication (for fast detection and recognition of subtle facial expressions, Guo et al., 2010) and for human language comprehension (Lewkowicz and Hansen-Tift). Guo and colleagues hypothesized that the failure to detect a differential gaze distribution in viewing dog and cat faces may depend upon a lack of interest and/or perceptual experience in processing subtle emotional cues from dog and cat mouths in their sample of non-pet owners. They pointed out that this issue should be addressed by comparing gaze patterns in the viewing of dog/cat faces between pet owners and non-owners. We showed that, at least in children, experience gained by owing a pet, does not influence the distribution of fixations directed at local facial features across species. It cannot be excluded that this effect may be detectable only in adults or in dog/cat experts (e.g. subjects extensively involved in dog training and/or activities, but see Kujala et al., 2012) and further research is warranted.

4.6.3. Visual preference for baby schema

There is some evidence that adults tend to look longer at infant than at adult faces and at cuter than at less cute infants (Hildebrandt and Fitzgerald, 1978; Power et al., 1982; Parsons et al., 2011; Cárdenas et al., 2013; Hahn et al., 2013; Sprengelmeyer et al., 2013). Most of these studies have utilized images of different subjects (infants vs. adults or stimuli previously judged for cuteness) thus with great variation in their appearance (i.e. age, expression, cuteness). Moreover, no studies have investigated the emergence of this attentional response during development and its generalization to non-human faces.

Children in our study allocated overall more viewing time to images with a higher degree of baby schema (high vs. low infantile). However, when we analysed gaze allocation separately for each image category (human adult, human infant, dog, puppy, cat, kitten), proportion of fixations and viewing time to the high infantile images did not differ significantly from chance level, except during adult dog face presentation. In this case, faces with a higher degree of baby schema attracted more viewing time than the same face modified to show a lower degree of baby schema.

It could be hypothesized that children might be more sensitive to differences in the baby schema present in dogs since this is the most familiar (and preferred, Borgi and Cirulli, 2013) pet species. However, if an effect of familiarity caused the attentional bias towards more infantile dogs, we would expect the same result for puppies, human adult stimuli (since human adults are the primary caregivers of children) and we would also expect experience with dogs to affect children' visual preference. By contrast, in our study pet ownership did not affect children's gaze allocation to the images presented.

It has to be taken into account that, compared with the other stimuli (humans and cats), the unmodified dog's faces presented more variant facial parameters (higher standard deviations) leading to major differences between the two modified versions (high and low infantile versions were created by reducing or enlarging facial parameters of an amount that depended on standard deviation, see *Stimulus creation procedure*). The attentional bias towards more infantile adult dogs might derive from this methodological issue. In fact, the salience of infant stimuli may depend on the ability to evaluate small differences in cuteness (Sprengelmeyer et al., 2009; Lobmaier et al., 2010), a capacity that may emerge later in life. Future studies should employ procedures in which the differences in the level of baby schema vary gradually between stimuli (e.g. 0%, 25%, 50%, 75%, 100%), in a sample more representative of the different stages of development (children, adolescent, adults, elderly).

4.6.4. Conclusions and future perspectives

Overall our results show that the response to an infantile facial configuration can be detected early during development (at about 3 years of age). In children, the baby schema affects both cuteness perception and gaze allocation to infantile stimuli and to specific facial features, an effect not simply limited to human faces. These findings are in line with the idea that the incentive salience of infantile traits might be a causal factor behind human attraction to animals, especially pets (Archer, 1997). However, the appeal of infantile features only partially explains why animals have a powerful hold over human perception. Analyses of individual differences show that, both in children and in adults, the positive appraisal towards animals (cuteness ratings) is only partially affected by their facial configuration (degree of baby schema). While familiarity with animals is able to modulate cuteness perception in adults, children tend to respond with a general proneness towards animals, which appears less influenced by the presence of infantile traits and not mediated by experiential factors.

The effect of facial appearance on cuteness and attractiveness was shown to be tied to human interest in infants and motivation to care (Light and Isaacowitz, 2006; Cárdenas et al., 2013). The influence of individual factors in modulating responses to animals should thus be emphasized in future research. Pet ownership may be a measure not representative of interest in – and involvement with – animals. In fact, even if they have animals at home, children may have not a great commitment in their daily care. Future studies could thus employ measures more representative of their involvement with household pets, such as frequency of play with and care of pets, attachment to them and frequency of expressed interest (Melson and Fogel, 1996; Archer and Monton, 2011).

Most importantly, future research is needed to determine the link between overt attention and measures of interest and how both these measures reflect on actual care-giving. Cuteness judgements may enhance nurturing behaviour (Glocker et al., 2009a; Sherman et al., 2009) and has been shown to modulate mother-infant interaction (Langlois et al., 1995), and women's willingness to adopt a baby (Volk and Quinsey, 2002). This field of analysis has the potential to be successfully translated into the human-animal interaction research, as no studies have explored association between cuteness and adoptability in kennel dogs or cats or to what extent animal appearance influences owner-pet interaction style and care behaviour towards pets.

A more in-depth analysis of human proneness towards animals and its change during development appears of particular importance, especially in the light of the recent advancements in Human-Animal Interaction studies in child psychology research. Animals, especially dogs, are increasingly employed both in educational and therapeutic interventions based on the growing evidence of their positive effects on children's emotional development (Cirulli et al., 2011; Endenburg and van Lith, 2011). Since attention is one of the key aspects of the learning process, interacting with animals has also the potential to represent a mean for promoting cognitive development. For example, Gee and colleagues found that the presence of a dog in a classroom can provide many positive benefits for children, including enhanced motor skills, better ability to follow instructions and improved memory (Gee et al., 2010; Gee et al., 2012). Thus future research on the attentional aspect of children's relationships with pet animals should be encouraged. In addition, the analysis of specific animal characteristics able to elicit emotional/affiliative responses in children could ultimately help develop interventions for children with deficit in the social domain (Berry et al., 2013; O'Haire, 2013) by providing salient and emotionally relevant stimuli (e.g. helping in developing socially interactive robots).

More detailed knowledge of the factors underlying children's attraction to animals will also facilitate educational programs aimed at minimizing risk factors inherent children-animals encounters, especially in consideration of dog bite incidents. As especially young children under the age of 7 are most at risk of a serious dog bite injury, often after an interaction they initiated themselves, we need to investigate the causes further. Attractiveness to animals may be one of the causal factors behind the frequent and sometimes tragic involvement of young children in dog bite incidents. Interestingly, our results show children paying less attention to the mouth region in dog stimuli and this information is crucial insofar as it can help to direct educational efforts to teach children about safe behaviour with dogs (since more severe aggression signals in dogs like showing teeth, snarling and growling are displayed in the mouth region, Shepherd, 2002; Meints and de Keuster, 2009).

This research is a first and significant step towards characterizing both cognitive (attention) and psychological (overt preference) mechanisms underlying human attraction to infants (and infant-like stimuli including animals). Procedures and stimuli as used in this study can easily be further applied in psychological studies, as well as in fMRI and eye-tracking research and provide a wide-ranging platform to deepen our knowledge of the mechanisms and factors that promote human caregiving behaviour.

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CHAPTER 5

5. GENERAL DISCUSSION

The perception of a certain similarity with human beings, the familiarity, the predictability of the behaviour, as well as the infantile appearance, appear to be relevant factors to form positive attitudes towards animals and to evoke positive responses such as nurturing behaviour. However, the vast majority of the studies on attitudes to animals and the previous analyses on human attraction to certain animal features (e.g. baby schema) did not consider children younger than 6 years. Thus **the objective** of the studies described in this thesis was to explore the early emergence of animal-related predispositions and attraction to animals and whether they are influenced by the same factors observed in adults and older children. **To this aim** both attitudes (i.e. explicit preferences) and behavioural responses (i.e. preferential attention) towards animal stimuli presenting differential morphological characteristics (different animal species and animals with specific facial features, i.e. baby schema) were analyzed in 3-6 years old children.

5.1. MAIN FINDINGS

5.1.1. Children preferences for different animals: the effects of similarity to humans and domesticity

A substantial body of literature on human attitudes and likeness of some species has shown that animals that appear and/or behave similarly to humans tend to be preferred, evoke more positive affect, as well as higher concern in terms of welfare and conservation (Driscoll, 1992 ; Kellert, 1993b; Plous, 1993; Czech et al., 1998; Gunnthorsdottir, 2001; Serpell, 2004; Tisdell et al., 2005, 2006; Martín-López et al., 2007; Knight, 2008; Batt, 2009). Our analyses of kindergarten children's preferences for a wide range of different animals shown in **Chapter 2** are in line with this 'Similarity Principle' (Tisdell et al., 2006) and suggest an early emergence of such a predisposition. Results show children's propensity for higher order of species (i.e. mammals and bird) and confirm the general negative attitudes towards invertebrates observed in previous studies (Kellert, 1993b; Bjerke et al., 1998; Woods, 2000; Bjerke and Ostdahl, 2004; Prokop et al., 2010; Wagler, 2010).

However, there were many exceptions that did not followed this trend, confirming that similarity to humans (in particular phylogenetic closeness) is only one of the animal attributes explaining the enormous variance in people's attitudes towards animals (Serpell, 2004). The reasons behind some specific preferences expressed by our participants appear to be peculiar for childhood, in particular the higher appreciation of aesthetically appealing species (e.g.

butterfly) and of animals that may evoke in children anthropomorphized and infantilized representations (turtle, snake, and mouse).

Animal aesthetic qualities (e.g. colour, see the case of the parrot) may partially contribute to preference's forming (Ward et al., 1998; Gunnthorsdottir, 2001; Serpell, 2004; Stokes, 2007; Knight, 2008; Lišková and Frynta, 2013). However, children's perception of the threats/hazards that animals may pose to humans (vs. their instrumental value) appears to be the most relevant factors underlying their attitudes towards some animal species. In fact, results show an unbalanced and gender-based distribution of preferences for some species, mostly for animals reported to induce disgust/fear response in humans (Arrindell, 2000; Öhman and Mineka, 2003; Pagani et al., 2007). Children showed a preference for domestic animal species like dog, cat, horse and rabbit, which were often indicated by both boys and girls as the preferred species; bats, snakes, alligator, and biting and stinging invertebrates all obtained a low number of preferences, especially in girls, while their non-threatening counterparts (butterfly among invertebrates, the turtle among reptiles) were highly appreciated. Results confirm higher negative and probably fear-related and disgust-related attitudes in girls observed in older children and adults (Kellert and Westervelt, 1984; Davey, 1994; Bjerke et al., 2003; Røskaft et al., 2003; Bjerke and Ostdahl, 2004; Prokop and Tunnicliffe, 2008; Prokop et al., 2009b; Prokop and Tunnicliffe, 2010; Randler et al., 2012).

Our analysis of species preferences in kindergarten children - a population usually not addressed in the literature - represents a first step towards a more in-depth exploration of the development course of attitudes to a wide range of animals. Although limited to the Italian population, the results presented here are based on a large sample size, which allows generalization. Moreover, we believe that an explorative analysis of Italian children's attitudes to animals is fundamental for cross-cultural comparisons and also in consideration of the important role that animals play in Italian youths' lives (Pagani et al., 2007).

5.1.2. Children's preferences for dogs and cats: the effect of infantile characteristics

To our knowledge the analysis of kindergarten children's preferences for infantile features in faces of pets (i.e., dogs and cats), as well as in inanimate objects (i.e., teddy bears) (see **Chapter 3**) was the first attempt to analyse the emergence of a sensitivity for infant stimuli in children as young as 3 years.

Overall, results from our study suggest that a sensitivity to and a preference for selected infantile features in animals may emerge during early development. The presence of an infantile facial configuration in teddy bears directed children's preferences also for an inanimate stimulus and may explain the early emergence of pseudo-nurturing behaviours towards animal-like toys observed in children of both sexes between 5 and 6 years of age (Morris et al., 1995). However, preferences for baby schema in animals appear to be species-specific and more pronounced in girls. In particular while children showed a preference for more infantile cats, their attraction to dogs was independent of their facial configuration. Children showed a general preference for dogs (over cats), regardless of whether the dogs had infantile features and regardless of participants' familiarity with them (i.e. dog ownership). Only when exploring differential response showed by girls and boys, a higher likelihood of choosing infantile dogs emerged, specifically in girls, confirming an higher sensitivity to infantile traits in women observed in previous studies (Sternglanz et al., 1977; Hildebrandt and Fitzgerald, 1979; Sprengelmeyer et al., 2009; Lobmaier et al., 2010; Cárdenas et al., 2013).

Familiarity with an animal as well as age of participants were able to modulate preferences, particularly for cats. Children showed a preference for dogs over cats in all conditions presented (see also **Chapter 2**, the dog was more frequently chosen than the cat); images of non-infantile cats were the least chosen, even in comparison with inanimate stimuli. However our results show that the likelihood of a child choosing pictures of adult cats was higher in older children and in participants who have prior experience with this species (i.e. ownership). These results seem to suggest that children learn to appreciate non-preferred animals through age and familiarity, a notion that underlines the importance of educational programs to promote child-animal relationships.

In our study children showed a preference for animal over non-animal (i.e., human and inanimate) stimuli in all conditions, a result that confirms an early emergence of a 'biophilic' predisposition to be attracted by animals (Wilson, 1984; Kellert, 1993a; DeLoache et al., 2011; Lobue et al., 2012). Our results represent further evidence that there are not individual differences in children's strong preference for animals as a function of either sex/age or prior experience with animals (Nielson and Delude, 1989; DeLoache et al., 2011). In Archer and Monton's study (2011), when asked to rate the same photographs for their attractiveness, adult participants showed a preference for faces with infantile features but, differently from children in our study, they found photographs of animals to be as attractive as those of humans, an observation that seems to confirm that animal stimuli are particular appreciated during childhood.

5.1.3. Cute perception and visual attention to human and animal faces: the effect of baby schema

In **Chapter 4** we reported a study analysing the effects of the baby schema on cuteness perception and visual preference in young children (3-6 years old). We used a carefully controlled design in which stimuli (human and animal faces) were objectively quantified according to the baby schema content. The procedure used to modify facial configuration was originally developed by Glocker and colleagues and applied to faces of human infants. These researchers not only demonstrated that the baby schema affects cuteness perception and motivation for caretaking in adults (Glocker et al., 2009a), but they also suggested a neurophysiologic mechanism by which baby schema could promote human nurturing behaviour (Glocker et al., 2009b). By applying Glocker's procedure also to human adults and to faces of adult and young animals, we were able to dissociate the response to a specific stimulus (e.g. humans vs. animals) from the response to its facial configuration (i.e. high baby schema vs. low baby schema).

Overall, our results extend Glocker's findings and provide the first rigorous demonstration that the baby schema drives cuteness perception in young children: images with a higher infantile facial configuration were rated as cuter than those with a lower degree of baby schema. However, the analyses of individual differences show that, both in children and in adults, the positive appraisal towards animals (cuteness ratings) is only partially affected by their facial traits. While experience/familiarity with animals is able to modulate cuteness perception in adults, children tend to respond with a general proneness towards animals, which appears less influenced by the presence of infantile traits and not mediated by experiential factors (Nielson and Delude, 1989; DeLoache et al., 2011). Children rated images of animals as cuter than images of humans, independent of the degree of baby schema. Furthermore, they gave similar cuteness scores to images of adult and young animals, while the age of the viewed subject did affect their ratings of human stimuli. By contrast, adult participants showed a more differential appraisal for images of young animals (puppies and kittens), judging them as cuter than adult animals and an effect of pet (i.e. cat) ownership was also found.

This study also shows that the attentional response to an infantile facial configuration can be detected early during development (at about 3 years of age). In fact, the concept of cuteness not only encompasses the evaluation of specific morphological traits (i.e. cuteness ratings, preference, attractiveness), but also involves a positive/affectionate behavioural response (cute response), which appears to be anticipated by a visual prioritization of - and an attentional bias to - infantile stimuli (Brosch et al., 2007). There is some evidence that adults tend to look longer at infant than at adult faces and at cuter than at less cute infants (Hildebrandt and Fitzgerald, 1978; Power et al., 1982; Parsons et al., 2011; Cárdenas et al., 2013; Hahn et al., 2013; Sprengelmeyer et al., 2013). Overall children in our study showed a visual preference for images with a higher degree of baby schema, although results indicate a limited ability to evaluate subtle differences as those obtained by parametrically modifying facial images. This observation is in line with the evidence that the salience of infant stimuli may depend on the ability to evaluate small differences in cuteness (Sprengelmeyer et al., 2009; Lobmaier et al., 2010), a capacity that may emerge later in life.

Interestingly, 3-6 years old children showed a precocious ability to extract relevant information from faces of different species and from images with a dissimilar degree of baby schema. The general assumption behind this analysis was that, while judging cuteness, gaze patterns would be sensitive to cues specifically related to infant-like characteristic (i.e. big eyes in baby schema). For the first time such an assumption was tested in young children. We thus analysed whether cuteness perception of different faces involves a different gaze strategy (gaze distribution across key internal facial features, i.e. eyes, nose, and mouth). Our findings confirm a general oculomotor strategy employed by humans while exploring faces (both human and animals), previously observed in adults (Guo et al., 2010). Nonetheless, our results show that viewing time allocation to the same facial feature is species-dependent (i.e. attention to the mouth) and is also sensitive to the degree of baby schema (i.e. attention to the eyes). The eyes contain critical information about face identity and emotional state (Emery, 2000), and eye size may affect both aesthetic ratings of and visual preference for human faces (Geldart et al., 1999). Here we suggest that, more than other facial features, they may also be crucial for cuteness perception and associated attentional response. Presentation of pictures of different species resulted in a differential distribution of fixations directed to specific face regions. The mouth in human faces attracted significantly more fixations and longer viewing times than in dog and cat faces, similarly to what was observed in a sample of adults by Guo and colleagues (2010). As in adults, children's differential gaze allocation to the mouth could indicate the precocious ability to extract relevant facial information from different species, in particular the importance of the mouth for human visuo-social communication (for fast detection and recognition of subtle facial expressions, Guo et al., 2010) and for human language comprehension (Lewkowicz and Hansen-Tift, 2012).

To conclude, the employment of eye tracking technologies, allowing to record in details which specific features of a stimulus attract participants' attention, appears a promising tool to deepen our knowledge of human perception of animals and to evidence the basic mechanism underlying motivation and preference.

5.1.4. Factors modulating children attraction to animals: effect of age, gender and familiarity with animals

So far we have strengthened the evidence that responses to an image (e.g. preference and visual attention) may be driven by perceptual features (species-specific shapes and attributes, relative dimensions of some facial features). However we should take into account that the reaction to a stimulus may also be affected by the viewers' attitudes, motivation and preferences (e.g. interest in infants, preference for animals, attachment to animals, Archer and Monton, 2011; Borgi and Cirulli, 2013; Cárdenas et al., 2013).

Results described in **Chapter 3** and **Chapter 4** confirm an early emergence of a 'biophilic' predisposition to be attracted by animals and represent further evidence that in children there are not individual differences in their preference for animals as a function of either sex/age or prior experience with them (Nielson and Delude, 1989; DeLoache et al., 2011). Only when analysing children's response to specific animal traits or to diverse species, the role of human individual attributes (i.e. age, gender, pet ownership) emerges (**Chapter 2**, **Chapter 3**, and **Chapter 4**).

A substantial body of evidence indicate gender as one of the most important demographic variable affecting attitudes and behaviour toward animals (for a review see Herzog, 2007). Results from the study described in **Chapter 2** clearly confirm that gender differences in the preference for animal species are mediated by a higher level of fear/disgust of less popular animals among females relative to males. This has been previously observed both in older children and adults (Kellert and Westervelt, 1984; Davey, 1994; Bjerke et al., 2003; Røskaft et al., 2003; Bjerke and Ostdahl, 2004; Prokop and Tunnicliffe, 2008; Prokop et al., 2009b; Prokop and Tunnicliffe, 2010; Randler et al., 2012). Our results extend the current knowledge about gender-based attitudes towards animals to younger children (3-6 years old), showing that, in comparison with girls of the same age, kindergarten boys indicate a higher appreciation of fear-relevant animals, such as alligator, snake, and shark, and biting and stinging invertebrates (e.g. scorpion, spider, beetle, bee). However, differently from previous research on older children (Kellert, 1985; Bjerke et al., 1998), girls in our study were not more pet-oriented than boys and gender did not affect the probability of choosing either farm or companion animals. Girls showed a greater preference for the butterfly, ostrich, hedgehog and sea lion, confirming a more aesthetically oriented attitude towards animals observed in females (Kellert and Westervelt, 1984), including a higher sensitivity to infantile characteristics (Archer and Monton, 2011).

Consistent with this observation, in the study described in **Chapter 3** a species-specific higher sensitivity for infant-like features (i.e. *Facial index*) in animals (specifically dogs) was observed in 3-6 years old Italian girls in comparison with boys of the same age. However, in the study described in **Chapter 4**, which employed British children and adults as participants, gender-biased effects were not observed either when analysing positive appraisal towards animals or attentional responses towards infantile human and animal stimuli. Although data are still conflicted (Glocker et al., 2009a; Parsons et al., 2011), a number of studies have shown women to be more responsive to the baby schema then men: they not only tend to be more attracted to and prefer baby-like stimuli but they also appear more motivated to exhibit nurturing behaviour towards infants than men (Sternglanz et al., 1977; Hildebrandt and Fitzgerald, 1979; Sprengelmeyer et al., 2009; Lobmaier et al., 2010; Cárdenas et al., 2013). The failure to detect gender differences may be due to the fact that in the latter study we used images of the same subjects with very subtle differences in terms of baby schema, while in the previous study we used images of different subjects (e.g. adults vs. young) thus with a higher variance, also in traits not specifically related to the baby schema. Some preliminary evidence show that the salience of infant stimuli may depend on the ability to evaluate small differences in cuteness (that appears to be higher in women, Sprengelmeyer et al., 2009; Lobmaier et al., 2010), a capacity that may emerge later in life. However, in the study described in **Chapter 4** adult women did not show differential responses either; specifically their cuteness ratings were similar to those given by men. Nevertheless, it should be taken into account that these results may have been caused by an unbalance in the number of men and women recruited or by the young age and childlessness of the participants. These findings call for further research to explore in details the emergence of a gender-biased sensitivity to infantile features. The final aim is to explore how measures of preferences impact upon behaviour, in particular on the emergence of salient aspects of the cute response (nurturing behaviour, attentional shift towards infants) and to definitively answer the question as to whether such predisposition could be extended to include the human-animal bond.

The employment of different stimuli and methodologies makes extremely difficult a comparison among studies and the analysis of possible intercultural effects (i.e. Italian vs. British nationality) on children's response. Gender differences in cultural conditioning and experiences, such as exposure to media and toys, which encourage caring behaviours in girls, are well-known. Whether such factors may also influence our relationship with pets from an early stage of development and whether the responsibility for the caring of animals might facilitate the acquisition of mothering skills prior to the onset of reproductive activity (Maestripieri and Pelka, 2002) remain unexplored (Melson and Fogel, 1996).

With the aim to have some clues on the role of experience in modulating individual responses to animal stimuli, we also analyzed the effect of age and familiarity with pet animals (i.e. pet-ownership) on children's preferences (**Chapter 3**). We found that, while dog ownership did not affect either preferences for infantile features or orientations towards dogs, familiarity with cats was able to modulate species-specific preferences. The likelihood of choosing images of cats (independently from the presence of infantile features) over those of dogs was higher in children who had cats at home than in those who did not, a result that was replicated in the study described in **Chapter 4** in which adult participants owning cats showed a more positive orientation towards this species. Moreover, the odds of a child choosing pictures of adult cats without infant features - which represented the least favourite stimulus – was more likely in older children. These results seem to suggest that children learn to appreciate animals through age and familiarity. While the liking of very popular animals like dogs is more widespread (Woods, 2000) and appears more independent by experiential factors, the appreciation of less popular animals like cats probably needs time to develop and appears more dependent of our contacts with them and our knowledge of this species.

Finally, the study described in **Chapter 4** show that, when analysing more direct measures of interest and attention (i.e. visual preference and face processing), most of the effects of human individual attributes (such a gender and experience with animals) disappear. Neither gaze allocation to more infantile stimuli nor gaze distribution among facial regions were affected by gender of the participants and by pet ownership.

It cannot be excluded that these effects may be detectable only in adults or in dog/cat experts (e.g. subjects extensively involved in dog training and/or activities, but see Kujala et al., 2012). Moreover pet ownership may be a measure not representative of interest in – and involvement with – animals. In fact, even if they have animals at home, children may have not a great commitment in their daily care. Future studies could thus employ measures more representative of their involvement with household pets, such as frequency of play with and care of pets, attachment to them and frequency of expressed interest (Melson and Fogel, 1996; Daly and Morton, 2006; Archer and Monton, 2011).

The influence of individual factors in modulating responses to animals should thus be emphasized in future research. Our results indicate that while human preference and propensity for some stimuli (e.g. animals, infants) may be affected by age- and gender-related motivations, the cognitive mechanisms underlying these responses (such as species-specific face processing or attentional bias towards attractive features) appear to be more resistant to changes and to experiential factors.

5.2. IMPACT AND PERSPECTIVES

Due to the extraordinarily prominent position that animals occupy in human lives from childhood to adulthood (Serpell, 1999) and in consideration of the increasing number of household pets in Western societies, including non-traditional pets (e.g. USA and Italy, APPMA, 2013; Eurispes, 2013), the examination of human attitudes towards animals, and the analysis of the different factors influencing them, has attracted the attention of researchers from different disciplines. First, the self-evident and empirically-established fact that humans have different attitudes towards animals, that some animals are favoured, while others are disfavoured, are a matter of concern to the field of animal welfare, as well as to conservation biology (Plous, 1993; Czech et al., 1998; Serpell, 2004; Tisdell et al., 2005; Kaltenborn et al., 2006; Tisdell et al., 2006; Martín-López et al., 2007; Knight, 2008; Batt, 2009). In addition, the analysis of why not all animals are equal “in the eyes of the beholder” has implications for the management of tourism and recreational facilities (zoos and other venues), and can be used as a valuable tool to improve educational programs and address misconceptions (Woods, 2000). Last but not least, attitudes towards animals have attracted the attention of psychology, with an increased interest of child research in different aspects of the Human-Animal-Interaction field (HAI), e.g. benefits of contacts with animals during development, dog bite prevention, links between animal abuse and intrafamily violence.

Greater knowledge on early attitudes towards animals has implications for promoting interest towards animals. This consideration is of particular importance in the view of the positive contribution of growing up with animals on emotional and social development. Building a healthy and safe relationship between children and animals is particularly significant, also in the light of the growing employment of different animals in educational and therapeutic contexts, as well as from an animal welfare perspective.

A major discrepancy between results obtained using measures of behavioural interest and those obtained using picture preference can occur (Berman, 1980). Therefore, the future challenge is to determine the link between attitudes to animals and direct assessment of preference (e.g. visual attention) and to explore how both these measures reflect on actual behaviour.

5.2.1. Educational aspects: promoting positive attitudes towards animals

Knowledge of animals may influence humans' beliefs and behaviour. Hence building positive attitudes towards animals is one of the main aims of biology teachers and environmental education programs (Iozzi, 1989). Scarce information on animal biology and behaviour, together with false beliefs and prejudices or incorrect assumptions about their danger, are the principal factors behind unpopularity of certain species such as snakes, bats and insects (Arrindell, 2000; Öhman and Mineka, 2003; Pagani et al., 2007; Prokop and Tunnicliffe, 2008; Prokop et al., 2009a). Although it is very unlikely that children around 3 years of age have had direct contact with animals such as bats and snake (also in the light of the fact that most of the participants enrolled in the study presented in **Chapter 2** had urban residency), a negative attitude towards these animals seems to emerge very early during development. Several educational interventions have shown that by providing information on biology of the living organisms, as well as through observation of animals in nature and direct contacts with them (e.g. handling) is possible to increase appreciation of animals and to change attitude typologies among children and youths (Morgan and Gramann, 1989; Ascione and Weber, 1996; Lindemann-Matthies, 2005; Prokop et al., 2009a; Randler et al., 2012). Our findings strongly suggest that educational programs should be directed at children before they enter primary school. Interest in less popular animals such as snakes, bats, spiders or insects, should be encouraged very early in children, especially in girls, since negative attitudes to these animals may became highly resistant to change (Bjerke et al., 2003; Prokop and Tunnicliffe, 2008; Prokop et al., 2009a; Prokop et al., 2009b). By anthropomorphizing and neotenizing selected animal species, educational programs may successfully make some animals appear cuter and thus attract children's attention (but see Lawrence, 1986; Grauerholz, 2007). However, while aesthetic quality may influence children's initial evaluation of different species and attitude discriminations, a better knowledge of bio-behavioral attributes of some animals (e.g. bats extraordinary and unique communication system), as well as direct contact with animals (e.g. observation and handling, monitoring local animal populations) appear the relevant factors that may have a strong impact on children attitudes forming and to help address misconceptions (Kellert, 1985; Ballouard et al., 2011).

Attitudes of children towards nature are influenced by family, personal experiences, media, and school (Eagles and Demare, 1999). Nowadays the educational aspect of interactions with animals assumes a particular relevance in consideration of the reduction of outdoor activities and thus lack of direct familiarization with animals and the consequent internet-based knowledge acquisition (Ballouard et al., 2011).

5.2.2. Promoting healthy and safe relationships between children and animals

Although complex, there is a correspondence between attitudes and actual behaviour (Glasman and Albarracin, 2006). Hence building positive attitudes to animals from childhood is of primary importance for the development of a healthy and safe relation between children and animals and for its impact on animal welfare.

Experience gathered by owning pets and caring for them was observed to have beneficial influence on several aspects: pet owners better understand animal physiology and behaviour (Inagaki, 1990; Prokop et al., 2008) and have more positive attitudes towards both popular and unpopular animals (Paul and Serpell, 1993; Bjerke et al., 2001; Miura et al., 2002; Bjerke et al., 2003; Prokop et al., 2009b; Prokop and Tunnicliffe, 2010). Pet ownership may even influence career choices (Serpell, 2005). In our study (**Chapter 3**) the experience gathered by owning a cat was able to modulate preferences for this species.

The fact that not all children have the possibility to come in contacts with animals in their house, and to own a pet until adulthood, underlines the important role of educational settings to promote child-animal relationships. A humane education with animals in the classroom has the potential to promote social integration, empathy, at the same time addressing behavioural problems (such as aggressiveness) and can thus influence the affective area of the learners (Morgan and Gramann, 1989; Ascione and Weber, 1996; Zasloff et al., 1999; Hergovich et al., 2002; Daly and Suggs, 2010). Considering the animal point of view, building an empathic and affectionate relationship between children and animals may have also positive effects on animal welfare. Negative attitudes to animals are associated with less humane behaviour towards them and *vice versa* (Hemsworth, 2003).

It should be highlighted that, even if in several reports (including our studies, see **Chapter 2** and **3**) dogs appear to be one of the most favourite species for both children and adults (Woods, 2000), these animals may also be the recipient of fear-responses from people and thus of negative attitudes (Di Nardo et al., 1988; Doogan and Thomas, 1992; see also questionnaire survey in

Chapter 2). Surprisingly, very few studies have analysed how dog appearance (e.g. breed traits or individual traits) may influence human reaction to these animals (fear-response vs. affiliative response). In a study by Wells and Hepper (1992) it was shown that people expressed clear preferences for dogs having long blond hair, show a tendency to approach them, or play (Wells and Hepper, 1992). In another study people with dogs and dog puppies were seen as more approachable and passers-by contacted them more often directly (conversing) and indirectly (look, smile) in comparison with people without dogs; interestingly, dogs belonging to breeds having a "bad" public reputation, such as Rotweilers, did not have this effect (Wells, 2004). In this context further analyses on human perception of cuteness appear particularly relevant. Cuteness judgements may enhance nurturing behaviour (Glocker et al., 2009a; Sherman et al., 2009) and modulate mother-infant interaction (Langlois et al., 1995) and women's willingness to adopt a baby (Volk and Quinsey, 2002). This field of analysis has the potential to be successfully translated into the human-animal interaction research, as no studies have explored association between cuteness and adoptability in kennel dogs or to what extent animal appearance influences human-pet interaction style and care behaviour towards pets.

More detailed knowledge of the factors underlying children's attraction to animals will also facilitate educational programs aimed at minimizing risk factors inherent children-animals encounters, especially in consideration of dog bite incidents. As especially young children under the age of 7 are most at risk of a serious dog bite injury, often after an interaction they initiated themselves, we need to investigate the causes further. Attractiveness to animals may be one of the causal factors behind the frequent involvement of young children in dog bite incidents. Interestingly, our results (**Chapter 4**) show children paying less attention to the mouth region in dog stimuli and this information is crucial insofar as it can help to direct educational efforts to teach children about safe behaviour with dogs (since more severe aggression signals in dogs like showing teeth, snarling and growling are displayed in the mouth region) (Shepherd, 2002; Meints and de Keuster, 2009).

5.2.3. The challenge of HAI research: animals as adjuncts in therapy

By being able to respond affectionately to human attention, to elicit prosocial behavior and positive feelings, animals seem to possess a unique capacity to serve as an emotional bridge in specific therapeutic contexts and to act as social catalysts (Serpell, 1996; McNicholas and Collis, 2000). These evidence have led to an increase employment of animals, especially dogs and horses, both in educational and therapeutic interventions addressed to both typically and atypically populations, also known as Animal Assisted Interventions (Friedmann and Son, 2009; Berget and Braastad, 2011; Cirulli et al., 2011; Grandgeorge and Hausberger, 2011; Berry et al., 2013; O'Haire, 2013).

Attitude towards animals and attraction to them is thought to be sufficient to explain some of the beneficial effects of these programs, since things that tend to absorb people's attention in non-threatening ways are also known to exert a calming and de-arousing influence (Katcher et al., 1983; DeSchriver and Riddick, 1990). A more relaxing environment might, in turn, increase people's responsiveness and willingness to communicate (Limond et al., 1997; Esteves and Stokes, 2008; Friesen, 2010). Thanks to their ability to catalyze social interactions and to create a more relaxed environment conducive to self-disclosure, a requirement necessary for the therapeutic process, animals may indeed represent a valid help in therapeutic contexts. Since attention is one of the key aspects of the learning process, interacting with animals has also the potential to represent a mean for promoting cognitive development. Thus future research on the attentional aspect of human interactions with animals should be encouraged.

Our analyses represent a first step towards a more in-depth knowledge of the mechanisms underlying some of these effects. Further studies on specific animal characteristics able to elicit emotional/affiliative responses in children could increase the effectiveness of interventions for subjects with deficits in the social domain (Berry et al., 2013; O'Haire, 2013) by providing salient and emotionally relevant stimuli. This information can also be used to help in developing socially interactive robots in the view of their utility in providing social interaction for people in need. In some cases such robots can have an advantage in comparison with animals because they could be used easier in hospital environments or with people who are sensitive to infections and can work for extended time avoiding the issues of animal welfare (Miklósi and Gácsi, 2012).

While experimental evidence on the effects of pets for human health is still in the process of being gathered, thousands of volunteers, associations and health professionals worldwide have gradually introduced animals to a variety of health care settings (Cirulli et al., 2011). Thus an ever-increasing research effort is needed to search for the mechanisms that lie behind the human-animal bond as well as to provide standardized methodologies for a cautious and effective use of Animal-Assisted Interventions.

5.3. CONCLUSIONS

There is increasing evidence that children observing and interacting with animals learn things and acquire skills that they probably cannot learn or acquire in other ways (Serpell, 1999) and evidence is accumulating on the potential benefit of interacting with animals on their social and emotional development (McCardle et al., 2011).

The question now is how we can promote positive child-animal relationships in both educational and therapeutic programs. The work presented in this thesis underlies the importance of considering animal traits and characteristics when analysing attitudes towards both popular and unpopular species in children. We have indicated some of the attributes intrinsic to animals that may induce children's positive responses to them (species similarity to humans, domesticity and familiarity, facial configurations) and that can thus be used in promoting positive attitudes and building healthy and safe relationships with animals from early development.

But we have only begun to explore these aspects. Although it is not easy to achieve a comprehensive understanding of how different variables influence children's perception of animals, a better knowledge of the basic mechanisms underlying attitudes towards animals and affective response to them may have important implications for different fields (environmental psychology and education, child therapy, recreational programs, animal welfare). Our research is a first and significant step towards characterizing both cognitive (attention) and psychological (overt preference) mechanisms underlying attraction to some non-human species. However, the widely-supported notion that interaction with an animal has a beneficial influence on children's social-emotional and cognitive development and the mounting evidence of the valuable role of animals as adjuncts in therapeutic programs, call for further research exploring the multi-faceted ways in which children perceive animals and relate to them.

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LIST OF PUBLICATIONS (2011-2013)

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APPENDIX: THESIS PUBLICATIONS