Motor lateralisation in domestic cats and dogs

Lateralized behaviour in humans has primarily been characterized as " handedness" – preference to use one hand over the other (Mutha et al., 2013). Once considered to be uniquely human trait, lateralized behaviour patterns recently been reported in animals, such as apes, horses, dogs, cats and mice (Aydinlioglu et al., 2000; Bard, Hopkins, & Fort, 1990). However, most of the research has focused primarily on non-human primates, but recently attention has been directed towards the domesticated animals such as cats and dogs (Wells & Millsopp, 2009). It is important to note that various methods have been employed to measure motor laterality in these animals. For example, asymmetries of medial (unpaired) organs such as the head (turning bias; Siniscalchi et al., 2010) and direction of tail wagging (Quaranta et al., 2007) have been used as indicators of dog motor laterality, but the focus of this essay will be on paw preference in domestic cats and dogs as it is the most widely used indicator of motor laterality in these animals (Tomkins, McGreevy, & Branson, 2010) and consequently wider source of literature on paw preference should allow to draw more accurate conclusions about motor behaviour in domesticated cats and dogs. I will structure this essay by firstly describing how paw preference usually are tested, then I will review the papers discussing how valid are these methods. Then I will briefly outline theories explaining what determines the preferred use of a particularlimb[GZ1]and finally I will focus on reasons why it is useful to have reliable methods measuring paw preference in domestic cats and dogs.

In studies on dogs and cats " handedness" the method by which paw preference have been classified and reported varies. For cats examples of task that measure they " handedness" include task such as putting a small piece of tape on a pet's muzzle and recording which paw the cat uses first to remove the tape. Or observing which paw a cat uses to ' trap' a laser pointer light or reach for a dangling toy above their head; while for dogs examples that measure paw preference include the following tasks: place a treat or a toy under the sofa just out of a dog's reach and see which paw an animal uses first to try to reach for the treat; put an adhesive tape on the dog's eyes or nose and see which paw will be used in order to remove the tape (Batt et al., 2009), or teaching a dog to " shake paw" with an experimenter, and recording the presentation of a paw to the tester to shake hands. In addition, there are reports of several locomotory tests, such as the first paw used to lift and depart from a stand position (Tomkins et al., 2010).

However, even the method by which paw preference have been classified and reported varies, but results from these studies consistently agree that domestic cats and dogs performs lateralized behaviour just on some but not all motor tasks (Wells & Millsopp, 2009). Research found stronger lateralization of behaviour on more complex motor challenges, suggesting that laterality often varies as a function of task complexity. For example, research run by Tomkins and colleagues (2010) tested 42 domestic cats (21 males, 21 females) on three different tasks. First task required the cat to retrieve a food treat from a glass jar and the experimenter recorded the paw that was first used by the animal to try to retrieve the food from the jar. The second challenge involved a small toy (a fabric mouse or a string) that was suspended about 10 cm above the cat's head and paw preference was recorded by counting with what paw an animal first reached for the toy. In the third task the same toy like in task two was shown to the cat and later slowly moved away from the pet, again the paw that was first used by the cat to reach for the toy was recorded by the experimenter. Results from this study indicated that in task one cats displayed apparent lateralized behaviour (consistently showing preference to use either left or right paw), while on task 2 and 3 all cats showed ambilateral motor behaviour (i. e. no significant paw preference). These results supports the idea that task complexity influence laterality. Furthermore, Rogers (2009) explains this results by saying that as task 1 was the most challenging, that required the obligate use of the processing specialization of one hemisphere. While task 2 and 3 were more simplistic, requiring simple reaching in the vertical and horizontal planes, that did not require such a restricted use of a particular hemisphere, consequently allowing either limb to be used. These observations point to the functional brain specialization in domestic cats, that means that right and left hemispheres in these animals have specialized functions and possible control both motor responses and preferential processing of stimuli (Tomkins, Thomson, & McGreevy, 2010)

Equivalent observations (stronger lateralization of behaviour on more complex motor challenges) were seen in studies with dogs too (Hunt et al., 2006). For example study run byBatt et al. (2008) explored the paw preference of 43 dogs on two different tasks. One of the tasks involved a flannel blanket which was placed over the head of the dog by the experimenter so that the animal’s vision was completely obscured consequently encouraging the dog to remove the blanket, while another task, so called Kong test (food retrieval task), where a dog is given a hollow dog toy filled with food and paw preference is measured by recording each dog’s ï¬ rst 50 uses of the left or right paw to restrain a Kong. The results from this study indicated that dogs exhibited a significantly stronger paw preference on food retrieval task than on tape removal challenge. That is again in line with studies that found stronger lateralization of behavior on more complex motor challenges. These findings leads to the conclusion that llaterality in domestic dog and cats is task-specific, and knowing the fact that previous research used different tasks to measure paw preference that might be the cause of different results and conclusions (Tomkins, McGreevy, & Branson, 2010).

Conflicting findings of population-level ” handedness” were reported in Tan et al. (1990) and Pike & Maitland (1997) studies. Tan et al. (1990) concluded that cats have a right-sided bias in paw preference after they found that majority of cats tested in their experiment preferred their right paw on a food-reaching challenge. In contrast, study reported by Pike & Maitland (1997) indicated that cats showed a left-sided behavioral bias in moving-target reaching tests. However, some scientist criticized this studies not because of different test used in assessing animals paw preference but because most of the cats in Tan et al. (1990) sample were female, while Pike & Maitland (1997) study used more male than female cats (Wells & Millsopp, 2009) and as growing body of evidence suggests that male cats and dogs tend to be “ left-pawed” and females are more likely to be “ right-pawed”. Hence by using mostly females and in Pike & Maitland (1997) case mostly male cats lead to conflicting conclusions that again highlights the importance of challenging animals on more standardized tests (Wells & Millsopp, 2009)

In humans, the steroid hormone testosterone has been linked to left-handedness (Geschwind and Galaburda, 1985a, Geschwind and Galaburda, 1985bandWitelson, 1991). Similarly, the finding that direction of the dogs'or cats' paw preferences is significantly influenced by the animals' sex indicate a role of the sex hormones in motor lateralization (Wells & Millsopp, 2009). However, according to the literature the adaptive advantages of male and female animals using different paws to achieve complex motor goals are unclear, although Wells & Millsopp (2009) suggest that these differences may be related to sexual dimorphism in theethologyof these species. Male and female cats, for instance, differ in their behavioural patterns (e. g. hunting styles, parental care), and it is possible that these place different demands on motor functioning (Wells & Millsopp, 2009).

The possibility of a hormonal influence in explaining the sex effect on paw preferences in cats and dogs lead to further research on paw preferences in both intact and neutered animals as it was expected to yield useful information on the relationship between sex hormones and lateralization. Branson & Rogers (2006) found no sex difference in paw preference in neutered dogs (i. e. neutered pets showed no preference for using one paw over the other), suggesting a role of the sex hormones in motor use. Equivalent findings were reported with studies investigating paw preferences in neutered cats. Discovery News reported a study on paw use that was done on 42 domestic cats (21 male and 21 female). It found that pets that had beenneutered, showed no preference to one paw over the other.

However other studies reported different results. For example, Carleton-Prangnell (2012) research project with 51 male dogs (26 neutered and 25 unneutered) during two tests, the Kong and the gait test found that neutered dogs displayed a right paw preference and unneutered dogs displayed a left paw preference in both tests. That again suggest that different tasks used to measure paw preference might be the cause of different results and conclusions (Tomkins, McGreevy, & Branson, 2010).

As previously mentioned studies have shown that task complexity influences both the degree and strength of laterality (Trouillard and Blois-Heulin, 2005). In addition to that, some authors claim that some of the tasks cannot be considered as reliable in assessing paw preferences because of their bias. For example Wells (2003) suggest that prior training of the animal may bias the results obtained in the paw lifted to ” shake hands” task as most owners teach their dog from an early stage of its acquisition to give a paw in exchange for a reward, (e. g. food, verbal praise). Having learned that lifting a paw results in a reward, the chances of that same paw being used again in the future are much higher. The existing learned association may explain the extremely strong preference of dogs for one paw over the other across the 100 trials on this particular task. This is a learned behaviour pattern resulting from positive reinforcement. In addition Palmer (2002) suggest that findings of paw preference in this task might be a “ by-product of being reared in an environment where the captors are handed. That again point to the need of more standardized and reliable test when assessing paw preference in domestic cats and dogs.

In addition, if task used in measuring paw preference is unreliable that might have a notable implications. For example, the lack of paw preference in dogs is associated with noise-related fearfulness that is important characteristic in determining suitability of the particular animal to be trained as a guide dog (Branson and Rogers, 2006). Hence, using unreliable test might compromise the chances of some perfectly suitable dogs to be selected for the training. The example of such biased test is KongTest, previously it was commonly used in assessing dogs “ pawedness”. According toBatt et al. (2008) in Kong test each paw used is influenced by the previous paw. Hence, quite often when using this task dogs were considered as lacking paw preference leading them to be considered as fearful and unsuitable to be trained as a guide dog. That again highlights the need of more valid test that could reliably assess what paw preference the animal has.

Knowing paw preference when selecting a dog for a guide dog training is just one of many reasons, why it is useful to know “ pawedness”. Determining laterality-or what part of the brain is dominant over the other-could also help breeders figure outwhich puppies are best suited to be military, service, or therapy dogs.

An American study determined that ambidextrous pets (no bias for either paw when chewing on a bone or special chew toy) were at higher risk for behavior problems, separation anxiety and noise phobia. Ambidextrous dogs showed extreme reactivity to thunderstorm and fireworks compared to both left and right-pawed dogs.

Future clarification may help to breed dogs that are more emotionally stable. For example, working dogs selected for contraband and bomb detection are often rejected from explosive and sniffer dog detection programs because of noise phobia, sometimes after years of training and expense.

It is important to mention that some researchers claim that cats and dogs might have no real paw preference as they do not have written language or cultural pressures to prefer right-” handedness” as human does. Corballis (1983)supports this idea by emphasizing that bilateral symmetry (i. e. the absence of lateralization) is in itself an evolutionary adaptation. It may be important for cats to be able to respond to sudden moving stimuli with either paw, rather than having to orient themselves into a position that enables the use of a dominant limb. It may also be the case that some actions in the cat simply do not need to be bilaterally represented and “ pawedness” observed in some studies could be just a result of being reared in an environment where the captors are handed. Even if in certain tasks might look that an animal has a paw preference that might just be a consequence of domestication and learned behaviour.

Learned behaviour was supported by Biddle (), by working with laboratory mice. Biddle has found that he can train the rodent populations to become predominantly left- or right-handed using specially designed feeding chambers that force the animals to use a particular paw to procure food. These observation suggest that paw preference may be simply an unintended consequence” of an environment that causes an animal to use one paw more than the other. However the lack of standardized methods of motor laterality assessment in domestic cats and dogs still leave the question if these animals really have paw preference.

Hence this essay illustrate the need of more standardized methods of motor laterality assessment so that comparison can be made between populations sampled. As results of previous studies indicate that lateralization of behavior usually is more common in challenging tasks (e. g. Fagot and Vauclair, 1991 and Helms Tillery et al., 1995). As like Tomkinset al (2010 point that the consistent lack of standardization between the studies (e. g. such as different tasks used) might cause different results in reported paw preferences in domestic cats and dogs. And As results of previous studies shown that task complexity influences both the degree (Fagot and Vauclair, 1991) and strength (Spinozzi and Truppa, 1999; Trouillard and Blois-Heulin, 2005) of laterality. Hence by testing the paw preferences of dogs and cats on a unified number of tasks may yield more conclusive information regarding the ” pawedness” in domestic cat and dogs.