

# Socially tuned: Brain responses differentiating human and animal motion

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Typical adult observers demonstrate enhanced behavioral sensitivity to human movement compared to animal movement. Yet, the neural underpinnings of this effect are unknown. We examined the tuning of brain mechanisms for the perception of biological motion to the social relevance of this category of motion by comparing neural response to human and non-human biological motion. In particular, we tested the hypothesis that the response of the right posterior superior temporal sulcus (pSTS) varies according to the social relevance of the motion, responding most strongly to those biological motions with the greatest social relevance (human > dog). During a functional magnetic resonance imaging (fMRI) session, typical adults viewed veridical point-light displays of human, dog, and tractor motions created from motion capture data. A conjunction analysis identified regions of significant activation during biological motion perception relative to object motion. Within each of these regions, only one brain area, the right pSTS, revealed an enhanced response to human motion relative to dog motion. This finding demonstrates that the pSTS response is sensitive to the social relevance of a biological motion stimulus.

**Keywords:** Biological motion; Superior temporal sulcus; fMRI.

Typical observers exhibit robust sensitivity to biological motion, and this sensitivity is thought to support adaptive social behavior (Blake & Shiffrar, 2007; Kaiser & Shiffrar, 2011). Studies of biological motion commonly utilize point-light stimuli, which are created by attaching visual markers to a person's body and then recoding that person's movements so that only the point-lights are visible (Johansson, 1973). The resultant displays isolate motion information as they are best recognized when the dots are in motion. An extensive behavioral and neuroimaging literature has examined sensitivity to biological motion. The goal of this study was to identify the degree of specificity of neural responses to veridical human versus animal motion. Do the brain mechanisms supporting the visual perception of biological motion operate as general animacy detectors (Westhoff & Troje, 2006)? If so, one would predict equivalent patterns of neural response to

human and animal motion. An alternative hypothesis is that responses in some neural regions are specifically tuned to the social relevance of animate stimuli (e.g., Pelphrey & Morris, 2007). Such hypotheses predict greater responses to human relative to animal motion in at least some of the neural areas previously identified as processing human motion. To test these predictions, we used functional magnetic resonance imaging (fMRI) at 3 Tesla to examine the brain mechanisms for the perception of point-light displays of human, animal and object motion.

Human observers can categorize (Mitkin & Pavlova, 1990), identify (Mather & West, 1993; Pavlova, Krägeloh-Mann, Sokolov, & Birbaumer, 2001), and detect (Kaiser & Shiffrar, 2011; Pinto & Shiffrar, 2009) point-light defined animals in motion. This ability is evident at a young age, as 2-day-old infants preferentially attend to coherent point-light hen

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This work was funded by the Simons Foundation grant no. 94915 to M.S and by grants from the Simons Foundation, the John Merck Scholars Fund, Autism Speaks, and the National Institute of Mental Health to K.P.

motion over scrambled hen motion (Simion, Regolin, & Bulf, 2008), and infants as young as 6 months of age can distinguish point-light quadrupeds from vehicles (Arterberry & Bornstein, 2002). Although it is clear that humans are tuned to biological motion early in life (Fox & McDaniel, 1982; Simion et al., 2008), there is debate, in a broader literature, as to whether the animate–inanimate distinction includes a differentiation between humans and animals. Some research suggests that visual depictions of human and non-human animals are processed differently from a young age. For example, the results from two preferential looking tasks with infant observers aged 5–7 months suggest an increasing ability to differentiate static images of people and animals with age (Pauen, 2000). Consistent with this differential processing of static images, infant observers between the ages of 3 and 6 months exhibit increasingly specialized processing of human compared to animal motion in point-light displays (Pinto, 2006). Further, adult observers exhibit enhanced sensitivity to the presence of human motion relative to dog motion (Kaiser & Shiffrar, 2011) and horse motion (Pinto & Shiffrar, 2009). Taken together, these studies suggest that differential processing of human and non-human biological motion emerges over the course of typical development and is reliably exhibited by adult observers.

Others have argued that the animate–inanimate distinction does not include a significant differentiation between humans and non-human animals. Support for this hypothesis relies heavily on behavioral studies with static displays. For instance, Minnebusch, Suchan, and Daum (2009) found similar inversion effects in a same-different form discrimination task with static images of people and dogs. Change detection studies have shown that children and adults exhibit equivalent sensitivity to animate (human and animal) versus inanimate (object) components in static images of naturalistic scenes (New, Cosmides, & Tooby, 2007; New et al., 2010). New and colleagues describe these results as reflecting prioritized social attention. However, the social relevance of people differs dramatically from that of other animals. Nonetheless, the brain mechanisms for processing human and non-human biological motion in particular have not been directly compared (but see Buccino et al., 2004). While the studies described above include a variety of tasks and stimuli, each compares the perception of human and animal stimuli. And, the question remains as to whether there are typically distinct or overlapping brain mechanisms for processing human and animal biological motion.

The brain mechanisms underlying the processing of biological motion are well documented, and the

superior temporal sulcus region has been implicated in the analysis of biological motion cues, including eye, hand, and whole-body movements (e.g., Bonda, Petrides, Ostry, & Evan, 1996; Grossman & Blake, 2002; Pelphrey, Viola, & McCarthy, 2004; Pelphrey, Singerman, Allison, & McCarthy, 2003). The right posterior superior temporal sulcus (pSTS) responds more strongly to point-light displays of human motion relative to random dot motion, inverted human motion, or scrambled human motion (e.g., Beauchamp, Lee, Haxby, & Martin, 2003; Bonda et al., 1996; Grossman & Blake, 2002; Peuskens, Vanrie, Verfaillie, & Orban, 2005). While such comparisons have solidified this region's role in the perception of biological motion, the specificity of the response to human versus animal motion, *per se*, has not been previously examined.

There is growing evidence from behavioral studies that the visual system is tuned for the detection of human movement, relative to animal and object movement (Kaiser & Shiffrar, 2011). Although there are similarities in the processing of human and animal motion in point-light displays (Pinto & Shiffrar, 2009), typical adult observers exhibit enhanced sensitivity to the presence of human motion relative to dog motion. Consistent with this, Blonder and colleagues (2004) found that although common brain areas are involved in the processing of static images of people and dogs, social brain regions (i.e., the amygdala) exhibit distinct activation in response to the two animate image categories. Such results suggest that neural mechanisms for biological motion processing may reveal a differential response to human and animal motion.

We tested the hypothesis that the brain mechanisms for the perception of biological motion are tuned to human movement. Expanding upon prior behavioral studies with adults that find enhanced sensitivity to human versus animal motion (Kaiser & Shiffrar, 2011; Pinto & Shiffrar, 2009), we compared brain mechanisms for human, animal, and object motion in point-light displays. Twenty-one healthy adults viewed highly familiar point-light biological motion displays of a human or dog and, for comparison, point-light motion of a tractor performing similar actions. We expected to replicate previous findings of brain regions for processing point-light biological motion, including (1) the right pSTS (e.g., Beauchamp et al., 2003; Gobbini, Koralek, Bryan, Montgomery, & Haxby, 2007; Grossman et al., 2000; Grézes et al., 2001; Pelphrey et al., 2003; Puce & Perrett, 2003; Vaina, Solomon, Chowdhury, Sinha, & Belliveau, 2001), (2) the inferior frontal gyrus (IFG) (e.g., Saygin, Wilson, Hagler, Bates, & Sereno, 2004), (3) the fusiform gyrus (FG) (e.g., Beauchamp et al.,

2003; Gobbini et al., 2007; Grossman & Blake, 2002), and (4) middle temporal regions (area MT) (e.g., Grézes et al., 2001; Vaina et al., 2001). While we expected to find common regions of brain activity in response to biological motion (human and animal), the purpose of this study was to determine whether any of these biological motion regions exhibit an enhanced response to human versus animal motion.

## MATERIALS AND METHODS

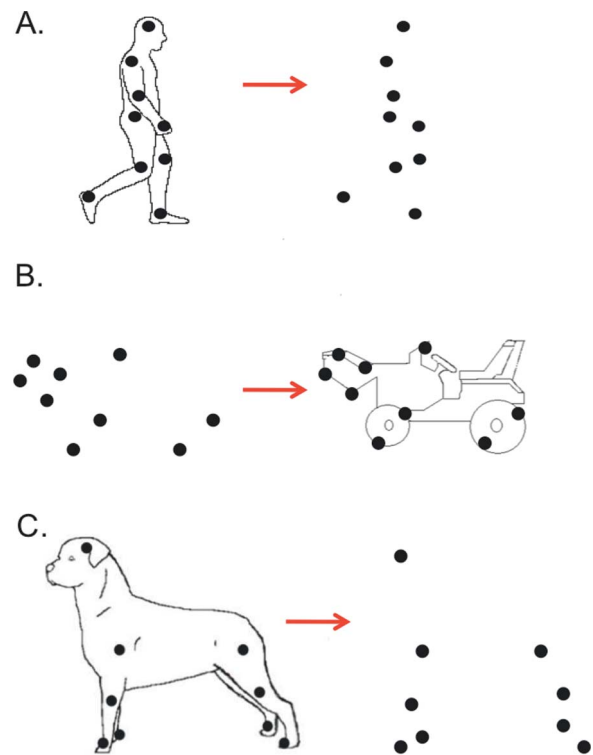
### Participants

Twenty-one healthy, right-handed volunteers with normal or corrected-to-normal vision and no history of neurological or psychiatric illness participated in the study (14 women, mean age = 24.99 years,  $SD = 4.36$ ). Two additional participants were excluded due to being left-handed and exhibiting motion during the scan exceeding 4 mm, respectively. Written, informed consent was obtained from each participant. The study was approved by the Yale School of Medicine Human Investigations Committee.

### Stimuli and apparatus

During the MRI scan, stimuli were presented with E-Prime 2.0 software (Psychological Software Tools, Inc., Pittsburgh, PA, USA). Participants completed two runs in the scanner, which included 20-s initial and final fixation periods. This two-run design was implemented in preparation for running the same task with children, in which case a break between runs is especially useful. Each run contained three blocks of point-light motion comprising coherent and scrambled displays of one stimulus condition (human, dog, or tractor). Within each block, six point-light clips were shown in a pseudorandom order for 10 s each followed by 10-s fixation. 'Each clip included two 5-s videos played in succession'. Participants were asked to watch the videos and were reminded to remain still and alert.

The stimuli used in the present study were used in our previous behavioral studies and included point-light displays of a human, animal, or object performing similar actions (Figure 1) (Kaiser, Delmolino, Tanaka, & Shiffrar, 2010; Kaiser & Shiffrar, 2011). Spatiotemporal measurements were made of a moving person, dog, or tractor ( $123.5 \times 63.5$  cm; Peg Perego, Fort Wayne, IN, USA) inside a ReActor motion capture system (Ascension Technology, Burlington, VT, USA). Videos were processed with Motion Builder



**Figure 1.** Schematic images of the point-light stimulus conditions of the human (A), dog (B), and tractor (C). While this is difficult to detect in static images, observers report compelling percepts of human, dog, and tractor motion in dynamic displays.

5.0 (KaydaraTM, San Rafael, CA, USA). Nine sensors were attached to the actor (head, wrists (2), elbow, shoulder, feet (2), knee, waist), who repeatedly performed three actions: (1) walking a linear 3-m path, (2) bending down to pick something up, and (3) walking 1.5 m and then bending down to pick something up. Then, nine sensors were attached to a mid-sized German shepherd dog: head (1), paws (4), elbow (1), shoulder (1), knee (1), hip (1). The dog repeatedly performed three actions: (1) walking a linear 3-m path, (2) bending down to pick something up with its mouth, and (3) walking 1.5 m and then bending down to pick something up with its mouth. Finally, nine sensors were attached to the wheels (4), pivot joint (1), and front bucket (4) of a "John Deere Loader" (Peg Perego,  $124.5 \times 63.5$  cm) toy tractor which performed actions similar to the actor: (1) rolling along a 3-m linear path, (2) rotating the bucket downward, and (3) rolling 1.5 m and then rotating the bucket.

Motion capture data were converted into point-light human, dog, and tractor videos (5-s duration each). Note that in the experiment, two 5-s displays were shown in succession, resulting in 10-s blocks per condition. Motion direction (left/right) was counter-balanced within each block of trials. The point-light

displays, maximum extents:  $5.0 \times 5.5^\circ$  visual angle (DVA), had lateral displacement distances ranging from approximately 8.8 to 16.1 DVA and speeds ranging from 1.76 to 3.22 DVA/s. The points defining each stimulus were white, were 0.33 DVA in diameter, and appeared against a homogeneous black background. One scrambled point-light display was constructed from each coherent point-light display by scrambling the starting locations of the points to within 1–5 pixels of the original points.

Although the person, dog, and tractor performed similar actions in the stimulus displays, vision scientists have struggled for decades to create an ideal control for biological motion. Indeed, the non-biological motion control differs from the biological motion in several ways. For example, unlike the points on the limbs of the person and dog, each of the two wheel markers move in constant relationship with each other, and the motion of each wheel is correlated with the other wheel. Nonetheless, a tractor was selected, as it shows globally non-rigid, complex motion, and the various points in the tractor displays move in a varied manner (e.g., the top marker moves horizontally and in an arc during bucket movement, the wheel markers move in circles, and the basket moves in either a straight line or an arc). Given our focus on the differential response to human and dog motion, both relative to the motion of an object control condition, any limitations of the use of a tractor motion as a control will equally affect the biological motion conditions.

### Subject self-reports

Participants reported whether or not they own or have ever owned a dog. After the fMRI experiment, each subject reported what he or she saw in the videos.

### MRI data acquisition

Scanning was performed on a Siemens MAGNETOM Trio, Tim 3 Tesla scanner (Siemens, Erlangen, Germany) at the Yale Magnetic Resonance Research Center, Yale School of Medicine. T1-weighted anatomical images were acquired in an MPRAGE sequence (TR = 2530 ms; TE = 3.34 ms; FOV = 25.6 cm; image matrix =  $64^2$ ; voxel size =  $1 \times 1 \times 1$  mm). For each run, 164 whole-brain functional images were acquired, using a single-shot, gradient-recalled echo planar pulse sequence (TR = 2000 ms; TE = 25 ms; flip angle =  $60^\circ$ ; FOV = 22 cm; image matrix =  $64^2$ ; voxel size =  $3.2 \times 3.2 \times 3.2$  mm; 34 slices) sensitive to blood oxygenation level-dependent (BOLD) contrast.

### Data analyses

Data were preprocessed and analyzed by the BrainVoyager QX 235 2.0 software package (Brain Innovation, Maastricht, The Netherlands). All 10 volumes prior to the onset of the first stimulus event were discarded to allow for T1 equilibrium. Preprocessing of the functional data included slice time correction 237 (using sinc interpolation), 3-D rigid-body motion correction (using trilinear-sinc interpolation), spatial smoothing with a FWHM, 4-mm Gaussian kernel, linear trend removal, and temporal 240 high-pass filtering (fast Fourier transform based on a cutoff of three cycles/time course). Functional datasets were coregistered to within-session anatomical images, which were in turn normalized to Talairach space. Estimated motion plots and cine loops were examined for each participant in order to identify movement and eliminate runs with head motion greater than 4 mm. An additional subject was not included in the final analyses because of being left-handed. Analyses focused on the coherent human, animal, and object motion conditions rather than the scrambled motion conditions. The comparison of coherent and scrambled human, animal, and object motion is being considered in separate analyses not reported in the current paper.

To correct for multiple comparisons, we used a cluster threshold of  $k > 34$  contiguous voxels (Forman et al., 1995; Xiong, Gau, Lancaster, & Fox, 1995). This cluster threshold was calculated for each comparison to correspond to a corrected threshold of  $\alpha < .05$ , using a BrainVoyager QX Cluster-level Statistical Threshold Estimator plug-in. After 5000 iterations of a Monte Carlo simulation, an  $\alpha$  value was assigned to each cluster size based on its relative frequency. By restricting the number of active voxels to 34 contiguous voxels within each comparison, the chance of discovering false-positive voxels was less than 5% for the key analyses.

## RESULTS

Our analysis strategy included first identifying brain areas that exhibited a greater response to biological motion relative to object motion and then examining the specificity of the response to human motion in each of these regions. To identify brain areas that were more responsive to biological motion than object motion, we performed a RFX GLM of the conjunction of human > tractor, and dog > tractor,  $p < .01$ ,  $k = 34$ . The conjunction analysis revealed several regions of interest (ROIs): right pSTS extending into right MT and occipital activation, left MT, right FG, and right IFG.



**TABLE 1**

Brain regions responsive to biological motion, as defined by the RFX GLM of the conjunction of human > tractor  $\cap$  dog > tractor motion,  $p < .01$ ,  $k = 34$ . Extent, number of voxels in the ROI. The x, y, and z refer to the coordinates of the center of activation within an ROI

Brain region	X	Y	Z	extent	t	p value
Right pSTS	42	-55	16	886	3.888	.000915
Right MT	21	-82	4	5946	5.564	.000019
Left MT	-45	-76	7	3299	4.800	.000109
Right FG	39	-46	-11	1249	4.038	.000644
Right IFG	39	11	25	2401	4.212	.000429

Given our *a priori* hypothesis regarding the role of the right pSTS in the perception of biological motion, the pSTS region was separated from the large pSTS/MT ROI. The pSTS ROI was defined as those voxels in the larger ROI that overlapped with the anatomically defined pSTS (based on Talairach coordinates implemented in a BVQX toolbox). Table 1 describes the ROIs in terms of centroids and extents.

We then compared the beta values in each region to determine whether any of these regions revealed differential activity to human and dog motion (Figure 2; Table 2). Paired sample *t*-tests revealed that only one region, the right pSTS, exhibited enhanced activation to human vs. dog motion at the  $p < .05$  level corrected for multiple comparisons;  $t(20) = 3.19$ ,  $p = .005$ . The differential response within the pSTS is also evident in the waveforms of percent signal change for human and dog motion with a condition-per-file baseline computation, as shown in Figure 3.

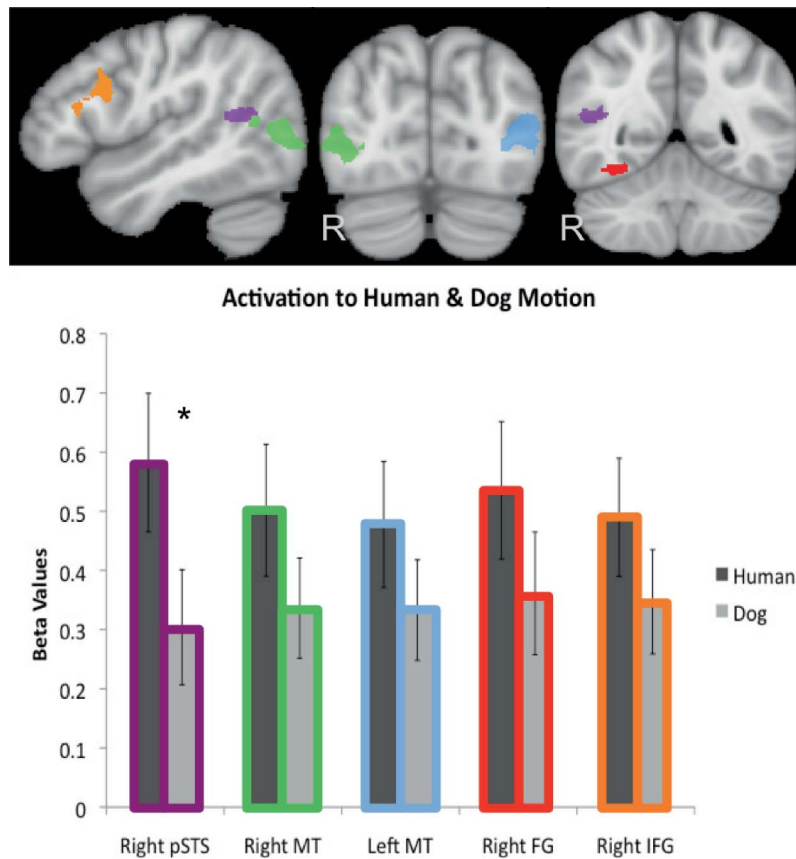
Behavioral reports of dog ownership and scan experience were analyzed in conjunction with the fMRI data. About half of the subjects reported currently owning or having owned a dog ( $n = 9$ ). We conducted paired sample *t*-tests of the beta values for person and dog in each of the biological motion regions described in the conjunction analysis above. There were no statistical differences between the mean percent signal change for dog and person in any of the biological motion regions (all  $ps > .05$ ). In post-scan reports, all of the subjects reported seeing a person, dog, and vehicle present in some of the displays. This indicates that the unmasked point-light displays of the person, dog, and tractor were easily recognizable (see also Kaiser & Shiffrar, 2011).

## DISCUSSION

An fMRI task in which adult observers saw point-light displays of human, animal, and object motion revealed several common brain regions for processing

biological motion (human and dog) relative to complex, recognizable, and namable mechanical motion (a tractor). These regions include the right pSTS, right IFG, right FG, and bilateral MT. The biological motion regions identified in the current study are consistent with past findings of common neural mechanisms for the perception of human and non-human biological motion (e.g., Buccino et al., 2007; Pelphrey et al., 2003). Further analyses examined the specificity of the response to human versus dog motion within each of these biological motion regions. Only one brain area exhibited distinct hemodynamic responses to the two types of animate motion. A region of the right pSTS, while responsive to biological motion versus object motion, revealed enhanced activation to human motion relative to dog motion. We suggest that these findings clarify the established role of the pSTS in the perception of biological motion (e.g., Allison, Puce, & McCarthy, 2000; Pelphrey et al., 2003) and are consistent with a theory of a specific tuning of this social brain region to human movement (e.g., Kaiser & Pelphrey, 2011; Pelphrey & Morris, 2007; Pyles, Garcia, Hoffman, & Grossman et al., 2007).

The current results support and extend psychophysical findings of enhanced sensitivity to human versus animal motion in point-light displays. Previous studies have shown that adult observers exhibit enhanced sensitivity to the presence of point-light humans relative to point-light animals (Kaiser & Shiffrar, 2011; Pinto & Shiffrar, 2009). While past neuroimaging studies have implicated the pSTS in biological motion processing, here we demonstrate tuning of this region's response to human motion *per se*. The typical visual system can be understood as tuned for the detection of human motion (e.g., Kaiser et al., 2010), and the fMRI findings presented above identify the neural underpinnings of this effect. The current results complement the finding of Pyles and colleagues (2007) that the pSTS is more responsive to point-light human motion than to novel point-light creature motion, even when the non-human creature motion is seen as animate.



**Figure 2.** Brain slices depicting areas of activation to biological motion, human > tractor  $\cap$  dog > tractor. Bars indicate SEM.

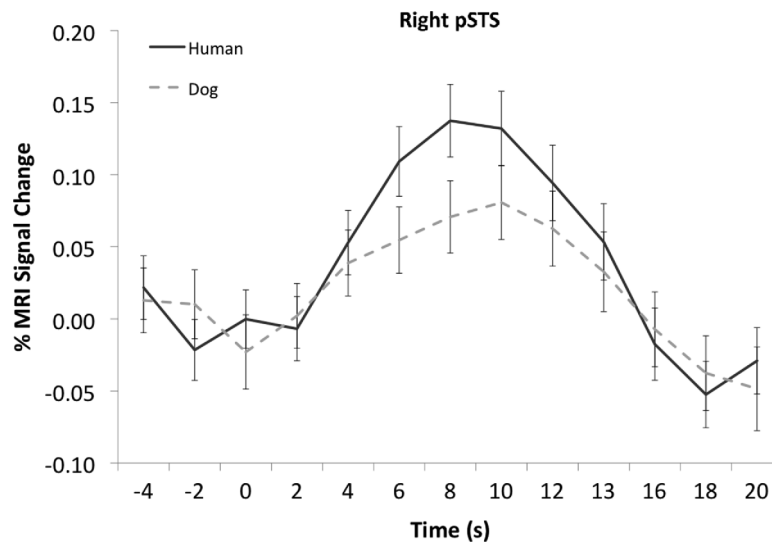
**TABLE 2**

Paired sample *t*-tests of human and dog motion, both relative to tractor motion, in the biological motion regions,  $df = 20$ . \*This *p* value reveals a significant difference at the  $p < .05$  level corrected for multiple comparisons

Brain region	Human mean (SD)	Dog mean (SD)	<i>t</i>	<i>p</i> value
Right pSTS	.582 (.537)	.304 (.445)	3.189	.005*
Right MT	.501 (.511)	.336 (.388)	2.009	>.05
Left MT	.107 (.489)	.085 (.389)	1.954	>.05
Right FG	.535 (.532)	.361 (.475)	1.887	>.05
Right IFG	.490 (.458)	.347 (.404)	1.901	>.05

In that study, the comparison of human motion to computer-generated creature motion leaves open the question of whether the pSTS is differentially responsive to authentic human and authentic animal motion (created from motion capture data). Furthermore, without directly comparing human motion to veridical animal motion, it is unclear whether these results reflect the pSTS response to biological motion in general or to human motion in particular. The current results also complement imaging research involving the visual perception of actions performed by humans and animals in displays containing extensive form information

(Buccino et al., 2004). In an fMRI study in which observers viewed actions performed by a human, dog, and monkey, Buccino and colleagues found similar regions of activation to all conditions, consistent with the regions discovered in a conjunction of activity to human and dog motion, each relative to tractor motion. The visual perception of biological motion from motion information and from form information depend upon different neural pathways (Ptito, Faubert, Gjedde, & Kupers, 2003). Thus, the current results establish the existence of neural processes that appear to be tuned for the analysis of human motion, *per se*.



**Figure 3.** Time courses of the average BOLD signal  $\rightarrow$  change from the right hemisphere pSTS region of the human  $>$  tractor  $\cap$  dog  $>$  tractor activation. Bars indicate SEM.

This holds true even during the perception of people and dogs performing the same categories of actions.

We identified several brain regions that respond to biological motion relative to mechanical object motion and further demonstrate a functional tuning of the response within the pSTS to human movement relative to familiar, non-human biological motion of a dog. These findings likely reflect sensitivity in the typical adult brain to the social relevance of human motion. It is unlikely that visual familiarity accounts for the differentiated brain responses to human and dog motions. The response to dog motion within all of the biological motion regions did not differ as a function of dog ownership. It is possible that observers in the study simply have more visual experience with human biological motion than dog motion. Nonetheless, the results of the dog ownership analysis suggest that visual experience cannot explain the differential response to these two types of motion. Although perceptual mechanisms for biological and non-biological motion have been shown to be comparably influenced by learning (e.g., Jastorff, Kourtzi, & Giese, 2006), the underlying brain mechanisms likely differ. Moreover, the complexity of the actions cannot explain the differential pSTS responses to human and dog motion, as the point-light dog and person depicted highly similar motions. In summary, activity in the pSTS to human versus dog motion indicates a highly specialized brain response to human motion that is likely not explained by visual experience or action complexity. We posit that the enhanced neural response to human motion reflects specific sensitivity of the brain mechanisms for biological motion to the most socially relevant stimuli.

The biological motion areas reported in this study are consistent with past fMRI findings with point-light displays (e.g., Grossman & Blake, 2002; Puce & Perrett, 2003; Vaina et al., 2001), animated characters (e.g., Pelphey et al., 2003), and videos of animals (Bottger et al., 2010). The recruitment of the common neural mechanisms during the perception of human and animal motion supports the animate monitoring hypothesis, which posits an evolved prioritization of living things (New et al., 2007; Rees, 2008). Mirror-neuron theories would predict that some of the found biological motion regions, such as the right IFG (e.g., Kilner, Neal, Weiskopf, Friston, & Frith, 2009) and right pSTS. While there was a trend in all regions for an increased response to human relative to dog motion, the only significant difference was shown in the superior temporal region.

The present study clarifies the role of the pSTS in social perception. Whereas both human and animal motion resulted in activation in the right pSTS, this brain region appears to be especially tuned to human movement. These results are consistent with findings that the social brain is tuned toward detecting human agents (Mar, Kelley, Heatherton, & Macrae, 2006). Further, the results suggest that rather than coding for biological motion in general, the pSTS is especially responsive to socially relevant motion.

This pattern of results, highlighting an enhanced neural response to human versus animal motion, is consistent with accounts of a developmental tuning to respond to human motion (e.g., Pinto, 2006). While some behavioral studies have indicated differential processing of human and non-human biological

motion emerges within the first year, these results seem to be somewhat task dependent. For instance, a detection task with masked point-light displays of the same human, dog, and tractor motion failed to reveal enhanced detection of human motion in school-age children (Kaiser & Shiffrar, 2011). Indeed, it is unclear whether the tuning of the STS reported above is the result of a developmental process whereby social brain mechanisms are tuned to human over non-human biological motion, or is a characteristic of the function of this social brain region from early in life (for thoughtful discussion, see Johnson, 2006). To date, behavioral and neurophysiological research examining biological motion perception in the first days of life has not compared human and non-human biological motion (Lloyd-Fox et al., 2009; Simion et al., 2008), leaving the question open as to whether infants differentiate human and non-human motion at a neural systems level from birth.

## CONCLUSION

The current fMRI study compared brain responses to human and animal motion in brain areas that respond to biological motion. We identified a tuning of the pSTS response to human motion, while other brain areas that code for biological motion did not exhibit differential responses to these two types of stimuli. These findings are consistent with and expand upon prior research that indicates that the pSTS codes actions at a basic and abstract level, and activity in this region is influenced by the social context of an action (e.g., Pelphrey et al., 2003; Pyles & Grossman, 2009). According to evidence from single-unit recordings in monkeys (Perrett et al., 1985) and imaging studies with humans (Grossman, Jardine, & Pyles, 2010; Vander Wyk, Hudac, Carter, Sobel, & Pelphrey, 2009), cells within the pSTS encode actions from a basic level of body kinematics to more abstract properties, such as those seen in anthropomorphized moving shapes. Gobbini and colleagues (2007) reported a high degree of overlap in the right pSTS during the perception of Heider and Simmel animations and point-light displays of human movement, suggesting a role for this region in representing perceived actions and the implied intentions of those actions. Such work illustrates the role of the pSTS in social perception and complements the interpretation of the current findings as evidence for a specifically social tuning of this brain region. The behavioral and neural results reviewed above indicate that action interpretation, for human motion, an inherently social source of information, is typically encoded by the STS region.

Original manuscript received 27 April 2011

Revised manuscript accepted 30 July 2011

First published online day/month/year

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