prioritization of objects to be searched. Future research will be required to determine the conditions under which the different effects of object-based attention operate.

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Axes versus averages: High-level representations of dynamic point-light forms

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Even when simultaneously masked by a large number of similar moving points of light, one can almost effortlessly extract a small number of dots whose coherent global motion depicts the moving limbs or joints of a person.

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Just as face perception, as a special case of visual object perception, has lent itself to the study of recognition, categorization, memory, expertise, attention, etc., so may this form of biological motion perception be plumbed as an extremely rich and fruitful example of complex object processing. Moreover, it may be studied using visual stimuli whose low-level spatiotemporal properties are amenable to quantitative analysis and systematic manipulation.

We are able to digitally capture, analyse, and model whole-body human movement and subsequently depict it using a small number of discrete points of light. Further, we are able to manipulate these stimuli in important ways, creating synthetic individuals whose movement and/or form are produced through, e.g., averaging or exaggeration of real individuals (Troje, 2002). The stimuli thus produced not only retain a very natural appearance, they also inspire exciting new approaches to the study of the mechanisms and representations underlying this intriguing and important perceptual process.

Starting with some relatively high-level perceptual questions that can be studied with these dynamic point-light displays, we first asked whether the seemingly straightforward categorical judgement of a walker's gender (i.e., male/female discrimination) relies on representations that are prototype/norm based (e.g., distance from the average of each category) or if these may be better described as an opponent-style axis, explicitly coding the transformation (i.e., high-dimensional "direction") between two categories.

Hypothesizing that the latter opponent system should exhibit a marked rebound effect following adaptation to a given gender, we tested subjects' gender ratings with point-light walkers of varying masculinity/femininity, following viewing of clearly male, female, or neutral adapting stimuli (Troje, Sadr, Geyer, & Nakayama, 2006). The results strongly support the idea that these perceptual categories are represented in an adaptive opponent-like fashion, as seen in a directional shift of the psychophysical functions in this simple forced-choice task.

Subsequently, we further investigated this perceptual gender "axis" in relation to the more subtle dimension of attractiveness. These point-light stimuli drive such a vivid and rich percept that we find subjects can indeed provide reliable judgements of point-light walkers' attractiveness, prompting some very interesting questions in relation to the current state of the surprisingly analogous study of face processing. In that literature, the predominant theory suggests that facial attractiveness and mating strategy are strongly driven by tendency toward the mean, such that the group prototype or average is what is considered the most attractive (e.g., Langlois & Roggman, 1990). A contrasting notion, however, is that sexual dimorphism is an important signal for attractiveness (e.g., Perrett et al., 1998). Following this latter theory, we hypothesized that not only would attractiveness ratings in biological motion be highly correlated with gender ratings (see also Troje, 2003), but also that manipulating these ratings by system-

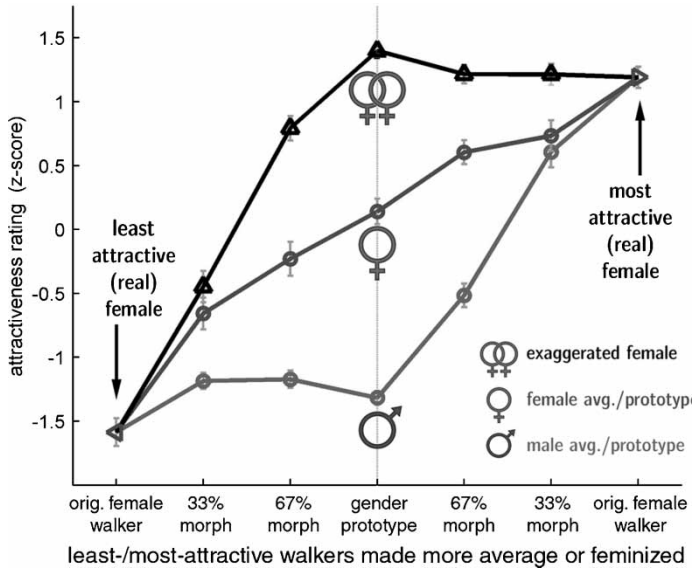

Figure 1. Attractiveness ratings (z-score; $n = 9$) as a function of point-light walkers' "averageness" or femininity, manipulated here by morphing original female walkers towards gender prototypes (i.e., average female or male) or towards an exaggerated female.

atically varying the form and kinematics of walkers could explicitly contradict the "averageness" theory of attractiveness—specifically, that the most attractive individuals would not be those closest to the group mean but rather individuals exaggerated along the gender axis, perhaps far from the norm or prototype.

Our results bear out the above hypothesis quite clearly. Compared to a set of original female walkers, synthetically averaged walkers did receive slightly greater attractiveness ratings from male and female subjects, perhaps due in part to increased symmetry (e.g., Penton-Voak et al., 2001). However, as indicated in Figure 1, synthetically feminized walkers were rated as far more attractive than these averages. (NB Averaging and feminization were performed using very similar arithmetic procedures, differing mainly in the direction of the morphing.) These findings, as we hypothesized, show a strong connection between the two complex perceptual dimensions of gender and attractiveness (as in Perrett et al., 1998) and simultaneously augment our gender adaptation results to provide a sketch of the high-level coding of these stimuli; we see, for instance, that exemplars are better members of a category (e.g., "female") not due to greater proximity to an averaged norm of that category but by something akin to a dot product with a vector describing the differences between categories.

In conclusion, subtle properties of the position and motion of a few dots can provide us with a rich percept not only of a single, coherent object (i.e., human actor) but also of complex, interrelated characteristics of this object and its actions (gender and attractiveness, not to mention identity, emotional expression, etc.; e.g., Cutting & Kozlowski, 1977). Here, perceptual hysteresis and the relative influences of prototypicality and exaggeration further demonstrate important properties on the mechanisms and representations underlying such a compelling and important perceptual experience.

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fMRI reactivation of the human lateral occipital complex during delayed actions to remembered objects

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We employed a delayed reaching and grasping paradigm to investigate brain areas involved in delayed hand actions to 3-D objects. The two brain areas of

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