



**Fig. S1** Mean vectors 1 min after release at the nine site. The releases of the present study are given by arrows with a solid arrowheads, their mean directions are indicated by triangles; those performed prior to this study are given as arrows with open arrow heads and their mean directions are indicated by round symbols. Open symbols, pigeons familiar with the site; solid symbols, birds unfamiliar with the site. The home direction is indicated by a dashed *radius*, the gradient directions at 1 km are given by dotted *radii* with arrowheads, the arrowhead pointing outward indicating the direction of the maximum of increasing intensity at 1 km, those pointing inward the respective direction of decreasing intensity.