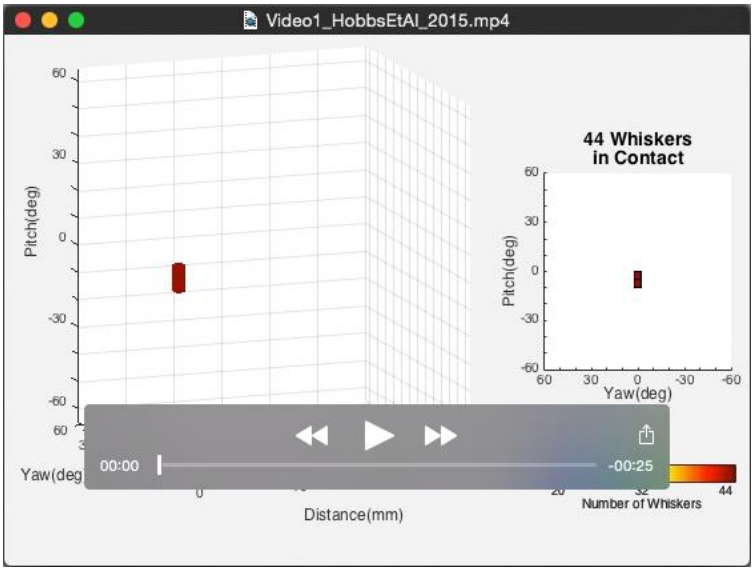
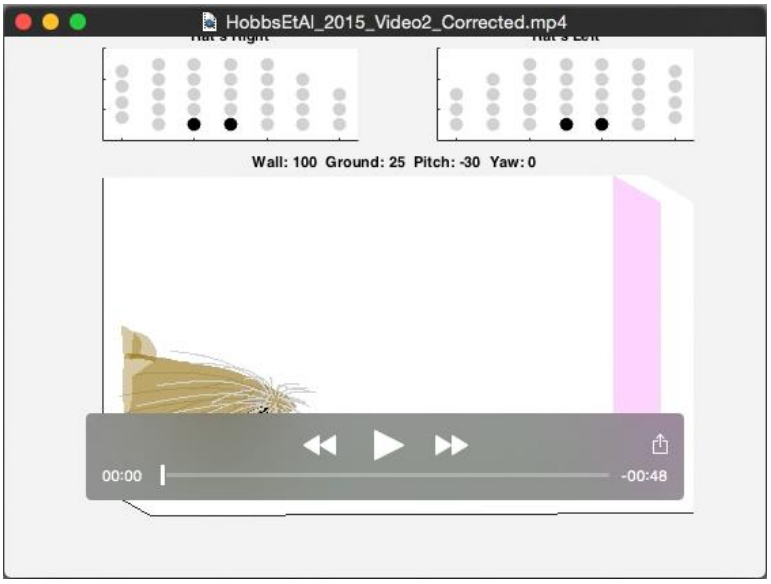
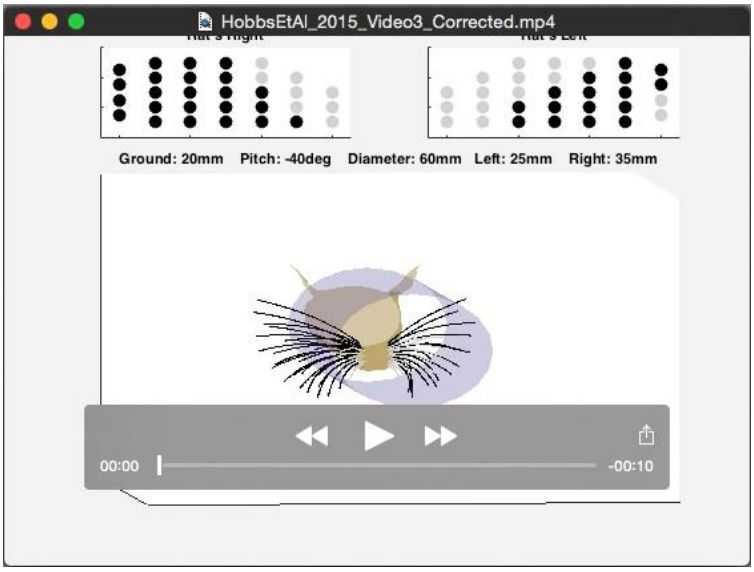


Movie 1. The number of whiskers in contact as a function of head pose. This video is associated with Fig. 5A in the text. **(Left panel)** The number of whiskers from both sides of the array in contact with a flat vertical wall is a function of distance, pitch, and yaw. For clarity, only those configurations that have greater than 20 whiskers in contact are plotted. The number of contacts is globally maximized at 44 contacts, for yaw = 0 deg, pitch between 0 deg and -10 deg, and a distance of 4mm. For larger distances, the head must be pitched upward to maintain a large number of contacts with the surface. Thus, when considered over all distances, a pitch of 20 deg maximizes the number of contacts. **(Right panel)** The same plot looking down the distance-axis. Note that this panel is not the same as Fig. 5B in the text, it is simply another view of the left panel in the video.



Movie 2. Contact patterns during exploration of a flat wall. This video is assocaited with Fig. 6 in the text. Contacts with the ground and wall are plotted as a rat approaches a vertical wall, rears against the wall from low to high, and then turns to follow along the wall. Note that the right/left arrays are reversed (the viewer faces the rat) to make the geometry of the turn more intuitive. Gray corresponds to vibrissae that never make contact, black corresponds to vibrissae in contact before the onset of protraction (resting contacts), and colors code for the θ_{impact} of each vibrissa. Color scale is shown in Fig. 6. First, the rat approaches the wall with its head pitched at -30 deg. Only a few vibrissae are in contact with the ground, either at rest or with limited protraction. Next, the rat explores the intersection of the wall and ground. In these poses the D and E row vibrissae are in contact with the ground, while vibrissae in rows A through C are in contact with the wall. As the rat begins to "rear" and then return to level, numerous vibrissae contact the wall -- even the ventral vibrissa are brought into contact with the wall. Once the rat brings its head down to level and starts to turn to the side to follow the wall, an increasing number of vibrissae on the left side are in resting-contact with either the wall or ground, while only a few ventral vibrissae are in contact with the ground on the right side.



Movie 3. Contact patterns during exploration of a burrow: This video is associated with Fig 7. in the text. Contact patterns with the walls of a burrow, modeled as a cylinder, are shown for the right and left arrays. Note that the right/left arrays are reversed (the viewer faces the rat) for consistency with Video 1 and Fig. 6. Resting contacts are colored black, whisking contacts are colored according to θ_{impact}, and no-contacts are colored gray. Color scale is shown in Fig. 7. The head is pitched downward at -40 deg and the nose is 20mm above the bottom of the cylinder. The rat is offset to the right of the midline of the cylinder by 5mm. For small burrows, almost all of the vibrissae are in resting contact with the tunnel walls. As the burrow size increases, some resting contacts become whisking contacts for very small angles of protraction. Even for the largest burrows, the ventral vibrissae maintain contact with the “floor” of the burrow while the caudal vibrissae maintain contact with the “side” of the burrow.