

Supplemental figures and legends for “Haptic Perception in a Scanning Sensorimotor System”

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Figure S1. Stimulus position relative to the full vibrissa field. Video still images of rats in the stimulus assembly nose poke (*cf.* figures 6B and 6E). Each of (A), (B), and (C) shows both side and bottom views. The two views in each panel were not taken simultaneously but show comparable times in a behavioral trial. The scale bar in all cases is 4 mm. **(A)** Rat with all vibrissae intact. Note the large span of the vibrissa field in both rostrocaudal and dorsoventral directions. **(B)** Rat with only C row intact. The C3 vibrissa is shown contacting the rostral stimulus. The green arrows point to the location of contact. **(C)** Rat with only C row intact. The γ stradler is shown contacting the caudal stimulus. The red arrows point to the location of contact. This stimulus is 30° caudal to the stimulus shown in (B).

Figure S2. Duration of stimulus availability. **(A)** Overlaid stimulus motion traces from 58 **S+** and 56 **S-** trials. A stimulus descended after an animal had initiated a trial by placing its nose in the nose poke and ascended when the animal first broke nose poke fixation. The descent and ascent motions were estimated from the video recordings and are plotted here. This motion was highly repeatable and smooth; the descending traces appear jagged because the stimuli traversed less than one camera pixel per frame. The discretization evident in the stimulus ascent traces was due to the finite sampling rate (16 Hz in this case) of the behavior computer. **(B)** Distribution of stimulus availability times. The total time during which the stimulus was in motion was determined from the traces in (A) and is shown histogrammed here for **S+** and **S-** trials. Note that the animal moves out of the nose poke rapidly (200 to 300 ms) in most **S+** trials and waits longer in most **S-** trials. This interval is consistent with the time at which the lever press responses first become distinct (Fig. 4).

Figure S3. Evolution of lever press response distribution. The mean cumulative lever press count as a function of time (Fig. 4B) does not convey information about the distribution of responses. For example, a mean count of 0.5 responses at 1.0 s could arise from equal numbers of trials with zero responses and with one response, or it could come from many zero response trials and a few trials with two or more responses. Since we rely on the separation of these mean cumulative curves to establish the time scale of the perceptual computation, we

show here the complete response distributions corresponding to the mean curves. **(A)** Response distributions for 58 **S+** trials. At each point in time, the distribution of cumulative lever press counts is plotted such that each column in the image sums to 1.0. The weighted average of each column is equivalent to the mean cumulative response (Fig. 4B). The top row shows the fraction of trials that have reached 5 lever presses as a function of time (equivalent to the cumulative distributions in figure 4C). **(B)** Response distributions for 56 **S-** trials. Note that a fraction of the trials never reach five lever press responses. Our conclusion that the **S+** and **S-** responses diverge after 250 ms (grey arrows in figure 4B) is reflected here by the overall rightward shift, at all cumulative counts, for the data shown in (B) relative to those shown in (A).

Figure S4. Complete stimulus assembly, including support structures omitted from figure 2. The rostral stimulus is shown in a position that would overlap with the vibrissa field while the caudal stimulus is shown fully retracted. **(A)** Three-dimensional perspective. The large horizontal rectangular block is the main platform. Two air-driven pistons are held above this block. Each of these pistons independently drives a carriage that supports a stimulus pin. A hole pattern in the carriages matches the guide pattern inset into the stimulus platform, and these patterns together define repeatable stimulus positions. The Teflon rods on which the carriages travel are shown in brown. The nose poke is the cylindrical black object hanging below the main platform, and it defines the position of the rat relative to the stimulus hole patterns. **(B)** Front view. **(C)** Side view.

Figure S5. Detailed schematics of stimulus assembly main platform and guide. **(A)** Main platform. This Lexan platform rested above the rat (as described in the Methods and figure 2) and supported the stimulus assembly **(B)** Stimulus guide. This Lexan block was inset into the main platform and provided guide holes to direct the stimulus pins to various angles on a 25 mm radius. The nose poke was positioned under the main platform such that a line connecting the caudal edges of both mystacial pads would coincide with the center of this circle.

Figure S6. Detailed schematics of stimulus assembly piston support and carriage. **(A)** Piston support bracket. This fixed Lexan block held the body of the air pistons in place. Precision Teflon rods connecting the bracket to the main platform ensured that piston travel was perpendicular to the stimulus guide. **(B)** Stimulus carriages. Each of these blocks was affixed to the shaft of an air piston and allowed to slide along the Teflon rods on a captured linear bearing. Stimulus pins would rest on this carriage and travel with it when the pistons moved.

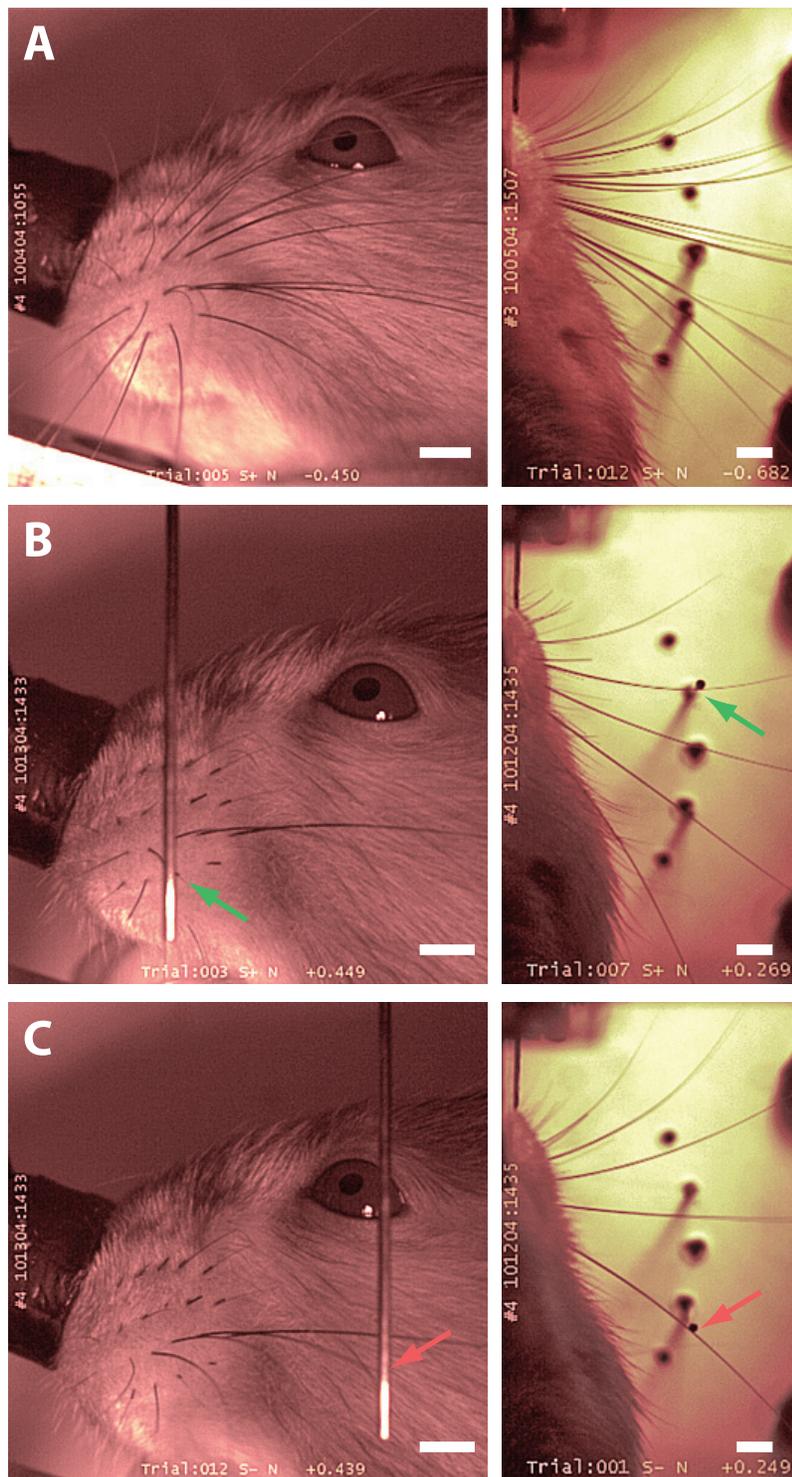


Figure S1 - Mehta, Whitmer, Figueroa, Williams and Kleinfeld

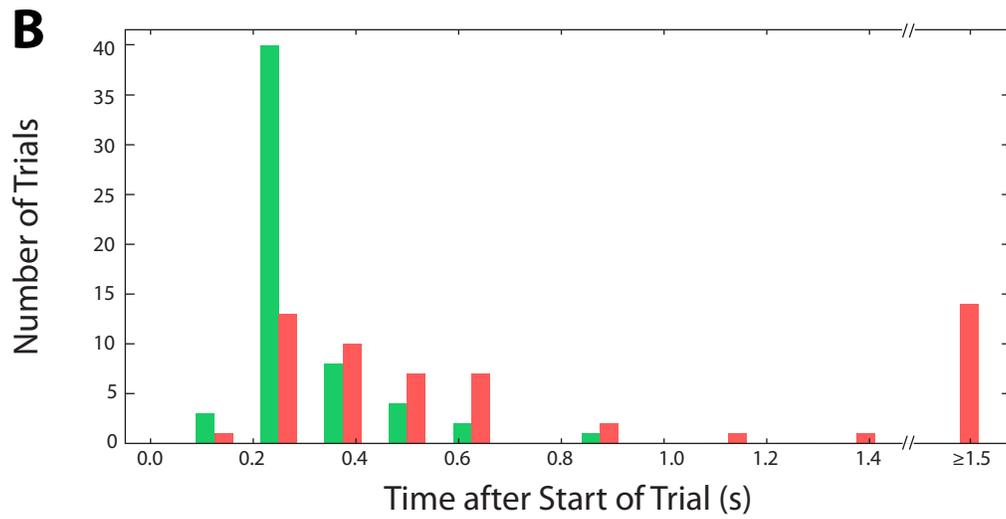
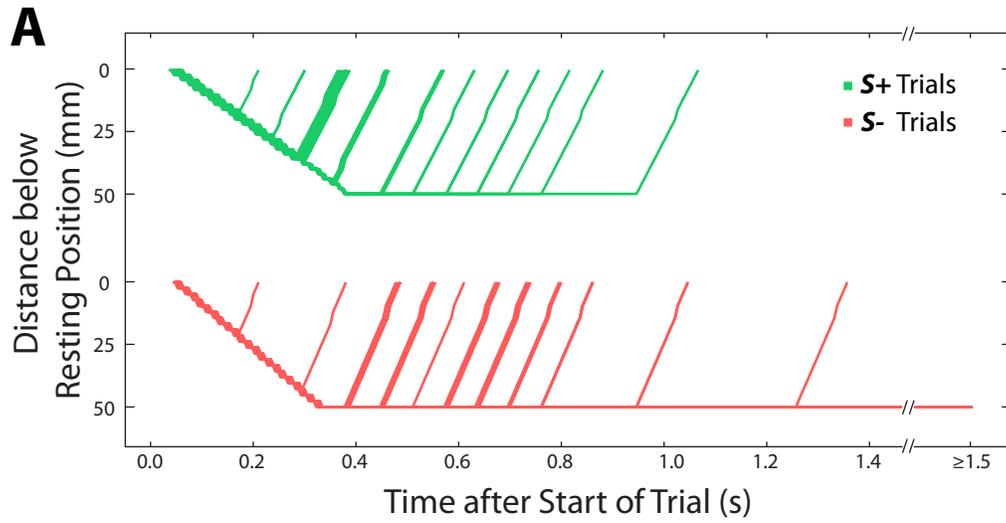


Figure S2 - Mehta, Whitmer, Figueroa, Williams and Kleinfeld

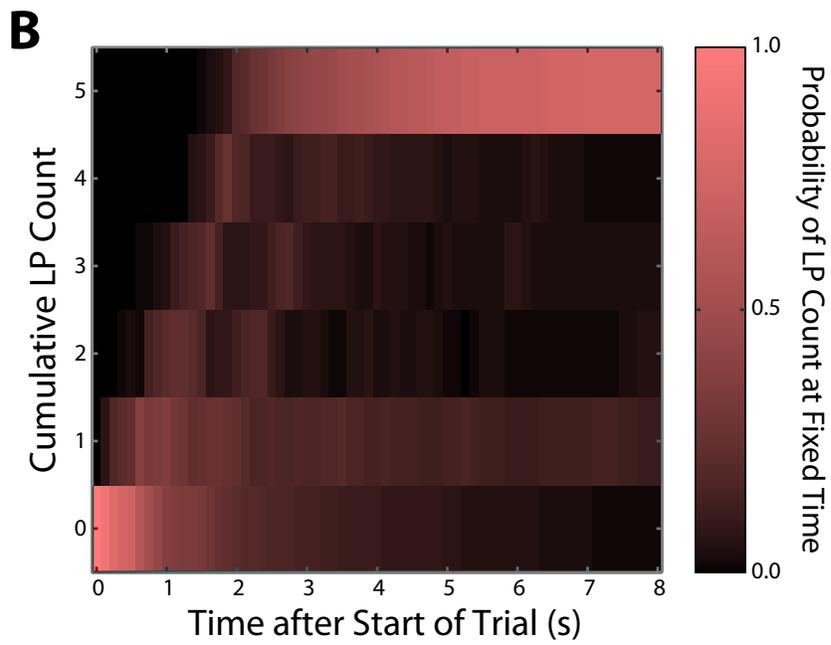
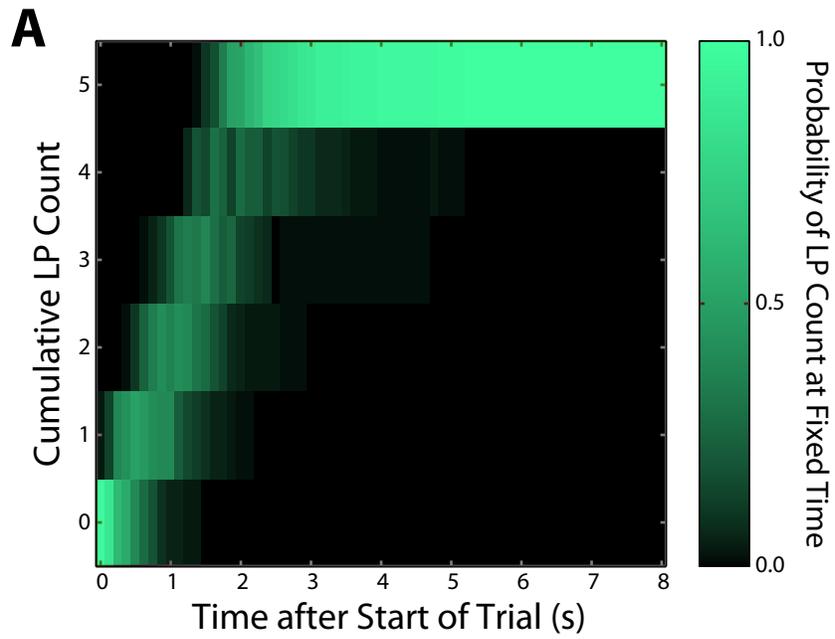


Figure S3 - Mehta, Whitmer, Figueroa, Williams and Kleinfeld

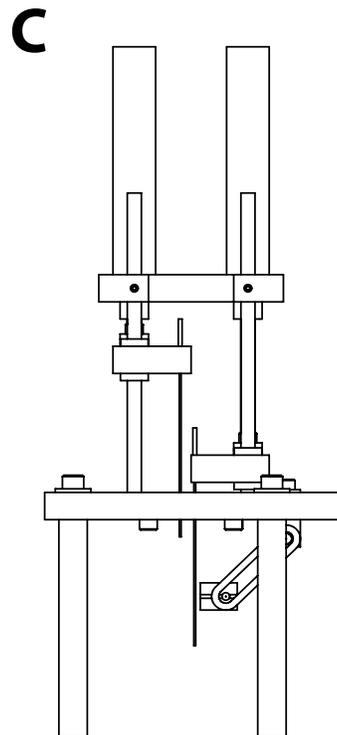
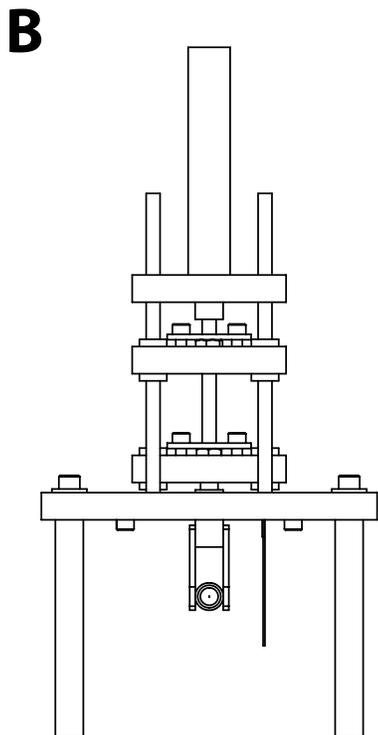
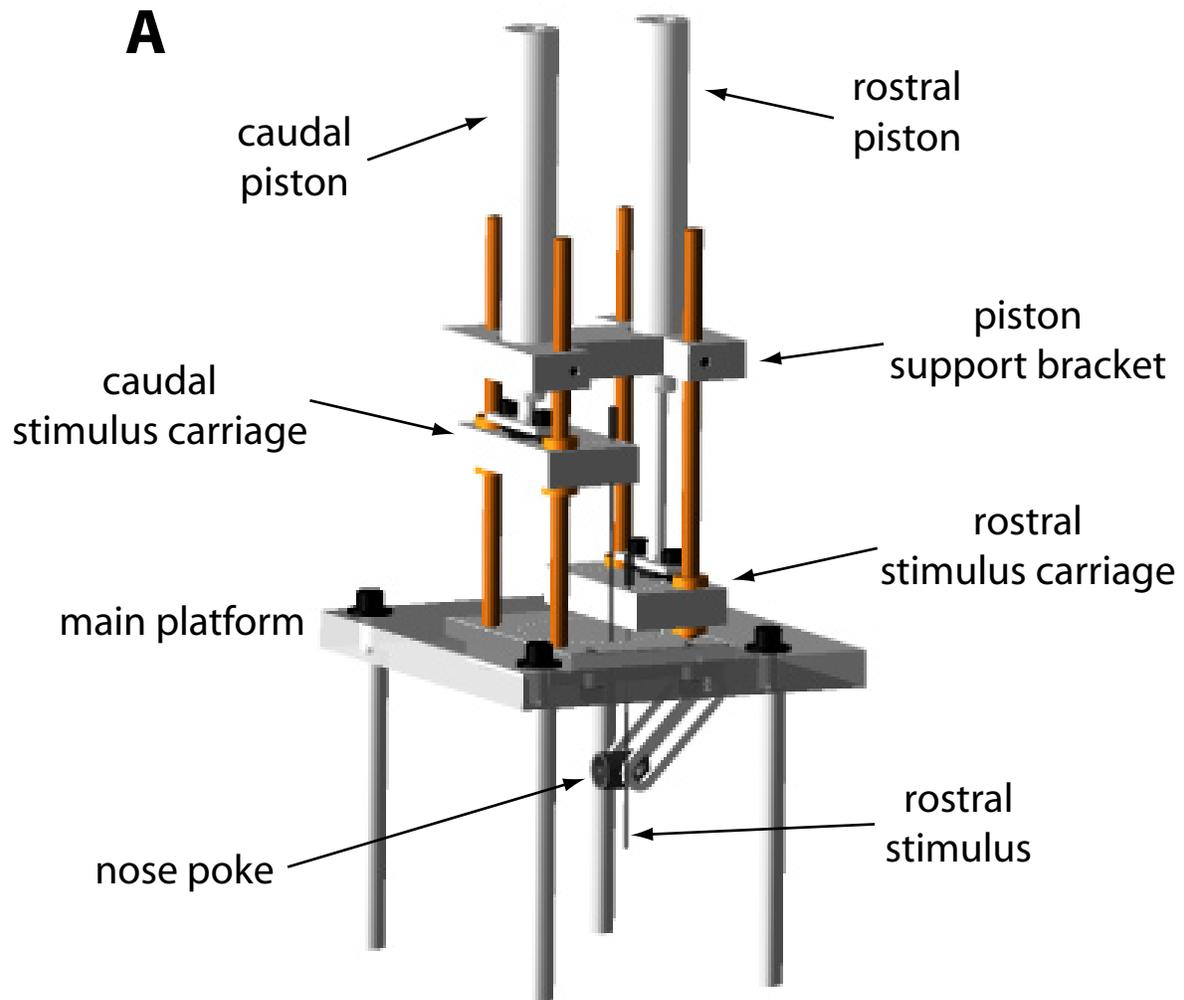
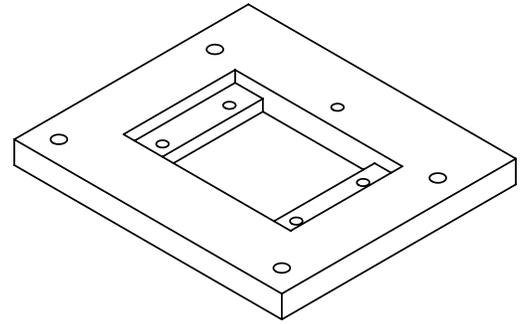
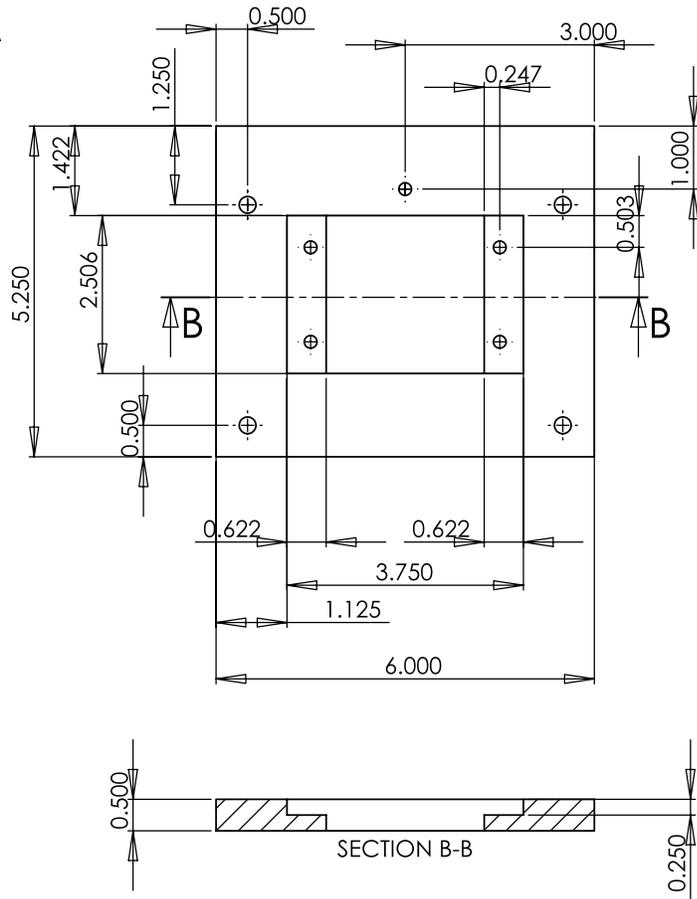
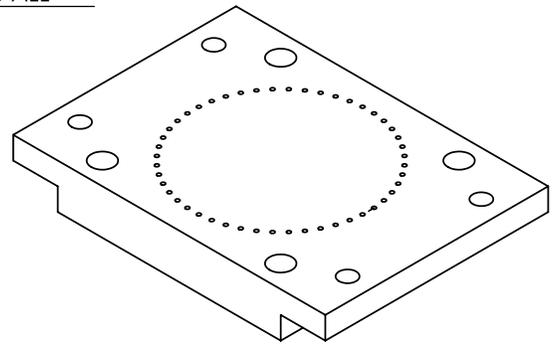
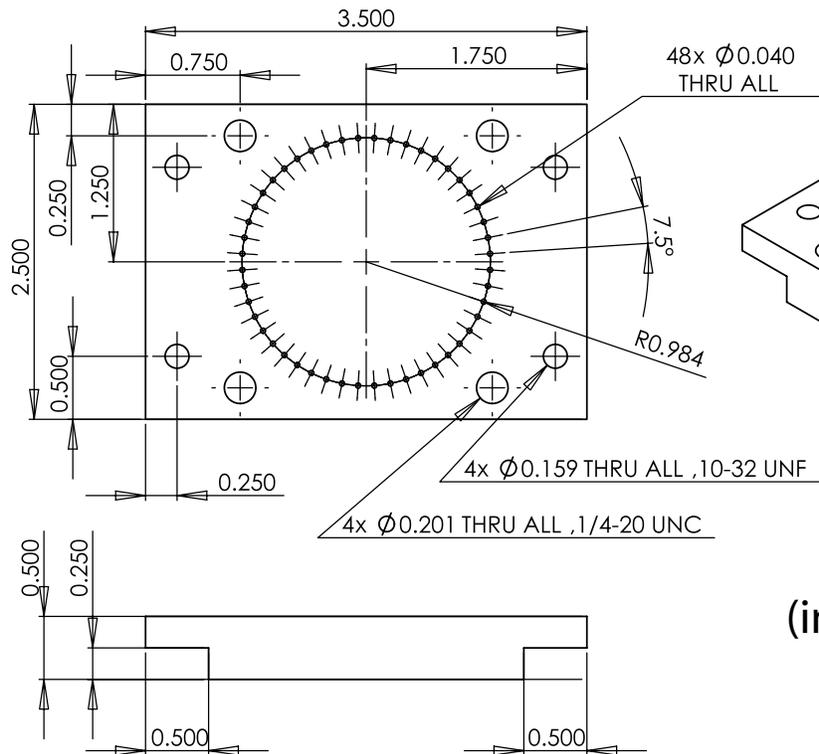
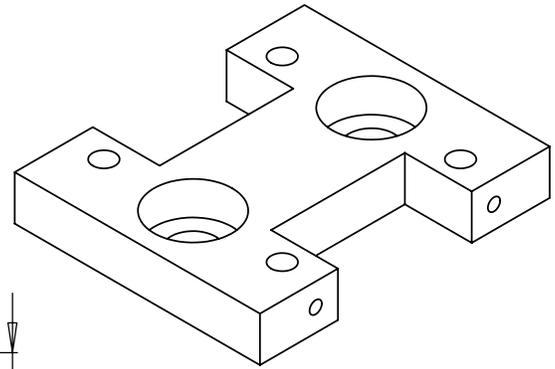
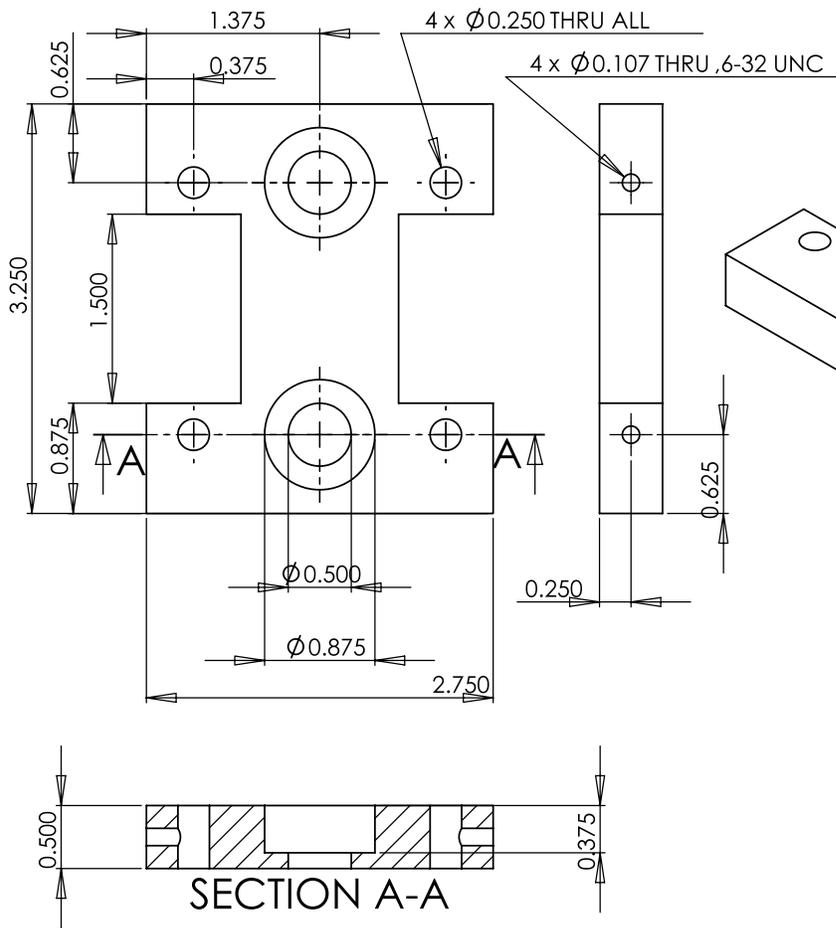
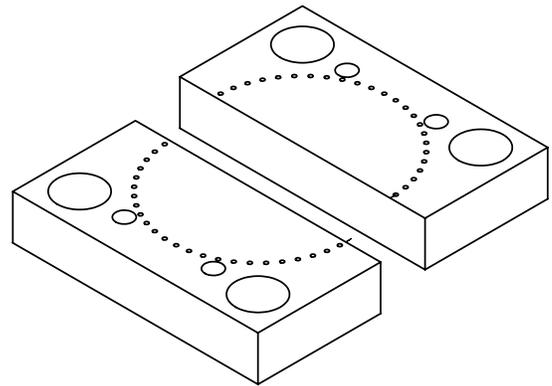
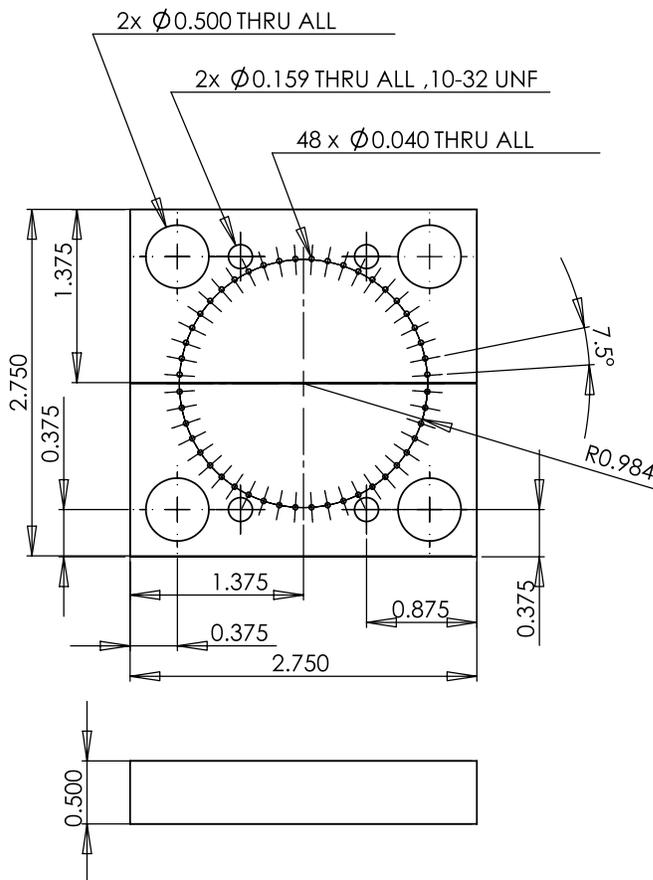


Figure S4 - Mehta, Whitmer, Figueroa, Williams and Kleinfeld

A**Main Platform****B****Stimulus Guide
(inset in main platform)**

A

Piston Support Bracket

B

Stimulus Carriages