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0.1 Translation symmetry

The distance between two vectors is:

$$(v - w)^T M (v - w)$$

So what operations can we do now?

As before, we can do the transformations which preserve $u^T M v$, such as the orthogonal group.

But we can also do other translations

$$(v-w)TM(v-w)$$

$$v^TMv + w^TMw - v^TMw - w^TMv$$

so symmetry is now $O(3,1)$ and affine translations

0.1.1 Translation matrix

$\begin{bmatrix} 1 & x \\ 0 & 1 \end{bmatrix}$ moves vector by x