

Reversing a charged crossbow's first-person effects on the item model

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1 Introduction

When a crossbow is charged, it is centered on the screen in the first-person perspective. The third-person pose also changes, which can be useful when creating custom items via resource packs.



Figure 1: A stationary crossbow.

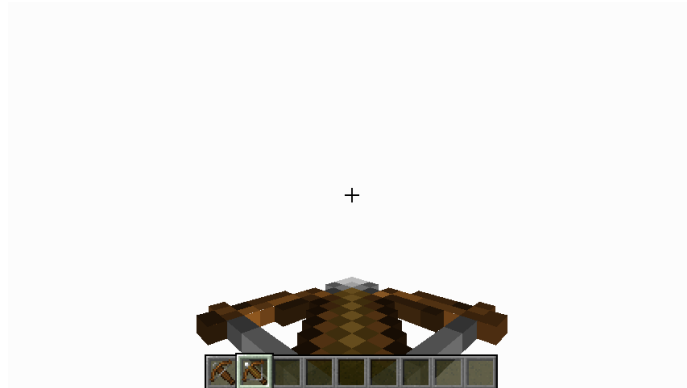


Figure 2: A charged crossbow that is centered horizontally on the screen.

2 What effects are applied?

The following numbers were discovered by reading the game code.

The model is moved to the left by a 10.269824. This is what centres the crossbow on the screen. Furthermore, a 10° rotation is applied in the y-rotation (yaw).

3 Reversing the effects

First, the translation must be reversed. Translations to the left are negative values in x. To reverse this we must add 10.269824 to the x-translation of the model's display settings for the first-person perspective.

Second, the rotation must be reversed. The y rotation must be subtracted by 10 to reverse the positive 10° rotation.

The rotation although means that the translation will now be rotated. To reverse this we must rotate the translation by multiplying it by a rotation matrix. This rotation matrix is the following:

$$\begin{bmatrix} \cos -10^\circ & 0 & \sin -10^\circ \\ 0 & 1 & 0 \\ -\sin -10^\circ & 0 & \cos -10^\circ \end{bmatrix}$$

This is a rotation matrix for rotation around the y-axis (yaw). Source: $R_y(\theta)$ where $\theta = -10^\circ$ from https://en.wikipedia.org/wiki/Rotation_matrix#Basic_rotations [Read 2022-02-01]

To multiply the translation with this matrix, the following can be used to calculate the new x and z translation (y is unchanged).

$$\begin{cases} \text{newX} = \cos -10^\circ \cdot x + \sin -10^\circ \cdot z \\ \text{newZ} = -\sin -10^\circ \cdot x + \cos -10^\circ \cdot z \end{cases}$$

This equates to approximately:

$$\begin{cases} \text{newX} = 0.98480775301 \cdot x - 0.17364817766 \cdot z \\ \text{newZ} = 0.17364817766 \cdot x + 0.98480775301 \cdot z \end{cases}$$

4 Example

```
{
  "parent": "example:item/foo",
  "display": {
    "firstperson_righthand": {
      "rotation": [0, 90, 0],
      "translation": [5, 8, 12]
    }
  }
}
```

Figure 3: Example model for a normal item

```
{
  "parent": "example:item/foo",
  "display": {
    "firstperson_righthand": {
      "rotation": [0, 80, 0],
      "translation": [12.954062930378171, 8, 14.469270146908931]
    }
  }
}
```

Figure 4: The same example model, but with the crossbow effects reversed as per the instructions in this paper

The model in Figure 4 should be used as a model on a charged crossbow, for example with custom-model-data:

```
"overrides": [
  [...]
  {
    "predicate": {
      "custom_model_data": 100,
      "pulling": 1
    },
    "model": "example:item/Figure_4.json"
  }
]
```

The model in Figure 3 on any other, normal item should look identical to a charged crossbow with the model from Figure 4 in the first person right hand perspective. The centering and 10° rotation has been successfully reversed.