

< 덤벨로우 준비 자세 > - ZXY 순서

순서	좌표축	부위	Euler Angle	Rotation Matrix
0	$C_0$	World	—	
1	$C_1$	Hips	$E_1 = [ 63.3797895, -180, -180 ]$	$R_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_1$
	$R_{HI} = r_1 R_1$			
2	$C_1$	Hips	$E_1 = [ 63.3797895, -180, -180 ]$	$R_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_1$
	$C_2$	Spine	$E_2 = I, e_2$	$R_2 = I, r_2$
	$C_7$	Left Upper Arm	$E_{7a} = [ 63.3797895, -180, -180 ]$	$R_{7a} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_{7a}$
			$E_{7b} = [ -26.5251081, 86.6173969, -28.0770934 ]$	$R_{7b} = \begin{bmatrix} -0.448074 & 0 & 0.893997 \\ 0 & 1 & 0 \\ -0.893997 & 0 & -0.448074 \end{bmatrix}, r_{7b}$
	$R_{LUA} = r_{7a} R_{7b} r_{7a} R_{7a} r_2 R_2 r_1 R_1$			
3	$C_1$	Hips	$E_1 = [ 63.3797895, -180, -180 ]$	$R_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_1$
	$C_2$	Spine	$E_2 = I, e_2$	$R_2 = I, r_2$
	$C_4$	Right Upper Arm	$E_{4a} = [ 63.3797895, -180, -180 ],$	$R_{4a} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_{4a}$
			$E_{4b} = [ 0, -116.6202118, 0 ]$	$R_{4b} = \begin{bmatrix} -0.448074 & 0 & -0.893997 \\ 0 & 1 & 0 \\ 0.893997 & 0 & -0.448074 \end{bmatrix}, r_{4b}$
	$R_{RUA} = r_{4b} R_{4b} r_{4a} R_{4a} r_2 R_2 r_1 R_1$			
4	$C_1$	Hips	$E_1 = [ 63.3797895, -180, -180 ]$	$R_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_1$
	$C_{10}$	Right Upper Leg	$E_{10} = I, e_{10}$	$R_{10} = I, r_{10}$
	$C_{11}$	Right Lower Leg	$E_{11} = [ -63.3797895, 180, 180 ]$	$R_{11} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & 0.893997 \\ 0 & -0.893997 & -0.448074 \end{bmatrix}, r_{11}$
	$R_{RL} = r_{11} R_{11} r_{10} R_{10} r_1 R_1$			

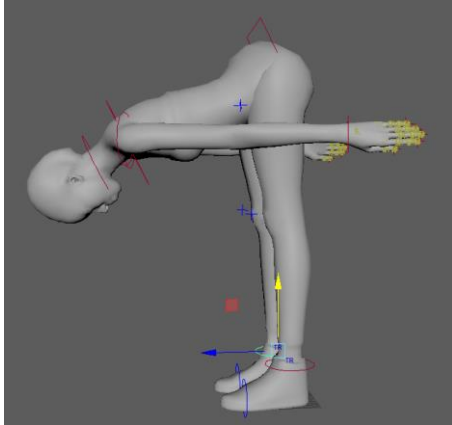
< 덤벨로우 동작 >

순서	좌표축	부위	Euler Angle	Rotation Matrix
0	$C_0$	World	—	
1	$C_1$	Hips	$E_1 = [63.3797895, -180, -180]$	$R_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_1$
	$C_2$	Spine	$E_2 = I, e_2$	$R_2 = I, r_2$
	$C_7$	Left Upper Arm	$E_{7a} = [63.3797895, -180, -180]$ $E_{7b} = [-26.5251081, 86.6173969, -28.0770934]$	$R_{7a} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_{7a}$ , $R_{7b} = \begin{bmatrix} -0.448074 & 0 & 0.893997 \\ 0 & 1 & 0 \\ -0.893997 & 0 & -0.448074 \end{bmatrix}, r_{7b}$
	$C_7$	Left Upper Arm	$E_7 = [35.4935279, 0, 0]$	$R_7 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.814181 & -0.580611 \\ 0 & 0.580611 & 0.814181 \end{bmatrix}, r_7$
	$R_{LUA} = r_7 R_7 r_{7a} R_{7b} r_{7a} R_{7a} r_2 R_2 r_1 R_1$			
2	$C_1$	Hips	$E_1 = [63.3797895, -180, -180]$	$R_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_1$
	$C_2$	Spine	$E_2 = I, e_2$	$R_2 = I, r_2$
	$C_7$	Left Upper Arm	$E_{7a} = [63.3797895, -180, -180]$ $E_{7b} = [-26.5251081, 86.6173969, -28.0770934]$	$R_{7a} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_{7a}$ , $R_{7b} = \begin{bmatrix} -0.448074 & 0 & 0.893997 \\ 0 & 1 & 0 \\ -0.893997 & 0 & -0.448074 \end{bmatrix}, r_{7b}$
	$C_7$	Left Upper Arm	$E_7 = [35.4935279, 0, 0]$	$R_7 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.814181 & -0.580611 \\ 0 & 0.580611 & 0.814181 \end{bmatrix}, r_7$
	$C_8$	Left Lower Arm	$E_8 = [0, 0, 0], e_8$	$R_8 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_8$
$R_{LLA} = r_8 R_8 r_7 R_7 r_{7a} R_{7b} r_{7a} R_{7a} r_2 R_2 r_1 R_1$				
3	$C_1$	Hips	$e_1 = [63.3797895, -180, -180]$	$R_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_1$
	$C_2$	Spine	$E_2 = I, e_2$	$R_2 = I, r_2$
	$C_7$	Left Upper Arm	$E_{7a} = [63.3797895, -180, -180]$ $E_{7b} = [-26.5251081, 86.6173969, -28.0770934]$	$R_{7a} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_{7a}$ , $R_{7b} = \begin{bmatrix} -0.448074 & 0 & 0.893997 \\ 0 & 1 & 0 \\ -0.893997 & 0 & -0.448074 \end{bmatrix}, r_{7b}$
	$C_7$	Left Upper Arm	$E_7 = [35.4935279, 0, 0]$	$R_7 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.814181 & -0.580611 \\ 0 & 0.580611 & 0.814181 \end{bmatrix}, r_7$

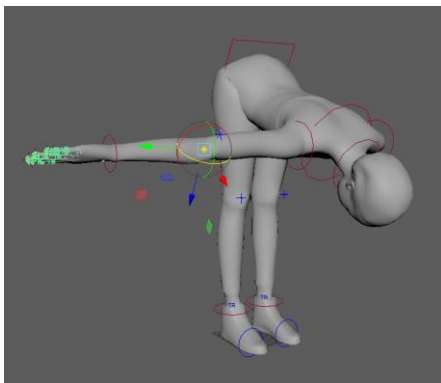
4	$C_7$	Left Upper Arm	$E_7 = [35.4935279, 0, 0]$	$R_7 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.814181 & -0.580611 \\ 0 & 0.580611 & 0.814181 \end{bmatrix}, r_7$
	$R_{LUA} = r_7 R_7 r_7 R_7 r_{7a} R_{7b} r_{7a} R_{7a} r_2 R_2 r_1 R_1$			
	$C_1$	Hips	$E_1 = [63.3797895, -180, -180]$	$R_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_1$
	$C_2$	Spine	$E_2 = I, e_2$	$R_2 = I, r_2$
	$C_7$	Left Upper Arm	$E_{7a} = [63.3797895, -180, -180]$ $E_{7b} = [-26.5251081, 86.6173969, -28.0770934]$	$R_{7a} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_{7a}$ , $R_{7b} = \begin{bmatrix} -0.448074 & 0 & 0.893997 \\ 0 & 1 & 0 \\ -0.893997 & 0 & -0.448074 \end{bmatrix}, r_{7b}$
	$C_7$	Left Upper Arm	$E_7 = [35.4935279, 0, 0]$	$R_7 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.814181 & -0.580611 \\ 0 & 0.580611 & 0.814181 \end{bmatrix}, r_7$
	$C_8$	Left Lower Arm	$E_8 = [0, 0, 0], e_8$	$R_8 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & -0.893997 \\ 0 & 0.893997 & -0.448074 \end{bmatrix}, r_8$
	$C_7$	Left Upper Arm	$E_7 = [-35.4935279, 0, 0]$	$R_7 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.814181 & 0.580611 \\ 0 & -0.580611 & 0.814181 \end{bmatrix}, r_7$
	$C_8$	Left Lower Arm	$E_8 = [0, 0, 0], e_8$	$R_8 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -0.448074 & 0.893997 \\ 0 & -0.893997 & -0.448074 \end{bmatrix}, r_8$
	$R_{LLA} = r_8 R_8 r_7 R_7 r_8 R_8 r_7 R_7 r_{7a} R_{7b} r_{7a} R_{7a} r_2 R_2 r_1 R_1$			

< Matrix를 토대로 덤벨로우동작 >

### 1. 준비자세



### 2. 첫번째 동작



### 3. 두번째 동작

