Mean Centering

The purpose of this document is to clarify the impact of mean centering on parameter estimates and when it is necessary. It typically won't hurt a thing (unless you're centering within groups), but you may be adding extra steps to your analysis that aren't necessary.

Model setup	Fitted model	Contrast	Mean center?
$\begin{pmatrix} 1 & x_1 \\ 1 & x_2 \\ 1 & x_3 \\ 1 & x_4 \\ 1 & x_5 \\ 1 & x_6 \end{pmatrix} \begin{pmatrix} \beta_0 \\ \beta_x \end{pmatrix}$		[1, 0]	**Yes!** Without mean centering the interpretation is the mean BOLD when X is 0! With mean centering the interpretation is the mean BOLD for mean X (or just mean BOLD).
		[0, 1]	Nope. Mean centering X will not change the slope.
$\begin{pmatrix} 1 & 0 & x_1 \\ 1 & 0 & x_2 \\ 1 & 0 & x_3 \\ 0 & 1 & x_4 \\ 0 & 1 & x_5 \\ 0 & 1 & x_6 \end{pmatrix} \begin{pmatrix} \beta_{G1} \\ \beta_{G2} \\ \beta_X \end{pmatrix}$		[1, -1, 0]	Nope. This is the difference between the intercepts and will not change since the lines are parallel. The distance between the lines is the same regardless of the value of X.
		[0, 0, 1]	Nope. Will not impact slopes
		[1, 0, 0] or [0, 1, 0]	**Yes!** You likely want the mean for each group for average X (not X=0). Do **NOT** mean center within group. That removes the ability of X to adjust your group comparison.
$\begin{pmatrix} 1 & 0 & x_1 & 0 \\ 1 & 0 & x_2 & 0 \\ 1 & 0 & x_3 & 0 \\ 0 & 1 & 0 & x_4 \\ 0 & 1 & 0 & x_5 \\ 0 & 1 & 0 & x_6 \end{pmatrix} \begin{pmatrix} \beta_{G1} \\ \beta_{G2} \\ \beta_{X_{G1}} \\ \beta_{X_{G2}} \end{pmatrix}$		[0, 0, 1, -1] or [0, 0, 1, 0] or [0, 0, 0, 1]	Nope. These are all slopes or comparisons of slopes. Note these are the only contrasts of interest in this model.
		[1, -1, 0, 0]	This contrast doesn't have a useful interpretation. If the interaction ([0, 0, 1, -1]) is significant this doesn't make sense to study since the group difference varies by X. If the interaction isn't significant, simplify to the middle model.
		[1, 0, 0, 0] or [0, 1, 0, 0]	These also do not make much sense to test in this model. If you don't have an interaction effect, simplify to the middle model.