## Supplementary method 2: Multilevel regression analysis including intercepts from individual errors.

We modeled the response value of the a\*-axis for the associated colors by each odor as a normal distribution. The model included intercepts $τ\_{a[k]}$ of individual errors as follows:

$$a\_{[j]}^{\*}\~ Normal(α\_{0\left[i\right]}+α\_{S\left[i\right]}Strength\_{\left[i\right]}+ α\_{P\left[i\right]}Pleasantness\_{\left[i\right]}+ α\_{F\left[i\right]}Familiarity\_{\left[i\right]}+ α\_{E\left[i\right]}Edibility\_{\left[i\right]}+ α\_{A\left[i\right]}Arousal\_{\left[i\right]}+ τ\_{a[k]}, σ\_{a[i]})$$

$σ\_{a[i]}$ > 0

$τ\_{[k]}$ > 0

where *i* indicates the odor ID, *j* denotes the data index, and *k* denotes participant ID. In this model, the intercept term was $α\_{0[i]}$ + $τ\_{a[k]}$. The intercept $α\_{0[i]}$, and each coefficient, $α\_{X[i]}$, followed a normal distribution with mean coefficients as described in Manuscript.

The intercept $τ\_{a[k]}$ followed a normal distribution as below:

$$τ\_{a[k]} \~ Normal(0 , τ\_{a0})$$

$$τ\_{a0}>0$$

where $τ\_{a0}$ indicates the standard deviation of $τ\_{a[k]}$ among all participants.

Regarding the model for a\* value estimation, we modeled the b\*-axis values as follows:

$$b\_{[j]}^{\*}\~ Normal(β\_{0\left[i\right]}+β\_{S\left[i\right]}Strength\_{\left[i\right]}+ β\_{P\left[i\right]}Pleasantness\_{\left[i\right]}+ β\_{F\left[i\right]}Familiarity\_{\left[i\right]}+ β\_{E\left[i\right]}Edibility\_{\left[i\right]}+ β\_{A\left[i\right]}Arousal\_{\left[i\right] }+ τ\_{b[k]}, σ\_{b[i]})$$

The intercept $τ\_{b[k]}$ followed a normal distribution as below:

$$τ\_{b[k]} \~ Normal(0 , τ\_{b0})$$

$$τ\_{b0}>0$$

where $τ\_{b0}$ indicates the standard deviation of $τ\_{b[k]}$ among all participants.

Similar to the steps with a\* and b\* values, we model the L-axis values as follows:

$$L\_{[j]}^{\*}\~ Normal(λ\_{0\left[i\right]}+λ\_{S\left[i\right]}Strength\_{\left[i\right]}+ λ\_{P\left[i\right]}Pleasantness\_{\left[i\right]}+ λ\_{F\left[i\right]}Familiarity\_{\left[i\right]}+ λ\_{E\left[i\right]}Edibility\_{\left[i\right]}+ λ\_{A\left[i\right]}Arousal\_{\left[i\right]}+ τ\_{L0} , σ\_{L[i]})$$

The intercept $τ\_{L[k]}$ followed a normal distribution as below:

$$τ\_{L[k]} \~ Normal(0 , τ\_{L0})$$

$$τ\_{L0}>0$$

where $τ\_{L0}$ indicates the standard deviation of $τ\_{L[k]}$ among all participants.