# 3.4: Multiplication Operation for Symmetry Elements

Multiplication is fairly simple when it comes to symmetry operations. One simply applies the operations from right to left. Going back to the tennis racket example, it is fairly simple to visualize each symmetry element. To show this, it is useful to construct a group multiplication table. To do this, it is useful to pick a corner of the object and imagine where it is transported under a pair of sequential operations. Then imagine what operation will affect the same transformation directly. By applying them pairwise, one can generate the group multiplication table:

| $\boldsymbol{C_{2v}}$ | $E$ | $C_2$ | $\sigma_v$ | $\sigma_v'$ |
|---|---|---|---|---|
| $E$ | $E$ | $C_2$ | $\sigma_v$ | $\sigma_v'$ |
| $C_2$ | $C_2$ | $E$ | $\sigma_v'$ | $\sigma_v$ |
| $\sigma_v$ | $\sigma_v$ | $\sigma_v'$ | $E$ | $C_2$ |
| $\sigma_v'$ | $\sigma_v'$ | $\sigma_v$ | $C_2$ | $E$ |

What should jump right out from this multiplication table is that the group $C_{2v}$ 1) is abelian (actually, this will become clear after the term is defined) and 2) has the property that each element happens to be its own inverse! For some objects (such as a three-legged stool or an ammonia molecule) this will not be the case.