Directional Bias Induced Error Patterns when Translating Structural Representations

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Abstract: Organic chemists must be adept at translating between various structural diagrams that represent the spatial configurations of molecules from different orthogonal perspectives. In three studies, participants translated between three structural diagrams showing side-view (Dash-Wedge), end-on (Newman), and top-down (Fischer) perspectives. Analyses showed strong directional biases in the drawn diagram relative to the given diagram for all six translation pairs. The left, front and top defined the dominant position of the different projections and translations typically preserved this dominance. For example, elements on the left of a Dash-Wedge were typically drawn on the front of a Newman and vice versa. These results are interpreted in relation to cultural influences that bias drawing direction. Analysis of the drawn diagrams also revealed that errors were most frequent in the non-dominant position, suggesting that translations are performed piecemeal due to spatial working memory limits, with priority given to dominant positions in the drawing sequence.