FLORAL SYMMETRY AFFECTS BUMBLEBEE APPROACH CONSISTENCY IN ARTIFICIAL FLOWERS

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Across flowering plants, many lineages have transitioned from radially symmetric flowers (with multiple planes of symmetry) to bilaterally symmetric flowers (with a single plane of symmetry). Several hypotheses have been proposed to explain this trend, including the "pollen placement hypothesis". This hypothesis reasons that a reduction in the number of planes of floral symmetry should result in more precise placement of pollen (and stigmas) onto pollinators as a result of more consistent pollinator entry into flowers. The resulting improvement in pollen-transfer efficiency should increase the plant's potential reproductive output per unit floral reward produced.

Using video recordings of bumblebees (*Bombus impatiens*) visiting artificial flowers, we measured the difference in entry-angle consistency between circular (radially symmetric) and rectangular (disymmetric – having two planes of symmetry) flowers. Entry-angle consistency was used as a proxy to estimate the precision of pollen placement. We also tested for preference for one symmetry over the other by counting the number of visits to each symmetry.

Bombus impatiens visiting a real bilaterally symmetric flower (a snapdragon, *Antirrhinum majus*).

We found that the angle of bee entry into disymmetric flowers was more consistent than angle of entry into radially symmetric flowers, with radial entry being, on average, 43% more variable. We found no significant preference for either floral symmetry. These results suggest that disymmetric flowers should have a pollen-transmission advantage over radially symmetric flowers. Our findings provide the first experimental support for the pollen position hypothesis and help illuminate one of the major evolutionary trends in flower shape.