1145-J1-583   **David Pengelley*** (`davidp@nmsu.edu`), Mathematics, Oregon State University, Corvallis, OR 97331. *Group theory via a rectangle tethered up to homotopy by strings or strip: from middle school to general education to abstract algebra.*

A two-person manipulative is created by a rectangle with movable strip or strings attached, and the richness of the resulting possible symmetry discoveries by students applies from pre-teens to upper division abstract algebra students: Low floor, high ceiling. Ultimately it's all about discovering the 8-element quaternion group, with its noncommutativity and connections to complex numbers. Hands on challenges and big surprises abound at every level with this wonderful elementary manipulative. (Received September 10, 2018)