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VARIABILITY IN KINEMATICS OF NUT-CRACKING IN CAPUCHINS AS A FUNCTION OF STONE WEIGHT, NUT SIZE AND INDIVIDUAL BODY WEIGHT

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Biomechanical studies of percussive actions and their effects on stone tools, combined with archeological and reconstructive studies of ancient tools, can provide insights into early hominid tool use. Studies of how nonhuman primates use percussive tools provide another source of information about actions that produce wears on tools. We show that bearded capuchin monkeys (*Cebus libidinosus*) in general lift and strike with stones in a manner reminiscent of humans lifting heavy weights and also adopt action strategies reflecting individual efficiency and morphology to crack nuts using stones. We examine how stone weight, nut size and the monkey's body weight affect the action of nut-cracking. With a few exceptions, each monkey cracked similar sets of piassava nuts (weighing between 14-64g) with each stone. We analyze nut-cracking actions of eight individuals, with body mass ranging from 2.0 - 4.3 kg, using five different hammer stones (0.57 – 3.47kg). We report the maximum velocity of the stone during downward striking and the maximum height to which the stone was lifted in the highest strike per nut-cracking episode per monkey. For example, the largest monkey lifted all the stones to the same maximum height except the largest stone, which was lowest. However, he added more force to the smaller stones in the downward striking phase and produced higher velocities than when he used a heavier stone. The wear patterns on an ancient tool may reflect the size of the user as well as the materials struck.

Keywords: tool use, biomechanics, percussion, body weight