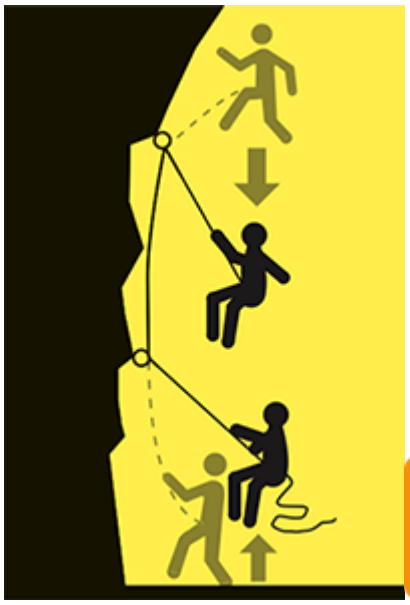
Dynamic Belaying

When the leader starts to fall, our first instinct is to lock down the rope quick and hard, minimizing the overall distance the climber will fall. This can cause a leader to slam hard into the wall, resulting in snapped ankles, jarred spines, and serious head injury if the climber falls upside down. A way to mitigate this is to aim for giving a “soft catch” by dynamic belaying, which eases the climber into the wall and greatly reduces the chance of injury. Keep in mind that a dynamic belay isn’t always appropriate and it’s an expert technique, so make sure the answers to the following questions are yes before you employ this method.



Is the path of the fall free from ledges, slabby sections, or other obstacles (including the ground) that the climber would hit if she takes a longer fall? If these are present, give a catch that will land the climber in a spot that avoids these hazards altogether.

Is the belayer a similar weight to the climber or heavier? A lighter belayer will get pulled up in the air when the heavier climber takes a fall, and that unintentional movement by the belayer will naturally result in a soft catch.

Are you on a trad line with marginal gear? A soft catch will reduce the force on the piece catching a fall, which could mean the difference between a safe catch and pulling gear.

The Process

We talked to physicist and climber Adam Scheer to see how a dynamic belay works. The belayer jumps as the climber begins to weight the rope. Because the belayer introduces upward momentum from the jump, it momentarily takes less work to continue pulling him upward, in essence reducing his weight from the standpoint of the climber. This lengthens the time over which the catch takes place, thus softening the catch. The belayer needs to stay light on his feet and be prepared to get pulled into the wall quickly. Keep knees and feet soft for low impact. Timing the jump is a mix between art, science, and practice, but you want to be moving upward just as the climber starts to put downward force on the rope. Falls happen quickly, so if the climber isn't very high above his last piece, the belayer can usually plan to jump as soon as the climber comes off. If the climber is 10 feet or more (spicy!) above his last piece, the belayer can wait a split second before jumping.

$$\text{Fall Factor} = \frac{\text{Length of fall}}{\text{Amount of rope in system}}$$

>>**Don't feed out extra slack.** This results in a harder catch because it increases the fall factor. If a climber takes a 10-foot fall with 20 feet of rope in the system, the fall factor is 0.5. If the belayer includes an extra five feet of slack (15-foot fall, 25 feet of rope in the system), the fall factor increases to 0.6, resulting in a harder catch (increased maximum force). Only give extra slack to make sure the climber clears an obstacle.

>>**Don't mistime your jump.** If the belayer jumps too early, his center of gravity will actually be on the way down when the climber is reaching the point of maximum force. The belayer acts as a counterweight, and if he is traveling downward, his momentum will be counteracted by the falling climber, causing a harder catch.

>>**Don't run toward the wall,** which will not soften a catch when the first piece is high (20 feet or more). This is dictated by trigonometry. (Scheer says, "Trust me, I've done the math." For more info on this, visit climbinghouse.com.)

Adam Scheer *— As a Ph.D. physicist and an avid rock climber, Adam has studied the physics of climbing and belaying for climbinghouse.com. Based in California's Bay Area, he is currently researching the fundamental chemistry of new biofuels.*