

Problem Statement:

In 2018, researchers at UCSF reported that 57.5 million people around the world have lost one or more limbs due to trauma. Car collisions (36%), falls (22%), and workplace hazards (13%) being the most common contributors to these non-fatal accidents.

In America and other countries which score high on HDI, there is access to medical infrastructure which can rehabilitate the residual limb and provide prosthesis to recover some function. This is not the case for most of Africa, South America, and SouthEast Asia. These areas are often underdeveloped economically and thus lack the medical infrastructure to monitor and help amputee patients, but most critically the patients and their families cannot afford even the cheapest prosthetics offered by the major manufacturers. Fillauer owns 42% of the prosthetic market share. Their cheapest solution starts at \$2000. Hosmer Dorrance owns 17% of the market and their cheapest option is \$3000. These figures far surpass the yearly income of people from outside developed cities in low HDI countries.

While 73% of amputations occur in lower limbs, the upper limbs are the most missed when they are gone according to surveys conducted by The Amputee Coalition (i.e, depression indexes are significantly higher for upper limb amputees than lower limbs amputees). Extrapolating from the data, we estimate there are 1.2 million upper limb amputee patients without access to any prosthesis.

Proposed Solution:

The solution to the problem is the design, prototyping, and manufacturing of a cheap and durable prosthetic prehensor which can recover the function of a lost hand. There are two key components to the solution. A strong grasping mechanical device which models a hand's uses and a comfortable yet firmly stable mounting mechanism. The former can be affected by the development of a compact ratcheting mechanism which achieves large variability in its clamp diameter and force applied. The latter can be accomplished by designing a cuff, brace, or socket which can be simply tightened to the limb in a manner which optimally distributes the load for comfort and stability. We propose to affect these exact solutions. Such a device could potentially ameliorate the problem of a missing limb for 1.2 million people. Moreover, the prosthetic could be brought to those under served users by the global non-profit network.