CUSTOMIZED ATHLETIC SHOE MIDSOLE DEVELOPMENT TO ADDRESS PLANTAR HEEL PAIN

REDUCING HUMANITY'S CARBON SHOEPRINT

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SOCIOTECHNICAL SYNTHESIS

Humans have specific, unique needs for their footwear and the search for the perfect shoe has led to countless wasted pairs of shoes thrown away in landfills. The following thesis hopes to remedy both issues focusing on both the microscale effect of shoes on an individual and the macroscale effect shoes have on the environment. The technical research topic aims to create a unique, customized, underfoot shoe midsole to treat plantar fasciitis and support optimal biomechanics. Many who suffer from plantar fasciitis go through multiple pairs of bulky corrective shoes and insoles when a single customized 3D printed midsole could hopefully ease their pains. The socio-technical research investigates how custom or bespoke shoes made in tandem with artisans and experts may result in less need for consumers to waste through multiple shoes and help the environment. The technical project offers one way of helping the environment through custom shoes.

In the current market, there are specialized shoes that require vast amounts of time and money in order to create a shoe fitted to the contours of an individual. The whole process results in excess waste and carbon emissions. 3D printing can allow for both while greatly reductions in carbon emissions. Through a scan of a patient's foot, a midsole modeled off the contours of the foot can provide for superior support and minimize pressure hotspots in the foot. By increasing support, the plantar fascia ligament will reduce extraneous work and reduce pain and aching.

Under optimal circumstances the midsole effectiveness would be tested mainly through patient-focused trials with the Motion Performance and Motion Analysis Lab under Dr. Shawn Russell. Using infrared sensors and markers, a specialized group would gather biometric data such as stride length and center of pressure progression during basic movements with control shoes and with our midsole. The adapted plan has pivoted more toward simulations in CAD

software under loaded conditions showing proof of concept. Simulations on all design iterations have allowed analysis for how each performs in relation to each other in terms of cushion and support as a midsole. In each iteration, there has been lesser amounts of hotspots and greater maximum stress according to the simulations in Fusion 360.

The STS research proposed can be summarized as how can carbon emissions from the shoe industry be minimized. Manufacturing practices need real change as the processes account for the majority of emissions. By working with a custom artisan or 3D printer, one can successfully reduce environmental impact while maintaining a good product. Sources from heritage companies show their practices to be more open while keeping true to the handmade artisanal nature of shoe-making. Lack of shoe chemicals and glue will result in a higher quality shoe that lasts longer preventing these shoes going into the landfills for longer.

The manufacturing practices are hard to pinpoint and fix as each shoe company has their own practices that come with their proprietary technology. These shoe companies also have their factories in outsourced countries with less stringent environmental policies. The interactive nature of working in tandem with a designer and artisan allows the customer to choose the practices and materials according to their specifications. The good product comes from a more attentive creator as the artisan or creator will either be someone in close contact with the customer or the customer themselves. Sources in the do-it-yourself maker movement have research showing the additive nature of 3D printing saves large amounts of carbon.

In conclusion, a custom 3D printed midsole can help consumers with their foot issues as well as help the Earth's environment. A movement toward custom shoes may be slow but, with time, each prevention can help the world as a whole. Finally, creating a shoe in person will result in increased knowledge for the customer and help support smaller businesses.

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