A key goal for bottom-up nanofabrication has been to generate structures whose complexity matches that achieved by top-down methods. Here I describe a method for folding long single strands of DNA into arbitrary two dimensional target shapes using a raster fill technique. Self-assembled in a one-pot reaction from the 7 kilobase genome of phage M13mp18 and more than 200 synthetic DNA strands, the shapes are roughly 100 nanometers in diameter and nearly 5 megadaltons in mass. Experimental shapes approximate target shapes, such as a 5-pointed star, with a resolution of 3.5 to 6 nanometer and may be decorated by arbitrary patterns at 6 nanometer resolution to form words or images.

Enabled by a program for laying out complicated designs and, utilizing inexpensive unpurified DNA strands, this method helps move DNA nanotechnology from the realm of research towards that of engineering. The ability to create arbitrary shapes provides a new route to the bottom-up nanofabrication of complex nano-scale devices and instruments. Physicists and materials scientists should be able to use DNA origami to arrange optical, electronic, and mechanical components into novel materials or even an integrated "nano-laboratory" of their choosing. Biologists may be able to use these structures to position proteins and other biomolecules in precise arrangements to study their coupling. Indeed these structures may be thought of as a versatile "nanobreadboard", a simple platform for creating arbitrary nanostructures.