Shephard Prize: citation for Andrew Lobb

Short citation:

Professor Andrew Lobb of Durham University is awarded the Shephard Prize in recognition of his remarkable paper 'The Rectangular Peg Problem', published in the *Annals of Mathematics*.

Long citation:

Professor Andrew Lobb of Durham University is awarded the Shephard Prize for his remarkable paper 'The Rectangular Peg Problem' (joint with Joshua Greene), published in the *Annals of Mathematics*. The regulations for the prize state that it should be awarded for making a contribution with "a strong intuitive component that can be explained to those with little or no knowledge of university mathematics." Lobb's result can be understood by a child in primary school, but it addresses a question that has been of interest to mathematicians for more than 100 years, and its proof uses the thoroughly modern theory of symplectic topology.

Here is the statement:

Call the *shape* of a rectangle the ratio of its long side to the short side. This is a number r greater than or equal to 1. Now take your pencil and on a piece of paper draw any smooth curve that you want, so long as the curve closes up and never intersects itself. **Then for any value of r there will be four points on that curve that form a rectangle of shape r.**

This *rectangular peg problem* is a variant of the *square peg problem* introduced by Toeplitz in 1911. This asks if we can do the same thing with r=1 and the curve only continuous rather than smooth. This problem and its variants have attracted considerable attention over the last decade, but the original square peg problem remains open.

Lobb and Greene's solution to the smooth rectangular peg problem is short, clever, and beautiful. The key idea is to apply a relatively recent result in symplectic topology, proved by Shevchishin in 2009: $\mathbb{C}^2$ does not contain an embedded Lagrangian Klein bottle. Given r and a smooth simple closed curve in the plane, Lobb and Greene construct an immersed Lagrangian Klein bottle $K \subset$ C^2 in such a way that double points of K correspond to rectangles of the desired shape. Their argument is a wonderful illustration of the way that mathematical ideas in one area can be applied to produce new and unexpected results in an entirely different field of endeavour.