

Researchers unravel the working of the bicycle

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Dr. Arend Schwab en ir. Jodi Kooijman investigate the behavior of a moving bicycle. Credit: Sam Rentmeester/FMAX

For nearly 150 years, scientists have been baffled by the bicycle. How is it possible that a moving bicycle can, all by itself, be so stable?

Researchers of the Delft University of Technology (Netherlands), working with colleagues from Cornell University and the University of Nottingham, UK, believe they have now found the ultimate model of the bicycle. The researchers discuss their findings in the new edition of Delft Outlook, the science magazine of TU Delft.

'Bicycle manufacturers have never been able to say precisely how a bicycle works', explains Dr Arend Schwab of the Faculty of Mechanical,

Maritime and Materials Engineering (3mE). 'They have always had to refine their designs purely through experimentation. In our model, they can enter into the computer all of the various factors that influence the stability and handling of their bicycle. The model then calculates how the bicycle will react at specific speeds.' The model has recently been published in the science magazine *Proceedings of the Royal Society, Series A*.

Because the model has the ability to indicate whether a design will deliver a jittery bicycle, or indeed a stable one for seniors, the bicycle industry is highly interested in the findings. The head of product development at the Dutch bicycle manufacturing company Batavus, Rob van Regenmortel, is following the research being conducted by Arend Schwab and his fellow researcher Jodi Kooijman very closely.

Van Regenmortel: 'In designing our bicycles, for years we have worked with three parameters: The overall geometry, the distance between the axles and the angle at which the fork points downwards. These choices were once made by all bicycle makers and have been rarely deviated from because the bicycle appeared to work properly. However, with the new model, we soon hope to be able to design bicycles that are much better oriented toward specific target groups.'

Rob Van Regenmortel hopes to collaborate with Arend Schwab and Jodi Kooijman on a follow-up project to study the human control. The ultimate goal of the bicycle research is to study the interaction between bicycle and rider in order to determine the handling quality of the bicycle. 'In this way, we can – in theory – create a customised bicycle for every rider', says van Regenmortel. 'Individuals who have trouble maintaining their balance, for example, would then no longer be restricted to a tricycle.'

Source: Delft University of Technology

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