# Designing the world's first glasses-free 3D television

LSE's Professor Henry Wynn led a collaboration to improve the design of a key component in TVs and mobile devices

## What was the problem?

The mobile phones, tablets and television sets we use every day depend upon tiny electronic slivers called piezoactuators (pee-yay-zo actuators.) Piezoactuators function in one of two ways: by turning pressure into electrical signals, or by converting electrical signals into sound or vibration. Whenever you hear a voice through your mobile phone or tap a touchscreen keyboard, there's a piezoactuator at work.

## What did we do?

Supported by a grant from the Engineering and Physical Sciences Research Council (EPSRC), Professor of Statistics Henry Wynn led a collaboration that included Brunel University and NXT, later Hi-Wave Technology, a company specialising in piezoactuators used in televisions, audio components and mobile devices. NXT/Hi-Wave was keen to gain a competitive advantage by developing new ways to combine computer modeling and physical prototyping to create better piezoactuators.

On this project, the starting point for Wynn and his team was Robust Engineering Design, or RED, a widely accepted process to engineer consistent, cost-effective and high-quality products. For a component like a piezoactuator, RED essentially poses a series of questions to designers. Where and how is it going to be manufactured? (Manufacturing technology and quality control vary widely across countries and industries.) In what devices is it likely to be used? (A mobile phone is used in a very different way than a television set.) How long are such devices likely to be used, and even reused? (This has implications for how robust piezoactuators need to be.)

Piezoactuators have an additional set of design challenges. They're remarkably small – about the thickness of two human hairs – and are built in very thin layers of material. They're also increasingly packed into devices very closely with other components and can be made from a wide variety of materials, including various crystals and ceramics, which increases variability in performance.

In the project, Wynn and his team created special RED-based design rules that balanced physical and computer-driven experiments in a unique way that mirrored an actual product development timeline, but with dramatically improved results. Brunel provided much of the engineering design input and intuition and was able to carefully bench-test prototypes built by NXT/Hi-Wave, while at LSE computer simulations constantly informed and adjusted Brunel's process.

## What happened?

As a result of this project, NXT/Hi-Wave realized that the typical two-stage development process they employed, simulation followed by prototyping, was not ideal for piezoelectric actuators. Whereas previous design rules led to two failed products for NXT/Hi-Wave, the rules developed by Wynn and his team led directly to several new products.

Perhaps most notably, Toshiba used the technology in the world's first glasses-free 3D television and has continued to be a pioneer in this area. For many years, 3D television has lagged significantly behind 3D cinema, and many analysts believe that removing glasses from the experience is a key factor to market expansion. Consumer research has found that for many people, glasses disrupt viewing because they're clunky and uncomfortable: while glasses might be acceptable in a one-off cinema experience, they're less appealing in a regular home viewing environment. In 2013, industry analyst TechNavia predicted that the 3D television market could grow by more than 15 percent through 2018.

The project also led to improved mobile phone technology through better power transmission and clearer sound, which has been incorporated into phones produced by Yota Corporation (Russia) and personal audio headsets made by Hybra Tech (US).

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Henry Wynn is Emeritus Professor of Statistics at the London School of Economics and Political Science, and Chair of the Centre for the Analysis of Time Series (CATS). He leads his own research group, the Decision Support and Risk Group (DSRG). He was head of the Department of Statistics from 2003 to 2006, and from 2000 to 2005 was also part-time Scientific Co-Director of EURANDOM, the international stochastics institute attached to Eindhoven Technical University (TUE), in the Netherlands.

He holds the Guy Medal in Silver from the Royal Statistical Society, the Box Medal from the European Network for Business and Industrial Statistics (ENBIS), is an Honorary Fellow of the Institute of Actuaries, a Fellow of the Institute of Mathematical Statistics, and has been awarded an Emeritus Fellowship by the Leverhulme Trust. He was awarded the Exzellenzstipendium des Landes Oberösterreich by the governor of Upper-Austria.

Email: h.wynn@lse.ac.uk

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