Getting cutting-edge eyewear tech to work is just the first step, good looks can never be forgotten, realises OT’s Olivia Wannan.
The real success of an optical invention goes beyond whether it works the way its innovator designed it to, as Harvard Medical School vision scientist, Professor Eli Peli (pictured above), knows well.

The inventor of Peli prisms for patients with hemianopia outlined to OT that: “The marketplace is the real test of things – if people actually use them. In low vision, it’s frequently trivial to show that it works, for example, just by measuring the visual field with the prism.”

With a background in engineering and optometry, Professor Peli has dedicated 33 years developing vision aids that improve the lives of visually impaired people. His priority is to engineer devices that effectively increase the visual function of patients.

However, he explained that: “When it comes to spectacles or head-mounted devices, the issue of cosmetic acceptability becomes very important. Even if something can be shown to work, and it’s even convenient and inexpensive, if people don’t like the way it looks for whatever reason – one reason may be that the device marks them as visually impaired – then they won’t wear it.”

An example of this comes from the in-the-lens telescopes that Professor Peli has worked on for a number of years.

His designs subtly incorporate telescopes into a standard spectacles lens. The positioning of the embedded, curved mirrors means that a patient can see a magnified portion in their field of view.

To allow for the patient’s full field of view to be as uninterrupted as possible, the magnified area is projected above the centre of vision where there are fewer obstacles, Professor Peli explained.

The new design is far less obvious than the spectacles-mounted telescopes available now, for which aesthetic concerns still trouble many of the patients who Professor Peli works with.

He continued: “I was struck when I was being driven by a man who has been wearing a bioptic telescope for at least 15 or 20 years by that time. The telescope afforded him the flexibility and the mobility that his career and family duties require of him.

“We were approaching a tollbooth, and he took his telescopic spectacles off. I asked him why, and he said that he didn’t want the tollbooth operator to see him with the telescopes. One wonders why someone would care about how he was seen by a stranger. And yet, he was sufficiently concerned,” he said.

Professor Peli highlighted that: “To me, that was a dramatic illustration about how we have to make these things acceptable.”

But he emphasised that a balanced approach was critical, explaining that: “In the mid-1990s there was a beautifully designed prism system marketed that had excellent aesthetics, but it did not expand the field at all and thus failed within a year or two.”

An augmented world

These pressures have come into play for Professor Peli in the continuing design of his head-mounted augmented reality systems for visually impaired patients.

The technology uses a semi-transparent display, he outlined, continuing: “You see the real world through it, and see whatever is being displayed on top of it.”

For patients with tunnel vision, objects in the missing areas in their peripheral vision are outlined for them within their remaining field of view, using a ‘minified’ cartoon. Meanwhile, those with central vision loss see distinctive superimposed edges to enhance the visibility of objects in their central field, Professor Peli said.

Originally implemented in a custom-built system, the technology was recently transferred to Google Glass spectacles, and Professor Peli sees the
licensed technology becoming transferable across various commercial devices in future.

The incorporation of an unobtrusive camera was also a vital aspect behind the success of the OrCam system. When activated, the vision device can scan any printed text – from plain street signs to the fanciest fonts on menus – and relay it to the wearer as spoken words.

Another feature of the system is the recognition of faces and products stored by the user. The 2000 patients who already own the system use it at home to cook or read mail, but also use it when commuting, meeting friends, attending school or working in the office, OrCam research and development executive vice-president, Dr Yonatan Wexler told OT.

“With a tiny mounted camera, people don’t notice it. At the beginning, customers told us that they weren’t going to wear anything that would make them look like an idiot – and that was the word they used. “They said that they were already disabled and made a lot of faux pas,” he explained. Dr Wexler said his company has big plans to add other features to OrCam – and a smaller, less noticeable camera was on the list. “We want to give people the information to allow them to do more…an upside with no downside,” he concluded.

Seeking the impossible
In another optical project, Professor Peli’s research team is looking to expand the visual fields of hemianopic patients

THE BOLD AND THE BEAUTIFUL
British bespoke eyewear designer, Tom Davies, of TD Tom Davies, on why good design changes for every spectacles wearer

Why is bespoke design important?
When I first started making spectacles, it really started to annoy me that spectacles didn’t really fit people the way they should. I discovered that the chance of getting a frame that actually fits you perfectly in the colours you want, the styles you want, is very rare.

Has technology changed how you work?
Most parts of our frames are handmade, and every craftsman that works with us has to have at least 10 years of experience. All our bespoke frames are finished with the name of the customer engraved discreetly on the inside of the side. For this, we use an ion laser. I also designed the machines that make my spectacles.

Where do you see the bespoke market going in future?
After many years of bespoke design, I want opticians around the world to be able to offer this, too. This is why I am introducing a new service called ‘Custom – Made to Order,’ which makes it faster and easier for opticians to make changes and order customised frames for their clients.
How did you start out with 3D printing?
I started doing 3D printing as a little bit of an experiment for Bill & Taylor Opticians. I used to create bespoke eyewear and it was a way of getting my concepts into a tangible thing. It was a great thing for the customers to look at. A few patients mentioned that the samples were pretty good.

I then started producing 3D-printed products as a kind of gimmicky thing.

How did it go from there, and why are you no longer offering the service?
It went fairly well, before it tailed off – again, this happened quite quickly. As the original printer-produced spectacles were quite brittle, we said that customers could have as many prints of the design as they wanted within a 12-month period.

The technology changed so rapidly, to a powder-form printer, which melts powder together, and the product is a lot stronger. But instead of being £1000, the printer was £10,000, so instantly we could not compete.

Where do you see the technology going for the profession?
As a one-off market, it’s a great idea. We had patients who came in with an eye missing from cancer, and it was brilliant because you can completely design the frame.

The downside is that if you don’t have the design know-how, there’s no way that you can get started. I think there will be a market for it, but the question will be – at what price?

We’re also looking at using these prisms to expand the sight of normally sighted people, beyond normal vision past what is currently possible – beyond the 30-degree limit of conventional prisms.

So far a yoked prism design – embedding a prism in a spectacle lens with prismatic power in the opposite direction – has offered 36 degrees of expansion to a patient’s blind side. Another prototype containing two Fresnel prisms angled to each other offers a 43-degree expansion.

A third design using angled mirrors could, when prototyped, offer a similar level of expansion with some additional advantages. Professor Peli has also received a major grant to study “multiplexing” prisms.

He continued: “We’re also looking at using these prisms to expand the sight of normally sighted people, beyond normal vision. We’re particularly thinking cyclists, law enforcement, the military. It’s not behind their head, but further than they would normally see.”

Professor Peli knows that good design will be key for this project as well.

“If these prisms are incorporated for cyclists, they would have to be in these cool, wrap-around type of spectacles. Bicyclists are a cool bunch. They are not going to be wearing something that has something funny-looking stuck onto it,” he emphasised.

Professor Peli warned: “You can’t really have what people want, which is an actively optical device that isn’t visible. I don’t say many things are impossible in optics, but I think no one will be able to create something that is optically active and invisible.

“If making them invisible is impossible, you just have to make them look as good as possible, as sharp as possible. And nowadays people are a lot more open to technology on their face,” he highlighted.

The unveiling of ‘Spectacles’ – stylish sunglasses with embedded cameras to record 10-second point-of-view videos – by the company behind Snapchat certainly points to exactly this.