



Design tackles diabetes

Facts at a glance

Challenge

To transform a new technology for self administration of insulin via an inhaler (rather than an injection) into a device that might attract potential investors.

Type of designer engaged

Industrial designer

Most important part of the immersion

Engaging the designer early so that the function of the product, not just its aesthetics, could be influenced by design.

Most difficult part of the immersion

The technology `inside' the prototype was still under development, meaning that the designer had to adapt to changes during the process.

Solution

An end user prototype of a pulmonary inhaler with some detachable parts that would give a sense of how the final product might look. The prototype was complemented by an animation showing how the device would work.

Outcome

The prototype was exhibited at Bio 2007 in Boston, US, where it attracted significant interest from potential investors.



"The final product was what we wanted: it was differentiated from the market, did not look like a medical device and appealed to adults and kids." – NanoVic



Company background	Designer background
Nanotechnology Victoria www.nanovic.com.au Established: 2002 Industry sector: Research and Development Project lead: Dr Sarah Morgan	Charwood Design www.charwood.com.au Established: 1993 Type: Industrial Project lead: Paul Charwood

Background to the project

Nanotechnology Victoria (NanoVic) is a publicly funded organisation focused on developing new technologies based on nanoscience¹. The organisation has developed a piece of technology that will enable some drugs to be administered via inhaler rather than injection. NanoVic, in conjunction with Monash University, had spent nearly AUD 1 million developing the technology for a pulmonary device which has potentially wide-ranging applications for treating multiple sclerosis, cystic fibrosis and side effects from chemotherapy. The first drug to be trialled with the technology was insulin. The device is intended to release tiny insulin particles into the lungs when the user inhales them. NanoVic understood the technology but had no idea what a working device would look like. They wanted an attractive, lightweight and small prototype they could exhibit.

Role of the facilitator

A facilitator was appointed by the Victorian government to undertake a number of roles: helping the `client` to make decisions about a suitable designer, ensuring that expectations were understood and managed throughout the process and providing a mechanism for problems to be addressed. The facilitator's main function was to help ensure that each party asked the `right` questions at different parts of the project.

Response – a seven week design process



Melbourne industrial design firm Charwood Design was selected to work with NanoVic to produce an end user prototype of the inhaler. This sort of prototype looks externally like a final product but has only limited moving parts. It is designed to convey a convincing image of the final product and is often used to attract further investment.

¹ "Nanoscience is the study of phenomena and manipulation of materials at atomic, molecular and macromolecular scales, where properties differ significantly from those at a larger scale. - "We need to talk: the future of nanotechnology", www.nanologue.net



The project had four key phases:

- Project set-up
- Developing a number of design concepts
- Refinement of favoured concept
- Production of the prototype

Phase 1: Project set-up

The design brief

The first phase involved NanoVic working with the business immersions facilitator to produce a design brief outlining the objectives and constraints of the project. NanoVic did not expect the design process to produce a sophisticated end user prototype of the insulin device that could be demonstrated to potential investors. They had expected a basic block prototype that gave a basic idea of its shape and size.

The design brief outlined to the designer the specifications of their technology as well as basic market information. The basic task was to develop a prototype of the external casing for a medical device to administer insulin via the lungs but also had to be different and more attractive than other devices on the market. Constraints included a fixed price budget, and a fixed deadline 7 weeks from issuing of the design brief to enable the prototype to be transported to Bio 2007 in the US. Within these constraints Charwood Design was challenged to come up with a device that did not look like a medical device (recognising that children would be a potential market), had aesthetic appeal and would be robust.

Selecting a designer

NanoVic's key requirements when looking for a designer included:

- An industrial designer with proven experience working with technology
- A designer who demonstrated an understanding of NanoVic's requirements as part of the interview process.

Clarify the design process with clients

Perhaps the most critical point in phase 1 was the first meeting between Charwood Design, NanoVic and the business immersions facilitator. A productive first meeting, according to Mr Charwood, provides a foundation for a successful project. The meeting is important in setting out roles and responsibilities of all players, establishing processes for key activities including agreement up-front on how design issues will be resolved, and in clarifying expectations.

In this case it was particularly important, according to Mr Charwood, as industrial design projects that involve technology are fraught with risk. The main danger is that the technology becomes the focal point, and that the designer is not given sufficient scope to do their job. This issue was



addressed at the first meeting, with NanoVic recognising that the technology was important, but that the designer could only add value if they were given freedom to innovate.

“Charwood asked all the right questions and were really interested in the technology. Their presentation showed they had done their research” - NanoVic

“Our role was to provide an understanding of what the market wants and be the glue between the technology and the market, or between the engineering and manufacturing. They had not really considered how you would get the drug in the device and make it available to the user.” - Charwood

Establishing IP rights

Because the technology was crucial to the project, Charwood’s designers paid a visit to NanoVic at Monash University. From NanoVic’s perspective that meeting also enabled them to get comfortable with the idea of having a third party analyse and manipulate their technology. For NanoVic, the technology had a ‘sacred’ status which they had to entrust to the designer. The confidential nature of the technology also created some operational complexities, including the need for signing of non-disclosure agreements by the designer and negotiation of the intellectual property status of the design. NanoVic felt a rapport/sense of trust had been established.

As part of the initial contracting process, the designer had agreed to assign IP in the prototype to NanoVic. This is standard practice, although designers naturally retain ownership of any proprietary knowledge that they use in developing prototypes. When the prototype was nearly complete, NanoVic took steps to protect the design.

Phase 2: Developing the design options, and selecting the favoured option

The next phase was the longest and most involved in the project.

Developing design concepts

Charwood recommended a ‘brainstorming’ meeting to kick off the design concept process. This is not always included in the process, but the designer felt that the technology was so new, and the final product so distant, that it would be well worth the extra cost. It would allow Charwood’s design team to understand more about their client’s needs, and give NanoVic the chance to explore ideas beyond their initial preconceptions for the device.

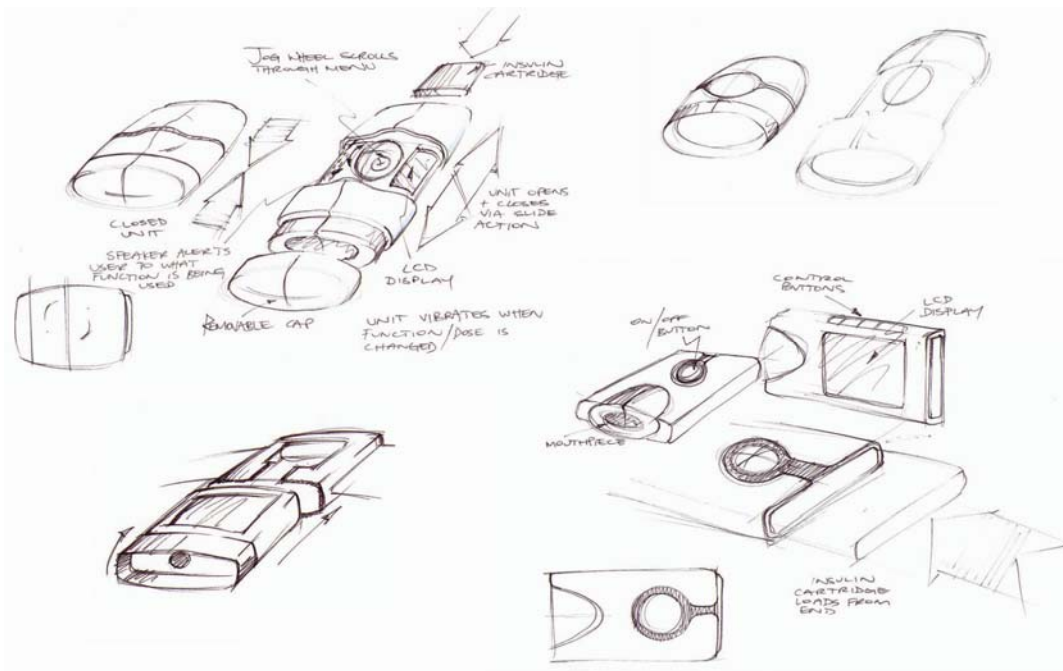
“We had made up our minds that the device had to look like something like a mobile phone. It was gratifying that the designer challenged this thinking and pushed our limits.” – NanoVic

This session also challenged Charwood to go further than first envisaged and to produce a more realistic end user prototype for the scientists to take to the US.



“We (NanoVic) were expecting something a lot more basic: a design and some pretty pictures and animation. We were over the moon that they went further.” – NanoVic

“We felt that if they wanted to take something to the conference and wanted people to say ‘wow’ then it should have a look that attracted attention to the technology” – Charwood



Design Concepts

The design concept phase involved further specification of the technology upon which the device would be built. Very early in the design process Charwood's design team visited the nanotechnology laboratory at Monash University where they viewed the technology in action. They were able to ask many questions, some of which challenged the nanotechnology team and influenced their thinking about the end use of the device. A week later, NanoVic used video to show the designers a further development in the technology. This process was crucial for the designers to be able to design an end product that could house the technology and accommodate its particularities.

According to Mr Charwood, this point in the process is where the ‘devil in the detail’ is revealed and a relationship can quickly sour if not handled professionally. A series of meetings and email/phone conversations were held between NanoVic and the designer to enable NanoVic to outline all of the relevant specifications that would impact on the final design.



These specifications included:

- The size of the technology that would sit within the device
- How the device would be powered (so that batteries could be accommodated)
- How the device would be used in practice – would it be self-administered, would the mouthpiece need to be re-usable or disposable?
- The technical limitations that governed its use – for example would the device need to be horizontal or vertical when being administered?
- The safety features that would need to be built in, including child locks, etc

An example of the difficulties in working with emerging technologies occurred early in the process, when an early technical specification that Charwood Design had been asked to accommodate, became obsolete two weeks later. It turned out the amount of insulin vapour the designer would be working with was far greater than originally envisaged, making his task easier.

Selecting the final design concepts

Once the technical limitations were resolved, the designer developed three different creative concepts for the insulin device. The design options for the inhaler were presented to NanoVic in a comprehensive sketchbook with mock-ups, and a rationale for each design – including a device that also featured a glucometer, which measures glucose levels in diabetics, a more radical vertical pen-like device and less radical horizontal version of the inhaler. NanoVic decided to select a horizontal inhaler on the basis that it was different to any rival products on the market, and was simple enough to explain to potential investors. The glucometer version was a product for the future but the ‘two-in-one’ factor would be too distracting for now, they said.

Phase 3: Refinement of favoured design concept

Charwood’s challenge now was to further refine the sketches for the device and take that to a fully developed animated model. From NanoVic’s point of view, once the favourite option was selected the designer’s questions stopped and they “went off and did their thing”.

Charwood set about developing a “funky and colourful” prototype which they felt satisfied their desire that it attract attention and be different but also be functional and not too radical, as the client wanted. NanoVic had wanted an LCD screen on the device that showed the insulin dose and battery levels but the designer convinced them a smaller device would look better with a dial and light replacing the screen. The client respected the designer and felt confident the large amount of research they had done and the ‘extra mile’ they had gone would ensure they produced a high quality product.

“This is not a really technical explanation but when I saw the designer’s prototype for the inhaler I said “Cool. That is really cool!” – NanoVic



Phase 4: Production of the prototype



Both the designer and client felt the most difficult aspect of the project was meeting the time constraints to have the prototype ready to go to the Bio 2007 conference in Boston. It was originally envisaged that the designer only had to produce sketches and animation images of the inhaler but NanoVic and the designer later agreed that with additional resources it was possible to develop a much more lifelike prototype. It would convey the colours (white with bright green), texture and 'finished' look that would be impossible with just sketches or three-dimensional images. Though timeframes were tight NanoVic pursued producing the prototype, causing some anxious moments for the designers having to co-ordinate production in Taiwan and collapsing the timeframes for sign-off on the final plan.

"At the end the designer told us the prototype had not arrived on a plane from Taiwan as it was supposed to. Charwood were transparent about the process, and it turned up on time as predicted, though we did have some nervous moments." – NanoVic



A model tested the user-friendly features



The final insulin inhaler prototype – a safe, fun solution for diabetics young and old





Results

The device boarded a plane on the due date, and was exhibited at the conference in May 2007 in the US. Exhibition of the device in the US was a success on a number of fronts. Firstly, it enabled NanoVic to achieve cut-through with potential investors who were attracted to the device's finished appearance. It also provided NanoVic with confidence to answer detailed questions that had been resolved during the design process. For example, they could demonstrate to investors that considerations such as safety, battery power and actual use had been factored into the design. Thirdly, NanoVic was able to demonstrate to its funders (the Victorian government and universities) that it was focused on moving from the technology to commercialisation.

“Producing a prototype meant we could display a model at our stall (at Bio 2007), which got a lot of interest. People were impressed, including potential investors.” – NanoVic

“The process was partly art but more science. It was not just how pretty it looked, they (the designer) wanted to know the technical side of things.” – NanoVic

Summary

Perhaps the most fundamental lesson out of the immersion was that engaging a designer early in the product development process is vital. In this case, questions posed by the designer revealed gaps in NanoVic's thinking – gaps which it was able to address before fronting investors. According to NanoVic, not only did the design work provide an aesthetically appealing prototype but it also helped to fundamentally improve the technology itself. NanoVic also discovered that a designer could, as Charlwood said, provide an insight into what the market wants. Though getting involved early is always advisable, Charlwood suggested that in this case it was almost too early. That is, because the technology had not been absolutely specified this information had to be back-filled while the designs were taking shape. In this case it worked, but in others it would likely delay the design process.

The project also `worked' because NanoVic trusted the designer, with that trust established, at the extra brainstorming session initiated by Charlwood. That trust enabled NanoVic to understand the importance of – and provide - Charlwood the freedom required.

Another key success factors was that the two parties were motivated to work on a project with potentially life changing results. The possibility of improving the quality of life for diabetics and, eventually, people with other diseases created highly motivated teams from both Charlwood and NanoVic. The device will also potentially create jobs and revenue for the state as well as develops Australia's scientific reputation, meaning that the project was underpinned by a strong community good.



Key observations about the process

Question	Designer's response	Company response
What you wish you had known at the outset	More knowledge about diabetics, including what they used and the amount of insulin used	More about the technology: such as the exact dimensions of it to save time with prototypes
Biggest fear going into the process	That the design brief would be vague, which was why the 'brainstorm session' was important	Getting the finished product on time
Most satisfying moment	The positive feedback from the client at the end	Seeing the options the designer came up with during phase two
Most important meeting	The concept meeting early on when we presented the three options because that was the 'path of no return'	The early brainstorming session, because it enabled us to get our views across but also get an insight into the way they were thinking about the problem
Most unexpected development	The video showing we had a lot more vapour to deal with than we thought. That positively affected our design greatly	Getting a sophisticated prototype – not just an animation – at the end of the process
Biggest challenge	The time constraints – there was not a lot of room for error but luckily it went smoothly	Letting go of our preconception that the device should look like a mobile phone
Most nervous moment	Waiting for the client's reaction to the prototype – whether they would like it	Waiting for the prototype to arrive by boat from Taiwan, knowing that the conference was looming