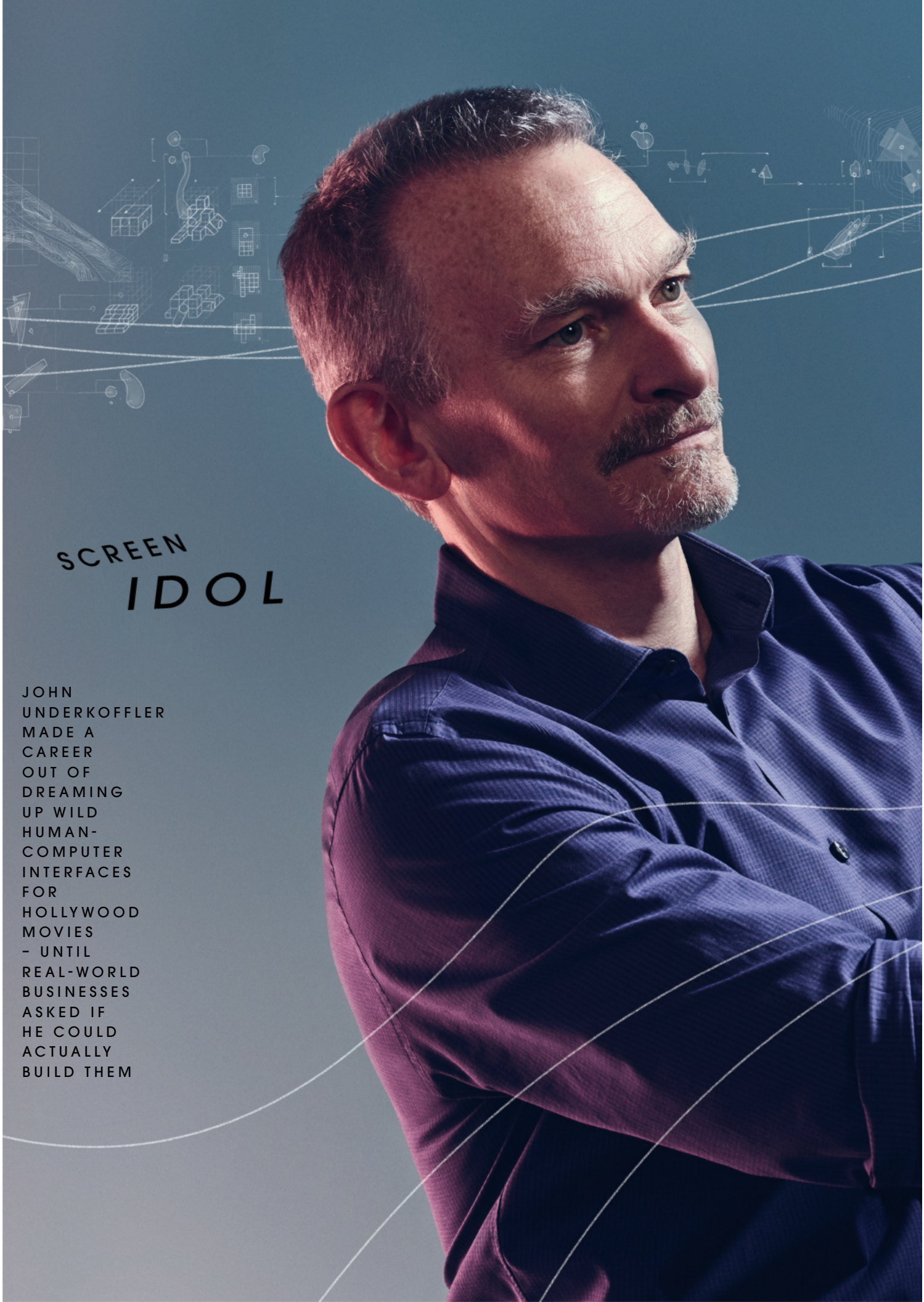

SCREEN IDOL

JOHN UNDERKOFFLER MADE A CAREER OUT OF DREAMING UP WILD HUMAN-COMPUTER INTERFACES FOR HOLLYWOOD MOVIES – UNTIL REAL-WORLD BUSINESSES ASKED IF HE COULD ACTUALLY BUILD THEM


BY
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PHOTOGRAPHY
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INTERFACE
VISUALISATION
OBLONG

ON

23
NOVEMBER
2000.

JOHN
UNDERKOFFLER

packed a bag, set off for the airport and left Boston for good. An MIT PhD research student who was obsessed by data representation and user interfaces, he was about to join his dream project as the official science adviser for a new movie called *Minority Report*.

Directed by Steven Spielberg, with Tom Cruise playing the lead role, this was a long-gestating adaptation of a Philip K Dick short story located in the Washington DC of 2054 – a future where criminal activity has been all but obliterated thanks to precogs, psychics who can predict crimes before they happen, and a specialist police unit, PreCrime, which is licensed to pre-emptively arrest criminals.

Embedded with the art department, Underkoffler spent a year helping to design the film's futurescape. The brief from Spielberg was to make the film's tech immediately visually legible. The director also didn't want typical "sci-fi gadgets". In his mind, the film was a noir, and the tech should be based on devices that were contemporary in 2001.

Underkoffler took a then brand-new technology, E Ink, and extrapolated this to foldable digital newspapers seen in the film's subway scene. Maglev transportation tech, then in development in Germany and Japan, became the basis for the self-driving cars that could move up the sides of buildings and dock with individual apartments. New technologies such as fMRI – functional magnetic resonance imaging – inspired the complex headgear by which the dreams of the precogs were recorded.

The most challenging task facing the production was the question of how to visually represent the precog visions, and how this data could be manipulated by PreCrime chief John Anderton, played by Cruise. For that purpose Underkoffler decided to adapt a technology he had been developing called g-speak, a spatial computing programme that allowed the user to control on-screen pixels with simple manual gestures.

G-speak had been inspired by the research of Colombian-American neurophysiologist Rodolfo Llinás. Llinás writes that as homo sapiens evolved as a species, our awareness of our surroundings increased so that we knew where to hunt, when to eat, and when to run. Everything that we see, taste, hear, sense and feel is new information – and the more of these inputs we can glean from our environment, the better equipped we are to deal with it. Underkoffler believes that the same rules apply to user interfaces. The more they are able to replicate how humans interact with the world, the more our interactions with computers will come to feel natural and intuitive. G-speak allows data to be shared across multiple machines, surfaces (from screens to tables) and users.

For *Minority Report*, Underkoffler used his early research around g-speak to develop a unique gestural interface that was unlike anything previously seen on screen. To demonstrate to Spielberg and the cast how g-speak would work, Underkoffler excused himself from the film set for a few days, jerry-rigged a green screen in a friend's back garden, and filmed himself executing sequences of gestural commands. After watching Underkoffler's trial video, Spielberg was enthused, ordering a script re-write to allow more characters to use Underkoffler's interface.

G-speak takes centre stage in the opening scenes, in which Cruise needs to locate a would-be murderer as the clock ticks down. Donning a pair of interface-enabling gloves, Cruise raises his arms like a conductor, and the precog's vision appears on a clear, curved screen in front of him. We see snatches of a woman in bed, an angry man raising his arm, then stabbing downwards. Cruise and his PreCrime team know who will die, and when – but not where the murder will take place.

LEFT: IN *MINORITY REPORT*, TOM CRUISE DONS INTERFACE-ENABLING GLOVES TO NAVIGATE CLUES IN AN IMPENDING MURDER ***RIGHT:*** JOHN UNDERKOFFLER

Holding his left hand up, palm towards him, thumb and first two fingers outstretched like a pistol, Cruise is able to pause the video. By sweeping his hands to the right, as if trying to toss a paper ball into a bin, he dismisses the image on screen. By extending two fingers, then tracing a loop in the air, he spreads out a digital file with mugshots of possible perpetrators. It's a flurry of movements, fluid and natural, each bearing Underkoffler's signature.

Cruise's character is required to zoom in on a newspaper that has been left on the lawn of the victim's home. Underkoffler had not designed a specific zoom movement, so he and Cruise pondered what to do. "What if I did this?" said Cruise, extending his left arm towards the giant curved screen and bending his wrist so the left hand formed a "stop" at the end of the arm. By sliding his right hand along his arm, he could access different zoom levels. "My arm is like a UI slider."

In the wake of the critical and box office success of *Minority Report*, Underkoffler was recruited to work on a number of blockbusters. For *Hulk* (2003), he was asked to conceive the gamma-radiation accident that leaves Bruce Banner with an angry green giant residing inside him. On *Aeon Flux* (2005), Underkoffler pondered what possible building material might be used in an isolated city in an otherwise ruined world – bamboo, it turned out.

Following the release of *Minority Report* in 2002, Underkoffler had also begun receiving calls from Fortune 500 companies, including Accenture, Wells Fargo and Fujitsu, inquiring whether the tech they had seen on the cinema screen was real. And if g-speak wasn't real, well, could Underkoffler develop it for them? After the fourth or fifth call asking the same question, he started to think it might be an idea to get back into the lab and give it a go.

As his six years in Hollywood rolled by, Underkoffler felt the urge to return to his unfinished research projects growing, until it became irresistible. "To spend a year of one's life [working on a film]... that commitment should be more

'I'M A DESIGNER AND ENGINEER, OBSESSED WITH USER INTERFACE. I FELT LIKE I HAD TO GET BACK TO IT'

directly meaningful and more personal," he says. "I'm a designer and engineer, and obsessed with user interface. I felt like I had to get back to it."

His mission wouldn't be restricted to developing data-sharing technology; he wanted to change how we interact with computers entirely. More than 30 years after the advent of the Apple Mac operating system, interfaces have mostly remained unchanged. Yet since 1984, memory, graphics power, processor speeds and disk capacity have been magnified by between 10,000 and one million per cent. Despite these advances, how we interface with computers has barely changed in those decades.

The mistake, Underkoffler argues, wasn't that we got user interfaces wrong back in 1984, but that they stopped evolving. An upgrade was long overdue, he believed. In 2006, he left Hollywood, founded Oblong Industries and dedicated himself to bringing the g-speak interface to the world.

BORN ON THE LAST DAY OF JUNE 1967

Underkoffler spent his childhood on a farm 55 kilometres outside Philadelphia. His mother had trained as a nurse, and his father worked in a family-owned company manufacturing synthetic tights after the Second World War.

Growing up, Underkoffler and his two brothers had free rein over 44 hectares of fields and woodland – in the middle of which he came across an old dump, housing the refuse of the previous half-century. "There were these beautiful old glass bottles," Underkoffler recalls. "It was a decaying record of life from the past five decades. It was an amazing history lesson." To Underkoffler, these bottles represented a past that was not restricted to a museum display case or a textbook, but something that he could hold and feel in his hands.

In 1980, his parents invested in their first home computer, an Apple II Plus, and Underkoffler began writing code in every spare moment. "There was a fantastic computer enthusiast magazine called *Softalk*," he explains. "It would publish programmes in machine language and you'd type them in. The beautiful thing about these machines is that you could become the custodian of this entire, infinitely expandable world."

Five years later, Underkoffler enrolled at the MIT Media Lab, set up that year to encourage collaborative research across a range of disciplines, from technology to media, art and design. "There was a perpetual amount of excitement," he remembers. "It was like being in the inside of a neutron star." One of his lecturers was Muriel Cooper, a graphic

designer who ran the Visible Language Workshop. She believed that society was moving away from a focus on mechanised processes and placing a new value on raw information – requiring new ways of visualising and communicating data.

Cooper's design philosophy was the inspiration behind the early versions of g-speak. In 1998 Underkoffler created the Luminous Room, a project in which the ordinary lightbulb was replaced with internet-connected projector cameras, dubbed "I/O Bulbs". The idea was that by enabling data to be projected on to any surface in a room, this data would be liberated from the computer screen, and, for the first time, situated in the real world. This also meant that data could be manipulated without a mouse or keyboard. As such, it was one of the earliest hints of the capabilities of what would eventually become g-speak.

One exploration of the Luminous Room was the "Chess & Bottle system", which allowed text, images and live video to be displayed on screen – then, with a particular gesture (in this instance, turning a vase 180 degrees), the data would be incorporated into a vessel transported across the screen, and unpacked on the far side. If the glass bottles of Underkoffler's youth had brought him information from another time, the g-speak glass vessels were able to transport data of many different mediums in real time.

Urp was another project that used the I/O Bulb – deployed by an architectural design tool to project digital shadows on to a workbench. The shadows would lengthen and shorten depending on the placement of small architectural models. This allows designers to see the shadow that a building would cast at any particular latitude, season or time of day. The simulated material could also be changed, so that in one instant a shadow formed by a brick wall could be displayed, and in the next, the reflection from a glass partition of the same size.

Inspired by the Media Lab's ethos, Underkoffler's ideology around user interfaces drew from various sources. He cites science fiction author William Gibson's writing on a shared virtual environment that melds virtual space with virtually enhanced physical objects – cyberspace, or the "metaverse". The 1981 Atari arcade game *Tempest*, in which the player shoots geometric shapes, was another influence. Both share the distinction of rejecting the "real world" that we recognise every day in favour of surreal visuals that can be manipulated in unconventional ways – something that Underkoffler was to make reality with the Luminous Room project. Who previously had thought of storing videos in a vase, after all?

'THIS IS THE ANTIDOTE TO IRKSOME CORPORATE MEETINGS IN WHICH A SINGLE PERSON HOGS THE ONLY USB PORT, SUBJECTING COLLEAGUES TO A DRY POWERPOINT PRESENTATION'

OBLONG'S LONDON SHOWROOM IS LOCATED

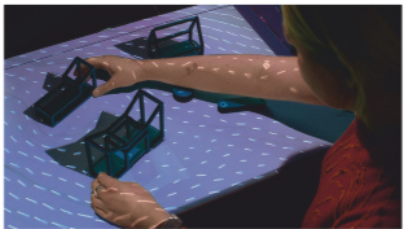
in a first floor office off Shoreditch High Street. Oblong employs some 120 people, and provides software to 150 of the Fortune 500 companies. Padraig Scully, Oblong's technical account manager, leads me into a conference room with six screens set into the walls. This, Scully explains, is Oblong's prime product: Mezzanine, a video-conferencing software that runs on g-speak and allows team members to share and manipulate each other's on-screen data, live. It's used by more than 150 customers on six continents, including JLL and Inmarsat in London, and Boeing and Nasa in the US.

In Oblong's LA headquarters, Underkoffler is waiting to take our call in a room with its own Mezanine setup. This, he tells me, is the antidote to irksome corporate meetings in which a single person hogs the only USB port, subjecting their colleagues to a dry PowerPoint presentation. To demonstrate this, Scully pulls up fake architectural blueprints. They appear on the three horizontal screens, to the right of our live link to Underkoffler, who can now also see them on his screen.

Mezzanine runs on g-speak, but instead of Cruise's sensor-embedded gloves, it is controlled by a wand – a sleek remote that uses infrared sensors in the ceiling. In order to use the wand to manipulate the data on the screen, each pixel is given an x, y and z co-ordinate instead of the usual numerical code, allowing it to be controlled via 3D movements. By pressing a button on the wand and moving the device towards the screen, I am able to zoom in on a section of the blueprints. Holding the same button down and drawing a square around the image produces a screen grab. The grab appears in a bank of saved images at the bottom of our screen. By clicking on it again, I'm able to drag it on to the left-most screen.

The three screens now display my screen grab, the live link with Underkoffler, and the original blueprints. In LA, Underkoffler can see the exact same information. And using his own wand, he's able to draw on top of my grab, highlighting a particular section.

Next, Scully turns to a whiteboard at the back of the room and writes a message to Underkoffler. Using the wand again, he's able to photograph the board and transport the message to the screen. In LA, Underkoffler is able to use his own whiteboard to write on top of Scully's words or scrub them out



LEFT: JOHN UNDERKOFFLER AND A 45-SCREEN DISPLAY
RIGHT: IN 1998, THE MIT I/O BULB COULD PROJECT LIVE, ADAPTABLE DATA ON TO REAL-WORLD SURFACES

entirely. Scully then pulls up a series of mock designs for a range of fictional fruit drinks. On screen, he is able to underlay different logos into mock iPhone, web and billboard adverts. Using the wand he moves them to the three vertical side screens, where we're able to instantly compare them: the electronic equivalent of pinning printouts to a cork board.

By allowing information to be manipulated by an entire creative team at once, Mezzanine seeks to make meetings more efficient. There is no need to pause while designers re-work an idea, or latecomers wait for an extra printout. As Underkoffler explains: "Projects that previously took five weeks can now be completed in five hours."

Not only that, he argues, but it allows corporations to share ideas in a 3D space. Underkoffler holds up a smartphone. "It's horrible that everything I want to see has to be on this little screen," he says. "Some things require more seeing."

LOS ANGELES' SKID ROW IS STILL

BELOW: JOHN UNDERKOFFLER IN OBLONG'S LOS ANGELES HQ

UNDERKOFFLER HOLDS UP A SMARTPHONE: 'IT'S HORRIBLE THAT EVERYTHING I WANT TO SEE HAS TO BE ON THIS LITTLE SCREEN. SOME THINGS REQUIRE MORE SEEING'

very much the home of the down-and-outs. Oblong Industries has had its HQ in the neighbouring Arts District since 2008. Other startups moved there only recently, along with sushi restaurants and a brewing company. It is a favourite area for film crews, with fake shoot-outs and car chases taking place on a near-weekly basis. Recently, Underkoffler remarks, a petrol station appeared nearby, much to the elation of his staff. A week later, it blew up. It had been a movie set all along.

The Oblong HQ is a warehouse space with open-plan workstations and beautiful, 100-year-old wooden roof beams. In previous lives, Underkoffler has discovered, it was a sweatshop, and a pornographer's set. Today it is a bright, modern space with swathes of coloured paint on the walls, and a stack of bicycles next to a dining area that resembles a trendy coffee shop. Banks of computer monitors hold the attention of employees in chinos and T-shirts, code scrolling across their screens.

In Underkoffler's office, a small space on the top floor, he discusses the transition from an academic researcher to the leader of a company developing usable tech for a real-world market.

"As a researcher, it's your job to invent new ways of looking at the world, and you do so with a set of theories about what'll be useful," he says as he pours coffee. "But you're not actually limited by on-the-ground details that would affect usability. In the commercial realm, those details are intensely critical."

In other words, should your ground-breaking new tech design not fit consumer requirements, it has little use. By the same token, Underkoffler believes that putting too much focus on real-world applications can limit creativity. As in most things, a balance between optimism and pragmatism offers the best approach.

A case in point is Oblong's work for Saudi Aramco. The company's

GigaPOWERS system is the world's most sophisticated oil and gas reservoir simulator. The problem was that the stakeholders, drilling foreman and engineers, all needed to interact with the system in real time, and on a massive visual scale. Three abutted high-definition projectors were used to visualise the relevant reservoir, allowing developers to ask questions like: "What happens to production if we move that wellhead 500 metres north?" The system would let anyone pick it up and move it on screen, and see what would happen.

For General Electric, Oblong constructed an interactive map of a smart grid energy management system. Problems included finding the best way to navigate the space; how to zoom in from national to street level to view downed power lines in real time; and how to allow a variety of workers to use the system at once, each working on different tasks and using a range of input modalities, from smart wands to tablets and web browsers.

The majority of such problems are tackled at Oblong's R&D and Prototyping Warehouse, a 15-minute walk from the Arts District office. Two-thirds of the warehouse space operates as a traditional storage facility, with stacks of wooden crates ready to be loaded into lorries and shipped around the world; the rest is where the developers live.

On a typical day, ten engineers work at the back of the warehouse space. In the corner of this zone stands a vast semi-circle comprising 45 screens, reaching some two metres high and all but enclosing a user inside. The set-up boasts over 90 million pixels.

As a demonstration, engineer Pete Hawkins pulls up a representation of the Earth, with coloured dots hovering around the surface. These, he explains, denote seismic data. They are arranged by magnitude: dots further out are the less common, larger earthquakes; those closer are smaller, more frequent quakes. Colours indicate the depth of the quakes. Blue is shallow, red something to worry about. The potential life-saving applications of such a system are immediately obvious, promoting analysis in a way that's difficult to do with a spreadsheet.

"Our goal is to get beyond columns of data," Hawkins explains. "In an Excel spreadsheet, our experience with the data is limited. By putting this in human terms we get more of a human take."

To date, Oblong's most successful collaboration has been with IBM. In particular, building a visual face for its abstract Watson technology. The solution was the bank of 45 screens, with visuals displaying stock market data in real time as a swirl of brightly coloured pixels, each representing a particular market trend. Geometry had again afforded an elegant solution.

"People ask about a portable VR version [of the software], but that's not a shared experience," explains B Cavello, from Watson. "When you're making decisions, and checking people's facial expression to see everyone is on the same page, that level of disconnect doesn't really work. Having a space where you can have a conversation and navigate the content immersively is really valuable."

Underkoffler believes that for g-speak to fully realise its capabilities, new user interface technology needs to appear everywhere, not just in conference rooms. Should larger technology companies get on board, he believes g-speak could become ubiquitous in as little as two years. Underkoffler mentions Microsoft in passing, but cannot discuss specific companies or details of any discussions that they may – or may not – have had.

"I've been wondering for a while what's the right place to ignite the conversation around user interface and extending human capability," he muses. "I'm not convinced that the place to do it is in a computer science context. It occurred to me that experimental architects are the minds that are [best] set up to talk about spacial interface, [and the] social and cognitive interactions that architecture already designs for."

Whether or not we're all using g-speak by 2021, the future of user interfaces is likely already in front of us, and may be more simple than it seems. "If we don't know how to design something, we ask what people would do in the real world, with other people," Underkoffler says. "That is always the answer." ▣

Tom Ward wrote about Anthony Geffen's Atlantic Productions in 11.18

ABOVE: SAUDI ARAMCO'S GIGAPOWERS SYSTEM INTERFACE, CREATED BY OBLONG TO SIMULATE OIL AND GAS RESERVOIRS

LEFT: THE REMOTE WAND THAT CONTROLS MEZZANINE G-SPEAK