# RE-TIMER

## INNOVATING A BETTER NIGHT'S SLEEP

Ever wondered why you wake up at roughly the same time each morning, whether or not your alarm clock is on? Well, it is because your body is programmed by circadian rhythms that dictate your sleeping and waking patterns. When these rhythms are disturbed, as may be the case with shift work, or international travel and time zones changes, the result is often insomnia. Disturbed sleep or insomnia is common, with up to 20% of Australians suffering the condition sporadically and 10% suffering chronic sleeplessness. As sleep is fundamental to our health and wellbeing with a lack of, or poor quality sleep affecting motor skills, memory and mental health, the benefits to finding a solution to this problem are significant.

**Background**

It was first demonstrated in the 1980's that bright light exposure could have a significant and direct impact on human physiological brain function. Light acts to suppress melatonin which is a key regulator of our sleep/wake cycle or 24 hour body clock. Since then, the use of bright light stimulation has been shown to change the timing of the body's circadian rhythm and light therapy devices are increasingly being used to reduce the effects of a range of conditions caused by a mis-timed body clock, including insomnia, jet-lag and Seasonal Affective Disorder. Although researchers have been using light devices since the 1980's as a treatment option, the standard delivery mechanism – the light box - provides inconsistent outcomes for users. Light boxes need to be used at a certain distance to ensure the correct intensity of light is received by the retina to create the desired physiological effect. In practice, the user will often not maintain a consistent distance and angle to the light source for the required 45-60 minutes of treatment, compromising efficacy.

To combat this problem, world renowned sleep psychologists Professor Leon Lack and Dr Helen Wright of Flinders University pioneered the use of eyeglasses frames to administer light. With over 25 years of research into sleep and sleep disorders, Professor Leon Lack and Dr Helen Wright are world experts in falling asleep, staying asleep and the effects of not sleeping enough.

Their in-depth and comprehensive research into sleep and sleep disorders has led to the development of a new, drug-free, means of reprogramming the body's circadian rhythms using wearable light technology. This research included clinical trials which demonstrated that the greatest melatonin suppression during light stimulation occurred with blue-green light (470-525nm), achieving a suppression of 70%. Furthermore the average sleep duration of participants increased by 42 minutes a night.

"Wearable light' enables users to go about their daily lives whilst gaining the benefits of light therapy. Because the light source moves with the wearer, the angle at which the light is delivered remains optimised at all times during usage.

**FROM LAB TO MARKET**

To take this "wearable light technology" from Flinders Sleep Research Laboratory to the marketplace in the form of an ergonomic, wearable device that consumers were willing to buy and use, took over two years, involving five clinical trials, extensive market research and due diligence, prototype design and development, IP protection, raising funding, the creation of a spin-out company and the recruitment of commercial partners.

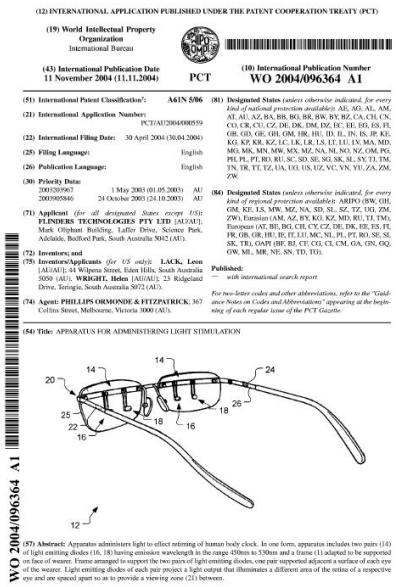
The result of these efforts is Re-Timer, the world's first wearable light therapy device. Worn like a pair of glasses, with an adjustable nose piece for customised fit, two levels of light intensity for maximum comfort, and portable and re-chargeable, Re-Timer is comfortable and convenient. LEDs embedded in glasses frames administer blue/green light to photosensitive ganglion cells in the retina, stimulating pineal gland and suppressing melatonin. The unique positioning of LED lights surrounding the pupil allows for maximum light to enter the eye while ensuring the peripheral retina is illuminated, rather than the macula. LEDs are positioned to the side of the eyes, so they do not form obstruction to the field of view. Re-Timer is worn while the wearer is awake, either in the morning or evening, depending on the desired change. A recommended schedule to change sleep outcomes is typically 7 days for 30 minutes each day. Re-Timer light is UV-free and has been independently tested for eye safety to the international standard CEI IEC 62471.

Flinders Partners provided tailored support and advice throughout the journey, working with multiple stakeholders including the inventors and research team, the University, government funding bodies and commercial investors and partners, ensuring that the project maintained momentum, stakeholders interests were protected and the impact and value of the research was maximised. To manage the commercialisation process and facilitate the recruitment of commercial partners and investors, Flinders Partners created a spin-out company, Re-Time Pty.

Early collaborations and investment partnerships saw Re-Time Pty win a "Commercialisation Australia" government grant in June 2010 and Ben Olsen was recruited as Managing Director in 2011, with a mandate to attract and manage investors and design and manufacturing partners for the device. Drawing on its extensive networks, Flinders Partners worked closely with Re-Time Pty to identify prospective commercial partners and facilitated an introduction to SMR Technologies. SMR Technologies had traditionally been an automotive manufacturer with strong capabilities and an asset base supporting manufacturing in lighting, electric drive units, coating and mouldings.

The company was actively pursuing an innovation and diversification strategy and, when presented with the opportunity to contract manufacture and invest in the Re-Timer device, were immediately interested. There followed a period of intensive due diligence on both sides, to ensure strategic fit and validate the technology and the market opportunity.

Market research validated the scale and accessibility of the commercial opportunity; this was a global and growing market, valued at over US$ 5 billion globally for insomnia products alone, competitive solutions, such as Philips GoLite were inferior and a number of customer segments and applications were identified such as Insomniacs (75 million in US), particularly elderly and adolescent, Jet Lag Sufferers (20 million in US), Shift Workers (22million in US) and SAD sufferers (35 million in US).



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(71) Applicant (for all designated States except US): FLINDERS TECHNOLOGIES PTY LTD [AU/AU]; Mark Oliphant Building, Laffer Drive, Science Park, Adelaide, Bedford Park, South Australia 5042 (AU).

(72) Inventors; and

(75) Inventors/Applicants (for US only): LACK, Leon [AU/AU]; 44 Wilpena Street, Eden Hills, South Australia 5050 (AU). WRIGHT, Helen [AU/AU]; 23 Ridgeland Drive, Ternagie, South Australia 5072 (AU).

(74) Agent: PHILLIPS ORMONDE & FITZPATRICK; 367 Collins Street, Melbourne, Victoria 3000 (AU).

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(54) Title: APPARATUS FOR ADMINISTERING LIGHT STIMULATION



(57) Abstract: Apparatus administers light to effect retiming of human body clock. In one form, apparatus includes two pairs (14) of light emitting diodes (16, 18) having emission wavelength in the range 450nm to 530nm and a frame (1) adapted to be supported on face of wearer. Frame arranged to support the two pairs of light-emitting diodes, one pair supported adjacent a surface of each eye of the wearer. Light emitting diodes of each pair project a light output that illuminates a different area of the retina of a respective eye and are spaced apart so as to provide a viewing zone (21) between.

WO 2004/096364 A1

The project moved into a development phase and product design and development became the focus of activity. Over the course of two years, a team of seven engineers, two ophthalmic experts and two sleep psychologists designed Re-Timer. 1,900 hours of work time was spent, in one year, on computer-aided design alone. The product went through four design iterations and 160 logged design changes later. Protecting the Intellectual Property created was critical to commercialisation and Re-Timer is subject to 11 patents filed in May 2003 and there are active patents in several jurisdictions including the US, Europe and Australia.

SMR Technologies invested as a joint-venture partner in Re-Time Pty, providing much needed financial investment as well as manufacturing expertise, market access and human resources. At SMR the project team included about 20 – 25 staff from boardroom to shopfloor, across multiple disciplines, including design, manufacturing, quality and testing, marketing, scheduling and procurement. In addition to design, they undertook the production of a new manufacturing cell with new testing capabilities, the development of new quality processes, engaging new parts suppliers and, ultimately, the development of a new, controlled environment, manufacturing facility, purpose built for the device.

## OUTCOMES AND BENEFITS

In November 2012 the Re-Timer device was successfully launched on the market as a world first in wearable sleep technology. Within two years, it has become a market-leader in wearable light therapy devices, is an export success, with 85% of sales shipped outside Australia to 40 countries and is profit generating. The spin-out, Re-Time Pty, was voted Australia's 9th most innovative company in 2013 (Anthill Magazine SMART 100 Companies). The launch, in November 2012, attracted global media coverage including the Wall Street Journal and resulted in over 30,000 views of the company's YouTube channel. The company sold out of stock in the same week it launched. The combination of a strong industry partner with world-class research and an experience commercialisation team highlights the potential of innovation partnerships.

For SMR Technologies, in addition to a new, high-value, revenue stream the business has built expertise and proven its capabilities in the medical devices sector and continues to pursue a range of opportunities in these new and attractive markets.

The project has had a deep and positive impact on the culture at SMR. As a large organisation, with a long legacy in the traditional automotive industry, a significant shift in culture was needed to manage a transition from embedded processes and systems to new, innovative and unfamiliar approaches. The success of the Re-Timer project has helped to showcase the opportunities available and to prove the company's ability to move into new products and markets. SMR technologies has applied for global certification as a medical device manufacturer, a move that will support its ongoing diversification and which will open up more innovation and partnership opportunities and, ultimately, secure the future of 500 staff.

Flinders University and Re-Timer have continued to work closely since it spun-out. After 25 years, the research team have the satisfaction of seeing their efforts bear fruit and are rewarded with a stake in the spin-out company. Re-Time Pty continues to collaborate with them to investigate further research and commercialisation opportunities, including the publication of an ebook on sleep health. Re-Time has utilised other sleep expertise within Flinders to conduct clinical studies into additional applications of the Re-Timer device. This has led to research funding flowing back into the University and additional publications. The Re-Time story has been integrated into undergraduate and post-graduate teaching on commercialisation of research and the Re-Time CEO has acted as a mentor to Flinders staff.

The Re-Timer project is an example of how research institutions can collaborate with local manufacturers. Re-Time Pty Ltd is currently investigating other opportunities for its product portfolio most of which are collaborative opportunities.

From a broader perspective, Re-Timer is improving people's lives. Feedback indicates that Re-Timer has helped; reduce the use of sleeping tablets, allow people to sleep earlier and longer, manage early morning shift work schedules, make people feel more energetic in the mornings and reduce jet lag for frequent flyers. Danielle Scott, Olympic Aerial Skier for Australia, states "Re-Timer has really helped me to prepare and adjust to the time zones throughout the competition season. Usually I find myself waking in the middle of the night and not being able to fall back asleep. This can be detrimental to training and competition preparation, so Re-Timer has helped me get ahead of the game and be ready to perform at my best".

**RELATED MEDIA**

**http://www.flinders.edu.au/people/leon.lack**

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**Wall Street Journal Article - http://www.wsj.com/video/curing-jet-lag-with-light/940E5600-681A-4A0F-8528-1C4737F6EDE7.html**

# CLEVERTAR

Ever wondered whether artificial intelligence and human-machine interaction really can really improve human welfare?

Researchers at the Artificial Intelligence Lab (AI Lab), based in the School of Computer Science, Engineering and Mathematics at Flinders University, explore this question daily. AI Lab is a world class research facility focussed on creating machine-based 'intelligence' to improve human welfare. Their Head X Research Platform, with a major focus on the 'Thinking and Teaching Head ', is one of their core projects. Research has found that when people interact with these 'embodied conversational agents' they tend to be more attentive and honest in their responses, are more likely to understand and trust the information given and are highly engaged in the interaction, both in the short and longer term. This engagement creates an ideal situation to positively influence user behaviour.

Clevertar, a spin-out company from AI Lab, has applied this research to become an expert in designing and developing relational agents – 'clever avatars' – for healthcare. Relational agents have been shown to attract attention, encourage healthy living, improve adherence to medication and treatment and motivate and empower users.

**BACKGROUND**

Clevertar's key service offering using relational agent technology is Anna Cares. Anna Cares is a revolutionary software application for health and aged care providers and their clients which combines mobile care and case management capabilities to support more efficient and effective health management. The platform is designed to support custom solutions, for example, in long-term health coaching, to engage, monitor, and educate consumers.

Anna Cares was developed for older people who want to maintain their independence at home and who have connections with family or service providers who support them. In Australia, this is conservatively estimated to be 0.5 million people. The web application is designed for care providers who need to manage multiple clients, which in aged care equates to 1,700 providers. Naturally, these markets can be extrapolated to other developed countries. The product market can also be expanded to other similar domains, such as chronic disease self managment. The Care Management Systems market is estimated at $4 billion globally and is projected to grow at 21% for the next several years. Clevertar intends to penetrate this growing market by solving the learge and expensive problems evident in the hearlth and care economies.

Backed by AI Lab science, 'Anna' is a personal assistant for iPad, designed to help clients with day-to-day activities and aimed at improving/maintaining their health and activity regimes. She is a talking, interactive assistant, supporting clients and helping them maintain their independence. Anna Cares manages the daily relationship between the patient and health care provider, allowing the provider to connect with and monitor client wellbeing on a daily basis, avoiding time-consuming phone calls and visits and focusing on genuine care coordination rather than routine disruptions. Thus, Anna Cares extends the care workforce at a fraction of the cost of human intervention, and is therefore ideally suited to environments where consumer adherence to their care plan is critical for successful self-management. Anna Cares also allows family members and other caregivers to seamlessly join the network.

Clevertar is also the technology provider for the My Diabetes Coach (MDC) virtual health coach system. Built through collaboration between the Bupa Health Foundation, The University of Melbourne and Diabetes Australia, the MDC system comprises a virtual health coach named Laura who delivers regular health coaching to people with Type 2 diabetes. This is done via their iOS or Android smart phone or tablet devices. Laura also receives blood glucose readings, monitoring the consumer over time, and sending alerts to the case manager when concerns arise.

In addition to healthcare, AI Lab's research and technology has numerous applications across human-machine communication including: telecommunications, e-commerce and mobile phone technology; personalised aids for disabled users, the hearing impaired, the elderly, and children with learning difficulties; foreign language learning and will also facilitate the development of animation in new media, film, and in particular games.

**FROM LAB TO MARKET**

Dr Martin Luerssen, an artificial intelligence specialist from Flinders University, played a key role in 'The Thinking Head' research program. His research forte is in the field of nature-inspired computing, specifically the application of biological principles to machine learning. With a comprehensive background in computational intelligence, Dr Luerssen is responsible for the 'clever avatar' technology which uses animated characters that interact with customers in a human-like way – creating social situations that didn't exist before. "CleverMe" was the original spin-off from that research.

To test the software and validate the technology, a commercial partner was sought. Rossdale Homes, one of South Australia's most respected builders, came on board as a partner, hosting a demonstration application of the CleverMe technology as a virtual guide for customers to "visit" their display homes. The initial Rossdale application enabled CleverMe to establish its legitimacy as a technology provider and demonstrate its application to other partners and customers. This proved the initial concept in this context: virtual characters are engaging.

In 2012, Clevertar, formerly CleverMe, was founded by Dr Martin Luerssen and Ms Tanya Newhouse as a vehicle to commercialise technologies, particularly innovative software developed in Flinders University's AI Lab, with the aim of bringing these technologies to a global market and realising their social and commercial potential. The company focused on product and market testing and development through collaboration with a range of commercial partners. In early 2012 it released an iPhone/iPod Touch app targeting tween-age girls with partner Pacific Magazines. The app was highly novel and game-like and was a real life demonstration of both the appeal of this interaction technology and the behaviour of this market segment. Early financial support, through a $240,000 Australian Government commercialisation grant, supported the development of a platform for use in care settings. Helping Hand, a not-for-profit organisation offering home care services, retirement living and residential care homes to over 7,000 clients in metropolitan and regional South Australia, undertook trials throughout 2014 and provided valuable feedback on functionality and market readiness.

In late 2014, Mark Pitcher was appointed as Chief Executive Officer of Clevertar to provide strategic direction and oversee day-to-day operational execution. Mark brought extensive experience as a senior leader across a range of industries and had been responsible for successful start- ups, venture capital injections and IPO'S, through to successful exits.

In mid-2015, Clevertar entered into a strategic partnership with Konica Minolta who injected $600,000 into the business enabling further market expansion and scaling operations.

Throughout this commercialisation journey, Clevertar worked closely with Flinders Partners, the commercialisation arm of Flinders University. Flinders Partners acted as a facilitator, providing advice and support in stakeholder negotiations, product prototypes, market research, legal/IP negotiations, corporate structure, financial evaluations, funding applications and investor management and deal structuring.

**OUTCOMES AND BENEFITS**

The Care Management Systems market is estimated at $4 billion globally and is projected to grow at 21% for the next several years. Clevertar is well positioned to be a commercial success story and take a significant share of this growing, global marketplace. A pilot trial of 'Anna Cares' is currently being conducted in Pennsylvania, ahead of a staged expansion in America. The company is already a technology leader with a multiple award wins at Tech23 and two South Australian-NT iAwards for Best New Product and Best Health Product.

The commercial partnerships proved to be a win-win for all involved. The partners gained insights and access to technologies and innovations outside their core business, whilst Clevertar gained access to commercial resources and reputation, market channels and customers to rapidly validate product fit and market adoption.

For Konica-Minolta, the strategic partnership with Clevertar helps advance its strategic objectives of being pro-innovation and pro-Australian start-up. It has recently established an Australian-based Innovation and Healthcare team which furthers the work of its Asia-Pacific Business Innovation Centre (BIC). The BIC understands that an ageing population will become increasingly reliant on mobile technology solutions to help people stay in their homes for longer. This view is shared by Clevertar and the companies are working together to revolutionise healthcare delivery.

Finally, Clevertar's relational agent technology helps consumers better manage their chronic conditions, keep healthy, stay out of hospital and maintain independence, resulting in quality of life improvements for patients and their families. Lower costs and more effective and efficient healthcare management, result in financial and human resource gains for healthcare providers and a reduction in the burden on the economy.

**RELATED MEDIA**

http://www.flinders.edu.au/science_engineering/csem/research/centres/ckit.cfm

http://www.flinders.edu.au/science_engineering/csem/research/programs/thinking-teaching-head/

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