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THE POTENTIAL OF
TECHNOLOGY AND DESIGN

SUTD

SINGAPORE UNIVERSITY OF
TECHNOLOGY AND DESIGN

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TIME CAPSULE - DESIGNED BY
ASSISTANT PROFESSORS CARLOS BAÑÓN
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MANY FIRSTS FOR SUTD’S GRADUATION



From left to right, PSC Scholar Leong Hei Kern, STEP graduate Pek Yun Ning, MUSPP graduate Zulkifli Fatin, and father and daughter graduates Yeo Kee Teck and Shireen Yeo.

More than 580 students celebrated their graduation in September. This fifth batch of graduates consisted of more than 430 undergraduates, 106 Masters and 44 PhD students. SUTD also celebrated several firsts at this year’s event.

This included our first:

- Public Service Commission Scholarship holder
- Batch of SUTD Technology Entrepreneurship Programme (STEP) graduates
- Batch of Masters of Science in Urban Science, Policy and Planning (MUSPP) graduates
- Father and daughter graduands.

SUTD’S FIRST PSC SCHOLARSHIP HOLDER

Valedictorian Leong Hei Kern is SUTD’s first Public Service Commission Scholarship holder. Hei Kern has been part of the SUTD family since his polytechnic days, where he studied mechanical engineering. He came to know about SUTD through his participation in the IDC Robocon 2010 (Shanghai), which is a competition where students from different universities and nationalities form teams to build robots. He was also an SUTD ‘campus builder’ in 2015 before joining the University for his undergraduate studies, where he did research and helped develop course materials for an Engineering Product Development module. During his Freshmore year, the common curriculum gave him a better understanding of where his passion lies, and led him to change his field of study – from mechanical engineering to electrical engineering. Hei Kern is now pursuing a Master in Energy Science and Technology at ETH Zurich.

Hei Kern said: “When I come back to serve in the Civil Service, I want to contribute to Singapore’s Smart Nation initiative, advancing Singapore’s energy infrastructure sector, in the areas of power distribution, alternative energy and electric cars.”

FIRST BATCH OF STEP

Graduating from the first batch of the SUTD Technology Entrepreneurship Programme (STEP), Pek Yun Ning received a Master of Science in Technology Entrepreneurship and a Bachelor of Engineering in Engineering Systems and Design. To date, she has founded/co-founded four start-ups which span the areas of climate change, education, music and entrepreneurship. Yun Ning joined investment management firm, Schrodgers, after graduating.

She will continue to keep her hands in her start-ups as she believes that the mental training building a start-up provides, will help keep her mind fresh for innovation, creativity and agile problem solving. Yun Ning’s secret wish is to be able to automate as many processes and decision-making as possible, so that humans can focus more on the quality of lives. She aims to achieve this by attempting

to give computers the ability to make investment decisions quicker and better than human beings, starting with her job at Schrodgers.

FIRST BATCH OF MUSPP

Zulkifli Fatin has been an air traffic control officer at the Civil Aviation Authority of Singapore for the past five years. Last year, out of personal interest to upskill and her passion in urban transportation, she took up SUTD’s one-year Masters programme in Urban Science, Policy & Planning; unsponsored by her company. Fatin wanted to couple her operational experience with further study on how transportation impacts urban policy and planning issues, such as regional connectivity, the economy and service delivery. One of the subjects in the programme that was new to her was data analytics. And Fatin has found particular interest in how to use data to drive informed policy and planning decisions. Fatin has benefited greatly from the Masters programme, and hopes to take on more challenges in her job in the future.

FIRST FATHER AND DAUGHTER PAIR TO GRADUATE TOGETHER

54-year-old Yeo Kee Teck is a graduate from SUTD’s Master of Science in Security by Design (MSSD) programme. He graduated with his daughter, 24-year-old Shireen Yeo Shi Yun, who received her Master of Architecture (M.Arch) from SUTD on the same day. Shireen had graduated with a Bachelor of Science in Architecture and Sustainable Design in 2016. She worked for two years in interior architecture followed by architecture consultancy. In 2018, she returned to SUTD to complete her M.Arch.

For Kee Teck, the MSSD was his second Master’s degree; his first was in electrical engineering from NUS. He is a researcher at the ST Engineering Electronics-SUTD Cyber Security Laboratory. Kee Teck took up the MSSD programme as he aspires to keep abreast with technology. Through the MSSD programme, Kee Teck acquired comprehensive knowledge on how to design cyber security into systems and other skills that were directly relevant to his work. Kee Teck continues working in the area of cyber security after he graduated.

Shireen was the one who told her father about MSSD. She said: “I thought it would be a good chance for my father to expand his expertise and pursue something I know he had interest in since long ago. Furthermore, I know that he already had a good impression of SUTD while I was doing my Bachelor’s here. Hence, I told him about it and my whole family was supportive of his decision to take up the programme. I’m proud of my father as I know it must have been hard for him going back to school at his age but I’m glad he had a fulfilling time at SUTD.”

REFLECTIONS FROM STUDENTS ON BEING A CEO FOR A DAY

Three SUTD students participated in the CEOxIDay (CEO for a Day) initiative organised by Odgers Berndtson, that matched them up with top CEOs in Singapore, providing them with the opportunity to walk in the shoes of a CEO for a full day.



Jing Deng from the SUTD-SMU Dual-Degree programme shared about her experience shadowing Janssen Pharmaceutica’s Asia Pacific Group Chairman, Ms Ong Ai Hua.

“As I have always been interested in the healthcare industry, this opportunity was truly invaluable to me. Ms Ong is a really charismatic leader! Having attended a few meetings with her, I realised that she is very open-minded and she values inputs from everyone. In the meetings, everyone was free to speak their mind. I believe Ms Ong really leads through the energy that she carries with her. From the way she spoke, to the way she greeted everyone along the corridors, spirits were lifted and it was obvious that she is strongly driven by her passion. I have also learnt that she motivates people through trust. She first trusts that everyone wants to do their best, and in turn, this optimism motivates her employees to give their best. I was really inspired by her and the people from Janssen and I believe they share a common vision for the company.”



Bai Xuefei from the Engineering Systems and Design pillar, shadowed Singapore Life’s CEO and entrepreneur, Mr Walter de Oude.

“Walter said his typical day usually starts with conversations to make sense of the latest work progress and to provide direction if needed. Clear communication is vital in a start-up environment to build trust among employees and within a team. And talking with colleagues was exactly the first thing Walter did when he arrived at the office.

Next, we had an interview with Global Views Monthly, an internal management meeting and an external meeting with potential investors and business partners. Walter is good at speaking with different people and making them feel at ease. He also has the ability to manage various conversations. The success that Singapore Life has achieved in a short span of five years could not have been done without Walter’s stakeholder management and interpersonal skills. In his opinion, managing people with different work styles

in the same team is one of the most difficult tasks, requiring techniques and patience.

After several meetings, we took a cab to attend the Independent Wealth Management forum. There, we had two more meetings on branding and external collaborations. I was amazed by both the breadth of knowledge and the amount of energy he had at work. At the end of the day, Walter shared with me about his unbridled inquisitiveness since a young age and how he wanted to make a difference by establishing Singapore Life. It is his firm belief in what he is doing that drives him to learn more and pursue greater achievement.

I asked Walter what he wished he could have done back in university. He shared that his regret was not taking enough courses outside his curriculum, and surprisingly, some dating tips. My CEO for 1 day ended with a warm conversation and much laughter. This unique and once-in-a-lifetime experience gave me the opportunity to interact with a sincere and transformational leader, and to learn from a real entrepreneur. Inspired by Walter’s great personality, broad spectrum of knowledge and passion for work, I hope I can make the most of the rest of my time in university and apply such leadership skills in an organisational context upon graduation.”



Tan Jia Hao, from the SUTD-SMU Dual-Degree programme, spent a day with Mediacorp CEO, Ms Tham Loke Kheng.

“Previously, as a TV-content consumer, I was oblivious to the immense efforts involved in content production, product marketing, etc. The one-day immersion, which included exclusive tours to the filming and recording studios, allowed me to experience different facets of the media industry. In particular, I was amazed by how different departments within Mediacorp were able to synergise and contribute to the eventual success of a media product. This synergy is especially prevalent and integral in the production of large-scale programmes such as, the General Elections, etc.

I also had the opportunity to hear from Ms Tham about the challenges facing the media industry and how Mediacorp has been restructured recently to better address market needs. I managed to share my candid views about what drives my generation of employees in the workplace.

Through this immersion programme, I have recognised the importance for a company to constantly adapt to changing market conditions in order to stay relevant in the industry. These adaptations are not limited to product innovations, but also include “softer” aspects of the company, such as the company culture and organisation.”

SUTD CELEBRATES ITS 10TH ANNIVERSARY



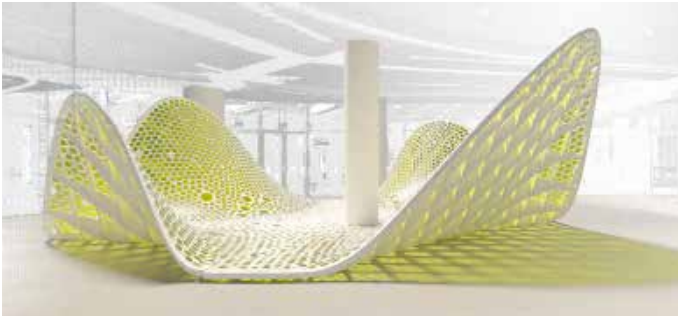
From left to right, Mr Philip Ng (SUTD Founding Chairman), Mr Lee Tzu Yang (SUTD Chairman), Education Minister Mr Ong Ye Kung, Prof Chong Tow Chong (SUTD President) and Prof Thomas Magnanti (SUTD President Emeritus) launching the SUTD Birthday Tree.

In celebration of its 10th anniversary, SUTD organised a slew of events and activities to commemorate its journey from a university with no ‘there there’ to what it is today. Since its establishment in 2009, SUTD has accomplished much and some of its more significant achievements are as follows:

- Produced five batches of graduate students since 2015 and achieved 94% employment rate in 2018
- Expanded partnerships to over 40 institutions across 14 countries for student exchanges, internships etc.
- Opened 13 research centres
- Produced over 40 start-up companies
- Launched the SUTD Academy, SUTD’s adult learning institution
- Topped the list of emerging engineering schools in the world (in an MIT report)
- Awarded fifth-most influential scientific research institution in telecommunications by Clarivate Analytics
- Nature Index listed SUTD in both the Top 25 Rising Young Universities and Top 100 Young Universities lists.

SUTD’S 10TH ANNIVERSARY CELEBRATION EVENT

On 10 July, SUTD held a celebration event in honour of its 10th anniversary. Guest-of-Honour, Minister Ong Ye Kung, together with SUTD Chairman, Mr Lee Tzu Yang, SUTD Founding Chairman, Mr Philip Ng, SUTD President Emeritus, Prof Thomas Magnanti and SUTD President Prof Chong Tow Chong, launched the SUTD Birthday Tree using customised rings that were delivered to them by a robot. SUTD students had designed the technology behind the Birthday Tree, robot and the rings. Subsequently, they also unveiled the faculty-designed and built time capsule.



SUTD’s time capsule

Designed by Architecture and Sustainable Design faculty, Assistant Profs Carlos Bañón and Felix Raspall, the time capsule would preserve and exhibit the university’s most significant innovations and milestones over the past decade for the next 20 years. In total, there are 33 artefacts in the time capsule.

The design of the Capsule coordinates form and materials to reflect the ambitious and adventurous spirit of the young university. The form of the Capsule represents the cyclical nature of time: a periodic surface peels from the ground in an oscillating motion, holding the collection in a secure yet open space. To create this unique form, digital tools and advanced manufacturing methods were developed and applied. The Capsule’s surface consists of 3,582 unique panels, which were computationally designed and 3D printed with biopolymers, producing zero waste. This surface sits over a timber structure, optimised to reduce material consumption and emphasise the feeling of lightness. Over 800 guests from the industry, academia and government attended the anniversary celebration.

SUTD’S 10TH ANNIVERSARY FUNDRAISING GALA DINNER

SUTD also organised a fundraising gala dinner for its 10th anniversary on 23 October at Shangri-La Hotel. Deputy Prime Minister Heng Swee Keat was the Guest-of-Honour, and in his address to the university, he challenged SUTD students to make “Singapore a better nation by design”.

Excerpt from DPM Heng’s speech:

“Your motto is to make “A Better World by Design”. I would like to challenge you to make Singapore “A Better Nation by Design”.

Many significant changes are coming our way. How do we turn these changes into opportunities? For example, how can we mitigate and adapt to climate change and innovate with new technologies and designs. How can we continue to have a vibrant economy and share the benefits of economic growth? How would we reimagine and rebuild Singapore so that it is both an exceptional nation of opportunities and an endearing home for all? And how do we harness diversity and build a more inclusive society, where each of us can Dream, Dare, and Define ourselves?

With SUTD’s unique offering of inter-disciplinary studies and integrating systems and design thinking – I hope you will continue to produce graduates who will continue to Dream, Dare and Define.”

At the gala dinner, SUTD made multiple announcements, including two significant new donations, a new Patron, and the inaugural SUTD Benefactors Fellows Awards.

The two endowed gifts, \$3 million by the Quantedge Foundation (Singapore) Ltd and \$1 million by Expand Construction Pte Ltd, will allow SUTD to provide greater support for more students from less privileged backgrounds, ensuring that education at SUTD remains accessible and affordable.



Receiving the endowed gifts from Quantedge Foundation, from left to right, Mr Sam Goi (SUTD Patron for Advancement), Prof Chong Tow Chong, Deputy Prime Minister Mr Heng Swee Keat, Mr Suhaimi Zainul-Abidin (Quantedge Foundation Board Member)

Quantedge Foundation Board Member Suhaimi Zainul-Abidin said “Social mobility is a key priority for our foundation. Every student from an economically disadvantaged background who qualifies, by merit, to attend university, but has to give that up due to uncertainty in securing sufficient financial aid, adds to social stratification in our society.

We are excited to support SUTD’s commitment to guarantee full financial aid for all Singaporean students with demonstrated financial need. This SUTD guarantee assures the availability of full financial aid to Singaporeans across a broad range of programmes offered by SUTD. We hope to see all other autonomous universities in Singapore stepping up to ensure the availability of truly need-blind university education to Singaporeans in the future.”

Mr Von Lee, Chairman and Founder of Expand Construction, said, “Expand Construction is proud to be given many opportunities to build iconic structures in the past 20 years including the Lion Grove Supertrees at Gardens by the Bay. We hope the Bursary, our contribution back to the society, will empower underprivileged students to continue to build their dreams. Together we can enhance our National Build Capabilities in the years ahead.”

The event also marked Mr Sam Goi, Executive Chairman of Tee Yih Jia Group, taking over the mantle of SUTD’s Patron for Advancement from Emeritus Senior Minister Goh Chok Tong. As one of SUTD’s pioneer Board of Trustees and the former Chairman of SUTD’s Advancement Sub-committee, Mr Goi led SUTD’s fundraising efforts to measurable success.



SUTD’s 10th Anniversary Gala Dinner reception

As Patron, Mr Goi will continue to help steer SUTD’s fundraising efforts as well as garner partners and donors who have a heart for educating and nurturing the next generation of leaders and innovators.

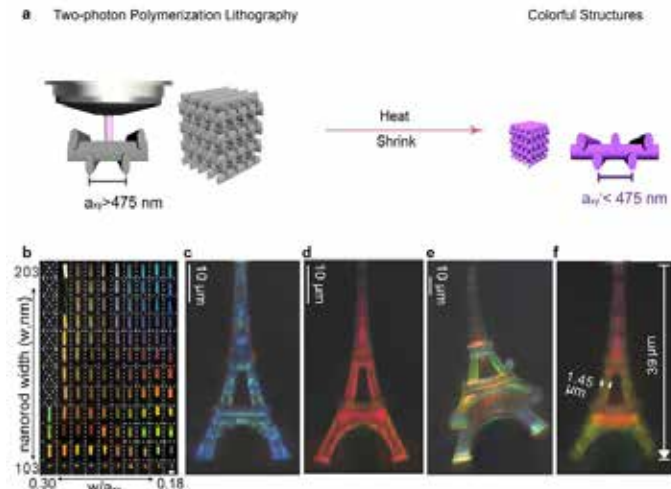
During the gala, SUTD presented its inaugural Benefactors Fellows Award to two distinguished individuals:

- Mr Philip Ng (SUTD Founding Chairman and major donor to SUTD), and
- Mr Sam Goi (Founding Chairman of SUTD’s Advancement Sub-committee and a major donor to SUTD)

This award confers the highest honour on benefactors whose contributions have been of paramount significance to the University.

Around 500 donors and guests from the industry, academia and government were present at the event.

SMALLEST COLOURFUL MICROSCALE EIFFEL TOWER 3D-PRINTED WITHOUT USING PIGMENTS OR INK



Heat-shrinking induced colours of 3D printed woodpile photonic crystals. (a) Schematic of the fabrication process. Left: Woodpile photonic crystal. Right: After heat treatment, the dimensions of the photonic crystal are reduced below the resolution limit of the printer and colours are generated.

The colours change with different degrees of shrinkage. (b) Composite optical micrographs of heat-treated woodpile photonic crystals with varying structural dimensions as viewed from the side; the Eiffel Tower in (c) structural blue, (d) structural red, (e) oblique view with intentional gradient of colours and (f) further down-scaled multi-colour model.

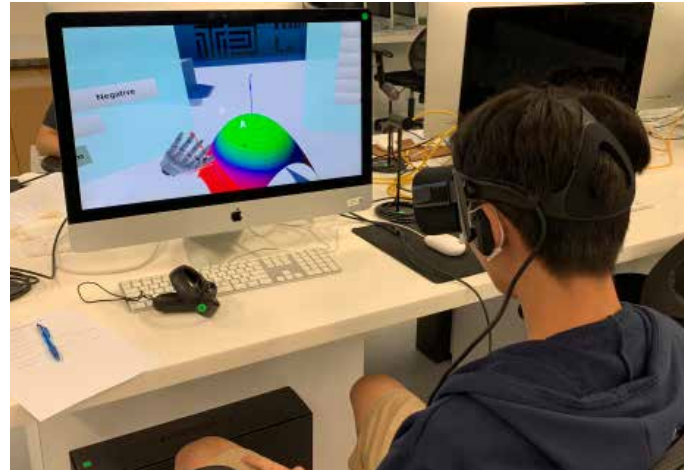
A research team led by Associate Professor Joel Yang from the Engineering Product Development pillar, printed probably the smallest colourful 3D model of the Eiffel Tower. Impressively, no pigments or inks were used. Instead, the 3D-printed model of the Eiffel Tower, measuring less than half the width of a human hair at 39 micrometers, exhibits multiple colours due to the manner in which light interacts with the nanostructures that hold up the model. The 3D model is made of a finely printed mesh of transparent polymer, forming photonic crystals. The design remarkably shrinks down in size by about five times when heated to produce a wide range of colours.

Prof Yang said: “There is great excitement in the research community to further develop sustainable sources of colours that aren’t extracted from animals or plants. What if the products that we make could derive its colour by nano-texturing of the material that it itself is made of? Certain butterflies and beetles have evolved to do this, perhaps we could learn to do this too.” Compared with pigments and dyes relying on chemical composition, structural colours are high-resolution, permanent and eco-friendly.

SUTD researchers have developed a “colouring-by-shrinking” method to print arbitrary 3D microscopic objects exhibiting structural colours. The design consisted of woodpile photonic crystals with varying lattice constants as the 3D building blocks. These structures remain colourless until they are heat treated, causing them to shrink and manifest colour, a result of their lattice constants shrinking down below the wavelength of visible light. A detailed report of this research can be found in Nature Communications.

TEACHING MATH IN VIRTUAL REALITY

BY JACOB CHEN



Student using VR to learn math

Over the past 1.5 years, three of us (PhD candidate Jacob Chen, researchers Song Young Bin and Alan Ng) who initiated the Immersive Realities Lab have been working on spearheading augmented reality/virtual reality (AR/VR) in SUTD. Having used these tools in prior projects, we felt that there was great potential in this new medium of presentation and communication. Not only did it promise a whole new paradigm of user experience, there were also obvious signs that industries of different fields (like architecture, video/movie production and automobile) have begun picking it up.

After our initial collaboration with the Architecture and Sustainable Design pillar to bring VR into Core Studio 2 earlier this year, the team started seeking out other areas that could potentially benefit from some experimental teaching contents. Thus, we started working with the Advanced Math 2 course leads, Senior Lecturer Dr. Sergey Kushnarev and Faculty Fellow Dr. Keegan Kang from the Science and Math cluster. The specific topic of partial derivatives in Multivariate Calculus was chosen as the target content for the initial prototype, as traditionally, it is a basic concept that some students may find difficult to visualise.

After a period of two months, we developed many iterations on how to bring concepts traditionally taught through 2-dimensional mediums like print, computer screens and whiteboards, into a 3-dimensional, immersive and interactive space. This hands-on learning activity in VR was introduced to the Freshmore classes in October. After the 15-minute activity, students were also tested in VR on their understanding of the concepts. Preliminary results suggested that the pilot run of the VR app went well and students indeed gained better understanding of the concepts via VR compared to traditional teaching formats.

Dr Kushnarev said: “We always felt that VR is uniquely suited as a learning environment for Multivariate Calculus, since it allows students to visualise and be completely immersed in a 3D world. I can see that students were really excited to go through all the explanations and activities in VR. Our future goal is to incorporate more topics from Calculus into the VR environment to better students’ understanding.”

The Immersive Realities Lab aims to be a development and research hub for interactive immersive experiences, and is now actively working on furthering a framework for developing educational content with AR/VR.

SUTD STUDENTS WIN TOP PRIZE FOR THE URA-REDAS SPARK CHALLENGE

BY VOON SOO JUN

Two students, Sally Tan (Master of Architecture) and Voon Soo Jun (Engineering Systems and Design pillar) who teamed up to participate in the URA-REDAS Spark Challenge, won the top prize for their efforts on ‘Musical Chairs’.

The two students decided to take on the Challenge because they could relate to the problem statement – “Connecting People in the City”. In public areas, the two noticed how most people tend to keep within their own bubbles or spaces, constantly looking down at their phones instead of the world around them and preferring seats in public transport with empty adjacent seats. Hence, they attempted to spur a change in this habit with their interactive installation.

By playing with the environment, such as the strategic arrangement of chairs and changing light formations, the students were able to capture the attention of passers-by, bring them together and lower the barrier of initiating conversations between strangers. The chairs were fitted with sensors that could detect weight changes when someone sat on one chair, the adjacent chair would light up to encourage the next passer-by to sit beside the first.

During the prototyping phase, the duo faced issues trying to keep within the budget provided and ensuring good safety standards. In the end, they managed to overcome them and gained a rich learning experience from it all. This project is a stellar example of SUTD’s mission to train technically grounded engineers and architects to work together on multi-disciplinary projects.

Soo Jun said: “This project has taught us lessons that go beyond the classroom and we were proud to have won this challenge with our design. We hope that our installation makes a lasting impact on users and most importantly, help them make new friends!”



‘Musical Chairs’ installation

DIGGING DEEPER INTO INNOVATION AND DESIGN THINKING



Prof Lui Pao Chuen giving a talk titled ‘Transformation and Innovation’

Professor Lui Pao Chuen, member of SUTD Board of Trustees, gave a talk on ‘Transformation and Innovation’ in SUTD on 25 September.

Prof Lui, also adviser to the National Research Foundation, Prime Minister’s Officer and six other Ministries and Government Agencies, was the former Chief Defence Scientist in his last 22 years of service in MINDEF, having served the Ministry for a total of 41 years.

In his talk, Prof Lui pointed out that Singapore’s investment in research and development has grown exponentially over the years, underscoring the importance of innovation. He cited Singapore’s first rock caverns as a prime example of the creative use of land in our land-scarce country.

He shared his experience in spearheading the development of Singapore’s Underground Ammunition Facility. It was recognised as the world’s most compact and urban ammunition dump for its large capacity.

The facility came about as an innovative solution to MINDEF’s requirement to move its ammunition storage site to free up land for residential and industrial usage. This eventually led to the development and opening of the Jurong Rock Caverns in 2008. He also spoke of using the rock caverns as possible solutions to water shortage and flooding in Singapore.

In his conclusion, Prof Lui urged SUTD to continue to think out of the box and be bold to try out unconventional methods when taking on challenges. In doing so, he explained, SUTD will then be viewed as the foremost university in the world for its research, technology and design education.



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