

「科技與倫理」系列座談—

葉祖堯博士、張經霖教授談 科技發展危機

Forum on Ethics and Technology Series -

Professors Raymond Yeh and Henry Chang Discussed the Technology Development Crisis

盧基文/譯

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萬佛城常住眾葉祖堯博士曾在賓州州大、德州大學奧斯汀分校、明尼蘇達大學、馬里蘭大學帕克分校等大學教電腦，並在德州大學與馬里蘭大學擔任電腦系系主任。在他領導下，將這兩個學系提升至全美前十大電腦系。也曾任電子電機工程師學會IEEE軟件工程匯刊創刊主編、系統整合創刊主編、國際軟件工程年會ICSE創辦人、國際軟件工程學會共同創辦人。跨領域研究學術機構—「設計與流程科學協會」及「美國跨領域高級研究學院」共同發起人；他並應邀擔任聯合國北京軟件研究室首席董事。

面對近年電腦與人工智慧的飛躍發展，葉博士有若干省思。2015年暑假，台北淡江大學物理系前系主任與現任教授張經霖到萬佛城短期修行，遇上同為科學界出身的葉博士，兩人於九月初在法界佛教大學舉行「科技與倫理」系列座談會的第一場「科學對社會的影響」，呼籲大家關注科技進展至今，全世界已逐漸面臨科技將控制人類的危機。

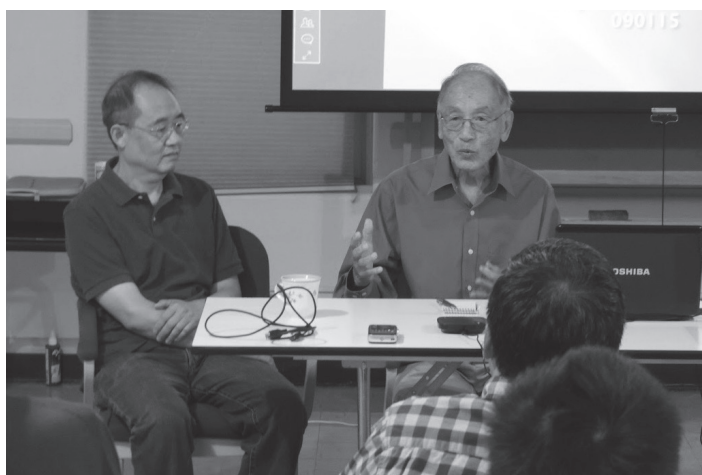
葉祖堯指出，曾獲諾貝爾獎的赫伯特·賽門在1956年已經預言，到2045年機器將能做人類所能做的絕大部分事情，即使不是全部的事情。谷歌公司工程主任瑞·柯智偉則預言，2045年將是「技術奇點」來臨的時候，屆時電腦或機器人理論上能

Dr. Raymond Yeh is a resident at the City of Ten Thousand Buddhas (CTTB). He taught computer science at Pennsylvania State University, the University of Texas at Austin, the University of Minnesota, and the University of Maryland at College Park. He was also Chairman of the Department of Computer Sciences at both Texas and Maryland. Under his leadership, he helped both departments to gain top-ten ranking nationwide. He was the founding editor-in-chief of IEEE Transactions on Software Engineering and founded the International Software Engineering Conference (ICSE) within the IEEE. He later co-founded the Society for Design & Process Science (SDPS) and the Academy of Transdisciplinary Learning and Advanced Studies (ATLAS). He was also the chief director of the board of the Beijing Institute of Computer Technology funded by the United Nations.

Dr. Yeh has some reflections on seeing the accelerated development in computer science technology and artificial intelligence. In the summer of 2015, Professor Henry Chang, chairman of Tamkang University's Department of Physics in Taiwan, came to CTTB for spiritual practice and met Dr. Yeh at the City. These two professors were the first speakers in the "Ethics and Technology" series held in the City. Their topic was "Effects of Science on Society." They urged the audience to pay closer attention to the problem of humans becoming over-reliant on technology and the possibility of humans eventually being controlled by technology.

Dr. Yeh started with a prediction made by Herbert Simon in 1956, saying, "I do believe that by 2045 machines will be able to do if not any work that humans can do, then at least a very significant fraction of the work that humans can do." Ray Kurzweil, Google's Director of Engineering, has





夠自我設計，甚至設計製造出更好的電腦與機器人。這樣的循環不斷重覆，造成智能爆炸。屆時智能機器的設計越來越強大，創造出來的智能遠超過人類所能控制的範圍，所有人類的智慧加起來沒有「智慧機器人」的智能高。麻省理工學院人工智慧實驗室共同創辦人馬文·閔斯基說：「未來的智能機器會讓人類成為寵物。」昇陽電腦公司共同創辦人比爾·佐伊更質疑：「未來還需要我們（人類）嗎？」

針對這些科技界大老的憂慮，葉祖堯的想法是：我們是否能夠在「技術奇點」來臨之前，找到方法，將倫理道德的觀念植入機器上？例如，著名的科幻小說作家艾薩克·阿西莫夫就在他的小說中提出「機器人三定律」，第一定律：機器人不得傷害人類，也不得因袖手旁觀而使人類受到傷害。第二定律：除非違反第一定律，否則機器人必須服

also pinpointed 2045 as the year of “technological singularity.” By then “a computer or robot would theoretically be capable of redesigning itself, or of designing and building computers or robots better than itself. Repetitions of this cycle would likely result in an intelligence explosion where smart machines design successive generations of increasingly powerful machines, creating intelligence far exceeding human intellectual capacity and control.” Dr. Yeh also quoted Marvin Minsky, who predicted, “Intelligent machines of the future may see humans as pets,” and Sun-Microsystems co-founder Bill Joy, who asked, “Will the future need us?”

Addressing the issues raised by these giants in technology, Dr. Yeh raised the question: “Can we design intelligent machines with ethical commitments before we reach the technological singularity?” An example of this is science fiction writer Issac Asimov’s “Three Laws of Robotics,” in which he postulated that, “1. A robot may not injure a human being or, through inaction, allow a human being to come to harm; 2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law; and 3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.”

However, in 2009, during an experiment at the Laboratory of Intelligent Systems in the École Polytechnique Fédérale of Lausanne in Switzerland, robots that were programmed to cooperate with each other (in searching out a beneficial resource and avoiding a harmful one) eventually learned to lie to each other in an attempt to hoard the beneficial resource.

Dr. Yeh pointed out that we humans are facing unprecedented challenges and need to find innovative ways to bridge the scientific and spiritual worlds. He called for an articulation of spirituality in the language of science and for the integration of spiritual knowledge into our lives, education, work, and businesses. For instance, former president of National Taiwan

從人類的命令。第三定律：除非違反第一與第二定律，否則機器人必須保護自己。

不過，2009年在瑞士洛桑聯邦理工學院智能系統實驗室進行的實驗發現，本來設定必須互相合作的機器人，原是要共同找尋有益的資源，並避免有害的資源。但最後機器人學會互相欺騙，以便囤積有益的資源。

葉祖堯指出，人類面對前所未有的挑戰，必須採取新的思維與行動，結合科學與性靈，並將性靈層次的發展融入日常生活、教育、工作、乃至企業。例如前台大校長李嗣涔就曾以科學方法研究「手指識字」，並針對信息場進行研究，而寫成「尋訪諸神的網站」。另一個例子是前美國太空人艾德格·米契爾在結束阿波羅14號飛行任務，返回地球之際，忽然產生萬物一體的人定經驗。如今米契爾在舊金山北邊成立「理性科學研究院」，針對人類意識以及性靈層次進行研究。

葉祖堯指出，近代量子物理學的二元論、不確定性原理、量子糾纏原理、全息宇宙等，已逐漸可以解釋一部分的佛法。他並引英國詩人威廉·布萊克的詩句「一沙一世界，一花一天堂，掌心握無限，剎那是永恒」，說明人類現在必須走向智慧的時代。

淡江大學物理系教授張經霖認為量子物理學發展至今，產生半導體科技，包括電晶體、積體電路、電腦、人工智慧、鐳射技術、奈米科技等，為人類生活帶來許多便利。

鐳射技術則是在1960年由休斯實驗室建造第一套設備，如今廣泛使用於不流血手術、腎結石治療、眼睛治療，乃至基因研究等，造福人類健康。

奈米科技是鐳射光鉗加上電子顯微鏡，運用在醫學上，可製造奈米機器人，用以修復受損細胞、找尋並摧毀引起疾病的細胞，還可進行精確的投藥治療。將目前所有最先進的科技結合，可製造出智能機器人、甚至複製人等等。但正如英國天文物理學家霍金所說：「人工智慧全力發展的後果，將導致人類滅亡。」

特斯拉電動車與太空X計劃執行長艾隆·

University Si-chen Lee conducted experiments on “recognizing words by fingers” using methods from science. Lee also studied the aspects of the information field and published a book entitled, “Searching God’s Website.” Another example of the integration of spirituality and science is the former American astronaut Edgar Mitchell who, having completed his mission on Apollo 14 and on his return to earth, experienced a state of unity at the sight of the earth from outer space. He went on to establish the Institute of Noetic Sciences which conducts research on human consciousness and spirituality. It is located to the north of San Francisco.

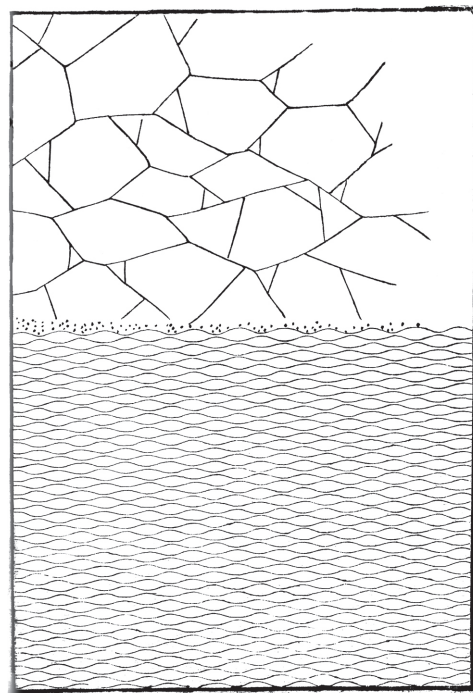
Dr. Yeh said that the principles of duality, uncertainty, entanglement, and the holographic universe in quantum mechanics could explain some of the teachings of the Buddhadharma. He cited William Blake’s poem as a call for a need to enter an age of wisdom:

*To see a world in a grain of sand,
And a heaven in a wild flower.
Hold infinity in the palm of your hand,
And eternity in an hour.*

Dr. Chang said that developments in the field of quantum physics have introduced semiconductor technologies (such as transistors, integrated circuit, computers, artificial intelligence, lasers and nanotechnology) into our lives and brought much convenience.

In 1960, the first laser was built by Hughes Laboratories. Now, laser technology is widely used for medical purposes such as bloodless surgery, kidney stone treatments, eye treatments, and genetic research, all of which benefit many people.

Nanotechnology brings together the technology of lazer tweezers with electron microscopes. When used in medicine, nano-robots can operate at the molecular level



穆斯克則表示，智能機器會做人的工作，將很快讓數以百萬乃至千萬個人類就業機會消失，這還只是短期效果。長期而言，人工智慧的發展將成為人類生存最大的威脅。

微軟創辦人比爾·蓋茲說：「我同意穆斯克與其他人對（超級人工智慧）這個問題的看法，而且我不明白為什麼有些人對這個問題並不關切。」

張經霖指出，當初上書給羅斯福總統建議美國發展原子彈的科學家之一愛因斯坦，在二戰後曾說：「如果早知道德國發展原子彈不成功的話，我就不會採取任何行動。」因為愛因斯坦看到那麼多平民老百姓死於原子彈爆炸，非常後悔在建議信上簽名。1960年愛因斯坦、奧本海默等科學界領袖成立世界藝術與科學學院，旨在成立一所「非正式的科學與倫理道德最高標準的世界級協會」。

匈牙利裔的美國物理學家愛德華·泰勒發明氫彈，獲得「氫彈之父」的稱號後，蘇聯於1961年製成超級氫彈「沙皇炸彈」，其威力為摧毀廣島與長崎的兩顆原子彈威力相加的1,400倍，也是二戰期間所有使用的傳統炸彈威力總和的10倍。這令曾獲諾貝爾獎的波蘭裔美國物理學家艾希多爾·拉比深深嘆道：「這個世界如果沒有泰勒的話，將會美好得多。」

目前全球約有20個國家擁有核武，諷刺的是，印度在1974年第一次核彈試爆成功時，代號竟是「笑佛」。

張經霖認為，科技除了發展出足以毀滅人類的武器之外，還有另一種「沒有爆炸聲、沒有火力、很多人還在享受」的科技災難，那就是智能手機等電子產品，造成年輕人越來越孤立，只跟機器互動，不跟人互動。人類社會正像是鍋裏的青蛙，溫度逐漸上升，卻不知何時才能跳離熱鍋？

這場座談之後，還有易果容教授透過五戒看高科技；武親道教授談佛教與資訊科技；史派克談高成長科技公司的設計原則與遊戲化；瑜伽谷醫療中心醫生王恆冰談癌症治療等系列講座，本刊將陸續為讀者報導。✻

to repair damaged cells, and detect and destroy disease-causing cells. They are also good for drug delivery. Combining these advanced technologies can create smart robots and human cloning. However, as the British scientist and theoretical physicist Stephen Hawking said to the BBC, “The development of full artificial intelligence could spell the end of the human race.”

Elon Musk, the CEO of Tesla and Space X, said that a shorter-term concern is that intelligent machines capable of performing work currently done by humans will destroy millions of jobs. In the longer term, artificial intelligence is “humanity’s biggest existential threat.”

Microsoft founder Bill Gates has said, “I agree with Elon Musk and some others on this and don’t understand why some people are not concerned.”

In his talk, Prof. Chang shared the story of how Albert Einstein regretted signing the petition to President F. D. Roosevelt suggesting developing the atomic bomb because it was later used against civilian population in Japan in World War II. Einstein said, “Had I known that the Germans would not succeed in developing the atomic bomb, I would have done nothing.”

Oppenheimer joined Albert Einstein and other leading public figures to establish what eventually became the World Academy of Art and Science in 1960 with the aim of “Creating an informal world association of the highest scientific and ethical norms and standards.”

In 1952, Hungarian-American scientist Edward Teller became known as the “father of the hydrogen bomb.” In 1961, the Soviet Union created “Tsar Bomba,” a bomb whose power was 1,400 times the combined power of the bombs that destroyed Hiroshima and Nagasaki and roughly 10 times the combined power of all the conventional explosives used in World War II. The Polish-American physicist and Nobel laureate Isidor Rabi has said, “It would have been a better world without Teller.”

Currently about 20 countries have their own nuclear weapons. Ironically, the code name of India’s first successful nuclear bomb test in 1974 was “Smiling Buddha.”

Professor Chang said that technological developments have brought us calamities not only in the form of weapons capable of destroying and wiping out the human race, but also in a stealthier way, without explosions or fire, by infiltrating our daily lives through smartphones and other electronic devices. Dependence on these gadgets has increasingly caused social alienation among their young users, who now interact with their gadgets more than they interact with people. He likened it to the metaphor of the frog in a boiling pot--the heat goes up gradually so that by the time the frog notices the rise in temperature, it is too late for it to escape.

Other talks in the series include DRBU Emeritus Professor Ron Epstein’s “Looking at High Tech through the Lens of the Five Moral Precepts”; Professor John Vu on “Buddhism and Information Technology”; Spike Morelli on “Built to Spread: Gamification and Design Principles of High-growth Tech Companies”; Dr. Hengbing Wang on “Cancer Treatment: Are We on the Right Track?” We will continue to cover these talks. ✻