20.224
Artificial & Architectural Intelligence in Design
# Summer 2020

Course Instructor

Immanuel Koh

Course Description
This course bridges the widening conceptual void faced by today's architects and designers who are urgently in need of a theoretical framework to critically engage with a newly emerged design material—artificial intelligence, or more specifically, machine learning and deep learning. Thus, it speculatively straddles between the field of artificial intelligence and intelligent architecture, to make potential epistemological connections. The course begins by tracing the fascinating and intertwined genealogies of both fields from the 1940s onwards. This history is vividly brought forth to the present with complementary readings on AI aesthetics, AI artists and other emerging AI design topics, such as adversarial-based design algorithms, post-truth redesign of visual culture, unsolicited algorithmic cultivation of collective design tastes, and the territorial politics of computer vision-based surveillances. In addition to the textual 'critical writings', students also work in groups to communicate their visual 'critical designs'.

Digital Twin

A learning, life-long AI which is connected to a single individual, with the aim of **improving their quality of life** through **virtual assistance** and **behavioral study.**

It learns as much as it can about the individual, including how they think and talk, to become their Digital Twin and serve as an extension of the physical self.
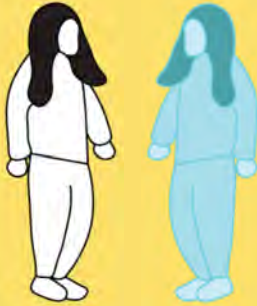
Stages of the Digital Twin

学 → **A smart assistant**
Learning mannerisms, preferences through regular interactions

助 → **A virtual proxy**
Perform tasks on behalf of the individual

死 → **A griefbot**
Help family cope with loss, an extension of life after death

生
birth

助
assist

学
learn

衍
evolve

死
death

Figure 01: <AI Digital Twin>
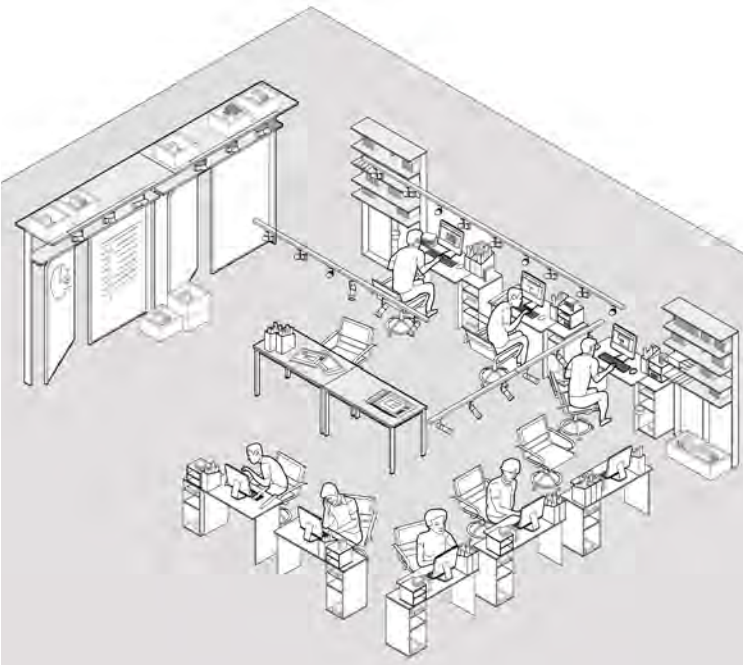Students: Teo Shao Tian and Benjamin Chong

Figure 02: <AI-ARCHITECTURE OFFICE>
Students: Lester Lim and Thet Naung Oo

"As tools advance and become 'smarter', there is a trend whereby the activities/ tasks become trivial. Will architecture face the same fate if AI-Architecture tools become a reality? Should such tools be resisted? Would you want everyone to be able to become an 'Architect' at their finger-tips? Would you envision a future where technology manifests itself boldly or in more muted forms -- integrated in your everyday objects?"
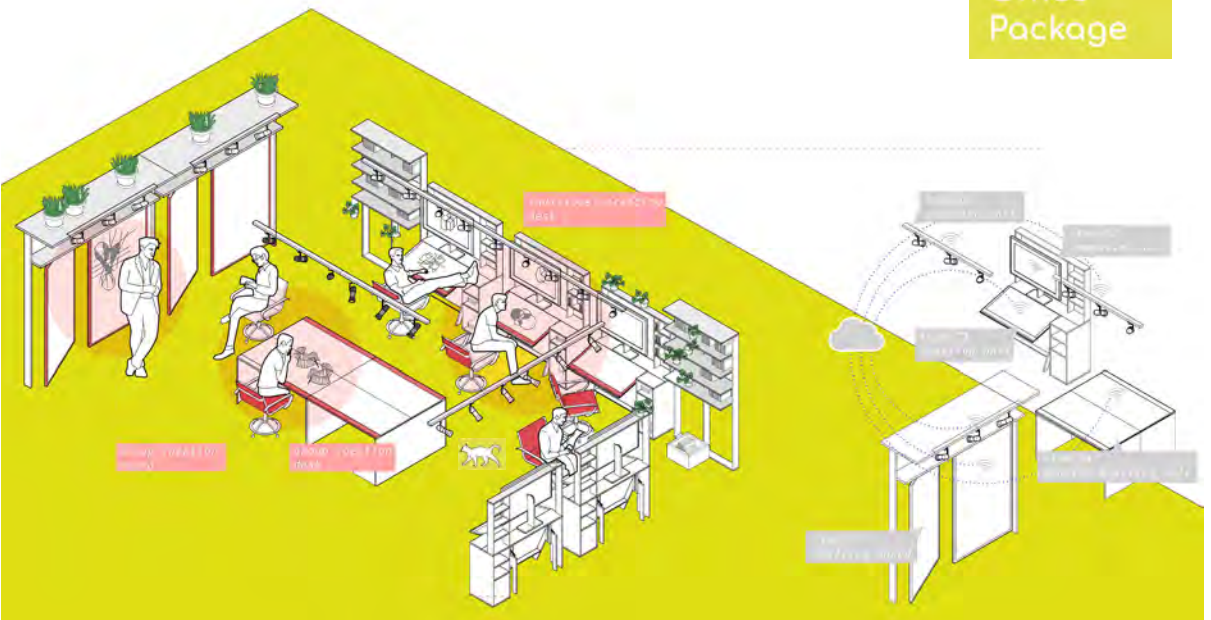

03.07.2030

SUMMER CATALOG

LATEST *AI INTEGRATED* SUMMER COLLECTION FOR YOUR OFFICE

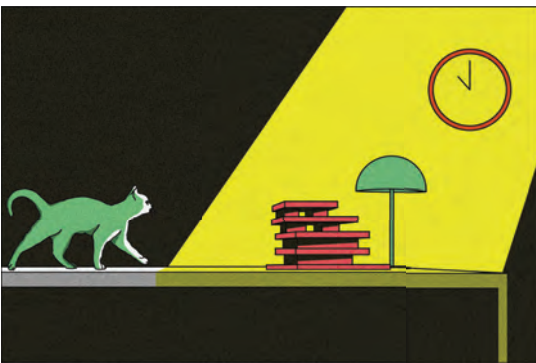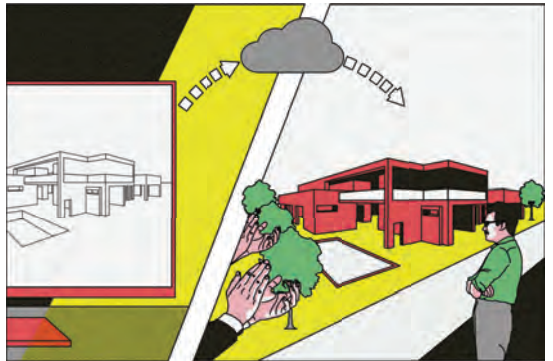AUTOSTUDIO INTEGRATED A

2030 Office Package

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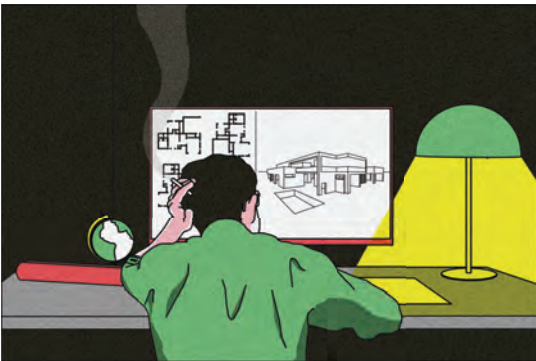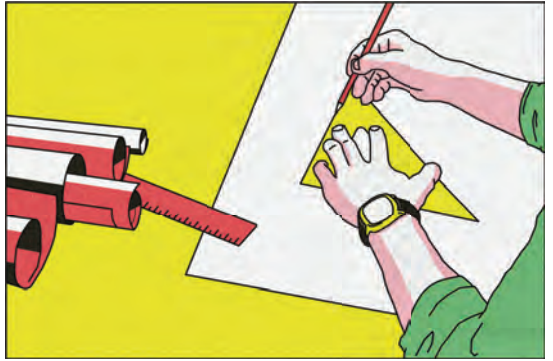
"With an increasing drive towards an AI-driven architecture that has a relationship with its inhabitants, how much data are we willing to forsake in this evolution? Is the evolution towards architectural intelligence an uncomfortable one? Assuming a future where people need to give up their data to use a building and are also given the choice to opt out of this data collection process, how would society look like?"

Stupid Home + Stupid Roomba

Smart Home + Stupid Roomba

Stupid Home + Smart Roomba

Smart Home + Smart Roomba

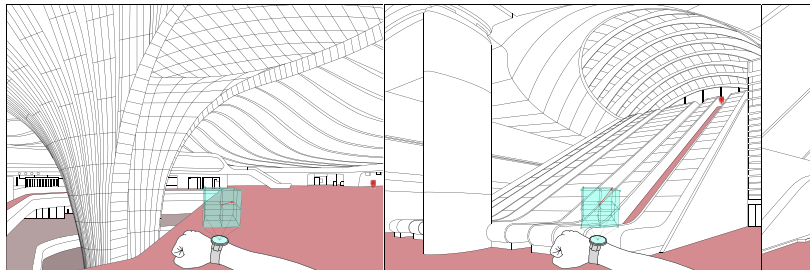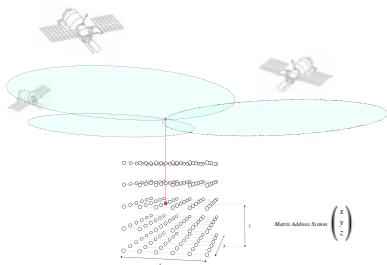"How should we perceive the future of smart living? If smart homes become more prevalent, would smart home devices be still relevant? The advancement in machine learning brings potential and opportunities but it has brought problems at the same time. As a designer, what are some of the ways which we can best use machines to better/worsen our design?"

"In the future, a Matrix Address System is implemented -- Address is no longer a point on a planar map, but rather a point in space. Altimeter incorporated into GPS device to indicate the point on Z-axis, while satellites inform the point on the XY-axis. The part of the brain responsible for navigation, the hippocampus, eventually shrinks with evolution of the human species. With increasing reliance on navigational technologies, the brain does not have to work as hard to figure out the circulation of a space. Ironically, people's taste of architecture may become simpler. People might start to yearn for simpler/ succinct designs with straightforward spatial qualities and easy to identify landmarks."

THE SHRINKING HIPPOCAMPUS

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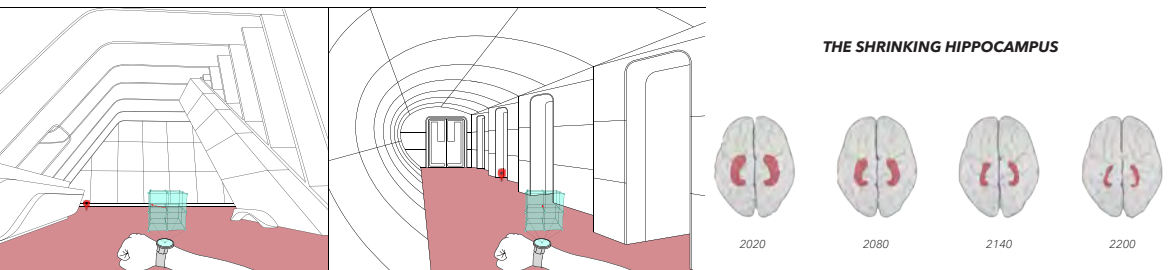
Essay Excerpt 01:
<WHAT DO YOU WANT TO DO? (Free will or Determinism of the Architectural Intelligence)>
Student: Benedict Tan Jee Khang

"...When an individual asks 'What do you want to do?', it is actually a question of free will. On the surface, this question inquires about our desire at a specific period. It also suggests that we have the ability to make a choice and the means to execute it. It assumes the perceived non-existence of the unknown unknowns, or the ignorance towards the unknowns. Under these multitudes of hypotheticals, a choice is still made. In the current period that we live in, the advent of Artificial Intelligence is opening up for us a multitude of possibilities to increase our ability to exercise our free will in architecture. However, the opposite can also be said to exist as well, where the Intelligence instead limits possibilities that can happen. There are two contrasting elements that AI can enable; Free Will and Determinism. However, the question remaining to ascertain which element comes out more prominently in this field would be whether Free Will in this case can truly be considered 'free'. When exercising free will, there is at least 2 actions that happen. The first being the basic mental action of thinking or desiring. After this then comes the physical act of performing a set of actions to lead to that desired outcome. Applications of AI can be used to complement these two processes..."

Essay Excerpt 02:
<URBAN SURVEILLANCE & ARTIFICIAL INTELLIGENCE IN CITY PLANNING>
Student: Matthew Tan

"...In the age of artificial intelligence and smart technology, design and architecture will not just exist in the tangible realm, but also flourish in the virtual. City planning councils cannot ignore the question of how to integrate the physical into the digital, and if we are to push for greater smart city development then we must also explore the possibility of digital heterotopic spaces. At this point it would be beneficial to introduce the concept of "geofencing": geofencing is essentially the implementation of virtual perimeters on real-world geographical areas, thereby creating zones in the digital realm for actual physical areas. With geofencing, governments and city planning councils will be able to create barriers that protect the rights of individuals and communities, such that the digital boundaries and spheres of privacy cannot be easily breached..."

Essay Excerpt 03:
<THE 'THINKING' PROCESS OF MACHINES & HUMANS (Can Machines then Pass the Modified Turing Test?)>
Student: Sim I-En Grace

"...It is inspired by the game Pictionary in which a player makes a sketch while other players make guesses of what the sketcher intends to draw. Similar to the Turing Test, there would be an interrogator, a human player and a computer player such that there would be no communication between the human and computer player, while the interrogators get to communicate with both players separately. After the game, the interrogator then must conclude which player is the human and the machine. Both players should play with the aim of winning the game. The main difference between both games is that the original Turing Test requires players to make a conversation as the mean of testing, while the modified game requires players to interpret an art in the form of sketch. This key modification would pose a much harder challenge as it encompasses all five aspects of intelligence in order to play it well. A conversation can be carried out with enough information to be brought across, while opinions and mindsets could be preprogrammed to mimic a stubborn way of thinking. In the case of a Pictionary game, the interpretation of a sketch as it requires another layer of unpacking which requires intuition and activation of the brain's memory to draw connections to different things. Of course, as a machine, it could also draw similar references through a series of visual database, analysis of the sequence of strokes that makes up that drawing as well as proportion of the drawing. A more ideal version of this test could involve interpretation of art pieces which are proven more abstract, with possible deliberate augmentation of visual graphics that still delivers the message to an intelligent subject. Nevertheless, this Pictionary version of the modified Turing Test could be a way to gauge how a machine learning algorithm can fare against a human brain through interpretative intelligence. Due to limitations of the machine learning model used in the experiment, the interrogating sketcher would be required to compromise and abide by some rules such as not using arrows to point to a certain part of the drawing and could only sketch nouns instead of adjectives without the use of alphabets in the sketch..."

Essay Excerpt 04:
<AI: LEADER OR MANAGER?>
Student: Wesley Koh Zhi Peng

"...No doubt, AI has a huge following. Sometimes, it may be even described as a cult. However, having a huge following alone does not make one a leader. A leader needs to have the ability to communicate, motivate, and to provide inspiration and guidance. He needs to be empathetic, creative and understand people. Humans, unlike machines, are unpredictable. Hubert Dreyfus argued that human reason and problem solving have no formal rules unlike machines. This counters Alan Turing's argument from the informality of behaviour. These are traits that makes human a human. It is not something that AI systems can possess. These social and emotional skills are soft skills that a machine can never acquire, which makes it impossible for AI to be a leader, be it a good or bad one. However, AI can contribute to the hard skills of good leadership, which is essentially a manager, by processing huge amount of facts and information. By taking over the role of managers in firms, AI has the potential to accelerate processes and facilitate higher productivity levels, which can eliminate the middle-management or "eunuch disease", removing unnecessary red tape and bureaucracy which that often then not, hinders the progress of the firm..."

Essay Excerpt 05:
<DEOPTIMISATION AS A CATALYST FOR COLLECTIVE OPTIMISATION>
Student: Lucas Ngiam Ju Jin

"... When we, as human beings, design systems that are meant to achieve optimisation, it is purely an extension of our behaviour in response to our own goal of optimisation. These models draw inspiration from the models of cybernetics, namely both the first and second order cybernetics, with the idea of feedback, control and behaviour shedding some light in understanding the reasons behind societal actions. With respect to architectural spaces, the push for optimisation is also present. However, the definition of "optimisation of space" is debatable based on each architect's perspective. The most common argument for an "optimised space" is where it is able to fulfil as much of its users' requirements while requiring the least amount of cost to build. While not necessarily contradicting the statement, one criticism towards that argument is that users' preferences change over time and as a result, might consider the built space that he/she occupies as irrelevant and would seek out another, more appropriate space. Thus, if a once "optimised space" is deemed irrelevant and abandoned by its user, is it still entitled to be labelled as "optimised" since it no longer serves its purpose of fulfilling its users' requirements? What if the solution for optimization does not come from suggestions of a singular artificial intelligence but rather from a collective of intelligence that uses those spaces?..."

Essay Excerpt 06:
<DO ANDROIDS DREAM OF ELECTRIC CRITIQUE?>
Student: Heong Kheng Boon

"...The researchers involve themselves in the architectural critiques, connecting the devices to student presenters, and the jury panel and then collecting graded data linked to the students. The AI collects audio and visual data discerning what presentation correlates with the tone and intensity of the discussion. This begins the conception of Dialogue Responsive Engaging Architectural Machine (DREAM), an AI able to understand the flow of the conversation and provide a moderate response to the situation, engaging all sides of the isle. It may seem odd to directly implant a new AI into the highly complex and at times, frustrating world of architecture critique and discourse as there will be many instances of misinterpretation and tangents that stray away from the crux of the project, especially as the day goes on. However, we can break down the process of the critique into distinct components, where each actor is given the time to speak and to explain their project, an artifact of a long arduous process, in about 15 minutes, to an audience that has never seen it before, very much like DREAM when it first enters the panel..."

Essay Excerpt 07:
<THE AI SCHOOL: A LEARNING SPACE FOR THE DIGITAL NATIVES>
Student: Naomi Marcelle Bachtiar

"...In starting to explore the potential of an intelligent architecture, Cedric Price's Fun Palace becomes an important case study. Joan Littlewood, founder of Theatre Workshop and the client for the project, described Fun Palace as a 'Laboratory of Fun' and a 'University of the Street'. In much the same way how Fun Palace allows the users to be active participants in dictating the kind of activities to take place in Fun Palace, the learning space of the future should be able to take in users' inputs and adapt. An adaptation in Fun Palace's case involved a travelling gantry crane and moving walls. However, in the learning space of the future, this change can be less physical. What is required is a change in spatial quality, not on the physicality itself. There are much more tools to play with now as compared to in the 1960s when Fun Palace was conceptualised. Refik Anadol, a digital media artist, have demonstrated the ability that light projection has to change the spatial quality and create an immersive experience that transports the person to a different sense of reality. By drawing inspiration from his works, it is possible to imagine a singular learning space that lasts a lifetime. The physical space is a canvas, and light is the brush that creates different realities for the learner... Lastly, there is the issue of morality. It is widely agreed upon that what makes a person is not just their hard skills, but also soft skills, personality and characters. To what extent could a learning experience guided by an artificial intelligence be able to impart these intangible aspects of learning?..."