Strange Attractors and Wonderful Automatons

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A stranger is far enough away that he is unknown but close enough that it is possible to get to know him. In a society there must be a stranger. If everyone is known then there is no person that is able to bring something new to everybody.

The Stranger, Georg Simmel, 1908

Humans have dreamt with the existence of autonomous artefacts since time immemorial. From walking ducks to quasi-human robots, ingenuity has succeeded in the production of machines able to spark wonder. In literature from Ancient Greece, automatons (self-acting machines) are recorded to be cunning inventions intended for entertainment, religious and scientific purposes. Daedalus, coined to be the first architect in ancient mythology, is said to have sculpted forms with such grace that they would come out from the stone and walk.

Machines and their capacity of being both, extensions of our bodies and 'bodies' in themselves, have specially attracted architects throughout history and they remain to do so in our present day. In order to build and design, architecture greatly relies on machines and machines require architects to think with them wisely. In his *Ten Books of Architecture*, Vitruvius mentions the work of Ctesibius, who made hydraulic machines to perform as clocks, and the work of Hero of Alexandria, known as *Michanikos,* who is acquainted with the first automatic door and steam engine.[i] The famous XX century motto by Le Corbusier "the house is a machine for living in" is one among many in the constellations of thoughts that have equated architecture with machines.[ii] Despite their relationship to efficiency and production, machines have a long history in being objects of wonder. Even René Descartes, father of Cartesian thinking and abstract space, is said to have owned an automaton, Francine, and he reflected upon wonder by saying:

> "When the first encounter with some object surprises us … this makes us wonder and be astonished … And since this can happen before we know in the least whether this object is suitable to us or not, it seem to me that Wonder is the first of all the passions. It has no opposite, because if the object presented has nothing in it that surpises us, we are not in the least moved by it and reard it without passion."[iii]

Today, we live in a so-called 'post-digital age.' Machines, reigned by digital interfaces, software and algorithms are a natural part of our everyday life. Automated systems coexist with us in a constant dynamic flow that alternates between organized and chaotic occurrences. A tweet goes viral. Strange actions turn into unexpected habits. Big Data has become so obscure that special skills, much closely to that of wizards, are required to decode and filter information.[iv] We live immersed in a blurry set of interactions that are both physical and virtual, organized and aleatory.

In Studio XX we ask the question: how can we imagine with machines? If our engagement with digital and mechanical technologies is so strongly rooted in how we work and produce architecture, the studio pedagogy focuses on pondering the role of machines as a creative tool for conceiving and reflecting upon architecture. As a first exercise, 33 students worked in groups of

four to design a machine for drawing. Starting from the operational complexities of understanding coding via Arduino, students were challenged by the relationships between virtual orders and physical actions generated by motors and any extension attached to them. As with everything in the world of architects, for things to exist they must be designed and made. Students undertook the challenge of making thoughtful, well-made artefacts, that in addition to their appearance, generate, through particular performances, wonderful drawings. The learning outcome is twofold, on one hand drawings are being produced with the intention to reflect upon their nature and what images and traces they evoke for further architectural translations, and on the other hand, the construction of one-to-one artefacts allow the students to deal with questions of construction, details and materials. The machines the students produced are made using the schools wood workshops, the metal water jet, 3D printers, CNC and laser cutting machines, traditional tools and welding and casting techniques. The making of drawings results then in a holistic process of engaged making that will continue to be implemented for the rest of project.

Through imagining with machines, students remain to undertake the challenge of designing places for dwelling that emerge from their potential and sense of wonder.

Pedagogical Framework

Greek mythology tells us that Chaos was the first thing to exist, the primordial deity from which Gaia (Earth) was formed (Hesiod's *Theogony,* c. 700 BC). Together with Gaia, Tartarus (the abyss and signifier of suffering in the lower parts of Earth) and Eros (Love) originated. Chaos was understood as a dimensionless potential from which cosmic manifestations originate. It could be argued that Chaos, with its intrinsic creational power, mirrors the architect's imagination and the architect's desire to build and make. Often architects juggle with multiple thoughts, dreams and references together with a desired goal to make at a particular time and place. Depending on how the various ideas are combined, architecture can emerge and evolve in very distinct ways.

According to physics, 'chaos is the property of a complex system whose behavior is so unpredictable as to appear random, and with great sensitivity to small changes in conditions.'[v] Just like in architecture, small changes can drive the architect's imagination and project development into very different journeys. Chaotic systems indeed, exist all over the practice and conception of architecture. When a design team is put together, different inputs and interpretations need to be negotiated for a good project to emerge. When the builders work in the construction of an edifice, unpredictable events occur requiring the architect to act and react creatively towards unforeseen problems. When mapping a new place, good architects analyse and interpret both visible and invisible conditions that give birth to new understanding of such context.

In order to deepen into the potentialities that come with chaotic and dynamic systems, the pedagogical framework of this studio academic year focuses on the conceptual and literal notion of *Strange Attractors.*

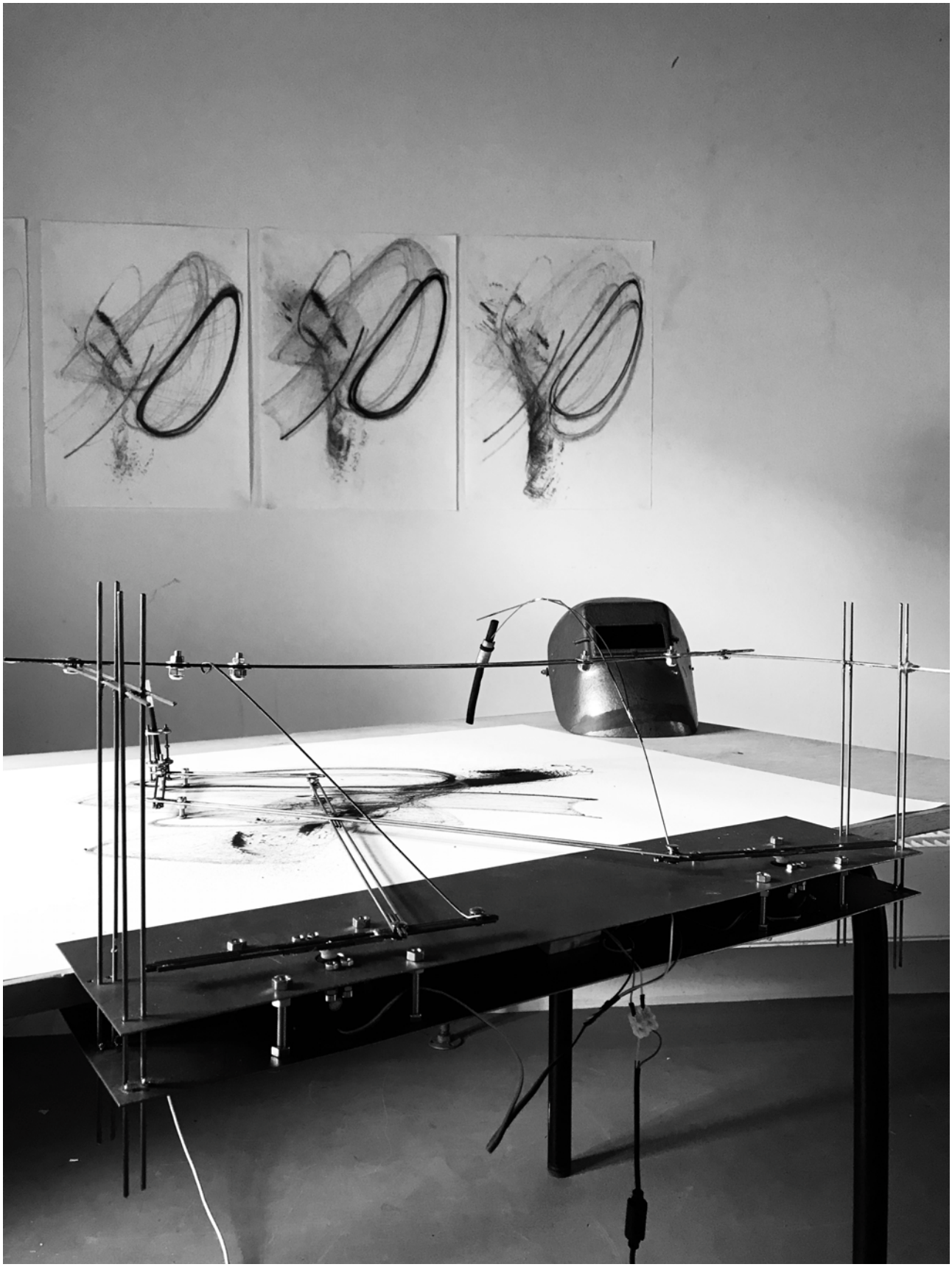
> The literal definition of Strange Attractor in mathematics is:
> 'the state of a mathematically chaotic system toward which the system has a propensity towards.'

’Strange attractors’ are dynamic and chaotic systems that evolve over time. Their unpredictable nature makes them have a particular beauty. For example, the Peter de Jong attractor when visualized three-dimensionally can generate mesmerizing images that convey depth, intricacy and elegance.

Conceptually, a ’strange attractor’ can be understood as that which is unfamiliar yet beautiful. Austrian phycologist Sigmund Freud, elaborated on this condition through his studies on the *uncanny (unheimlich).* The uncanny was defined as unhomely, or as something that has left the familiar to become strange or eerie, and yet it is extremely attractive. The unhomely, is a paradox in that is it both, familiar and unfamiliar. It is enchanting because it cannot be fully or immediately understood.

Considering the notion of ***Strange Attractors*** as both, a system of simple elements that are combined into unpredictable ways, and a condition that is both unfamiliar and beautiful, Studio XX focuses in creative and experimental architectural studies that investigate through the combinatorial and the emergent multiple dimensions of the discipline: materials and tectonics, space and atmospheres, context and culture, habitation and the built environment, etc. Through these investigations, Studio XX seeks to explore new ways to thinking space and tectonics in relation to current and future technologies, critical approaches to context and the role of new buildings in urban environments.

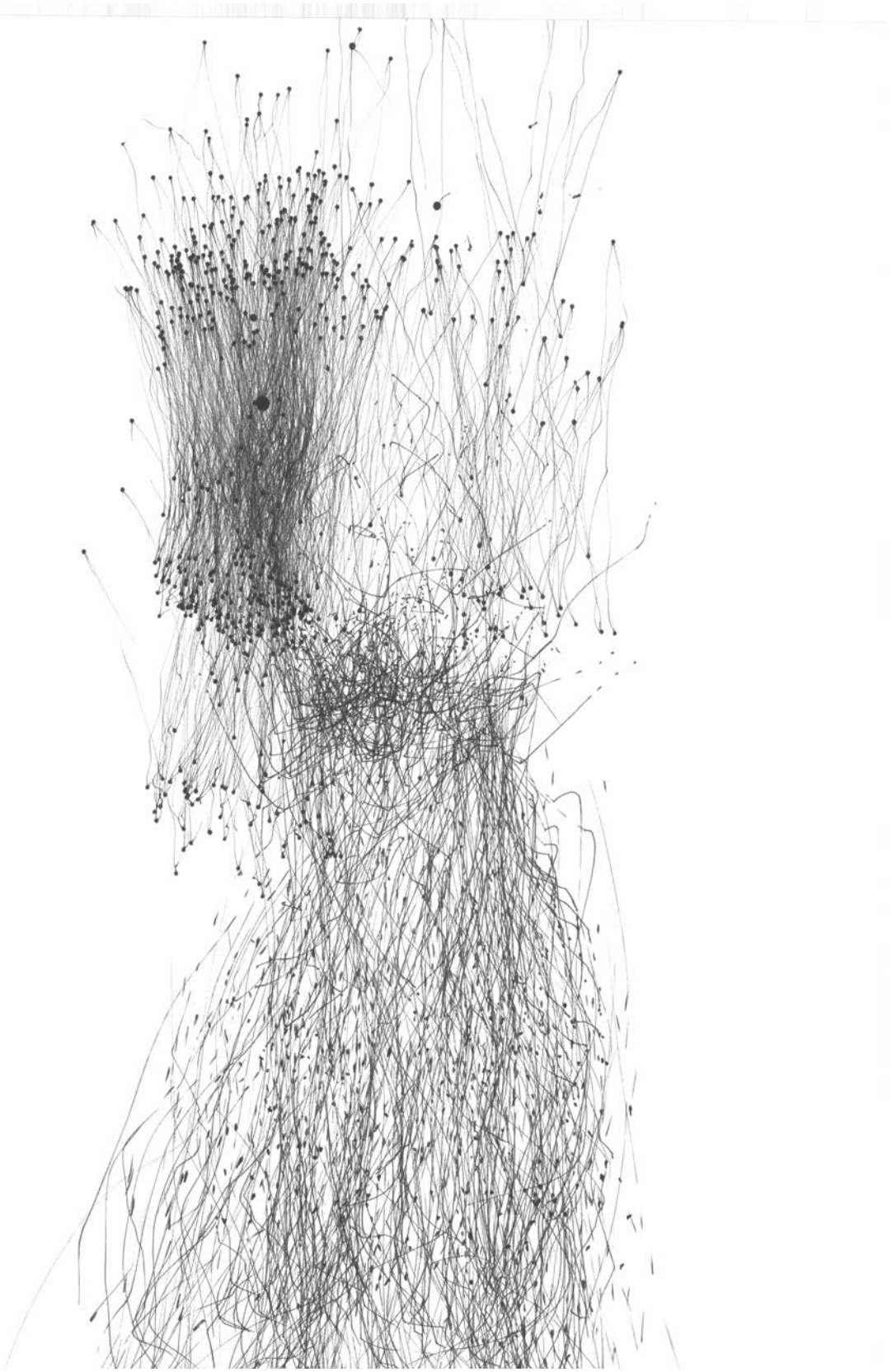
Disclaimer: because this studio project is on-going, final evaluations and reflections that analyse the entirety of the pedagogical framework and its outcomes have not yet made. However, if the paper is accepted to be part of the session, the author ensures to include and further meditate on the produced work, both through examples and theoretically.



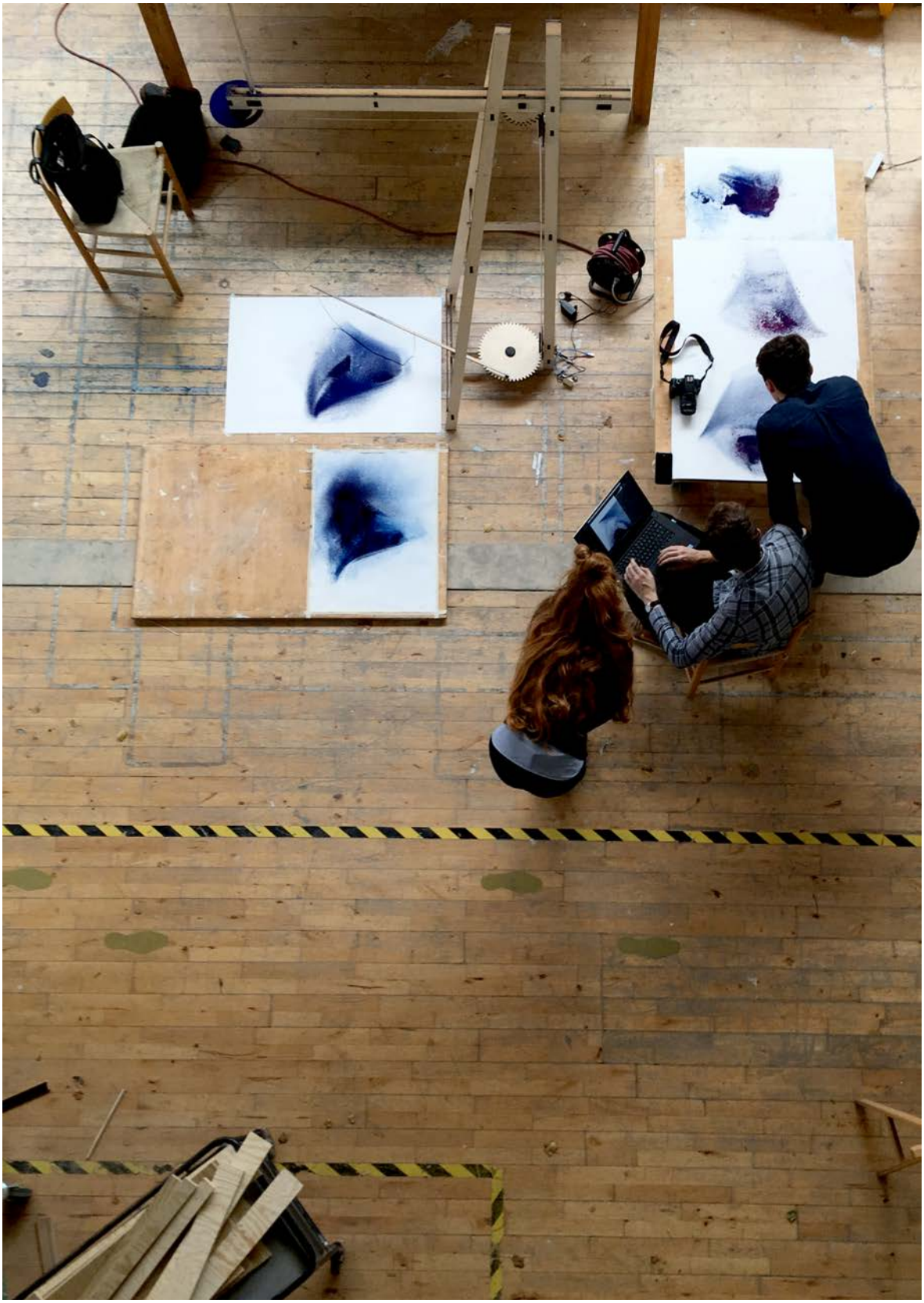
Machine #1: Interrupting Condition

Machine #2: The Anglerfish

Machine #3: Easel for One Drawing



Drawing from Machine #4: The Puppet Show



Students working with Machine #5: The Alchemist

[i] Vitruvius, Pollio M, translated by Frank S. Grange, *Vitruvius on Architecture* (London: Heinemann, 1962), book IX.
[ii] Le Corbusier, translated by Frederick Etchells, *Towards a New Architecture*, (New York: Holt, Rinehart and Winston, 1986), 89.
[iii] René Descartes, translated by S. Voss, *The Passions of the Soul* (Indianapolis, 1989), pt.2, arts. 70 and 53, quotations at pp. 56-57 and 52 respectively, in Caroline Walker Bynum, "Wonder", *The American Historical Review*, Vol. 102, No. 1 (Feb., 1997), pp. 1-26, p. 5.
[iv] Viktor Mayer-Schönberger and Kenneth Cukier, *Big Data: A Revolution That Will Transform How We Live, Work, and Think* (London: John Murray, 2017).
[v] Oxford English Dictionary, OED.