THOUGHTS ON LEVITATION AND FREE FALL

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The idea and dream of levitation[1] and weightlessness[2] has followed mankind through the ages. Farther back in time, weightlessness was an almost mythical phenomenon with religious, magical, spiritual and psychic characteristics. Today we can achieve weightlessness in several ways, such as in free fall in planes or in a space station. If we walk on the moon, the same phenomenon occurs. Earth's gravitation is partially nullified. Research on levitation and free fall is taking place in parallel in many different subject areas and contexts, such as chemistry, physics and parapsychology.

We have had an ongoing partnership for nearly twenty years with a common interest in exploring various natural and mythical phenomena. This collaboration has resulted in a series of installations in which we explore space and the limits of space, often frozen moments in everyday surroundings that seem to have a life of their own. A recurring theme in many installations has been nullifying the force of gravity with the help of various tricks. In the project *A Study of Free Fall and Levitation*, we have concentrated on the force of gravity. With artistic methods and approaches, we have drawn near and explored the phenomenon. Within the framework of the project, we have produced a series of objects and installations, all of which in various ways explore and give form to how levitation and free fall can occur or appear to occur. How can we get an object to levitate? The project is also about failing, situations when everything collapses in a free fall.

In the first exhibition at *Galleri 54 (2014)*, small segments of interiors have been constructed in the gallery space. Above a round table, concealed electromagnetism causes a simple crumpled-up paper bag to float. A blow-dryer produces air currents to make a ping-pong ball hover over a chair. Prisms in a cut-glass chandelier begin to slowly fall toward the floor like a gentle fall rain. A porcelain dog has fallen from a pedestal and crashed against the floor. In addition to the *Galleri 54 show, the project has resulted in exhibitions at the* Norrköping Art Museum (2014), *Oslo Prosjektrom* (2015), Rom for kunst (*Oslo Central Station)* (2015) and *Kunstplass (10)* (2015) in Oslo as well as at *Østfold Kunstsenter* (2016) in Fredriksstad. We have explored how an experience of the phenomenon can be created with illusion and magnetism, but we have also become familiar with research on such effects as diamagnetism and optical and acoustic levitation.

About diamagnetic levitation

The fact that a high-temperature superconductor levitates over a magnet in a mist of liquid nitrogen no longer amazes hardly anyone; superconductors are ideal diamagnets. However, when researcher and Nobel Laureate *Andre Geim (b. 1978)*[3] succeeded in 1997 in getting a living frog to levitate by using diamagnetic levitation, many were surprised. In principle, all matter reacts to a very strong magnetic force. Theoretically, a human being as well as a frog could levitate in this manner. Because of very weak molecular magnetism, all material and all living beings on the globe are magnetic and consequently have the

[1] Weightlessness occurs when you find yourself in a free fall. In scientific contexts, weightlessness often is termed microgravitation. Weightlessness in the international space station (ISS) is due entirely to free fall and not to the absence of gravitation. In the station the Earth's gravitational field is equal to about 90% of the field at the Earth's surface.

[2] Levitation comes from the Latin *levitas*, lightness. The phenomenon means that something is held aloft and floats freely. Within parapsychology and spiritualism, the floating phenomenon is described in seances. The ability to levitate is a property that has been ascribed to saints. The phenomenon is not scientifically proven; the photographs and eyewitness accounts that exist have never been able to rule out the involvement of some kind of deception.

[3] Andre Geim is a Soviet-born Dutch-British physicist and material scientist. Geim was awarded the Nobel Prize in physics in 2010 for discovering the material graphene. Because of the experiment with the frog, he was awarded the Nobel Prize in 2000, along with Michael Berry. Since 2001 he has served as a professor at the University of Manchester and as a fellow of the Royal Society.

potential to float freely with the help of magnetism. The only problem is that levitation using molecular magnetism requires a magnetic field that is about 100 times greater than, for example, a superconductor. Despite, or perhaps because of, technological development and the theoretical possibility, the fascination and the dream of being weightless is still as great as ever, if not greater. [4]

Water droplets

In a darkened laboratory in the Department of Physics at the University of Gothenburg, an experiment is under way to levitate water droplets with the help of optics[5]. An old print head measures out and then slowly releases tiny droplets past a concentrated and very strong laser beam with a power of 500 mW. Most of them fall through and disappear, but suddenly a droplet comes to a halt in the middle of the laser beam. It clings to the beam and levitates until another droplet dislodges it, causing it to fall freely and dissolve. One field of application for the experiments is to make it possible to hold onto small objects without having to physically touch them. The experiment shows yet another possibility for getting matter, in this case water, to defy gravity.

Acoustic levitation

With strong enough sound and a material such as dust particles, it is possible to visualise sound waves, and with even louder stereophonic sound, you can cause an object to start vibrating and eventually disintegrate. However, defying gravity with sound waves requires a more concerted force. With a reflector, ultrasound waves can be concentrated and a vertical sound wave can emerge. We're talking about immense forces, up to 160 dB. In comparison, a jet engine can attain sound pressure levels in excess of 120 dB. An increase of 3 dB means a doubling of the sound level. A breakthrough in contemporary research into acoustic levitation came in 2013 with the publication of a study titled *Morphing Surfaces Enable Acoustophoretic Contactless Transport of Ultrahigh-Density Matter in Air*[6]. The hope is to be able to apply discoveries of how to create acoustic levitation – for example, in the manufacture of pharmaceutical products and electronics.

In Tibet

Acoustic levitation is nothing new, however. In the book *Teknik i Forntiden*[7] (Technology in Antiquity), author, publisher and UFO expert *Carl-Anton Mattsson* (b. 1946) tells the story of how Jarl, a Swedish medical student at Oxford University, witnessed acoustic levitation of large boulders. The story was written down by the scientist, explorer and flight director *Henry Kjellson* (1891-1962). During his time at Oxford, Jarl became acquainted with a man from Tibet, who later would prove to be the supreme leader of a monastery situated in a valley south-west of Lhasa. Jarl's companion belonged to the Order of Yellow Monks and had reached the seventh and highest level, the level of consciousness where one is regarded as a living god. During a trip to Egypt Jarl is rerouted, and with telepathic powers he is conveyed to a distant monastery in Tibet, where he meets his companion. Once at the monastery, Jarl witnesses how the Tibetan monks have developed a sophisticated technique for collecting sound waves, using specially built horn-like instruments and big drums for this purpose. Combined with the voices of their assistants, an incredibly strong sound wave is generated, causing boulders to rise about 250 meters above the ground and ultimately be deposited on a cliff ledge. Kjellson recounts in detail how Jarl had seen the Tibetan monks levitate five to six boulders per hour. Jarl managed to film the entire sequence when the heavy boulders, weighing about 6,300 kg, were lifted. However, the report of the incident and the two films made are not available for study. After Jarl had presented his report in the 1940s and shown his films for the department at Oxford University from which he was sent, the material was classified as top secret for fifty years.

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[4] http://www.ru.nl/hfml/research/levitation/diamagnetic/

[5] The water droplets in the experiment are blended with 10% glycerin because water evaporates quickly.

[6] Foresti, Sambatakakis, Bottan & Poulkakos (2013) *Morphing Surfaces Enable Acoustophoretic Contactless Transport of Ultrahigh_Density Matter in Air*. Zurich: Department of Mechanical and Process Engineering, Laboratory of Thermodynamics in Emerging Technologies, Eidgenössische Technische Hochschule, Zurich http://www.pnas.org/content/110/31/12549.full.pdf

[7] Kjellson/Mattsson (1984), *Teknik i Forntiden*. Stockholm: Nybloms förlag pp. 192 – 222 ISBN:91-7780-001-X

Those who have attempted to obtain the films after the prescribed time expired have as yet not been successful.

With the right confession of faith

Jarl is not the only Westerner who has witnessed levitating stones in the East. Canadian author and photographer *Margaret Deefholts* describes in detail, how she has witnessed a special stone levitating above a sarcophagus in Shivapur[8], 180 kilometres east of Mumbai, India. In this case, there is considerably less weight involved, however – around 70 kg, or according to some sources, 90 kg. According to legend, Qamar Ali was born into a family with strong men, but unlike his aggressive older brothers, he was introverted and mild-mannered. At age six he became a disciple of a spiritual master who lived nearby and spent days fasting and meditating. Throngs of supporters soon began flocking around him and mysterious things began to happen. Qamar Ali died in his late teens, and as he lay on his deathbed, he indicated that he wanted a stone that has now become famous to be placed near his grave. According to the legend, on his deathbed he said to his brothers:

"If eleven men place their right index fingers under the stone and then jointly call my name, I will cause it to rise higher than their heads. Otherwise, neither singly nor together will they be able to move it more than two feet off the ground. Let it be a symbol, a reminder of my message that spiritual power is greater than brute strength. As Allah the Merciful, has loved you, so should you love all men of every caste and creed. For we are all brothers on the same journey. Think of this when you call my name and raise the stone."

In true Western scientific spirit, Deefholts ponders whether it is electromagnetic energy that makes the stone levitate or perhaps microwaves. Can the ground where the stone lies be a charged electromagnetic field that Qamar Ali knew about? She also speculates that the same technique that the Tibetan monks used might account for the phenomenon, that sound waves are generated when the eleven Muslim men lift the stone with their fingertips while intensely crying out: Qamar Ali Darv .... eeesssshhh!

In this tale, as in most folk tales, there is a message. That Qamar Ali has his origin in a family with strong, even aggressive, men probably is not without significance. Qamar Ali himself is described as weak and introverted. Only men with the correct confession of faith have the power to levitate the stone. Others need not try, especially women. The moral of the story is that spiritual power is stronger than physical power. The strong spiritual power described could explain why the stone levitates in the story, but unfortunately no reasonable explanation is given for how.

An illusion

In an apartment in Friedrichshain, Berlin, we made a first version in 1999 of what would become a series of works in which we artistically investigate levitation. The photograph shows a pillow floating above an unmade bed in the first light of day. When the work was done, there were several conceivable techniques for digitally manipulating photography, but we established a set of rules to not use these. Instead the challenge was to achieve the illusion of levitation using simple tricks and material. Usually levitating people or objects are presented in theatrical contexts. The floating cushion is more a matter of a snapshot, an event, a regular everyday morning. For a moment gravity has released its grip on things, and from the corner of our eye, we see an object rise. Luckily the camera happened to be nearby.

A revision of the work appeared in the *Suspicious Landscape* exhibition (2006) at Galleri Konstepidemin in Gothenburg, Sweden. The video version that was projected in full scale in one of the smaller rooms could suggest a landscape. The tranquil floating pillow was

[8] http://www.margaretdeefholts.com/levitatingstone-shivapur.html

transformed into a cloud over the undulating quilt, or was it a continuation, a director's cut of the video work *Sleep*[9] *(1963)* by *Andy Warhol* (1928-1987).

Levitation in the world of art

In the world of art the nullification of gravity has interested artists for a long time, including contemporary artists who have used levitation as a metaphor to comment on the course of events in our time. Polish/American artist Agnieszka Kurant (b. 1978)[10], showed her *Air Rights 2* piece in 2015 at the *Tunnel Vision* exhibition, Momentum 8, in Moss, Norway. A floating meteorite has been caught up in an endless motion, making visible the otherwise intangible airspace over real estate and its speculative value. The work is presented in classical style on a raised podium surrounded by a rope to further enhance the mystique.

The Stock Is Rising[11] by Swedish artist Annika Lundgren (b. 1964) is also about the fictitious value of money, while simultaneously paying homage to American social and political activist Abbie Hoffman (1936-1989), who in 1967 tried to levitate the Pentagon as a protest against the Vietnam War (Hoffman even used Tibetan singing, led by Allen Ginsberg, to achieve levitation). Levitation of the Old Frankfurt Stock Exchange (Alte Börse Frankfurt) was carried out in two parts. The first was an online levitation launched on 21 August 2010. People all over the world meditated, contributing with their collective, mental strength to lift the stock exchange building. In the second attempt the public was invited to collectively meditate on site in front of the stock exchange until it closed for the day.

From Thurston to a squirrel and an apple

Achieving the illusion of someone or something levitating has long been a device used by conjurers and other magicians. For example, Harry Kellar (1849-1922) and later Howard Thurston (1869-1936) became widely renowned when they conducted the *Levitation of Princess Karnac*[12]. The illusion was performed originally by John Nevil Maskelyne (1839-1917) in London, whose assistant was bribed by Kellar to reveal the trick for him.

In spiritualism and religion throughout the world, there are descriptions of mediums, monks, gurus and saints who can levitate. Jesus and Buddha had slightly different purposes with their walking on water. The former did so to meet his disciples who were in a boat; the latter tried to convert a Brahman to Buddhism. This was before the camera's time, so we'll have to rely on the Scriptures. At a séance in Worthley Hall, Finsbury Park, in 1937, spiritual medium Colin Evans explained how spirits lifted him from the ground while he photographed everything. The séance was conducted in total darkness, and the photograph was taken with a flash on the camera that he triggered himself. A year later he performed the same trick when he simply jumped up in the air while he took a photograph. This time people saw through him and spectators demanded their money back. Ancient stories of hovering monks have had their followers, though now in a more obvious commercial form. Hovering in a seated position supported by a cane and with a hat or jar of coins, they have become a common sight in most cities. Even though we all know they are sitting on a steel frame anchored in the ground, the illusion is fascinating. In the *Lightness of Matter* exhibition at Østfold Kunstsenter (2016), the same simple trick has been used. The squirrel seems to be rising, supported on its thin tail. The exhibition also displayed a

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[9] *Sleep* is an American film made in 1963 by Andy Warhol. It consists of one take in which Warhol's close friend John Giorno sleeps for five hours and twenty minutes. The film premièred on 17 January 1964. Of the nine people who attended the première, two left the room during the first hour.
https://vimeo.com/4880378

[10] http://www.tanyabonakdargallery.com/artists/agnieszka-kurant/series-works_10

[11] http://www.annikalundgren.net/art-work/the-stock-is-rising-32038960

[12] The trick was done using a disguised machine hidden from the audience's perspective. Kellar would claim the woman on-stage, sleeping on a couch, was a Hindu princess, whom he would levitate and then move a hoop back and forth around the woman's body to prove she was not being suspended. Inside the dress of the "princess" was a flat board on which she was resting, which was connected to a metal bar going out the side into the backstage. The other end of the bar was connected to a machine used to raise and lower the woman that was blocked from view by the curtain and her own body. To allow Kellar to "prove" with the hoop that she was floating, the bar was in a rough "S" shape, letting him move the hoop along the length of her body in any direction.
Source: https://en.wikipedia.org/wiki/Harry_Kellar (downloaded 2017/01/10)

large installation in which household goods appear to be falling freely down toward a small apple that is levitating.

Toward disintegration

A whirlwind could be described as a concentration of air waves, an accumulation of force fields that can cause things to be lifted up and then, with gravity's help, to fall out of control back toward the Earth's surface. In the piece *Office* (2003), which was shown at IASPIS in Stockholm, a whirlwind has made its way inside, perhaps through a window left ajar. The office is in a state of dissolution. Binders are turned into aeroplanes or birds and paper whirl around dizzily. The only thing suggesting that gravity still exists is the bit of coffee in the coffee pot left behind on the slanting cabinet.

The work was recreated in an exhibition at Oslo Prosjektrom (2014), this time as a tableau that could only to be viewed from the outside by passers-by on Plautous street in Oslo. The desktop and other miscellaneous office accessories float freely in the room like a cutaway view.

Falling free

The opposite of levitation could be described as falling – a fall toward the Earth's surface, toward the floor, when everything collapses. At the same time weightlessness comes about precisely through free fall. At the Bremen Drop Tower[13], experimenters study how objects become weightless through a free fall of 146 meters.

In our exhibition *Toward Gravity's End* at Kunstplass (10) in Oslo (2015), the phenomena interact. The chandelier has pulled the ceiling down with it, its crystals appearing to fall slowly and crash against the floor. The table legs are splayed upward by the powerful collision with the concrete floor, while the ceiling tiles appear to glide down like a whirlwind. There is no doubt that it is an illusion – again a simple game with thin nylon lines. A disposable cup, a potted plant and a wad of paper float above a table as a counterweight and with the help of invisible electromagnetism. Several books float out through the hole in the ceiling formed when the ceiling tiles fell away. An equilibrium and harmony occurs not only between free fall and levitation but also between fiction and reality.

A Study of Free Fall and Levitation has been a series of attempts to nullify one of the natural laws we normally take for granted, gravity, but it has also been about when everything falls, in a free fall. The year 2016 has been described as a year in which a great deal fell. Moral and ethical limits were overstepped; the world order found itself in a free fall. Now it is perhaps even more important to believe – like illusionists, monks and others stubbornly asserted – that levitation exists, and it does so without laser light, sound waves and magnetic fields.

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[13] https://www.zarm.uni-bremen.de/drop-tower.html