

This work explores entropy—how the Universe expands and contracts. I researched the particles that would influence the end of what we know of as our Universe. As we learn, our minds expand and capture new information to form greater and more complex ideas. This frees us, but also hinders our perceptions. As we acquire new knowledge, we throw out connections that no longer seem to make any sense to us. Even the body is influenced by entropy, as particles constantly wreak havoc on our tissues and fluctuations in our environment take their toll. Entropy, this all-powerful force that gives and takes existence, influences each of these fundamental aspects of our existence.

To visually demonstrate these ideas, I created a book. The book has pages that zip in and out, so that the viewer can change the order of the pages in whatever way pleases them. Instead of creating a specific narrative, I mashed together many different mediums and images to create a disorganized, yet unified piece. I used paper, fabric, paint, urethane, thread, and zippers to give the book a feeling of mutability. The book is a representation of the Universe, and the particles of the cosmos are each page. The particles can enter or move around the system. Each page addresses entropy as a physical or abstract idea.

Permanence and true stasis don't exist. This book invites the viewer to consider the value of meaning within a volatile existence.

Ella

Throughout our lives, we are constantly changing and growing, nothing is ever static, because if it was there would never be new life or new ideas. The universe, the mind and the body are all connected by entropy. Entropy can be described as:

“A thermodynamic quantity representing the unavailability of a system's thermal energy for conversion into mechanical work, often interpreted as the degree of disorder or randomness in the system.”

Or:

“Lack of order or predictability; gradual decline into disorder” (Google)

Or:

“The dispersal of energy process in our material world.” (Lambart, 2013)

There are many different interpretations of what entropy actually is, but this essay will focus on the physical dispersal of particles or energy, and the more common definition, that entropy is simply disorder. The universe expands and contracts, and the end will be determined by how matter reacts and how far it can be pulled apart by the expansion of the cosmos. The movement of particles influences the growth of the universe, it continuously strives to reach an equilibrium. But when it does, what will happen? How will the universe end? The mind incorporates and learns new information, which creates a higher level of awareness, but what is considered a higher level of awareness? Is it breaking down walls and connecting new ideas in a random way? Brilliance could be logical or unpredictable. The body eventually combusts and oxidizes, the things we need such as oxygen and food lead to our demise. How do the particles all around us inflict their damage on us? Each of these things is influenced by the ultimate driving force of life and creation, entropy. The universe, the mind and the body are similar in many ways, they are held back by certain forces such as gravity, society and activation energy that keep them from attaining their highest point of entropy.

## **THE UNIVERSE**

The expanse of the universe seems immeasurable and infinite; the chaos never ceases. Where does it end, and if it does end, how? Entropy is the main driving force to growth, and without it life itself would cease to exist. What drives entropy is the universe seeking equilibrium, which isn't possible if life wants to subsist. Energy itself creates entropy. As a life force we get energy from the food we eat, and eventually we transfer that energy back into the earth little by little, until we die. Life is about the transfer of energy and the creation of chaos, and without it nothing would theoretically exist (Prigogine, 1986).

So why do particles need to move in order for life to exist? The Second Law of Thermodynamics simply states, “In any cyclic process the entropy will either increase or remain the same.” (Carnot, 1824) If particles move and bump into each other, the entropy increases as this process occurs. If more heat is added to the system, the particles move faster, creating more microstates and thus the entropy grows. Theoretically, if it were possible, lowering a particle to Absolute Zero would mean that the particle itself would create no entropy whatsoever. Without any imbalance life itself wouldn't be able to exist and thrive. One common example of decreasing entropy is an exothermic reaction in a closed system. As heat is released, the particles in the system slow due to cooling, such as turning water into ice. Suddenly a viscous liquid has turned into a solid, which means that the particles have somehow structured themselves in such a way where their movement is limited, and released enough energy (in the form of heat) to slow

down their activity. This explains the nature of the universe and how things all around us are impacted by this movement of particles.

Turning back to the universe, in 1917 Einstein had a theory that seemed so outlandish to him that he threw away the idea (Becker, 2015). According to his theory of General Relativity, matter and energy will warp space and time. This must affect the universe as well, which means that the quantity of matter and energy will determine the fate of the universe. The universe would have to be expanding and decreasing. In 1929, Edwin Hubble found some hard evidence regarding Einstein's theory and how it could not just be nonsense. The universe could be rapidly growing. As the universe grows, and the more stuff that is created, the more gravity has an impact on the rate of expansion, and it begins to slow down. Once it has reached a certain point where there is too much matter, the expansion will stop and then begin to decrease, eventually resulting in "The Big Crunch"(Becker, 2015). The universe would be a very compact and heated ball of matter. The highest amount of entropy that was evenly distributed in the cosmos would turn into a black hole. A black hole is the densest matter known to man, which would sap out all of what we know of as life. Certain processes would no longer thrive, and the whole idea of entropy would be non-existent and unnecessary. Many things are holding back this event from occurring.

It is the way of life to always push forward and grow, because the opposite would be death and destruction. After billions of years of evolution and extinction, something has always risen from the ashes. What if this expansion and contraction is a cyclical process? If entropy ebbs and flows, how could something as basic as chaos die? The universe isn't creating matter, it merely takes it from another source, transferring it back and forth to where it is needed. Once the universe becomes too large and particles stretched too thin, the entire cosmos will suffer what is known as "Heat Death"(Becker, 2015), where basically the universe becomes a whole lot of nothing. When temperature is at a state of equilibrium, it means that there is no exchange of energy between various systems, making it impossible to have any type of growth.

If the expansion of the universe seems like an outlandish idea, there are facts to prove it. Two scientists by the name of Penzias and Wilson, who discovered cold, hard evidence back in 1964 that the "Big Bang" really did happen, and that the universe to this day is always expanding. They were listening through a giant horn when they heard a mysterious noise. That noise was made from cosmic microwave background radiation, which had a wavelength of 3cm, which means that the universe had expanded since the "Big Bang" (Atkins, 1984). The expansion of the universe is slow and as it gets bigger the expansion gets slower, because gravity and all the matter in the universe is pulling back against the expansion. Ultimately, the universe is so large maybe we cannot even comprehend the vastness of that space, but there is always an end somewhere and sometime.

## **THE MIND**

Every single human being has a mind, and therefore an awareness, yet some are considered more perceptive and open. This means that they can be pushed by harder-to-grasp ideas and mentally grow more than others. Some people are happy with what they are fed by those of a higher power. Following and believing without seeking justification is a very easy life to live. Many individuals seek truth, and some go mad looking for it. As we grow older, more events have occurred in our lifetimes, manipulating our bodies and souls. As we grow our thoughts, our emotions become more charged, we develop opinions, so much information begins swirling around in our heads. We are taking information from everywhere and internalizing it,

just as we take away energy to grow. In some ways, our minds entropy increases. We build off of each new bit of information we get, inquire about things that don't necessarily make sense or create a whole new idea to thrust into a public sphere.

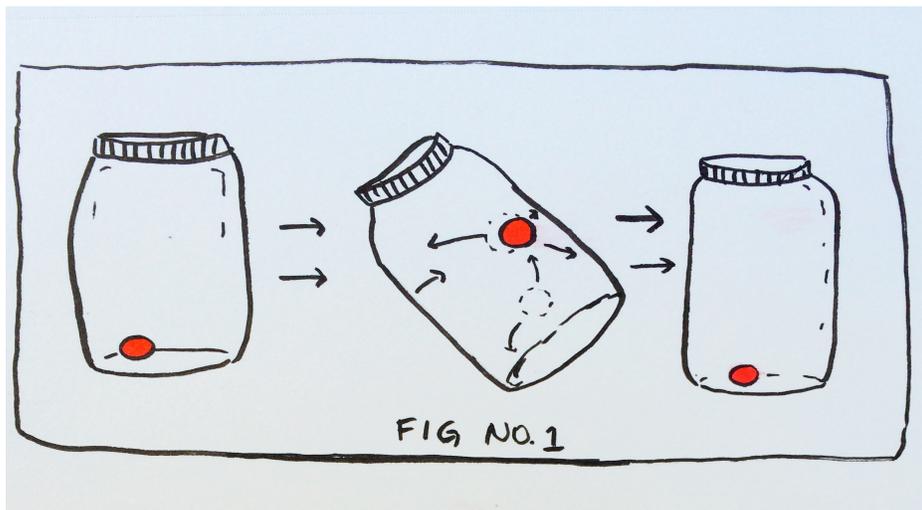
When Nietzsche declared, "God is Dead" in 1882 (*The Parable of a Madman*) a whole new way of life stemmed from this idea. Suddenly moral certainties weren't as certain, because there was nothing to justify what was considered good or bad. The lines between good and bad had been blurred, and now there was no judge in the heavens to be afraid of. For the longest time, the Church was the one who told people what to believe and who to believe, but now there was no point. The mind had been freed from the moral codes that were ultimately judged by god. Nietzsche had now taken it upon himself to be a truth seeker, a mortal leader that could explain all the uncertainties of the world. The reason religion was created was to keep people in line, to make sure that people feared how their time on this earth would influence their time in death. Karl Marx was a famous philosopher that declared that "(Religion) It is the opium of the people", he describes religion as a "Justification", and "Moral Sanction" for the people as well. They had to be afraid of hell. All these things were created to unify the people, and to more easily keep people in check. These stories had their time and place, and ultimately kept chaos to a minimum in a time where the law couldn't be enforced as it is today. When you give someone the power to think for themselves, it gives them individual freedom which isn't good for leaders if they want blind followers. By making everyone think uniformly, the leader is able to keep everyone together, and when everyone thinks the same, they do the same things. This is one point that holds back our minds from achieving a "higher point of entropy". If we are unable to learn or if a higher being is keeping us from searching for the truth, we can't expand our minds. Society is built around the fact that everyone is willing to think in the same ways to reach the same goals, which keeps everyone in check and at the same intellectual level.

Nietzsche, a famous philosopher can be an example of freeing oneself from the grasp of a higher power, or "God". When Nietzsche assumed the role as a moral truth-seeker, he put all the pressure on himself to find justifications for people's actions and to explain what could never be explained before (Meckler, 2012). He was searching for new ways to describe the world around him and break away from what was considered "the truth" (*Nietzsche: Beyond good or Evil*, 1999). All this stress eventually took a toll on him, and he went absolutely mad. In a lot of his writings, Nietzsche explains the dichotomy between Dionysian and Apollonian. Dionysian thought emphasizes joy, absolute freedom, imperviousness, intoxication, music, instincts, and dance; while Apollonian is the direct opposite. Apollo symbolizes reason and logical thinking. Throughout his life he loved music, and worshipped all of Wagner's work. During his later years, when the stress of being a moral truth-seeker had taken its toll, Nietzsche went mad (*The Madness Letters*). He wrote letters to various people, and they were later named "The Madness Letters". He wrote things that seemed like gibberish, but they seemed to attack leaders such as the Pope, Bismarck, and Wilhelm. He either signed them with "The Crucified" or "Dionysus". Why did he sign them this way? It seems that when he declared "God is Dead" he became the new leader to this new movement, just as Jesus was crucified, he was as well. Is madness the ultimate freedom of consciousness? Will it lead to higher points of understanding? When someone opens up their mind to new ideas and new things, they are presented with new paths of thought and ideas. When Nietzsche called himself "Dionysus" did he recognize his madness? I think that it is very ironic and funny that he did. He seemed to recognize the state of disorder and the passion that comes with being human. We are all emotion and impulse. Crazyness could be seen as just a radical, unsuppressed reflection of what we are truly like on the

inside. Why do we get to decide when someone is mad or not just because they aren't thinking the way the masses think? Our random thoughts inspire us and will eventually lead us to a higher level of awareness. Society is holding us back from our true selves, and what we perceive as normal is keeping us from thinking about ideas in a different way. This idea is a something that is holding us back from achieving an even higher level of entropy in our minds.

Being confused on what to believe and questioning your own awareness isn't something that everyone is comfortable with. For this portion of the essay, I am going to be explaining something that I call "chaotic thought". Instead of using entropy to describe a physical process, I will try to use it to describe a subjective process. When you start off with one idea, and then those ideas split off into different sub-ideas, you end up with a few more ideas bouncing around in your brain. Immediately, new things have been added to your repertoire, and it can only get more and more crazy from there. New connections are being made as more information is added to the brain. Just as a jar fills with water, the brain seeps up information and stores it away.

If you take a vessel and put one marble into it and shake it, the marble will bounce around, hit the edges of the container and settle back into relatively the same place (Fig. 1). No new connections have been made, because there aren't any other marbles to hit or to move

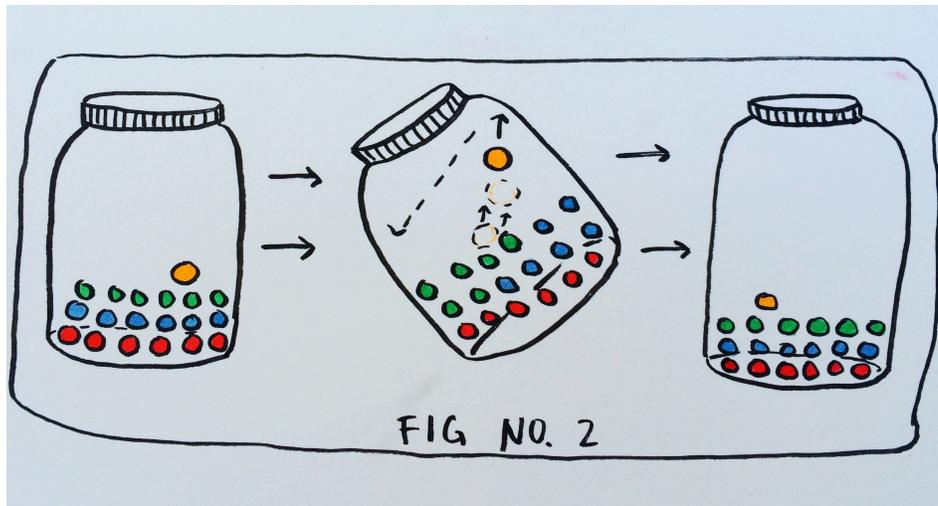


around. If you add a handful of marbles to the vessel and shake it again, the marbles will touch the other marbles, bounce off the walls and settle back into a completely different formation than before. In just that one event, many different marbles have just connected with each other, forming new bonds, and then re-configured themselves in a different way. This entire metaphor symbolizes thought and the randomized, entropic behavior of thought, especially when more bits of information have been added to the system.

But where is the point where we can't add anymore marbles? Where is the point where we stop making connections? Perception could be a tether that holds us back from letting ourselves make connections that we necessarily believe won't work. Say we have another jar (Fig. 2), and in this jar we have three different groups of marbles that are all fixed in the jar, a blue group, a red group and a green group. We introduce a yellow marble to the jar, and shake the jar. The yellow marble bounces around all the groups of marbles, but never becomes part of the fixed groups. The yellow marble then settles away from the other groups, because yellow doesn't match with the other colors. This is just like receiving new information. If you've never heard of a cat before but you know what a dog is, then when you learn what a cat is, you know

that it isn't a dog. So when you see a cat on the street you say "Oh, look at that cat." instead of "Look at that tiny dog with long hair and whiskers." Our brain does this amazing thing that categorizes what we see, so that we can make quick associations that we use to describe the world around us.

After a while, we know that certain "ideas of things" don't really mix, or belong in certain groups of ideas. Perception\* and categorizations make it so that our minds can never truly be free to think whatever it wants to think, or to make as many connections as it can. As soon as we learn that two things don't go together, we sever the connections between the two objects/ideas and never pursue that path again. We use patterns in order to find what works and



what doesn't work. We can never reach that highest point of entropy unless we were absolutely crazy and willing to throw away these groups of ideas and mesh everything together.

## THE BODY

As a child we start off as a very pure being, we have just come from the womb, and we are very impressionable. As our thoughts grow, we become more perceptive, and we get to decide where we go with our opinions. When we grow old our body sags from gravity, we have aches and pains as past reminders of what we've done. It was like that last day of summer, when you broke your foot skateboarding down a hill. When you were 8 and tripped over your dog, skinning your knee. A little scar still remains, a risen, fleshy lump on your knee. You hit a growth spurt and suddenly you feel really small in a very large body. You take up more space and push and prod around the world, hoping to make some sort of mark so that people can remember you. You stir up the air with your words and you secrete little shards of energy, you consume even more. Our bodies create entropy, and we were born from entropy as well.

Many people want to spend more time on this earth than what was given to them. As soon as we are born we oxidize, we feel the weight and pressure of gravity on our bodies. Everything we need to survive is ultimately toxic to us. It is almost as if Nature is telling us that we really weren't meant to last when she gave us life. What is life to us is also slow death. Entropy is a constant threat to our bodies but it is also what keeps us alive. Oxygen normally would like to bond with our essential organic compounds because they give off more energy than  $\text{CO}_2$  and  $\text{H}_2\text{O}$  when oxidized (Lambert, 2013). But, since we would automatically combust, our bodies were created in such a way where this process would not happen. Activation energy is

needed in order to jumpstart these reactions, so our bodies won't combust unless we get over the initial energy hump. The reason that the transfer of energy isn't as erratic as it seems is because the flow of energy is favorable when flowing from concentrated to dispersed. An example of this would be if you were standing in the snow, since the surroundings are colder than your body temperature, the heat/energy from your body would be flowing into the surroundings. If the movement of energy wasn't stable, it would be very hard for life to exist because life itself needs a stable movement of energy.

Ultimately, our bodies want to break apart and disperse. Potential energy plays a big role in how entropy works on our bodies. If we keep oxidation from happening in our bodies, we could live for longer and longer periods of time. There are a lot of factors keeping life around us from releasing all of their energy at once. Trees for example, have a lot of energy, but in order to release all this energy at once there needs to be some sort of energy to activate that process. If you were to light the tree on fire, the tree would go up in flames and release all of the energy it had stored away. Fire has a lot of energy and heat, enough so that the tree could have enough activation energy to combust.

Even though we won't necessarily combust and go up in flames, time is our enemy the oxidation process is slow but sure. When we are young we are like well oiled machines, we work well and we work fast, we are fast energy computing system. As we get older, the elements take their toll and we rust, we have to be fixed every once in awhile. Eventually, we have completely broken down and expended all our energy. We are just husks.

## **CONCLUSION**

As we can see entropy plays so many roles in our lives as a driving force. This qualitative idea is essential to the sciences when describing the movement of energy and particles and how it affects our lives. Even though we will try to escape it and evade the natural forces it is inevitable. Our minds will open and close, we will continue to perceive and categorize. We will never truly be free to be at our highest level of awareness, which means that we would have to become completely connected yet free from everything mentally. Our bodies will age and we will get hurt and healed. The universe will keep expanding, pulling apart matter and dispersing energy until eventually it will reach an inescapable death by heat or contraction. Although we are aware of these things, we should make sure that these ideas don't become our obsession, we should keep them in the back of our minds, but not worry about our ultimate fates. The idea of entropy can be understood, but not controlled. Death is eminent, and there are things to pull us a little farther away from it, but in the end we always reach it. There are checks and balances, making sure that we don't reach the end too quickly, but that we do reach it eventually. We should always find ways to expand our minds, and break free from these barriers in order to become a fully functional, entropic human. We shall keep going, venture into the darkness, make meaning out of it, then go away.

## BIBLIOGRAPHY

- Atkins, P.W. *The Second Law*. New York: Scientific American, 1984. Print.
- Becker, Adam. "How Will the Universe End, and How Could Anything Survive?" *BBC*. N.p., 2 June 2015. Web. 4 Nov. 2015. <<http://www.bbc.com/earth/story/20150602-how-will-the-universe-end>>.
- The Boltzmann Brain Paradox*. *Youtube*. N.p., 29 Sept. 2013. Web. 3 Nov. 2015. <<https://www.youtube.com/watch?v=e4C9bn7ZqS4>>.
- "How Can Entropy Apply to the Arts?" *UCLA*. N.p., n.d. Web. 12 Nov. 2015. <<https://www.ucl.ac.uk>>
- Lacewing, Michael. "Nietzsche on the Will to Power." *Routledge*: n. pag. *Routledge*. Web. 2 Nov. 2015. <<http://documents.routledge-interactive.s3.amazonaws.com/9781138793934/A2/Nietzsche/NietzscheWillPower.pdf>>.
- Lambert, Frank L. "Entropy Is Simple... If We Avoid the Briar Patches." *entropysimple*. N.p., Aug. 2013. Web. 12 Nov. 2015. <<http://entropysimple.oxy.edu/content.htm>>.
- Lombardi, Kate Stone. "Exploring Artistic Creativity and Its Link to Madness." *NY Times*. N.p., 27 Apr. 1997. Web. 2 Nov. 2015. <<http://www.nytimes.com/1997/04/27/nyregion/exploring-artistic-creativity-and-its-link-to-madness.html>>.
- Marx, Karl. "Works of Karl Marx." *Marx Archives*. N.p., n.d. Web. 12 Nov. 2015. <<https://www.marxists.org/archive/marx/works/1843/critique-hpr/intro.htm>>.
- "The Madness Letters." *The Nietzsche Channel*. N.p., n.d. Web. 1 Nov. 2015. <<http://www.thenietzschechannel.com/correspondence/corresp.htm#salis>>.
- Meckler, Jeremy. "Madness Letters: Friedrich Nietzsche and Bela Tarr." *Walker Art Center*. N.p., 16 Mar. 2012. Web. 1 Nov. 2015. <<http://blogs.walkerart.org/filmvideo/2012/03/16/the-madness-letters-friedrich-nietzsche-and-bela-tarr/>>.
- Moseley, Alexander. *A to Z of Philosophy*. New York: Continuum, 2008. Print.
- Nietzsche: Beyond Good or Evil*. BBC, 1999. Film.
- Prigogine. "Entropy, Matter and Cosmology." *PNAS*. N.p., Sept. 1986. Web. 2 Nov. 2015. <<http://www.pnas.org/content/83/17/6245.full.pdf>>.
- Zimmerman, Andrew. "What Are Boltzmann Brains?" *Physics.About*. N.p., n.d. Web. 3 Nov. 2015. <<http://physics.about.com/od/thermodynamics/f/BoltzmannBrains.htm>>.