CLASSIFICATION:
ABSOLUTISM vs RELATIVISM

By

Darren Weist

THESIS

Submitted in partial fulfillment of the requirements
for the degree of Master of Science in
Computer and Information Science

University of Michigan – Flint, 2016

Flint, MI

Approved by:

Thesis Advisor

Second Reader

DEDICATION

To all family, friends, and faculty. Thank you for all of your love and support!

TABLE OF CONTENTS

CHAPTER 1 - INTRODUCTION:

1.1 - OVERVIEW OF THE THESIS

The thesis is organized in the following approach. First, we will address some of the main issues for general artificial intelligence. Second, to enhance our understanding of the problems, this article will provide a general overview of two axiological theories presented from philosophy: absolutism and relativism. We will discuss some examples of how these concepts relate to machine learning algorithms. Third, we will argue the thesis statement that ***classification requires relativism to be useful***. Absolute classification can be very difficult, if not impossible. In the scope of general artificial intelligence, absolutism is not necessary. The concept of relativity can be useful for: (1) axiology, (2) defining things, and (3) memory. Then, the paper will conclude with future and final thoughts on the subject matter.

1.2 - ISSUES FOR ARTIFICIAL INTELLIGENCE

Narrow or weak artificial intelligence runs into the issue where it can only perform specialized tasks. These algorithms are excellent for executing static tasks, but fail to perform other jobs that lay outside of the limited scope of what they were originally designed to accomplish. To get to the level of general or strong artificial intelligence, machines will need to comprehend things in a relative context. For instance, they will need to overcome challenges, such as:

- Having the ability to perform across a wide range of different tasks.
- Adapting to new and changing environments over time and space.
- Classifying an indeterminate number of labels that can change dynamically.
- Being capable of learning without the use of large volumes of training data and time.
- Being able to identify, prioritize, consolidate, and retain relevant information.

1.3 - OVERVIEW OF ABSOLUTISM AND RELATIVISM

This paper covers several philosophical topics. Before we jump further into the thesis, first we will introduce you to the two main terms discussed throughout this paper to give you a better understanding of what they mean and provide you some examples of how they can relate to artificial intelligence. The field of philosophy debates two interesting moral theories: absolutism and relativism. This section will present a general overview of these terms and help explain them.

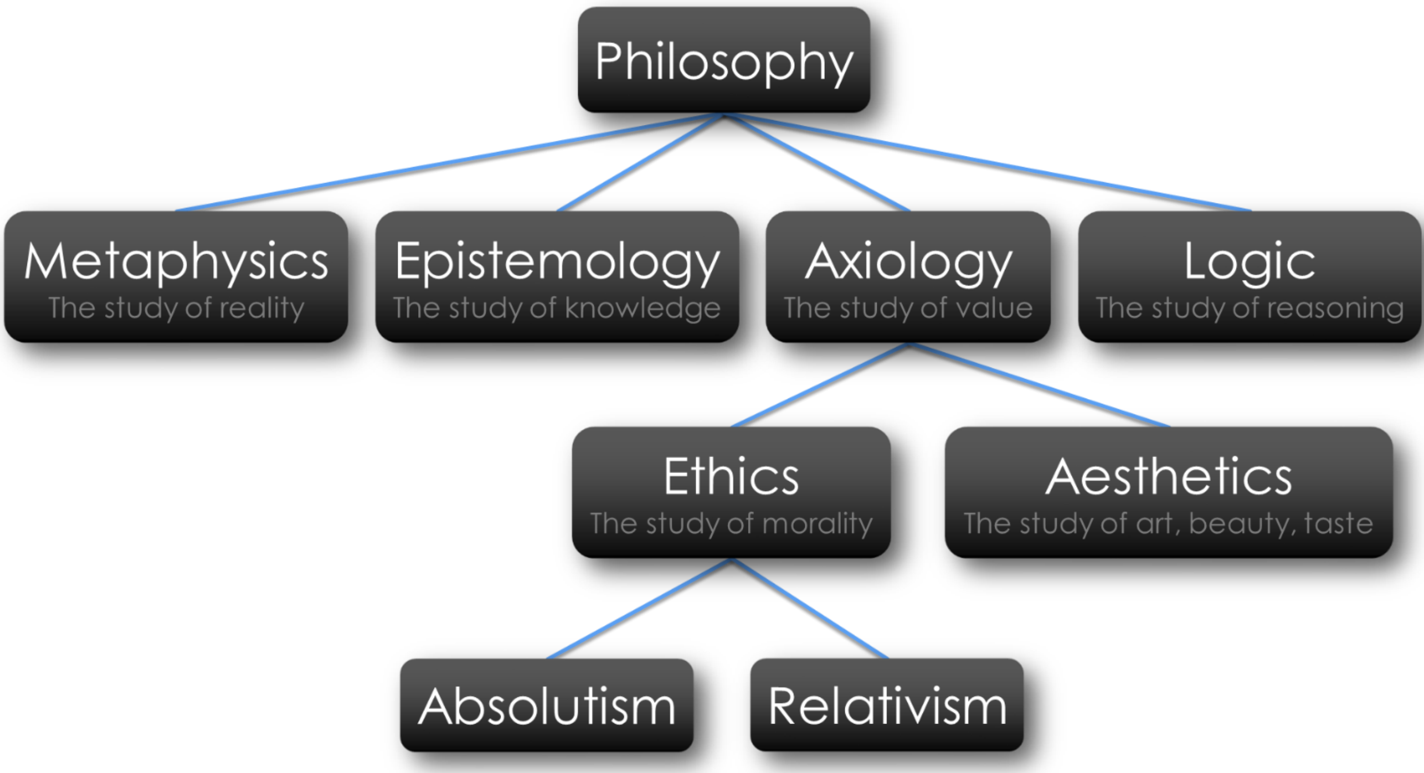

Figure 1.1: Overview of Philosophy Terms.

1.3.1 - ABSOLUTISM

One of the main theories of morality is absolutism. Absolutism is the idea that there is one right answer, independent of context or perspective. There is only one right way to represent something. Referring to something that is unchanging and always that way. We can say something is true, unconditionally, no matter what. For example, the statement all rectangles have four sides. That is considered an absolute statement. It holds true no matter what. We cannot have a three sided rectangle, can we? Some of the main absolutist philosophers include: Plato, Aristotle, and Immanuel Kant.

In the book, *Doing Philosophy*, Schick and Vaughn describe absolutism as "the view that there is only one correct way of representing the world" (Schick, 2004). For example, the act of killing might be considered to always be unethical. In this theory, the action would be viewed from an absolute perspective, without dependency on context. Even if the act was in a scenario of survival or for the greater well-being of others. Killing something, whether it be a plant or an animal, might always be measured as immoral. Schick and Vaughn also discuss the concept of universal moral laws. These universal laws are considered to be common moral standards. They are referred to as a fixed set of standards we can use to judge our actions. They are self-evident truths. Meaning, to support our belief, we don't need any further evidence. Self-evident truths contain their own justification and do not need any additional proof. For instance, Schick and Vaughn consider two potential universal laws. One being the principle of justice. The concept of justice is that we should treat equals equally. And, the second one is the principle of mercy. The concept of mercy is that unnecessary suffering is immoral. However, some suffering is alright. For example, the minor pain from exercising is necessary for the greater good of your health. On the other hand, unnecessary pain from torturing an innocent child is considered wrong.

Gael McDonald's article on *Ethical Relativism vs Absolutism: Research Implications* refers to moral absolutism as a universal principle of morality. It is discussed as a global standard. Absolutism is described as a set of common standards and values for ethical reasoning. McDonald says absolutism "dictates that an omni-present set of standards should apply universally, being equally valid in all places and times" (McDonald, 2010). There are moral norms like honesty, loyalty, and integrity. These norms are seen as basic ethical standards. These principles are asserted by many societies, however, observance of these standards may differ significantly.

The entry on *Relativism*, by Bagharamian and Carter, clarifies the view of absolutism as a main contrast to relativism. They describe absolutism as the idea "that at least some truths or values in the relevant domain apply to all times, places or social and cultural frameworks" (Bagharamian 2016). They explain absolutism values as being universal. For example, a truth or value that is unbound by social or historical circumstances. It is an idea that does not change relative to a frame of reference, such as time or location.

1.3.2 - EXAMPLES OF ABSOLUTISM IN AI

In the context of artificial intelligence, some machine learning algorithms follow along the lines of absolutism for coming up with classes and assigning labels. For example, the Multi-Layered Perceptron (MLP), neural networks, and crisp set methods use more of an absolute technique for assigning value to objects.

The Multi-Layered Perceptron (MLP): Many supervised learning methods classify items by using predetermined features and labels. For example, several neural networks and the Multi-Layered Perceptron methods use prearranged sets of training data to help teach or train the machine. The training data is assigned labels to let the machine know how to classify the objects it is given as input. The machine is given an input object, it extracts feature values from the object, it evaluates the feature values through a classifier, and then it makes a decision as to what the object should be classified as for the output. The machine has to decide from a predetermined set of features and labels what to classify the object as. The object gets classified under one absolute label from the given set of labels that the machine was arbitrarily programed to use.

Neural Networks: With neural networks, when transitioning from one task to another, they tend to start over with a blank slate. They need to go through several iterations of training to learn the new environment, variables, and mechanics to perform the new task successfully. With this type of absolute approach, the machine is not able to recognize relative similarities from one task to the other. And, it becomes difficult transitioning to a changing environment. Carey's article, *Inside DeepMind's Latest Attempts to Achieve a General Artificial Intelligence*, discusses some of the challenges Google's DeepMind has been working on. In 2015, DeepMind developed an agent that uses a deep neural network combined with reinforcement learning to master a number of different Atari 2600 games. After several iterations, the agent becomes capable of performing each one of these Atari games at a superhuman level. However, the neural network learns to master each game separately, one at a time. For example, the same neural network could not transfer from one game over to another game and still retain its learned skills like a human. This remains a challenge for neural networks and reinforcement learning. Usually, they are trained using large quantities of data and time in order to learn a specific task. For instance, learning how to recognize images, listen to music, and play games. But, it is very difficult to learn all those different tasks together. Just learning how to perform different games on a single neural network is said to be a hard challenge. Currently, neural networks do not maintain their ability to perform an old task after they are trained for a new one. In order to represent more of a general artificial intelligence, DeepMind is now trying to develop a progressive or continual neural network designed to perform multiple tasks on a single neural network.

Crisp Set Methods: In Zimmermann's book, *Fuzzy Set Theory - And Its Applications*, he explains the use of crisp sets. Most traditional crisp techniques are deterministic or dichotomous. Meaning, they follow an absolute valuation like the Boolean logic of true or false. It can only be a true or false value. There cannot be some variation between the given values. An element either belongs in the set or it does not belong. For instance, we could set up a classifier that would categorize vehicles according to engine type using only two classes. The classifier would label the cars as either a gas or an electric vehicle. However, if we were to encounter a hybrid vehicle that utilizes both gas and electric, then determining the class may be an issue. It would have to be assigned to one of the only two available classes given.

1.3.3 - RELATIVISM

Another main theory of morality is relativism. Relativism is the idea of using the context of different perspectives. We can say something is true relative to a point of view. For example, relative to an object, person, time, location, etc... The statement all rectangles have four sides can be relative. There are quadrangles (objects with four sides) and non-quadrangles (objects that don't have four sides). The non-quadrangles help define the identity of quadrangles. And perhaps, the term *rectangle* can take on a different meaning based on time or location. For instance, definitions to terminology can change over time and the word rectangle might have a different meaning to individuals in another region. Some of the main relativist philosophers include: Protagoras, Thomas Kuhn, and Paul Feyerabend.

Schick and Vaughn refer to subjective relativism as the idea that "what makes an action right for someone is that it is approved by that person." (Schick, 2004). In this theory, morality is relative to different views. It claims the appropriateness of an action is always relative to the individual. For example, if Bob says something is right, he means it is right for him. Nothing can be completely right or wrong in absolute terms. The view can change from person to location. Schick and Vaughn describe cultural relativism as the concept that "what makes an action right is that it is approved by one's culture" (Schick, 2004). Here, the context changes from the individual over to the culture level.

McDonald discusses how ethical relativism is not just about people having different moral thoughts. He explains that what is right for one person, country, or period may be wrong in another. The moral standards can be different across groups, cultures, and time. In addition to the premise of having different moral standards and beliefs, ethical relativism calls into question if there can be any commonality or universal set of standards. When it comes to moral beliefs, relativism argues that there is no uniformity. Our moral beliefs are relative to individual views and there are no set of universal or absolute ethical principles.

1.3.4 - EXAMPLES OF RELATIVISM IN AI

In the context of artificial intelligence, some machine learning algorithms follow along the lines of relativism for coming up with classes and assigning labels. For example, fuzzy sets, Dempster-Shafer, and histogram slicing methods use more of a relative technique for assigning value to objects.

Fuzzy Sets: Zimmermann describes the use of Fuzzy Set theory. Unlike most traditional crisp techniques, fuzzy sets are not deterministic and absolute. The assignment of elements is more relative. Elements in a fuzzy set can be allocated degrees of membership. Meaning, elements can be in one set as well as part of another set. For instance, given a classifier that categorizes vehicles into gas or electric classes. If the classifier encountered a hybrid car that uses both gas and electric engines, then the fuzzy classifier would be able to assign the vehicle under both gas and electric classes. Fuzzy sets are suitable for scenarios where objects may have a degree of membership in several different classes. It is useful for hand writing recognition and voice recognition applications.

Dempster-Shafer and Histogram Slicing: Farmer's article *Evidential Reasoning for Control of Smart Automotive Air-bag Suppression* demonstrates an example of applying Dempster-Shafer to classification and the histogram slicing process. The Dempster-Shafer method uses mass and probability assignment to compute a proposition's plausibility and belief. The classifier can vary from separate to continuous outputs depending on the class-wise likelihood measure given to each class. Instead of just identifying to a best matching class, Farmer's image classification process would assign a relative confidence level to each candidate class. Then, the confidence outcomes are represented in a histogram where it can perform a histogram slicing process. The histogram is sliced horizontally to allocate probability masses to the subsets. That way, it groups the different levels to the subsets.

CHAPTER 2 - THESIS STATEMENT AND SCOPE

Thesis Statement: This paper argues the thesis statement that ***classification requires relativism to be useful***. Absolute classification can be very difficult, if not impossible. In the area of general artificial intelligence, absolutism is not necessary. The concept of relativity can be useful for: (1) axiology, (2) defining things, and (3) memory.

Scope: For the scope of this thesis, the focus is on using relativism as a general strategy and not pursuing further philosophical claims, such as: which theory is correct and debating the concept of truth. The goal of this paper is to show how relativism can be used as a strategy to help solve some of the issues for general artificial intelligence. There are cases in the domain of artificial intelligence where the method of relativism can be useful. Some cases are straightforward while others are not as clear. We will begin with the more established axiology examples of ethics and aesthetics in which relativism can be useful. And, then work our way to the other instances in which the method of relativism can be useful for defining things and can be useful for memory.

CHAPTER 3 - AXIOLOGY

The field of philosophy is made up of different branches including metaphysics, epistemology, axiology, and logic. When it comes to classifying and defining values in the field of machine learning, the philosophical subject of axiology can help us explore these concepts. Schick and Vaughn explain axiology as the study of value. For example, it discusses the fundamental questions, such as: What is value? How do we define it? How do we attain value? What are the sources? And, how do we classify values?

In this section, we will review some familiar examples in which relativism can be useful. For instance, relativism can help us understand the areas of ethics and aesthetics.

3.1 - ETHICS

Within the branch of axiology, there is the sub-topic of ethics. Ethics is the study of moral value. For instance, what is the best action for you or for society? What actions do we take in particular situations? What is right and what is wrong? It explores the ideas of good and evil. How do we deal with justice and crime? And, discusses the influences of nature versus nurture.

We will review how relativism can help us understand some of these areas in more depth. First, we will go over the issues with right and wrong actions. Second, we will take a look at the concept of good and evil. And, then discuss some of the concerns with censorship.

3.1.1 - RIGHT VS WRONG

Relativism can help us understand between right and wrong actions. For example, we will examine the concept of absolute universal laws, observe how morality can change over time, and discuss how morality can differ by location.

Absolute Universal Laws: Theories based on absolutism claim that there exist some universal laws of morality. However, even those universal rules are subject to a frame of reference. Schick and Vaughn talk about two universal laws that could be followed as common moral standards we can use to judge our actions. The principle of justice and the principle of mercy. The concept of justice states that we should treat equals equally. However, this absolute law seems too vague and open to relativity. As a counter example, how do we determine who is considered an equal? We may determine one person to be equal and then omit someone else based on some type of measurement. How do we measure this equality? It could depend of a number of things which is more along the lines of relativism than absolutism. The concept of mercy states that unnecessary suffering is immoral. But, as a counter example, how do we determine what is considered necessary and what is unnecessary suffering? Again, this law is also too ambiguous and open to relative interpretation. Relativism argues that actions can be measured as either moral or immoral, depending on the point of view. For example, some people may consider an act to be necessary while others consider the same act to be unnecessary according to their perspective.

Morality over Time: Things can change over a period of time. Whether it is the laws or entities ourselves as we age. Relativism is more open to variations in time than absolutism. Baghramian and Carter mention how actions and judgments prevalent in society can change over time. They criticize how abominations in the past have been approved by moral code. For example, the toleration of human sacrifices, slavery, cannibalism, and physical torture. McDonald's article also explains how our moral behavior can shift over time. Our standards for what we deem as acceptable practices have changed over the years. Whether it is for a small gift-giving practice at your company or dealing with large historical atrocities. After World War II, for example, society has become less tolerate of people justifying their immoral actions based on a claim that they were just doing their duty. And, McDonald talks about how traditional and cultural values have changed as they have been passed down generation by generation. When living conditions change, then new moral norms evolve to justify the new behaviors.

Morality over Location: Things can change from one location to another. Relativism is more open to variations in location than absolutism. Baghramian and Carter state that relative beliefs on right and wrong can diverge greatly across individual, social, and cultural backgrounds. McDonald also argues that ethical relativism can view morality differently according to individual, group, and cultural levels. For example, at the individual level, each person may have a different interpretation for a given situation and believe their own actions to be moral. Meaning, each individual holds the standards to judge their actions. However, McDonald does point out some criticism of this level as being naïve and lazy. Stating that it would be hard to judge or improve an individual's moral standards. Next, McDonald talks about the group level of relativism. This is where moral standards are attributed to a person's role, organization, or social group. Morality can be determined by different groups rather than by the individual. Rules and standards are established for each group. And, these collective standards can vary from one group to another. The criticism of group level morality is that it is also difficult to evaluate and improve. It may be hard for an individual to decide what is right or wrong when they belong to several social groups or organizations that may follow conflicting norms. McDonald also discusses the relative cultural level. Cultural relativism describes value judgments according to the relative context of someone's culture or community. For instance, what we consider right or wrong depends on our strongly held cultural beliefs. One culture may hold values that differ greatly from another culture. For example, if you travel on a business trip from one region to another, you may experience a diversity of cultural norms. Places can have different standards for greetings, etiquette, and table manners. And, you will need to learn what is morally acceptable in their culture to earn their respect. However, McDonald does point out criticism of the cultural perspective. Like the other levels, it may be difficult to determine right or wrong actions in the scenario when a culture's values clash with another culture. Or, when an individual belongs to more than one culture that holds conflicting moral values.

3.1.2 - GOOD vs EVIL

What is considered evil? And, how do we differentiate what is good from what is evil? Relativism can be more useful for classifying concepts of good and evil. For example, we will discuss the concept of evil and then argue how one term is dependent on the other with the ontological defense.

The Concept of Evil: There are several theories when it comes to defining evil. In the book, *The Lucifer Effect: Understanding How Good People Turn Evil*, psychologist Philip Zimbardo defines evil as “intentionally behaving in ways that harm, abuse, demean, dehumanize, or destroy innocent others” (Zimbardo, 2008). In philosophy, the problem of evil is a subject that is commonly discussed along with the existence of God issue. For the scope of this paper, we will focus mainly on the topic of good and evil and avoid the religious arguments. In the article, *The Concept of Evil*, Calder explains that there are two main notions of evil. There is a narrow view and a broad view. With the narrow theory, evil is defined as the kind of actions or characters that are the most morally appalling. It is attributed to mainly just moral agents and the actions performed by moral agents. For instance, if we consider a human being as a moral agent, then that individual is capable of performing evil actions. On the other hand, with the broad theory, evil is defined in a more general sense. The broad concept of evil is described as any bad action, character, or event. For example, he explains that the minor suffering from a toothache or telling a white lie can be considered evil. The broad view of evil covers a lot. It is broken down into two sub categories. The two groups are natural and moral evil. Calder describes natural evil as the bad state of events that are not intentionally caused by moral agents. For instance, a natural disaster such as a hurricane would be an example of a natural evil because it was not the result of an intentional human action. In opposition, Calder defines moral evil as the bad actions or events caused by moral agents. For example, a human being intentionally murdering or lying.

The Ontological Defense: Does good depend on evil? Schick and Vaughn discuss this idea with the ontological defense. This argument claims that goodness cannot exist without evil. It is impossible to have a good domain that contains no evil. However, Schick and Vaughn assert that good is not a type of evil. Meaning, they are contradictory ideas. Schick and Vaughn give an example using colored objects. For instance, a red thing and a non-red thing. They say these contradictory concepts do not depend on each other. Meaning we can have a red thing absolutely by itself without the existence of a non-red thing. They give a thought experiment where we assume everything in the world is colored in red. In this scenario, the world does not contain any non-red objects. However, they assert that red objects can exist absolutely without having non-red things. Therefore, goodness can exist absolutely without evil in the world. The lack of one thing does not prevent the existence of the other. Mackie's article *Evil and Omnipotence* makes a similar claim. He argues that goodness and evil are not dependent on one another. Mackie believes it is fallacious for evil to be a necessary counterpart to good. He uses a couple of thought experiments. Mackie uses the color example with red things and non-red things. And, he gives another example of relating good and evil to the terms of great and small. Mackie says the terms great and small are used relatively as counterparts. Greatness cannot exist without smallness. However, he believes that great and small can be also be absolute. We can have one quality without the existence of the other. He states that it is possible for everything to be small or everything to be great. Therefore, goodness can exist absolutely without having evil.

I argue against the assertions made by Schick, Vaughn, and Mackie. I support the ontological defense that claims goodness and evil are relative to one another. It makes sense to consider that good cannot exist without its opposite. We can provide a counter-example to the color thought experiment mentioned above. For instance, if everything in the world was colored red, then how would we know what red is? Red relative to what? The color would be undefinable by itself. If everything was consistently red within our reference frame of space and time, then we would not be able to define red uniquely without an opposing non-red object. We would not be able to perceive red. We would have nothing to distinguish red from non-red things. Therefore, the terms good and evil are better defined using relativity. They need to be put into perspective. Good and evil do not exist absolutely by themselves. Good and evil can be considered as two labels on the same axis of measurement. Like temperature, you cannot perceive hot without cold. Or tactile sensation, how would we be able to experience pleasure without being able to feel pain? And, what is a superhero without a villain of some sort? For example, Batman would be a very boring series without the Joker or some other evil guy to oppose him. There would be no drama. If there was no bad guy to terrorize the city of Gotham, then the city would not need a good guy to save it from destruction.

3.1.3 - CENSORSHIP

What makes a word good or bad? Why do we ban certain words, images, books, music, videos, or other forms of art from our society? Relativism can be more useful for classifying the value of a word. In his book, *Bad Language: Are Some Words Better than Others*, Battistella argues how language is variable. He claims "that good and bad language cannot be defined in absolute terms" (Battistella, 2005, p.8). For example, the semantics or meaning of a word can change relative to location, time, and context.

***Terms by Location**:* There are different laws in different locations when it comes to the use of offensive language. Some areas in the world are more stringent on censorship than other areas. Battistella describes how there are different levels of acceptance for offensive language with different types of media and communication. Often, bad language is prohibited for the idea of protecting observers, stereotypically women and children. For instance, Battistella mentions the example of a man who was fined 100 dollars in 1999 for violating an old 1897 law in Michigan. He broke a law that prohibited cursing in the presence of women and children. Offensive words can vary from place to place. For example, the word *fart* means speed in Danish and Swedish. And, the word *slut* means final or end in Swedish.

***Terms over Time**:* In addition, the meaning of a word can change over time. For example, a good term may eventually become bad. Or, on the other hand, a bad term may change meaning and become good. Battistella talks about the history of cursing and how coarse language changes. The avoidance of profanity used to be a display and distinction of class symbolism. Then, by the twentieth century, American tolerance towards offensive language started to shift. With the arrival of the movie industry, the impacts of several wars, and the emergence of new forms of media, people eventually became more relaxed to the use of offensive words. And, the meaning of coarse language can change over time. Bad terms can become less taboo. Even the word *bad* was once considered offensive in the past. According to Harper's *Online Etymology Dictionary*, the term *bad* was originally used as a derogatory term in Old English to refer to a hermaphrodite or a womanish man.

Terms by Context: Battistella categorizes offensive language into different groups. For one, there is the epithets group. This is for words that are considered slurs that relate to things like race, gender, and sexuality. The profanity group is refers to religious cursing, like the words hell or damn. And, then there are the vulgarity and obscenity categories. These groups are for words that describe sexual anatomy and crude excretory acts. Even though bad words are offensive, they still convey meaning. Battistella discusses how words are used to confront underlying ideas. For instance, words can hold an emotive force and it can be challenging to ban bad words without banning their ideas as well.

Bad words are considered taboo to a society based on the deviance of the term's meaning. However, good words don't exist without the existence of bad words. Bad terms are needed to define good words. We cannot just banish a set of terms that are needed to fulfill the definition of another set of terms. In the place of where the set of exiled words used to exist, a new set of terms will emerge to replace the void. Bad words give meaning to good words, and vice versa. It's hard to get rid of the bad without diminishing the good.

To an extent, as a bad word becomes increasingly rare and taboo, the bad word may develop a stronger definition in the process. An attempt to erase a word from a society's vocabulary may end up giving the word a stronger meaning of deviance. It is kind of amusing how the process of censorship essentially gives our offensive words stronger meaning.

3.2 - AESTHETICS:
ART, BEAUTY, AND TASTE

Aesthetics is the branch of axiology dealing with how we value things such as art, beauty, and taste. For instance, how do we judge a piece of art? Absolutist would argue in favor for methods we can use to universally place value across all individual works of art. On the other hand, relativism argues against universal standards. Relativism can be more useful for classifying aesthetics. The way we value art, beauty, and taste can change over different contexts. For example, the definition of art is vague, art can be valued differently over time, and art can be valued differently from one person to the next.

How do we define art? We do not have a strict, absolute definition for what is considered art and what is not. Where does art begin and where does it end? For instance, the line is not so clear for work utilizing nude figures. Some may consider it art, others may dismiss it as pornographic material. Art can include several different forms, such as: drawings, paintings, sculptures, photography, literature, poems, music, concerts, film, operas, plays, dance/ballet, architecture, graphic design, video games, graffiti, cooking, gardening, fashion, etc... Plus, there can be several different genres within each of those examples. Music has classic, jazz, blues, rock, rap, hip-hop, country, etc... Film has action, comedy, science fiction, thriller, fantasy, etc... New genres can evolve over time and location. Also, it is unclear what determines a piece of art as beautiful or ugly. Can a piece of work be so horrible that it actually becomes valuable? Cynthia Freeland's book, *But is it Art*, argues that art includes both the good and the bad. She explains how art embraces both the formal, beautiful pieces with positive morals as well as the ugly and disturbing pieces with negative morals (Freeland, 2002, p.28-29).

How do we value art? There is no one absolute standard that everyone uses to value all forms of art. When it comes to valuating art, is the value influenced by the materials used, by the medium it was constructed in, by the frame that surrounds it, by the techniques used, by the time it took to create it, by the artist, or is the value also influenced by the emotions and experience that it provides to the audience? There are several factors that can relatively influence the value of art over time and location.

Value of art over time: The valuation of art can change over time. For instance, Freeland describes the classic imitation theory of art where pieces are created to imitate nature and humans. Innovations using perspective techniques and oil paintings created ever more realistic looking copies of objects and nature. By the late 1800s, the development of photography had a large influence on art. And, imitation became less of an objective for several art genres, like impressionism and abstraction. (Freeland, 2002. p.31-35) Freeland discusses how Andy Warhol's plywood Brillo Boxes were debatable sculptures that were not accepted right away as art. These ordinary looking soap boxes puzzled many critics and opened our views of what may be considered art. (Freeland, 2002. p.56-59) Museums are viewed as institutions that maintain classical standards for art and how it is valued. Over time, however, museums have been changing their standards and displays. Freeland discusses how museums have been arranging their displays and updating their locations with add-ons to attract more people and different audiences. For example, museums are now adding things like restaurants, gift shops, and theatres, and film sections. (Freeland, 2002. p.103-104) The value of art can change over time. She gives an example how an artist in the past, like Van Gogh, lived in poverty and found it difficult to sell his work. Then, over time, his pieces of work can now sell for astronomical amounts of money. (Freeland, 2002. p.105-107) Freeland concludes that there does not appear to be any universal standards for art. Art evolves over time. There is no common law that dictates what makes a piece of art beautiful or valuable. (Freeland, 2002. p.208)

Daniel Grant's article, *Is an Artist Only Appreciated after He Dies*, touches on one of the greatest factors that influences the value of an artist's work. The market supply and demand over time. For example, he mentions how collectors release pieces of work after the death of an artist. When collectors release too many pieces over a given period of time, they may end up flooding the market. A sudden increase in supply can decrease the value of these particular works of art. He gave an example of Pablo Picasso's paintings going down in value for a period of time as a result of an influx of his pictures being supplied to the market after his death. Also, he mentions that the art buying public can have changing tastes. And, these changes in tastes can influence market demand. (Grant, 2011)

The Value of Art: Money, Power, Beauty, by Michael Findlay, discusses how the value of art can change. He describes how the commercial value of art can be determined by our collective intentions. Art does not have a fundamental objective value. Our human demands determine the commercial worth. He gives an example, if people were given millions of dollars to either buy a painting or to buy a mansion, most people would prefer the mansion over the painting. He argues that the majority of people do not have criteria or a reliable set of standards to judge the value of art. Opinions of artwork and reputations of artists can change over time. (Findlay, 2012)

Value of art over location: The valuation of art can change from one place to another. Freeland describes how art is not well defined across different cultures and eras. There are many different practices and roles for artists. For instance, she gives an example of how art may include different things when comparing classical Japanese art to modern Western art. Japanese art may consist of things like Zen gardens, tea ceremonies, and swords. She explains that in the context of another culture, it is difficult to know what art is valued and why it is valued. Art may include African carvings and masks. It may include Hindu dances. Or, it may include Islamic coins, carpet, and calligraphy. (Freeland, 2002. p.60-66, 76) Even when comparing art work from within a single place or culture, it can be difficult defining the meaning of art and how it is valued. Pieces of work from other locations and periods can differ from our modern-day criteria for what we display as art. (Freeland, 2002. p.87-89)

Findlay gives an example of how the quality of the art can be relative. One individual may critique a painting and have a completely different experience than another person. He explains two people can observe the same Picasso painting of a red dog, but process it in different ways. One person may rank it as high quality because they have a bias for that particular artist and color. On the other hand, the second person may rank the painting as a lower quality because they do not like the artist, dogs, nor the color red. Findlay also talks about how value can depend on the size of the artwork and the market. For instance, larger paintings and sculptures tend to be more expensive than smaller pieces. However, if the painting or sculpture is too large and requires a lot of space, then it may not fit in most buildings. By decreasing the number of potential locations the piece of work can be installed, this can make it more difficult to sell the art and result in a decreased value. (Findlay, 2012)

There are several categories of art. Art can be valued differently depending on the person critiquing it. For example, some people may have a preference for realistic art. These are drawings, paintings, or sculptures that are more objective and representational of real life objects. For example, Michelangelo’s marble statue of *David*, Vermeer’s oil painting of the *Girl with a*

Pearl Earring, and Millet's oil painting *The Gleaners*. Some critics argue for universal standards of realistic quality that can be used to judge all art. However, not everyone values realism.

(a)

(b)

(c)

Figure 3.1: Examples of realistic art: (a) *David* - by Michelangelo, (b) *Girl with a Pearl Earring* - by Vermeer, (c) *The Gleaners* - by Millet.

On another side of the spectrum, people may have a preference for the category of abstract art. These are pieces of work that are more subjective and may not visually represent any real world objects. They tend to use utensils, materials, and mediums to depict art in new and creative ways. It can be used to expresses emotion and produce experiences for the audience. For example, there is Heizer's boulder called *Levitated Mass*, located at the LA County Museum of Art. Robert Rauschenberg's minimal, pure white paintings called *White Paintings*. And, Theo van Doesburg's oil painting, *Composition VII (the Three Graces)*.

(a)

(b)

(c)

Figure 3.2: Examples of abstract art: (a) *Levitated Mass* - by Heizer, (b) *White Paintings* - by Robert Rauschenberg, (c) *Composition VII* - by Theo van Doesburg.

CHAPTER 4 - DEFINING THINGS

This section will explore some other areas in which relativism can help in artificial intelligence. These are less familiar examples in which relativism can be useful. Relativism can be help us understand how we define things, such as: objects, patterns and deviances, measurements, language, and information.

4.1 - OBJECTS

Relativism can be more useful for defining objects. Absolutism can fall short of adequately classifying an object. Absolutism is only part of the equation that is explained by relativism. Relativism can provide a more valuable means of defining an object.

With absolutism, I argue that it is difficult to define an object absolutely by itself. Is it possible for something to be perceived independently without relation to other things? For example, the following diagram attempts to define something using only one thing or instance. Within a given context, imagine the only thing that exists is one instance of something. But, how can we identify this instance without anything else to compare it to? If the context consisted entirely of one instance and nothing else, then we would have nothing to put that instance into perspective. We would not be able to define that instance against anything. We would not be capable of sensing that instance. That singular instance goes on infinitely. As a result, the absolutism scenario makes it difficult to define or classify objects by themselves.

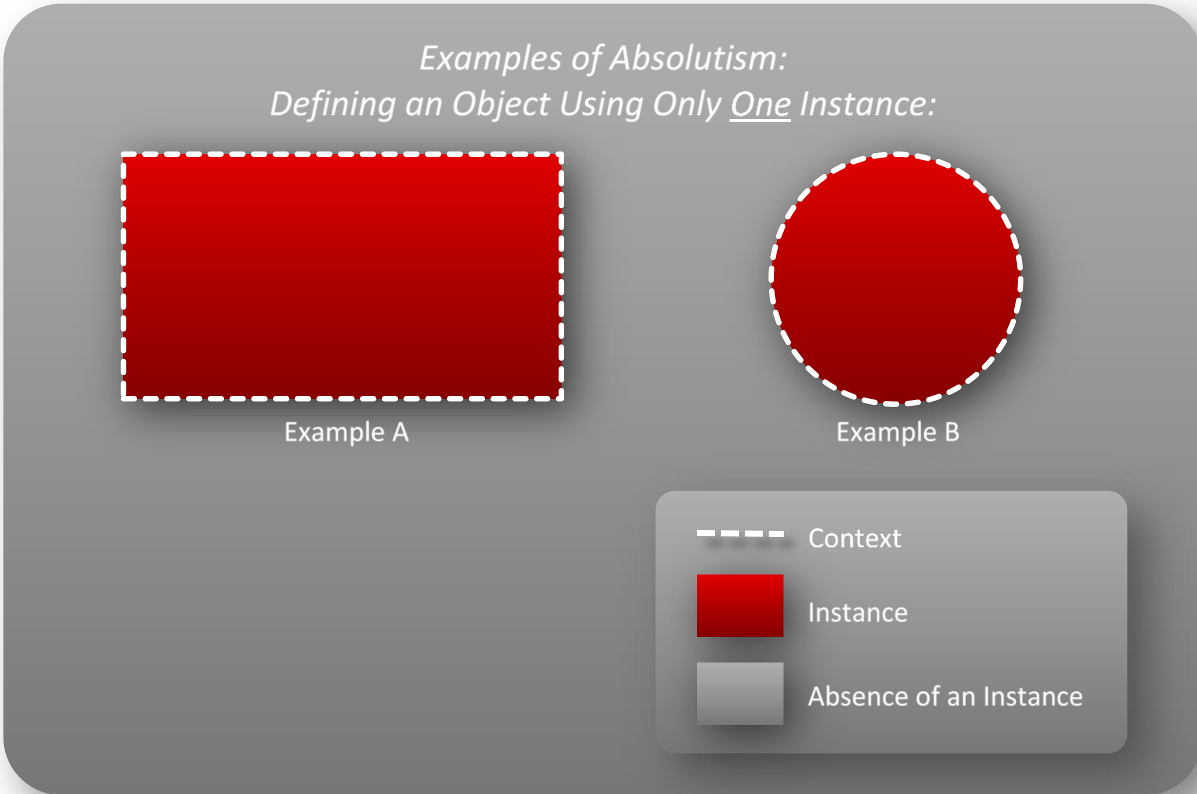

Figure 4.1: Examples of absolutism. Example A with a rectangular context. Example B with a circular context.

On the other hand, with relativism, I argue that things need to be defined by a pattern of at least two instances within a context. The idea is that things are relatively defined. Being able to define an object relies on a frame of reference. Things have to be put into perspective to derive meaning and classification. With relativism, an object cannot be defined alone, absolutely by itself. Relativism needs at least two instances. One instance needs something else to compare it to. In order for an instance of something to be perceived, it must be defined by an absence of that instance. For example, the following diagram shows how to define something using at least two instances. Here, an *instance* is referring to any object or pattern that can be uniquely defined. An instance can only observed when it is put into context. In other words, in order for an instance to be perceived, there must also be a perceived absence of that instance in the same context. A *context* is an arbitrary frame of reference that can vary in scope or form. A context could contain one instance, several instances, or perhaps some variation in between (which we will cover later on in the Patterns and Deviances section). But, the important thing to remember here is that things are relatively defined. In order to perceive an instance within a context, then there must also be an absence of that instance.

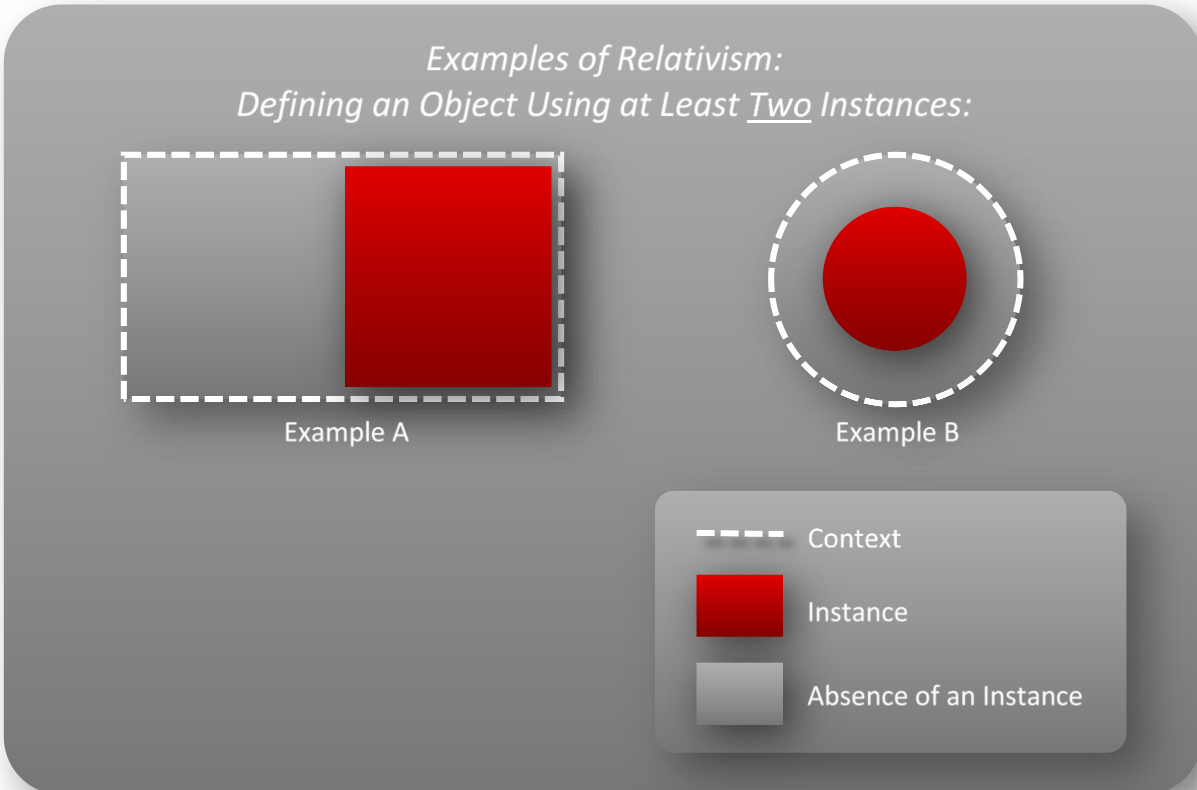

Figure 4.2: Examples of relativism. Example A with a rectangular context. Example B with a circular context.

4.2 - PATTERNS AND DEVIANCES

Relativism can be more useful for defining patterns and deviances. It can be difficult to define patterns and deviances absolutely by themselves. I argue that they are more valuable in relation to other things within a context.

A pattern can be created from an instance or a combination of instances. Patterns can range from simple to complex and from consistent to inconsistent. Simple patterns can be combined to create more complex patterns. The following figure shows a visual representation of the relationship between repeating instances and consistency. For example, consistency depends on the degree of repeating instances. The greater number of repeating instances within a context, the greater the consistency. A decrease in the number of repeating instances will result in a decrease in the consistency of the pattern. With relativism, a pattern cannot be perceived absolutely by itself. Like an object, a pattern is defined with the absence of the pattern. The absence of a pattern is also considered a pattern itself. As the consistency decreases for a pattern of instances, the consistency increases for a pattern of absence of instances.

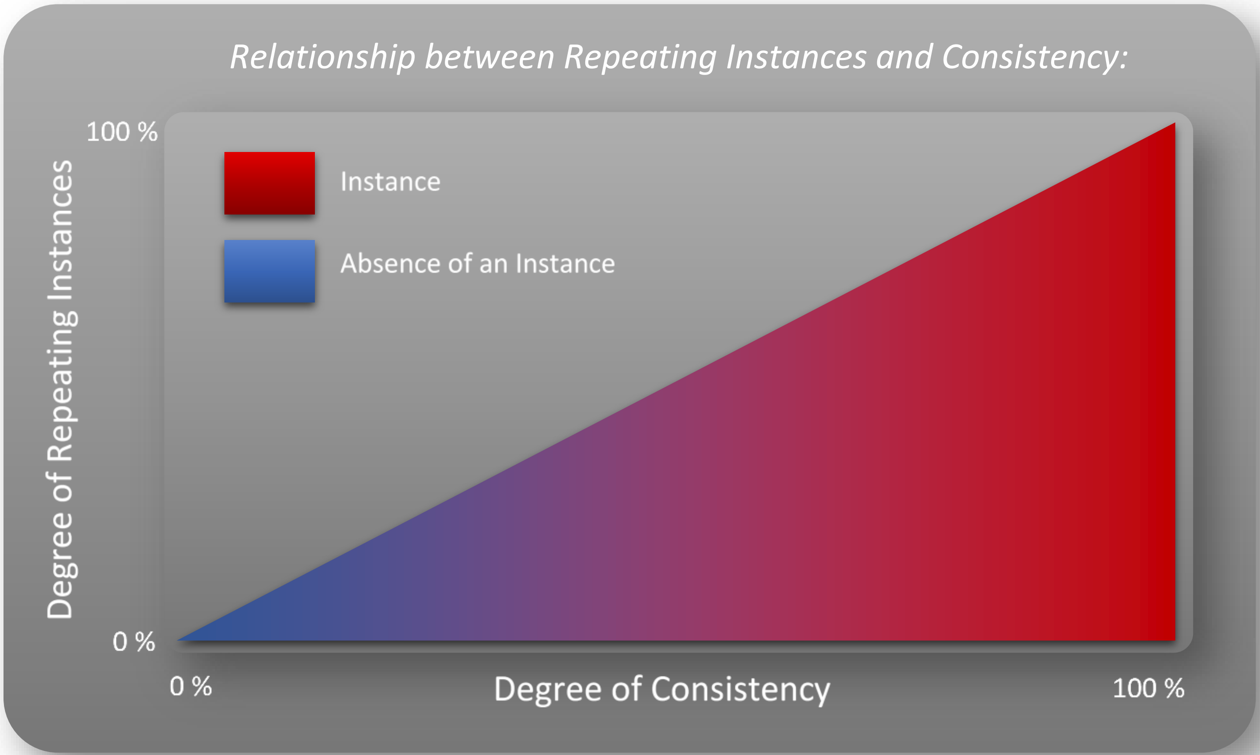

Figure 4.3: Example illustrating the relationship between Repeating Instances and Consistency.

The next figure depicts a domain or context filled entirely with one pattern. In this example, from the perspective of the red pattern, the context contains a high number of repeating instances, a high consistency, and no deviance. From the perspective of the non-red pattern, the context has no repeating instances, no consistency, and a high deviance.

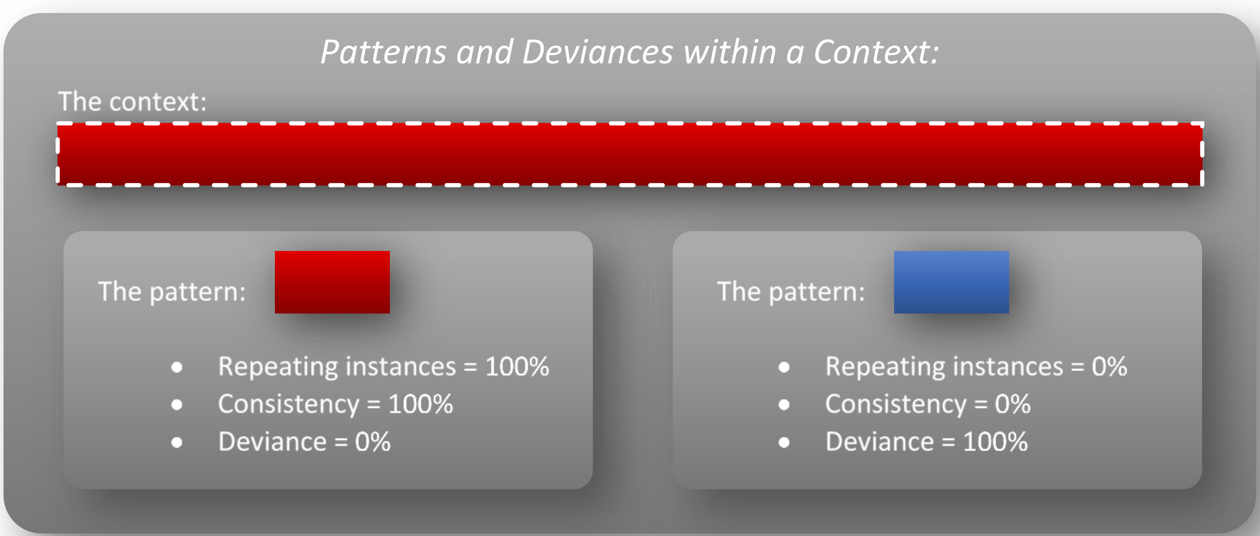

Figure 4.4: Example demonstrating the *low* deviance of the red pattern and the *high* deviance of the non-red pattern within the given context.

The next figure is just the opposite of the previous exhibit. The context is made up entirely of one pattern. In this example, from the perspective of the red pattern, the context has no repeating instances, no consistency, and a high deviance. From the perspective of the non-red pattern, the context contains a high number of repeating instances, a high consistency, and no deviance.

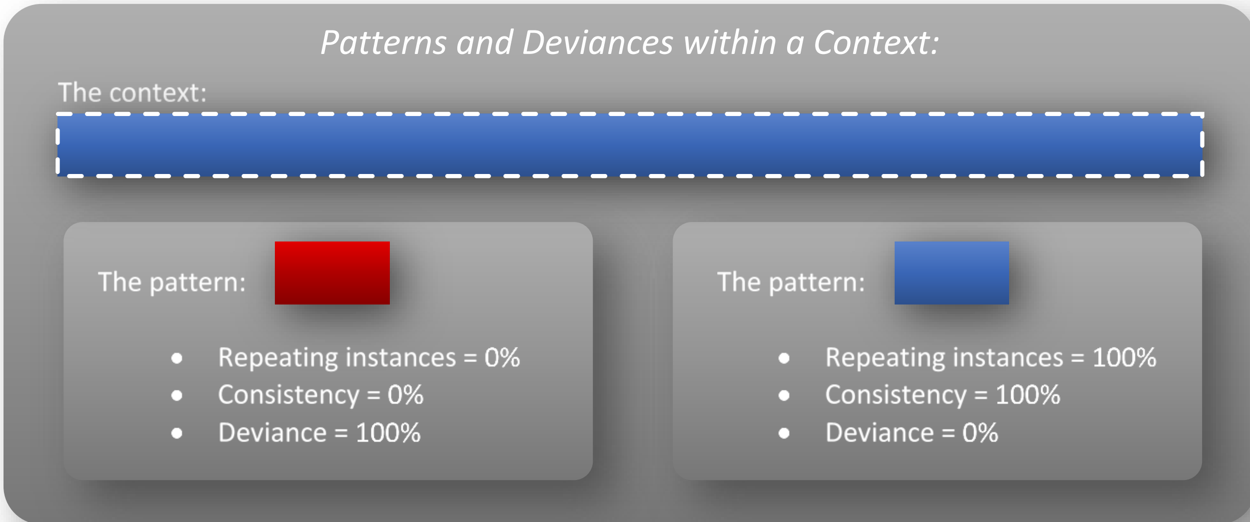

Figure 4.5: Example showing the *high* deviance of the red pattern and the *low* deviance of the non-red pattern within the given context.

The following figure shows how the patterns and deviances change when the composition of the context changes. In this example, a small portion of the context is made up of the red pattern while the remainder of the domain encompasses the non-red pattern.

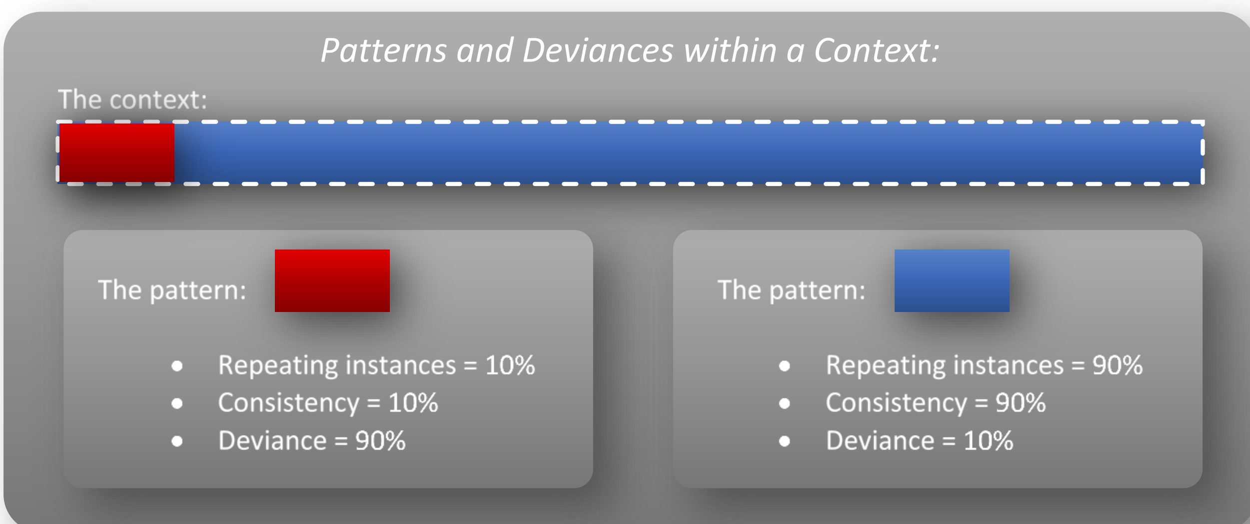

Figure 4.6: Another example illustrating the *high* deviance of the red pattern and the *low* deviance of the non-red pattern within the given context.

4.3 - MEASUREMENTS

Relativism can be more useful for defining measurements. For example, relativity can be useful for comparing size, relativity can be useful for classifying the maximum size of instances, relativity can be useful for defining the minimum size of instances, and absolute measurements have issues with precision.

Measurement Comparison: It is difficult to determine the size of something absolutely by itself. Measuring the dimensions of an object depends on a relation to other things within a context. For example, the diagram below shows how we determine the size of instances. In example-A, we only we only have one instance. In this absolute scenario, it is difficult to measure the size of the instance without being able to compare it to another distinct instance. In example-B, we have more than one instance. In this situation, we are now able to measure and compare things relatively. Instance-A is smaller than instance-B. And, instance-B is larger than instance-A.

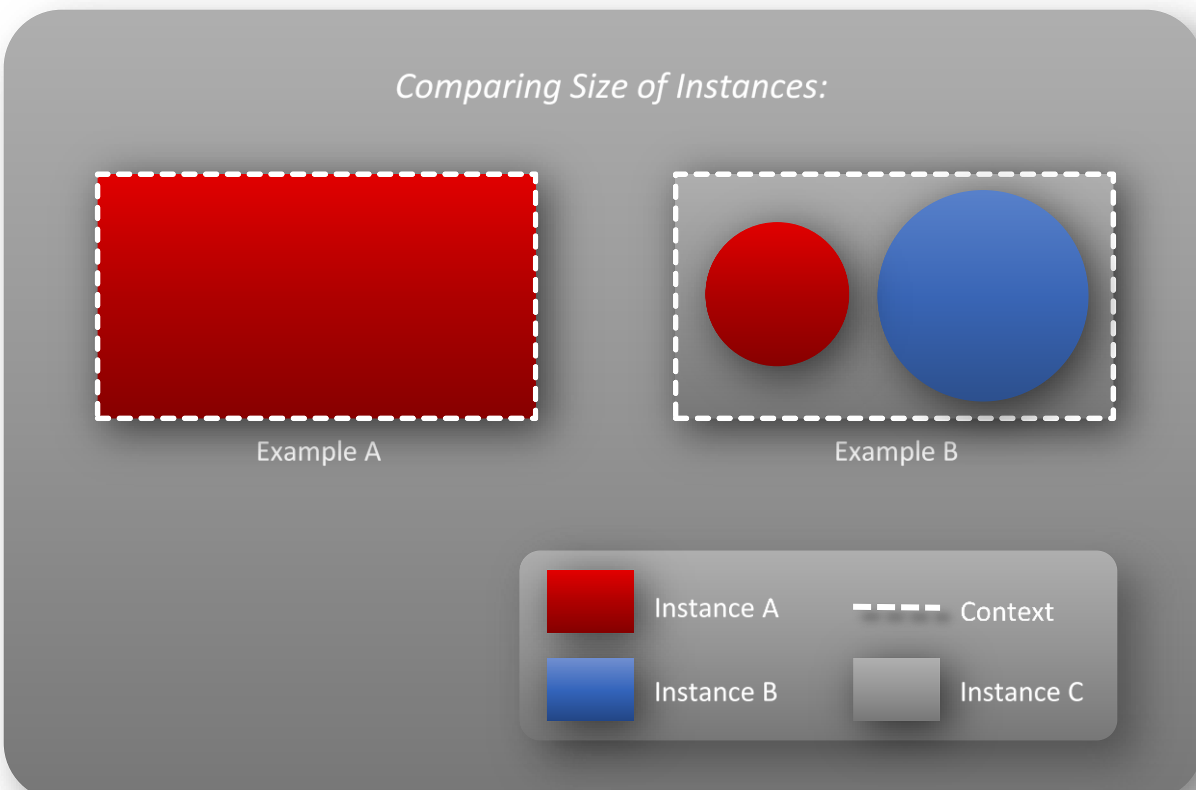

Figure 4.7: Example-A demonstrating size comparison using only one instance. Example-B showing size comparison using more than one instance.

Maximum Measurement: Is there an absolute maximum size? For instance, is there such a thing as an actual edge to our universe? Relativism can be more useful for defining the outer boundaries of an instance. In the following figure, step-1 demonstrates a context that contains only one instance. At this point, if no edges can be observed, then the instance can be considered to stretch out indefinitely. If we are able to perceive an outer edge for instance-A, then this edge would define another instance beyond instance-A. This brings us to step-2 where we have instance-A along with the outer instance-B. If no outer edge can be defined for instance-B, then it may stretch on forever. But, if we can observe an outer edge on instance-B, then this would define another instance beyond instance-B. This brings us to step-3 where we have three instances classified. These steps continue on and on. Every time an outer edge is defined, another instance is also relatively defined. Therefore, it is difficult to define an absolute maximum size or outer edge. The maximum size may continue on indefinitely.

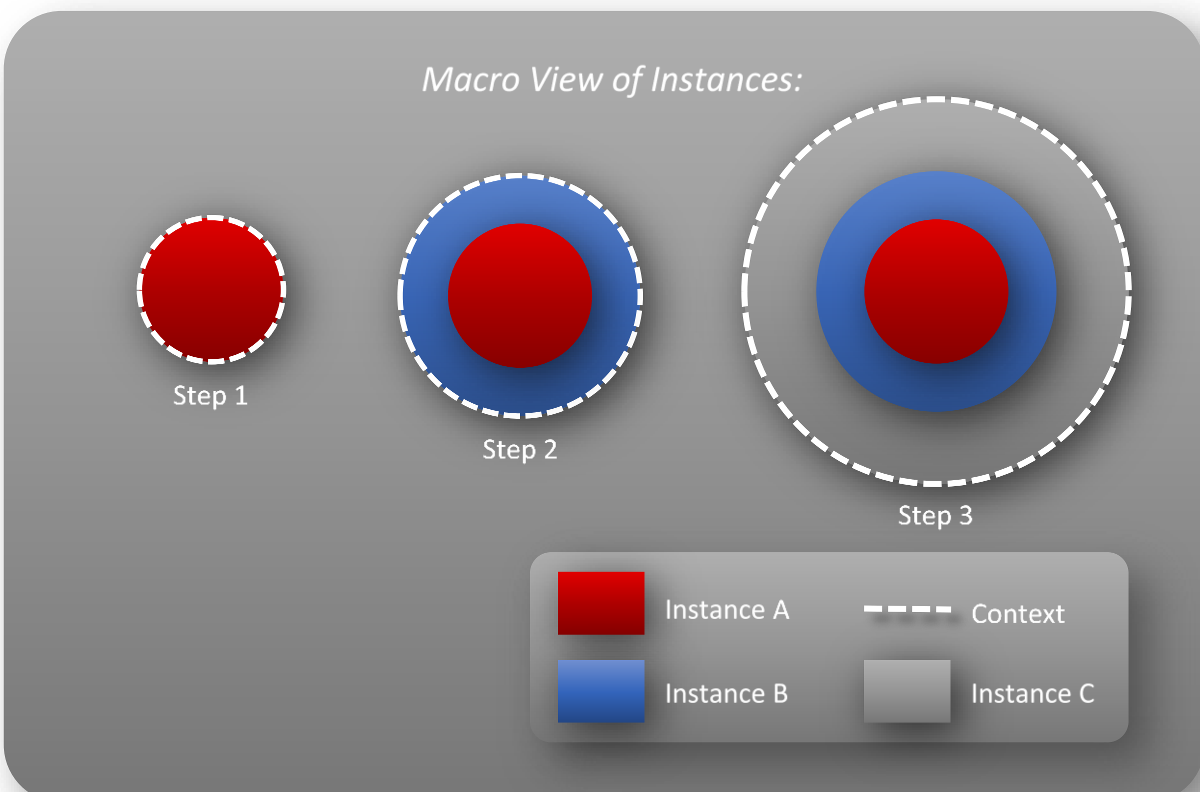

Figure 4.8: Example of relatively defining outer boundaries for an instance.

Minimum Measurement: On the other side of the scale, is there an absolute minimum size? For example, is there such a thing as an absolute minimum instance in our universe? Relativism can be more useful for defining the inner boundaries of an instance. In the figure below, step-1 demonstrates a context that contains only one instance. At this point, the instance can be considered to stretch on indefinitely. If we are able to perceive that instance-C is a pattern made up of smaller instances, then this would bring us to step-2 where we have instance-C defined by the inner instance-B. If no inner objects can be classified for instance-B, then it may stretch inward forever. But, if we can observe inner substances that make up instance-B, then this would bring us to step-3 where we have instance-B as a pattern defined by inner instance-A. These steps continue on every time a smaller instance is relatively defined. Therefore, it is difficult to define an absolute minimum size. The minimum size may continue on indefinitely.

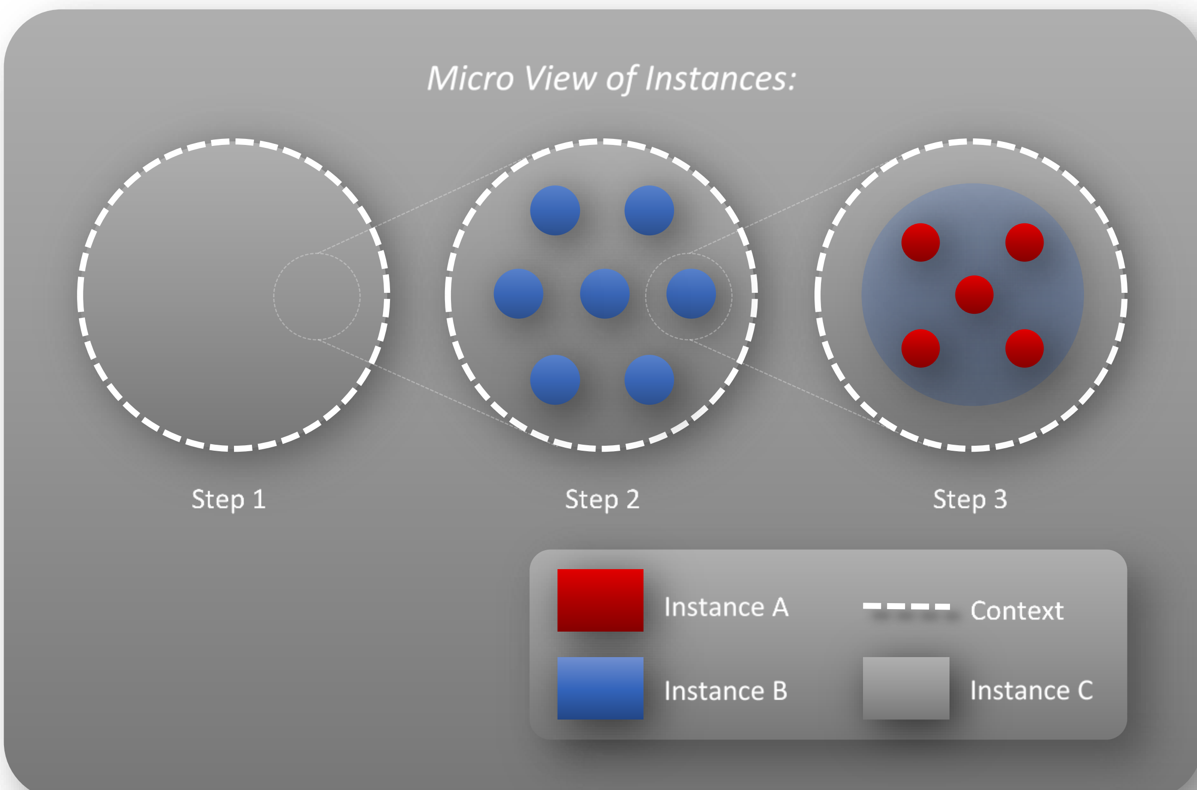

Figure 4.9: Example of relatively defining inner boundaries for an instance.

Precision and Uncertainty: Precision and uncertainty also plays a role in our measurements. It is difficult to measure something with 100 percent, absolute certainty. Zimmermann discusses how the accuracy of our measuring techniques have increased over time. Our technology progresses and becomes more precise at measuring physical features. However, he points out that uncertainty still exists. He explains that we cannot perfectly measure exact properties. We only have an indicated measurement. And, the real measurement will have some uncertainty. (Zimmermann, 2001, pg.116)

When it comes to our standards and measurements, we like things to be precise and replicable. But, can we rely on absolute, universal constants for our units of measurement? According to the UK Metric Association, before the 1800's, measurements often varied from place to place. This created a problem for trade. To alleviate this issue, a commission in France developed a unified metric system in 1789. This system included the meter and the kilogram. By the late 1800's, the metric system gained international acceptance among the industrialized countries and the International Bureau of Weights and Measures was formed. A challenge was proposed to create a prototype for the kilogram. This prototype would be used as an absolute definition for a kilogram and used for a standard comparison against other constructed kilogram masses. In the 1880's, a prototype was made out of an iridium-platinum alloy for its resistance to corrosion and stability. And, the standard for today's kilogram for which all other kilogram objects are measured is still currently based on that prototype. (UK Metric Association, 2013)

However, even these absolute units of measurement can change over time and location. In Jonathan Fildes' article, *Getting the Measure of a Kilogram*, he explains how this variation has happened. The prototype cylinder for the standard kilogram was constructed along with several other cylinder copies in the 1880's. Over incremental periods of time, the cylinder copies were taken back and measured against the original prototype to compare their consistency. But, over the past 40 years scientists started running into an issue. They discovered a small drift in the kilogram measurements. The mass of the standard prototype cylinder no longer matched up with the cylinder copies. And, this drift in measurement continues on today. Scientists cannot tell if the original prototype is losing mass or if the copies are gaining mass. The change in mass might be attributed to atmospheric pollutants that all the cylinders are exposed to. Whatever the reason, the small drift can lead to major consequences for our standard system of measurements that require a precise definition of mass. When scientists measure the prototype and all the other copy cylinders against each other, they are not able to determine absolutely which cylinders are losing mass or gaining mass. We can only make relative observations to determine that one cylinder weighs more compared to another. (Fildes, 2007)

Can we come up with an absolute, universal constant for measurement? In Geoff Brumfiel's article, *This Kilogram Has a Weight-Loss Problem*, he mentions how scientists are searching for a constant to redefine the standard kilogram. One proposed idea is to define the kilogram using a watt balance and the Planck's constant. Basically, the watt balance is a highly calibrated scale that measures mass by electrical and magnetic forces. The forces can convert to a number based on the Planck constant, which is used for very small scaled calculations in quantum mechanics. However, physicists note that relating something that small to a large kilogram object we can hold in our hand is quite difficult. The article mentions that the scale is so sensitive that there are many sources of noise that can cause issues for precise measurement. (Brumfiel, 2009)

Fildes' article proposes another method that redefines a kilogram based on the number of atoms within a crystal object. For example, this method suggested the use of a silicon sphere.

To calculate the number of atoms, we would measure the volume of the silicon sphere and divide it by the volume of an atom of silicon. However, even this method has difficulties with precision and uncertainty. The sphere is said to be made up of trillions of atoms and the accuracy of their current measurements reported an unacceptable level of uncertainty. (Fildes, 2007)

Universal Constants: When we measure things, we use the basic measurement types such as *M* for mass, *L* for length, and *T* for time. At some point, we came up with arbitrary units to represent each of these types. For example, someone deemed a kilogram as a standard unit of mass, someone came up with a meter to denote a unit of length, and someone decided on a second to designate a unit of time. The issue is that each of these arbitrary units are defined to objects that can change over time and location. So, we attempted to relate these units to things that are universal throughout the universe. But, are there any absolute, universal constants?

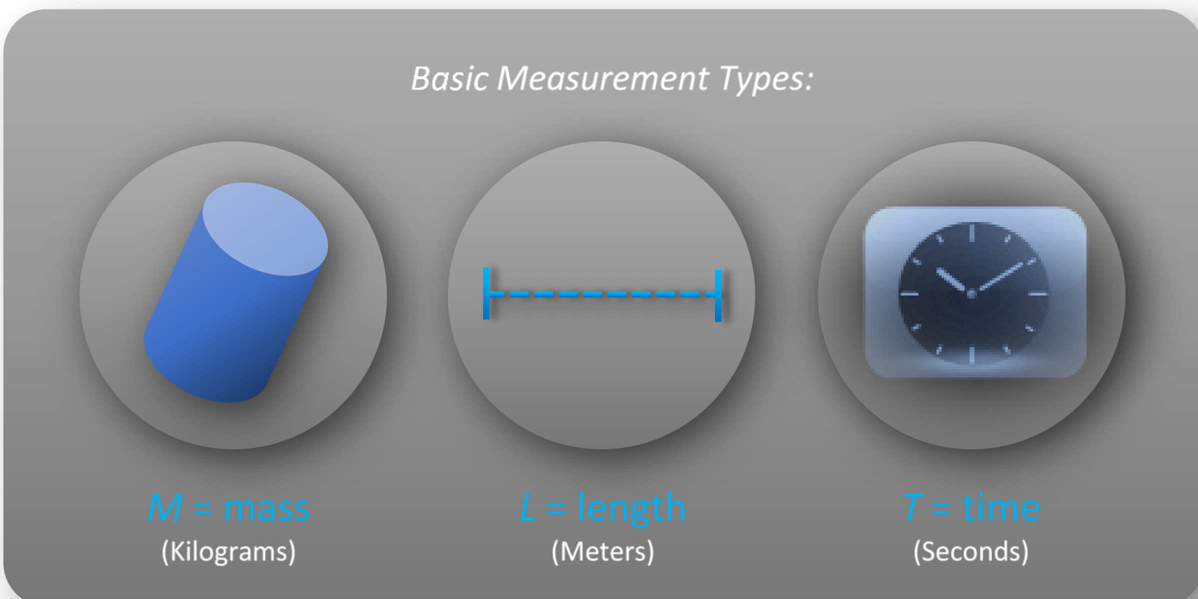

Figure 4.10: Basic measurement types: Mass (*M*) in kilograms, Length (*L*) in meters, and Time (*T*) in seconds.

Scientists believe there are some physical constants throughout the universe. The NIST reference on *Fundamental Physical Constants* illustrates some of these equations out for us. For example, there is *G* for the gravitational constant, *h* for Planck's constant, and *c* for the speed of light in a vacuum. With only these constants, physicists have come up with the following equations to represent mass, length, and time. There is *M* for Planck mass, *L* for Planck length, and *T* for Planck time.

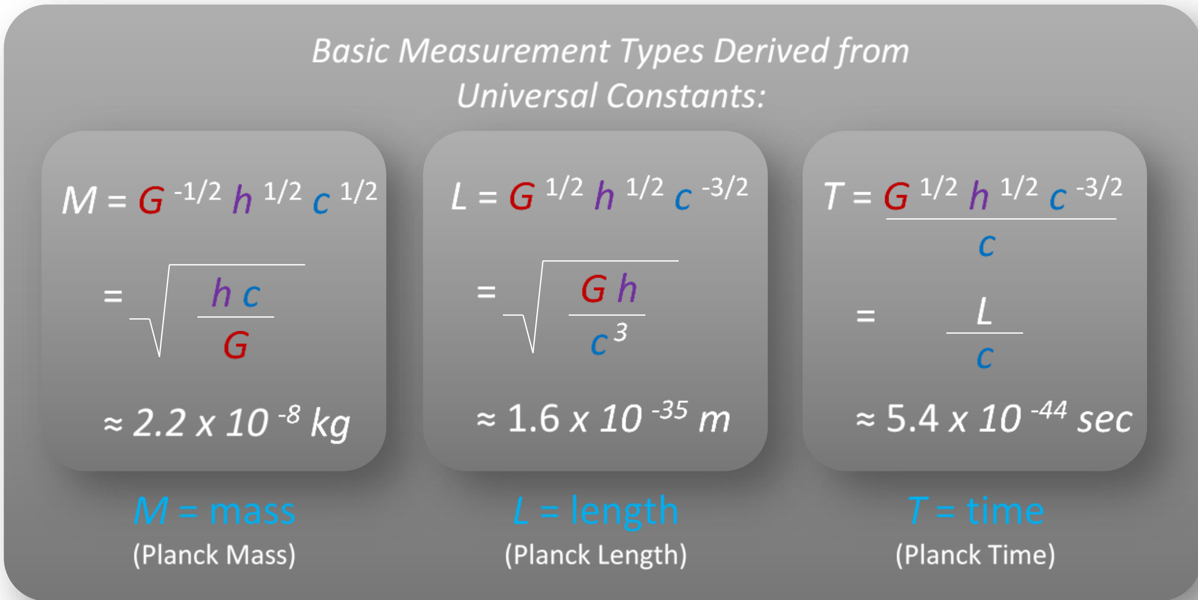

Figure 4.11: Basic measurement types derived from universal constants. Planck mass, Planck length, and Planck time. Where: *G* = gravitational constant. *h* = Planck's constant. *c* = speed of light.

But, what exactly are these constants that we threw into our equations? And, are they really absolute, universal constants? According to NIST, the constant *c* is defined as the speed of light in a vacuum. This equates to approximately 299,792,458 meters per second. However, this definition contains a couple of axioms.

What is light? For one, there is the assumption that we know what light actually is. Scientists have debated the classification of light for centuries. And, we still do not have one absolute answer for the definition of light. *How Light Works*, by Harris and Freudenrich, describes how light continues to amaze scientists. In some scenarios, light appears to have properties that behave like a particle. In other experiments, light appears to have properties that behave like a wave. In the late 1600s, Christiaan Huygens proposed the undulatory theory that suggested the existence an *ether*. This ether was said to be an invisible medium that made up the empty void of space around objects. And, he thought light might form as a result of objects causing waves in the ether. In the 1700s, scientists like Isaac Newton debated that light consisted of particles. Around the 1800s, other scientists came up with experiments to provide evidence that light was a wave. Thomas Young conceived of the *double-slit* experiment. He set up a mechanism that would shoot a beam of light from one end of a device over to a screen on the other end. Before the light reaches the screen, it would need to travel through a card that contained a couple of slits. The resulting pattern of light and dark bands that displayed onto the screen showed that light demonstrated properties of a wave. Later, James Maxwell, argued the theory of electromagnetism to define light as a type of wave created from electric and magnetic fields that does not require a medium for light to travel through. By the 1900s, however, Max Planck and Albert Einstein brought the concept of light as a particle back to life. Planck introduced the idea that light can carry discrete quantities of energy. And, Einstein used the concept of light as a particle to explain the photoelectric effect when a light is directed onto a material and we are able to detect the emitted electrons. So, which definition of light is the correct one? As of today, scientists accept both models. There is evidence for each side. It is subject to context. It depends on which kind of experiment is being performed. As a result, the idea of a wave-particle duality has emerged that defines light as both a particle and a wave. (Harris and Freudenrich, 2011)

The article by Koks, Carlip, and Gibbs, *Is the Speed of Light Everywhere the Same,* mentions some assumptions with definitions in the laws of physics. For instance, there is the assumption that a particle of light contains no mass. They explain that it is practically impossible to perform an experiment that could determine if the rest mass of a photon is exactly zero. And, if particles of light have a rest mass, then the speed of light would vary.

Grant's article, *Speed of Light Not So Constant After All*, argues that the speed of light can vary in vacuum conditions. He talks about a recent experiment that shows how manipulating the structure of light will reduce its speed. The research reveals how the speed of light can vary based on the photon structure. For instance, the experiment sends a pair of photons on separate paths on the way to a detector. One of the photons gets sent through a fiber unaltered. While the other photon gets sent through a device that modifies the light structure and then adjusts the configuration back. The pair of photons were expected to arrive at the detector at the same time. However, they did not. The detector measured the manipulated photon arriving later than the non-altered photon. The measured gap was several micrometers per meter. (Grant, 2015)

What is a vacuum? The second axiom in the speed of light definition is the assumption that we know what a vacuum is. A vacuum is said to be space that is void of matter. But, how do we know a vacuum is really void of all mater? According to Empsak's article, *Speed of Light May Not Be Constant, Physicists Say*, we may think of a vacuum as a unit of empty space. However, quantum physics argues that this empty space actually contains very tiny particles (such as: gluons and quarks) that come into and out of existence from the quantum level. Empsak explains that photons may run into these particles and get re-emitted as they travel through space. It is proposed that these tiny particles can affect the speed of the photons. And, the density of these particles can influence the speed of light.

In conclusion, it is difficult to classify with 100 percent certainty what light is. And, a vacuum may not be completely void of matter.

4.4 - LANGUAGE

Language, the medium through which we communicate, is more relative than absolute. Relativism can be more useful for classifying language for linguistics. It can be relative to the situation that it occurs in. Language, in general, can vary depending on location, time, and context.

***Location**:* Language can change from one place to another. In Battistella's book, he argues how language is continuously changing. Dialects and languages may attempt to follow standards. However, those standards depend on usage. And, usage is relative. (Battistella, 2005, p.153) When speakers or advertisers communicate to an audience, the dialect and speech is usually tailored to fit the background of the audience. Variation in dialect can also be seen on individual words. For instance, he gives an example with the adverb *anymore*. For Standard English, the term *anymore* is primarily used in negative sentences. However, in many locations throughout the United States, the word is also utilized in positive statements. The language standards of one region can differ significantly from another. Articles on arts and culture can differ from one publisher to another. And, speakers alter their styles to relate to their audience. Things like vocabulary and pronunciation norms get altered. (Battistella, 2005, p.7-8) Language doesn't follow an absolute standard in all locations. There can be multiple standards and the standards can change.

Certain words can take on different meanings in other languages around the world. For example, in the article *10 English Words that Mean Something Else in Other Languages*, Harris shows how the word *gift* can change meaning. In English, *gift* refers to a talent, skill, ability, or present. In German, however, *Gift* can mean poison. And, in Scandinavian languages, the word *gift* can refer to poison or marriage.

Time*:* Language can also change from one period of time to another. For instance, dictionaries provide a good example of how words change over time. We do not use the same, original dictionaries that were put together several years ago from the past. Eventually, new words are introduced. New meanings are added for existing terms. And, the rules of grammar transform over the years. (Battistella, 2005, p.5-6)

In Zimmermann's book, he mentions how natural languages depend on many things. For example, how they change over time and how they change according to the backgrounds of an individual. He differentiates between the label of a word and its meaning. Zimmermann says there is usually a one-to-many relationship between the labels and their meanings. He argues that the meaning of terms are not classified in a crisp way. For instance, generally they are not absolute. The meaning of words depend on relative context. (Zimmermann, 2006, p.117-118)

Words can shift meaning over time. For example, according to the Oxford English Dictionary, the word *evil* used to have an original meaning that was fairly mild. It was just a general word used for disapproval or dislike. Later on, the term evil took on a more intense meaning. Today it can refer to something that is malicious or immoral. And, the word *awful* used to express something that was worthy of awe or respect. But, now it can stand for dreadful, terrible, or appalling.

Context and Semantics*:* The situation of a word in relation to other words and the arrangement of the words within a sentence can change the meaning of what we are trying to convey. Zimmermann talks about the fuzziness of natural languages and how the meaning of terms are generally not very clear. For instance, he gives the example of the word *birds*. Birds can be used for a label of a set. However, when it comes to classifying which objects fall within the set of bird and not-bird, the borders of distinction become fuzzy. Classifying an ostrich, bat, or a penguin may be difficult. Zimmermann also gives examples of the labels *tall men* and *creditworthy customers*. Tall men is considered fuzzy and not absolute. The meaning of tall is relative to the context of the observer. And, the creditworthiness of an individual is fuzzy as well. He describes this term as being subjective. The distinction of creditworthy can be based on different financial valuations and the personality traits of the applicant. (Zimmermann, 2006, p.4)

Hobbs book on *Homophones and Homographs* shows how the English language contains several words that can have multiple meanings. Or, we could be using completely different terms that end up expressing the same meaning. The following table categorizes these words into groups called homonyms, homographs, homophones, and synonyms.

	Spelling	Pronunciation	Meaning
Homonyms	Same	Same	Different
Homographs	Same	Different	Different
Homophones	Different	Same	Different
Synonyms	Different	Different	Same

Figure 4.12: Table categorizing words into groups according to spelling, pronunciation, and meaning.

Homonyms are terms that are spelled and pronounced the same. But, the meanings are different. For example, words like *bark* change depending on the context of the other words surrounding it. We could be using a verb *bark* to describe the sound of a dog. Or, we could be using a noun bark to label the outside layer of a tree.

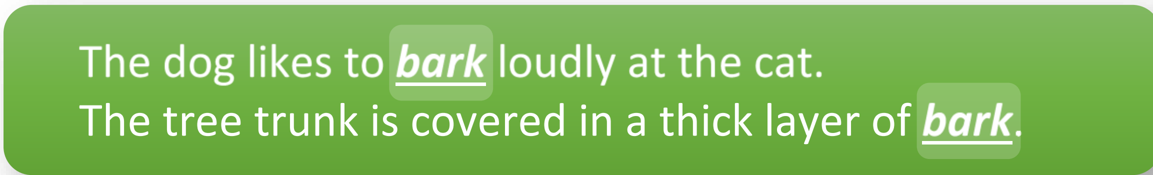

Figure 4.13: Example of homonyms. Terms that have the same spelling, same pronunciation, and different meaning.

Another example is the term *off*. *Off* can refer to something being activated or deactivated depending on the context. For example, we could say something is sounding *off* and we need to turn it *off*. What we really mean is that something is actually on or enabled and now we need to disable it.

Figure 4.14: Example of homonyms (continued).

Homographs are terms that are spelled the same. But, they are pronounced different and have different meaning. For example, the word *wind*. We could be talking about the windy weather outside. Or, we could be referring to the action of winding up an object.

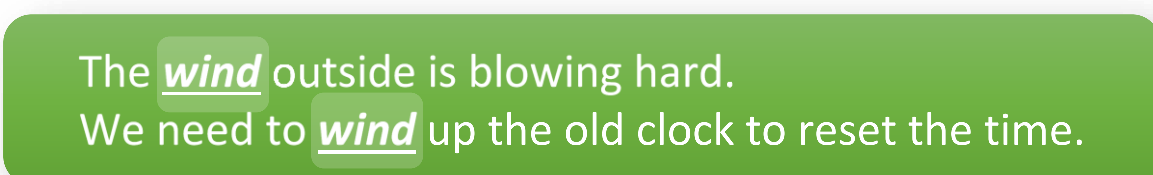

Figure 4.15: Example of homographs. Terms that have the same spelling, different pronunciation, and different meaning.

Homophones are terms that are pronounced the same. But, the terms are spelled differently and mean different things. For example the words *there*, *their*, and *they're*. The word we are hearing could be an adverb referring to a position, used as an exclamation, referring to a pronoun, or perhaps a simple contraction of two words.

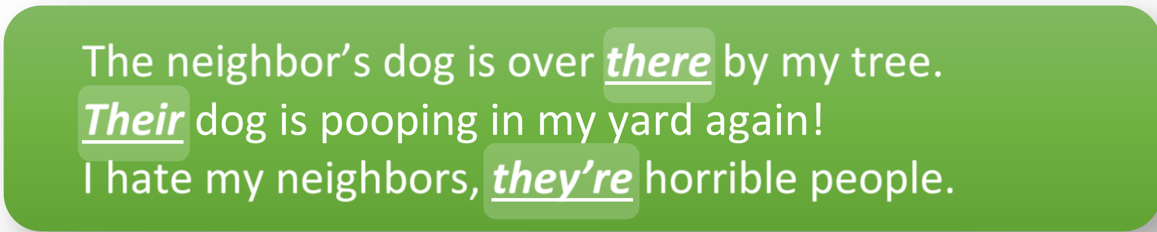

Figure 4.16: Example of homophones. Terms that have the different spelling, same pronunciation, and different meaning.

There are several words that can be placed within in the synonym category. Synonyms are terms that refer to the same meaning. However, the words are spelled and pronounced differently. For example, the terms *horrible*, *awful*, and *terrible* have different spellings and sounds. But, they express the same meaning.

Figure 4.17: Example of synonyms. Terms that have the different spelling, different pronunciation, and same meaning.

4.5 - DATA vs INFORMATION

Relativism can be more useful for defining information. Information can be made up of relative data that provides better value than absolute data. It can be difficult to evaluate raw data when it is presented absolutely by itself. Data needs to be put into perspective in order to derive meaning from it. For example, we will discuss definitions of data, definitions of information, and then explore some examples of data compared to information.

What is Data: Nunamaker, Romano, and Briggs article, *A Framework for Collaboration and Knowledge Management*, explains the differences between data and information and how context plays a role. For example, they declare that "data by itself has no context until someone interprets it and ascribes a context to it" (Nunamaker 2001, p.4). Data is referred to as raw symbols that do not have any significance. Raw data just exists absolutely by itself. It does not have any context. Thus, it has no meaning by itself and no relevant relations to other data. In order to assign meaning to data, we need to provide context by associating the data to other pieces of data. Another article, *Enterprise Knowledge Infrastructures*, by Maier, Hadrich, and Peinl, describes data in a similar way. Data is referred to as symbols in a basic description. For instance, data can be things like numbers, alphanumeric characters, and figures. They clarify that "data can be recorded, classified, and stored, but are not organized to convey any specific meaning" (Maier, 2009, p.4).

What is Information: When it comes to information, Nunamaker, Romano, and Briggs describe information as having "some embedded context within it by the nature of the relations that summarize and organize the data that comprise it" (Nunamaker 2001, p.4). Information is made up of organized data. With information, data is structured with meaningful relationships.

Meaning is given to the data by having relational connections. The functional usefulness is what distinguishes data from information. Data is not as useful as information. They give an analogy of a relational database and how it takes raw data from storage and builds it into relevant information. Maier, Hadrich, and Peinl discuss how most definitions distinguish data from information through meaning and semantics. For instance, several definitions express information as "data that have been organized so that they have meaning and value to the recipient" (Maier, 2009, p.4-5). And, they explain how information depends on the context of the interpreted signals.

Examples of Data vs Information: Here are a few scenarios to help explain the transformation of data into relevant information. For example, the number "*2*" absolutely by itself is quite meaningless. What are we talking about when we say "*2*"? Two of what unit? When we add context to the data and relate it to other data, then it transforms into relevant information. For example, that number "*2*" turns into information with more relevance when we add units and compare with other data in a ratio, like "*2 miles / 1 hour*". Now, we have more meaningful information. We have a valuation for speed, where we are taking a distance measurement and dividing it by a unit of time.

For another scenario, we will compare the strengths of two individuals. We can do so in absolute terms or in relative terms. Let's say Person A weighs 100 pounds and can lift 200 pounds and person B weighs 300 pounds can lift 300 pounds. Who is stronger? In an absolute sense, person B can lift 100 more pounds than person A. Therefore person B would be considered stronger. However, if we took into account how much each person weighs, in a pound-for-pound ratio, then we would come out with a different result. Person A can lift 2 times their body mass. Whereas, person B can only lift their own body mass. From a relative pound-for-pound view, person A is stronger than person B.

Putting numbers into context is important for valuating statistics and scores in video games. For example, some games like Halo have a multiplayer mode called team slayer. The objective for winning this particular game is to be the first team to reach a certain number of kills. In this scenario, the first team to reach 50 kills ends up winning the game. The following report demonstrates the results of the game. As we can see, the Blue team ended up winning over the Red team. Blue team reached a total of 50 kills and Red team only scored 30 kills. The next section of the report shows how each player scored individually. Players 1 and 2 represent the Blue team and players 3 and 4 were on the Red team. The players are ranked according to their score. In this case, each individual score is calculated by the absolute number of kills the player achieved. Using this method, players 1 and 2 scored the highest. And, player 4 scored the least number of kills. However, these absolute valuations can be very misleading. Is player 4 really the worst performer? Is player 3 really better than player 4?

POSTGAME REPORT: *(USING ABSOLUTE SCORE)*

Blue Team	50
Read Team	30

Place	Name	Score	Kills	Assists	Deaths
1st	Player 1	**25**	25	0	15
2nd	Player 2	**25**	25	0	15
3rd	Player 3	**20**	25	0	45
4th	Player 4	**10**	10	0	5

Figure 4.18: Postgame report using *absolute* scoring. Each individual score is calculated by the absolute number of kills the player achieved. Using this method, player 4 performed with the lowest score.

If we alter the calculation of the individual score values to be more relative. This will completely change the player rankings. For instance, in the second report below, the score evaluation has been changed. If we put the number of kills into context with the number of deaths, then we will have a better representation for the performance valuation of the players. Here, each player score is calculated in a kill-death ratio with the number of kills divided by the number of deaths. Using this relative perspective, we can see that player 4 is actually the best performer. And, player 3 scored the lowest. Player 3 may have really good offensive skills. But, his or her defensive skills are horrible! Player 3 had several more deaths than kills. Perhaps, the Red team could have won if player 3 did not die so much.

POSTGAME REPORT: *(USING RELATIVE SCORE)*

Blue Team	50
Read Team	30

Place	Name	Score	Kills	Assists	Deaths
1st	Player 4	**2.00**	10	0	5
2nd	Player 1	**1.67**	25	0	15
2nd	Player 2	**1.67**	25	0	15
4th	Player 3	**0.44**	25	0	45

Figure 4.19: Postgame report using *relative* scoring. Each individual score is calculated using the number of kills divided by the number of deaths. Using this method, player 4 performed with the highest score.

CHAPTER 5 - MEMORY:
ATTENTION, RETENTION, ALTERATION, AND FORGETTING

This section will explore an additional area in which relativism can help in artificial intelligence. Relativism can be useful for memory. For instance, relative deviances and relations can be useful for attention, retention, memory alteration, and forgetting.

Attention: Relative deviances and relations can be valuable for concepts like attention and fear. Sensory inputs with a strong deviance can attract greater attention. For example, imagine the event of a firecracker exploding in a setting of a silent room like a library. The bright flash and loud sound of the firecracker will have a relatively high deviance compared to the silent background. The stronger the deviance of the sensory input, the higher the attention. However, now imagine the same firecracker exploding in a venue with a large fireworks show. In this scenario, the firecracker will have a low deviance relatively compared to the noisy background of several large fireworks going off. The lower the deviance of the sensory input, the lower the attention.

Applying attention for artificial intelligence can be beneficial for filtering, extraction, compression, and taking on multiple tasks. Pashler's book, *Attention*, describes how important the process of attention is for us. For instance, our senses are continually overwhelmed with information from our external environment. Yet, merely a small fraction of the information is considered relevant to us. Our thoughts and behavior need to process the information in a selective manner. Our brains are presented with several inputs from different sources of sensory receptors. We perceive visual inputs, auditory inputs, tactile inputs, and a range of tastes and smells. The majority of this input is irrelevant and we only have a limited amount of processing resources available at a given time. To process these inputs efficiently and effectively, we are able to focus on a small set of the relevant information while ignoring the rest. Selecting only the relevant regions can help simplify object recognition. (Pashler 1998).

The book *From Human Attention to Computational Attention*, by Mancas, Ferrera, Riche, and Taylor, also addresses the importance of prioritizing and selecting relevant information. They use the term saliency. Meaning, how much an object or a thing stands out relative to other objects in a context. They discuss how attention is useful for perception and could be a step towards conscious awareness. Attention is useful for information reduction. Our brains are provided with massive amounts of sensory data from multiple sources. Attention allows our brain to filter out irrelevant data and helps to prioritize multiple tasks. Like our brains, machines have limited computational resources and memory. Applying these attention techniques to machines has several benefits. It can help them perform faster, increase efficiency in memory storage, achieve better abnormality detection, help information reduction, and prioritize information. With attention, machines can gain the capabilities of being curious and bored. (Mancas, Ferrera, Riche, and Taylor, 2016).

The book mentions how features like brightness, color, and motion can be extracted from the input signals. Then, the machine will look for deviations within a context. Calculating the saliency is useful for machine learning. Being able to limit resources and apply attention to a feature of interest can improve detection and decrease response times. Like humans, machines have a limited quantity of resources to process through large amounts of sensory inputs. Having attention similar to humans can help machines focus on similar things as we do. And, it can improve their interactions and communication with people. (Mancas, Ferrera, Riche, and Taylor, 2016).

Retention: Machines will need to retain and consolidate relevant information for recall. Applying relative retention techniques can be beneficial for compression, learning multiple tasks, and adapting to changing environments. To accomplish this, memory could be constructed with nodes and connected relationships with weights based on deviances.

The following graphs are simplified versions of a semantic network used to show how memory can be represented with relational deviances. The graphs contain nodes and weighted connections between the nodes. In the first example, we can see a strong connection between the Fire-engine node and the Red node. There is a high deviance. The Red node has a stronger deviation than the other nodes attached to the Fire-engine.

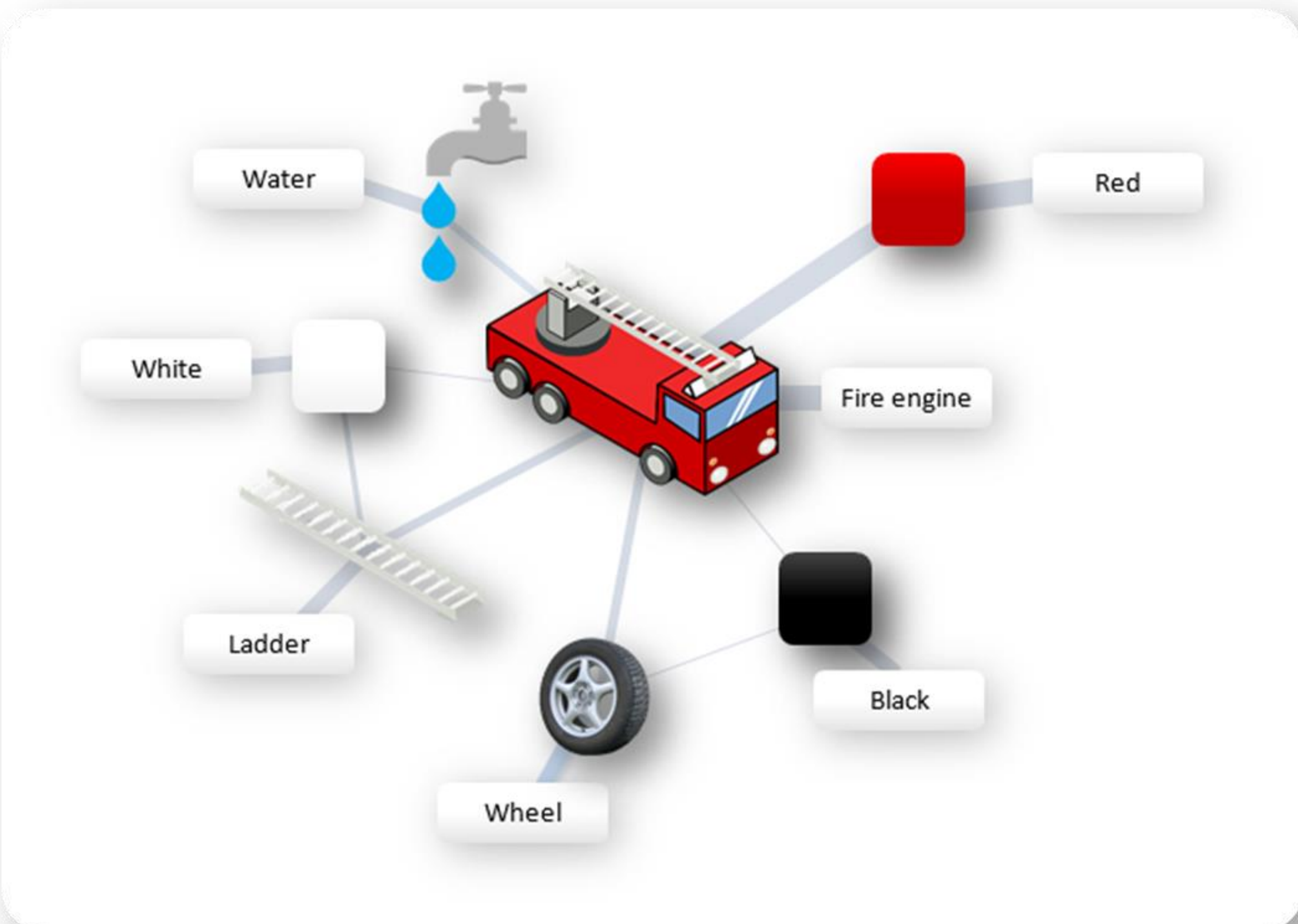

Figure 5.1: Semantic network illustrating how memory can be represented using relational deviances. The relation between the Fire-engine node and the Red node has a higher weight compared to the other associations. The Red node represents a stronger deviation relative to the other nodes connected to the Fire-engine.

In the second example, more nodes are now associated with the Red node. The Red node now shares several relationships. As the number of connections to the Red node increase, this can decrease the deviance between Red and the Fire-engine. Also note, there is a banana on this graph. For some reason, a connection between a Banana node and Red was made. This was a bad association. But, we will address this scenario in a later example when we discuss the process for forgetting.

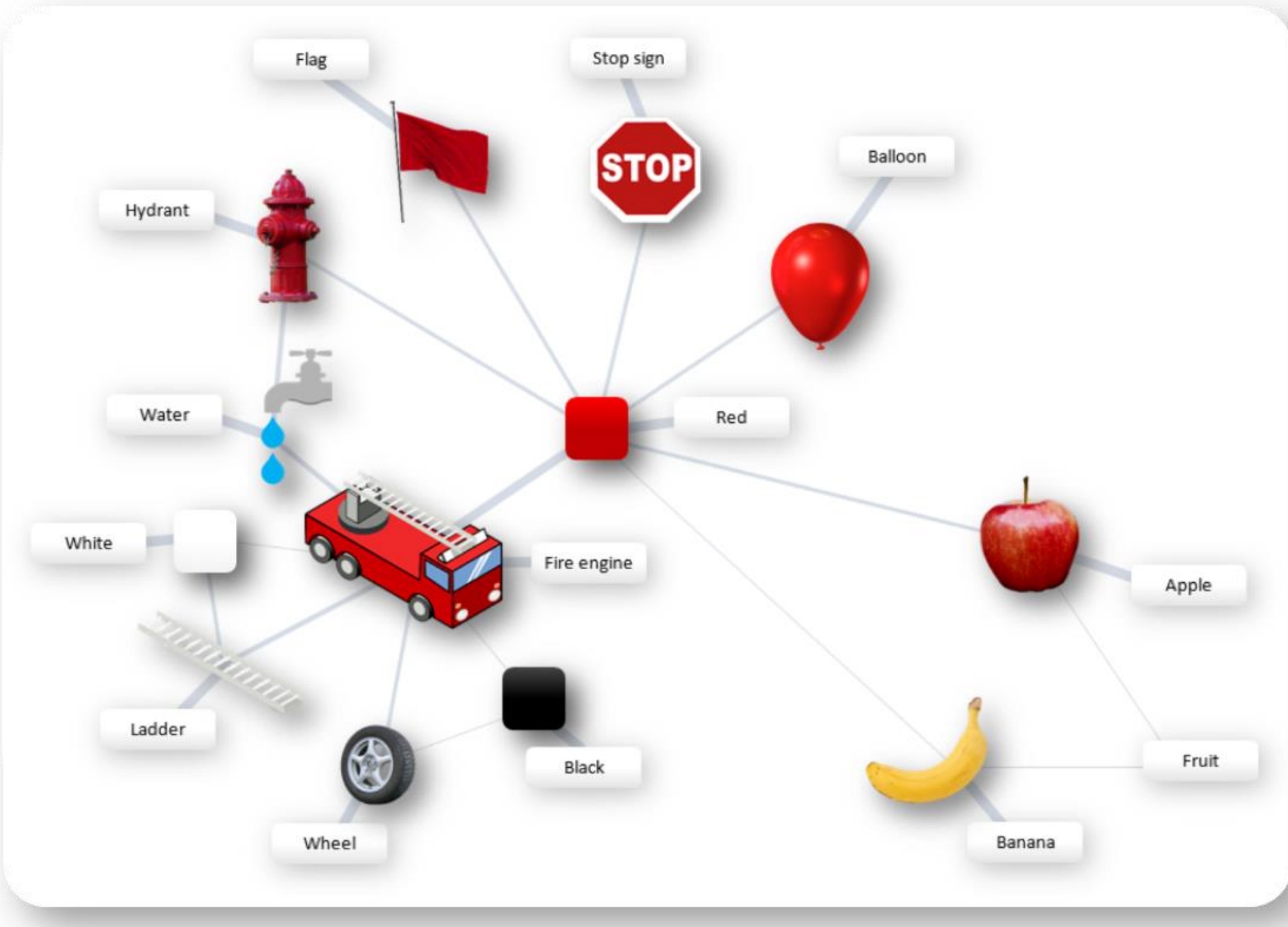

Figure 5.2: Semantic network illustrating memory. Increasing the number of relations to the Red node can decrease the weighted deviance between the Red node and the Fire-engine node.

The third example demonstrates how a deviant event of one node may influence the connection weights of the other associated nodes. For example, say we experienced a very loud event of a red balloon exploding. With the intense sound, the Explosion node will have a strong connection to the Balloon node. And, this event can increase the connection weight to the associated Red node.

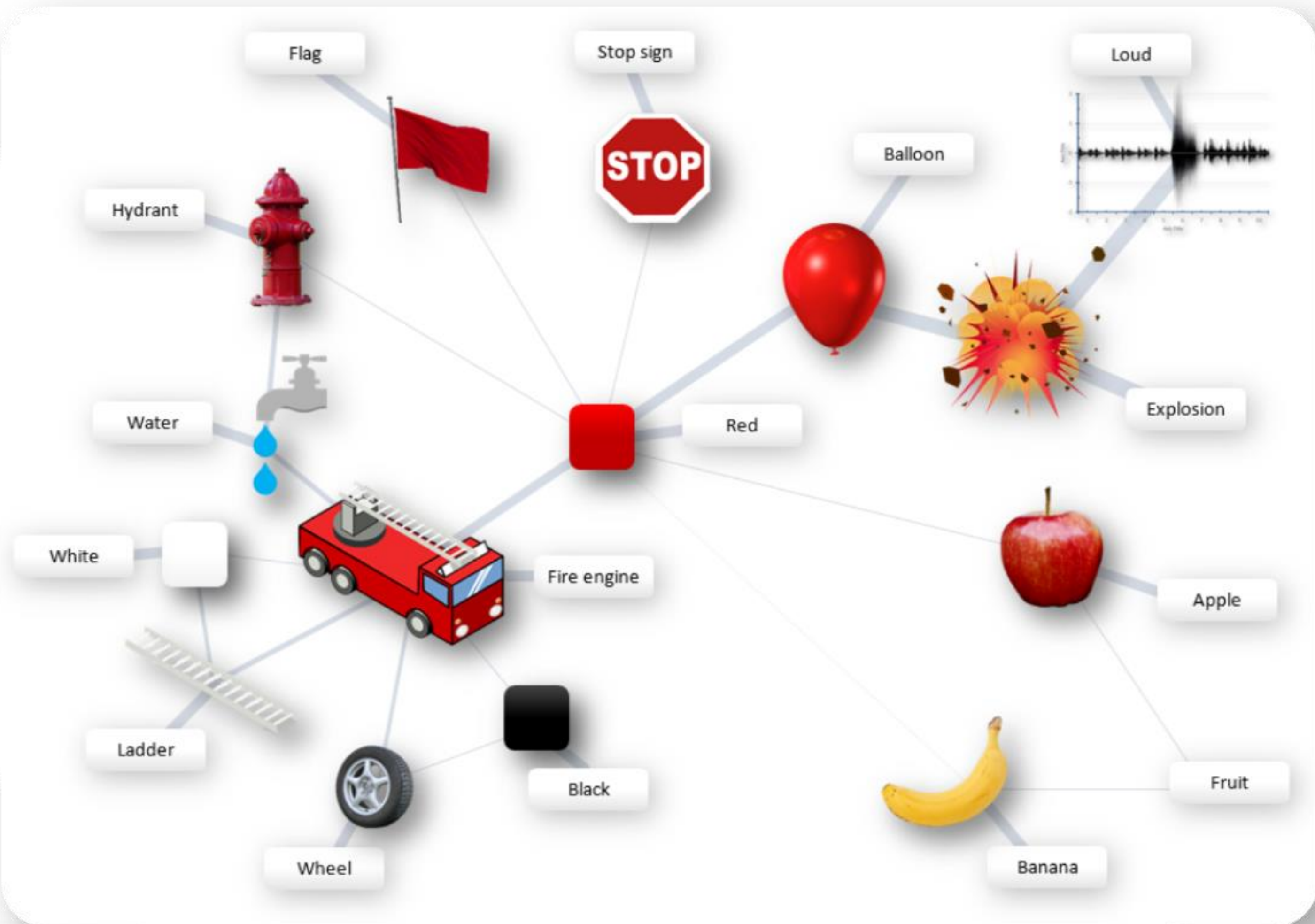

Figure 5.3: Semantic network illustrating memory. The addition of the Explosion node can influence the weights between the other associated nodes. The strong weight between the Explosion node and the Balloon node can propagate to the associated Red node.

The concept of relativism is useful in understanding memory retention. In your memory, you may be connecting nodes to other nodes that are relevant to you. However, your particular set of connections may not be relevant to other individuals. Not everyone may share the exact same set of experiences. They can have different experiences than you. Individuals may experience and store memories differently even for the same event. For example, two people may experience the same bank robbery event. However, each observer may be at different locations and may only pay attention to details they find relevant from their perspective as the robbery event unfolds. Thus, creating two relatively different memories to recall.

When it comes to memory retention, it can be difficult to establish an absolute method shared by all entities. For example, take this fill-in-the-blank question:

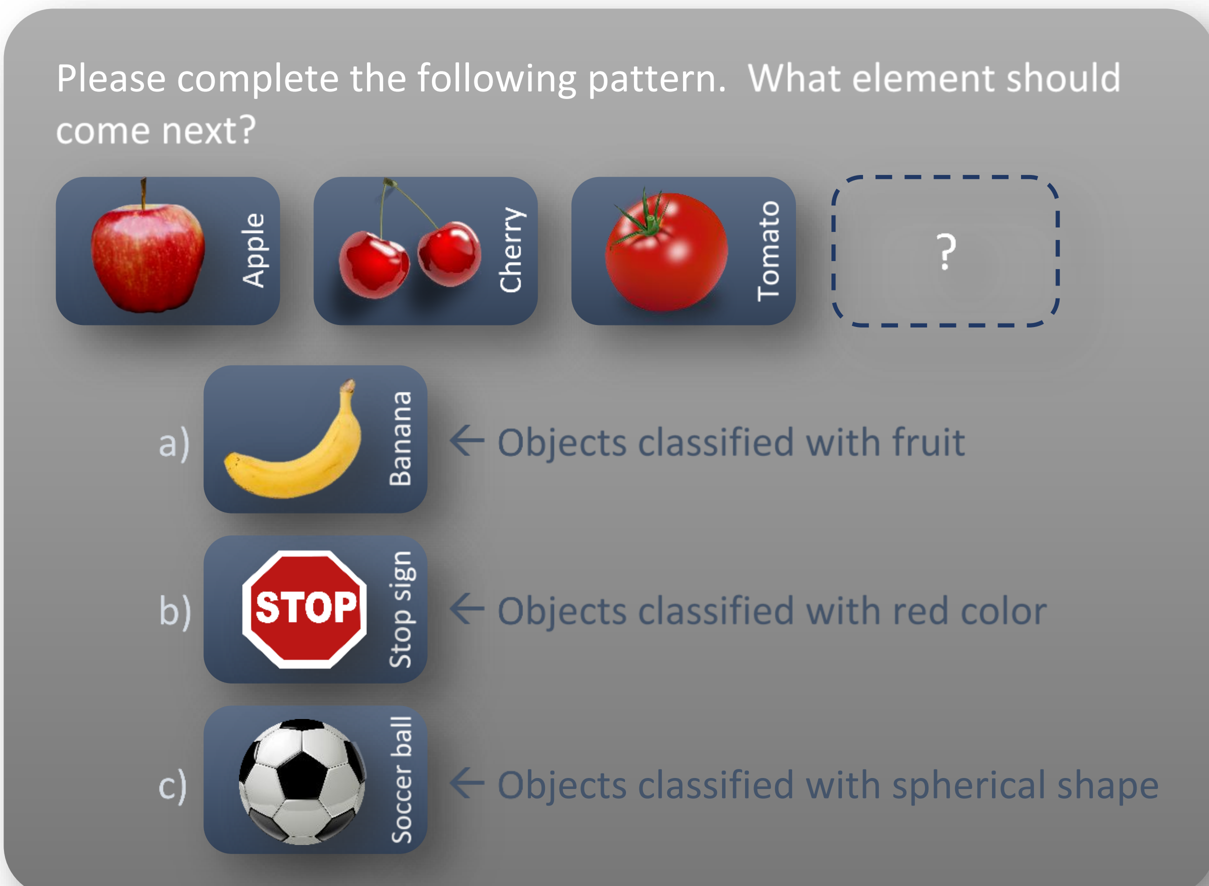

Figure 5.4: Fill-in-the-blank question demonstrating how different answers (*a*, *b*, or *c*) may be correct within their own context. It can be difficult to establish one absolute answer.

All answers may be correct within their own context. Perhaps the banana option was chosen because we wanted to satisfy the pattern of containing all objects classified with fruit. Maybe the stop sign was chosen because we wanted to fulfill the pattern of having all objects classified with the color red. Or, it could be that the soccer ball was picked in order to fill the pattern of all objects classified with a spherical shape.

Relativism is also useful with learning mnemonics. These mnemonic techniques can aid in memory retrieval. Recalling information can be easier when it is connected to relevant information that we already know. The memories with more deviant connections can be easier to recall. Roediger's article *The Effectiveness of Four Mnemonics in Ordering Recall* studied how particular mnemonics can help to improve recall over standard memorization techniques. Being able to connect terms to images can aid in memory recall. (Roediger, 1980). There are several different mnemonics. For example, there is the general keyword method where you connect a term to a strong visual object. And, there is the loci method, also known as the memory or mind palace method. With this technique, terms are linked to strong visual objects throughout a familiar location in your mind.

Memory Alteration and Forgetting: The process of memory alteration and forgetting is very important. Past memories can be influenced with new information. Machines will need to be able to forget irrelevant things in order to make room for learning new tasks. The following example depicts how deviance can be used to decrease the weighted relationship between weaker connections. A new increased connection between deviant nodes can cause a decreased connection between other, less deviant, nodes. For instance, the connection between Red and Balloon may have increased. But, this increase can cause the weaker nodes connected to Red to decrease. This can cause an already weak connection between Red and Banana to decrease further. In essence, we are forgetting the association between Red and Banana.

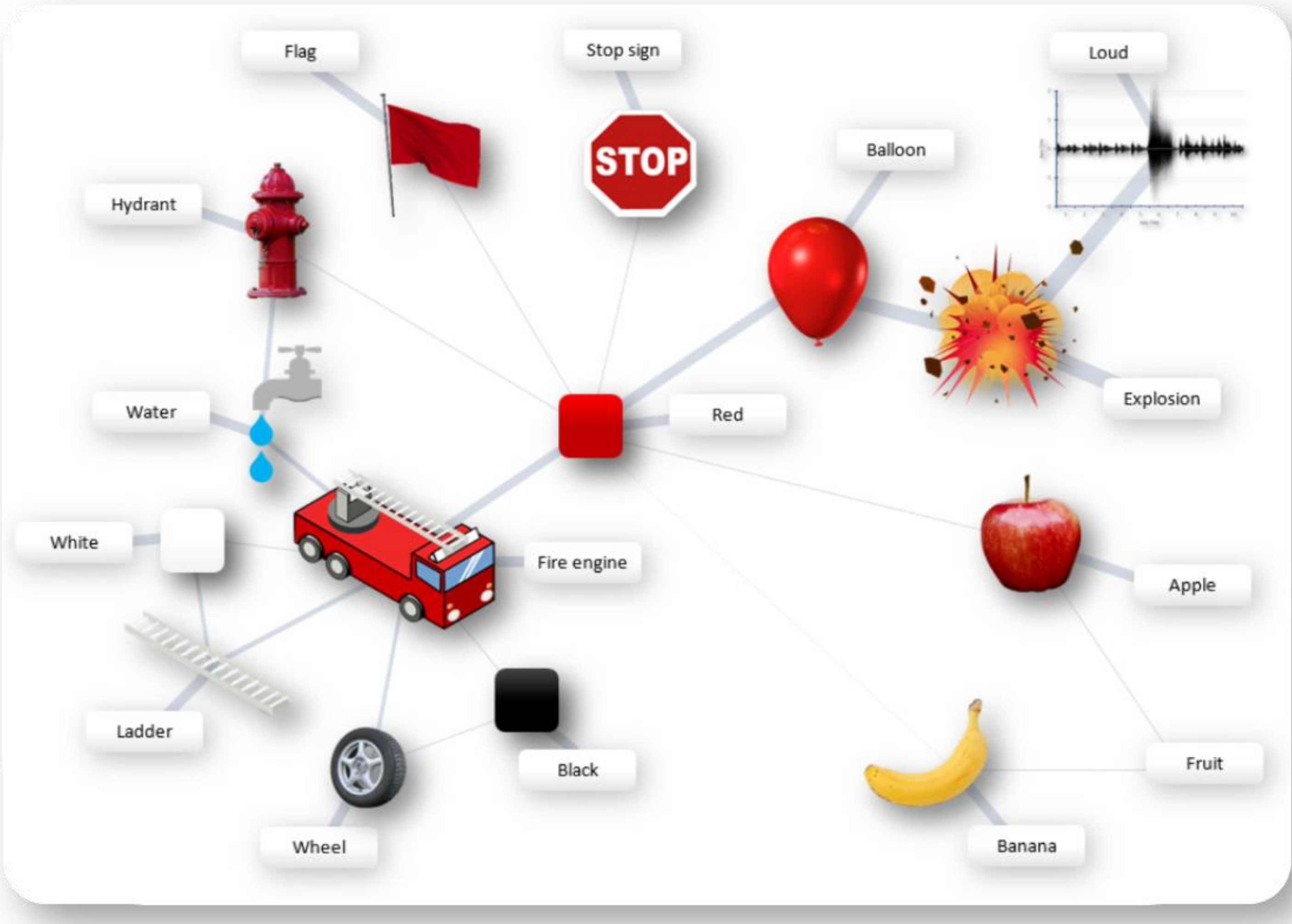

Figure 5.5: Semantic network illustrating memory. An increased connection between deviant nodes can cause a decreased connection between other, less deviant, nodes. The strong weight between the Balloon node and the Red node increased. However, the weaker connection between the Red node and the Banana node decreased.

CHAPTER 6 - FUTURE WORK

List of future work and projects to pursue:

- Discuss concepts of time and time perception.
- Discuss other senses, methods of perception. Such as: tactile perception.
- Develop and test general relative methods for machine learning.

CHAPTER 7 - CONCLUSION

In conclusion, here is a recap of what the thesis covered. First, we addressed some of the main issues for general artificial intelligence. Second, an overview was given for absolutism and relativism. We introduced some examples of how these concepts relate to machine learning algorithms. Then, we argued the thesis statement that classification requires relativism to be useful. The concept of relativity can be useful for: (1) axiology, (2) defining things, and (3) memory.

The goal of this thesis is to show how relativism can be used as a strategy to help solve some of the challenges for general artificial intelligence. There are cases in the domain of artificial intelligence where the method of relativism can be useful. Some cases are straightforward while others are not as clear. We started with the more established axiology examples of ethics and aesthetics in which relativism can be useful. And, then worked our way to the other instances in which the method of relativism can be useful for defining things and can be useful for memory.

REFERENCES

Baghramian, M., Carter, A. (2016.) "Relativism." *The Stanford Encyclopedia of Philosophy*. Edward N. Zalta (ed.). <http://plato.stanford.edu/entries/relativism>. ISSN 1095-5054.

Battistella, E. (2005). “Bad Language: Are Some Words Better than Others?” *Oxford University Press*. New York. p.3-22, 67-100. DOI: 10.1093/acprof:oso/-9780195172485.001.0001.

Brumfiel, G. (August 2009). “This Kilogram Has A Weight-Loss Problem.” *National Public Radio (NPR)*. Science section. Article No: 112003322. < http://www.npr.org/templates/story/story.php?storyId=112003322>. Accessed August 2016.

Calder, T. (2015). "The Concept of Evil." *The Stanford Encyclopedia of Philosophy*. Edward N. Zalta (ed.). <http://plato.stanford.edu/entries/concept-evil>. ISSN 1095-5054.

Carey, S. (September 2016). "Inside DeepMind’s Latest Attempts to Achieve a General Artificial Intelligence: What are Progressive Neural Nets?" *TechWorld*. Article No: 3646730. <http://www.techworld.com/big-data/inside-deepminds-latest-attempts-achieve-general-artificial-intelligence-3646730/>. Accessed September 2016.

Emspak, J. (April 2013). "Speed of Light May Not Be Constant, Physicists Say." Live-Science. <http://www.livescience.com/29111-speed-of-light-not-constant.html>. Accessed August 2016.

Farmer, M. (2005). “Evidential Reasoning for Control of Smart Automotive Air-bag Suppression.” *Proceedings of the Eighth IASTED International Conference on Intelligent Systems and Control, ISC*. p.228-234.

Fildes, J. (November 2007). “Getting the Measure of a Kilogram.” *BBC News*. Science and Environment section. Article No: 7084099. <http://news.bbc.co.uk/2/hi/science/nature/7084099.stm>. Accessed August 2016.

Findlay, M. (November 2012). “The Value of Art: Money, Power, Beauty.” *Artnet News*. Book excerpt. <https://news.artnet.com/market/defining-the-value-of-art-27673>. Accessed October 2016.

Freeland, C. (April 2002). “But Is It Art? An Introduction to Art Theory.” *Oxford University Press*. Oxford, New York. Book. ISBN: 9780191593772. Call No: N71.F653 2002.

“Fundamental Physical Constants.” (January 2016). *The National Institute of Standards of Technology (NIST)*. <http://physics.nist.gov/cuu/index.html>. Accessed August 2016.

Grant, A. (February 2015). “Speed of Light Not So Constant After All.” *Science-News Magazine*. Physics section. Magazine issue: Vol: 187, No: 4, p.7. <https://www.sciencenews.org/article/speed-light-not-so-constant-after-all>. Accessed August 2016.

Grant, D. (May 2011). “Is an Artist Only Appreciated After He Dies?” *The Huffington Post*. <http://www.huffingtonpost.com/daniel-grant/is-an-artist-only-appreci_b_512932.html>. Accessed October 2016.

Harper, D. (2016). “Online Etymology Dictionary: Bad.” *Etymonline*. Retrieved July 2016. <http://www.etymonline.com/index.php?term=bad>.

Harris, K. (July 2014). “10 English Words that Mean Something Else in Other Languages.” *Ink Tank*. Retrieved July 2016. <http://inktank.fi/10-english-words-mean-something-else-languages>.

Harris, W., Freudenrich, C. (July 2011). “How Light Works.” *How Stuff Works: Science*. <http://science.howstuffworks.com/light.htm>. Accessed September 2016.

Hobbs, J. (2006). “Homophones and Homographs: An American Dictionary.” 4th Ed. *McFarland*. p.3-4. ISBN: 9780786424887.

Mackie, J. (1955). "Evil and Omnipotence." Mind. Volume 64, Issue 254. P.200-212. *Thomas Nelson and Son, Ltd.* London. ISSN 0026-4423.

Maier, R., Hadrich, T., Peinl, R. (2009). “Enterprise Knowledge Infrastructures.” *Dordrecht: Springer Berlin Heidelberg*. p.4-5. ISBN: 9783540897675.

Mancas, M., Ferrera, V., Riche, N., Taylor, J. (2016). “From Human Attention to Computational Attention: A Multidisciplinary Approach.” *Springer New York*. New York, NY. p. 1-3, 15, 63, 405-419, 439-440. ISBN: 9781493934331. DOI: 10.1007/978-1-4939-3435-5.

McDonald, G. (2010). "Ethical Relativism vs Absolutism: Research Implications." *European Business Review*. Vol. 22. No. 4. p.446-64. DOI: 10.1108/09555341011056203.

Nunamaker, J., Romano, N., Briggs, R. (2001). “A Framework for Collaboration and Knowledge Management.” *IEEE*. p.3-4. DOI: 10.1109/HICSS.2001.926241.

Pashler, H. (1998). “Attention.” *Hove: Psychology Press*. East Sussex, UK. p.191, 223, 257. ISBN: 9780863778124. DOI: 10.4324/9781315784762

Roediger, R. (1980). “The Effectiveness of Four Mnemonics in Ordering Recall.” *Journal of Experimental Psychology: Human Learning and Memory*. Vol. 6. No. 5. p. 558-567. DOI: 10.1037/0278-7393.6.5.558.

Schick, T., Vaughn, L. (2004). “Doing Philosophy: An Introduction through Thought Experiments.” 3rd Ed. *New York: McGraw-Hill*. p.325-367, 536, 480. ISBN: 9780072991970.

“What is Metric? Making the First International Kilograms and Metres.” (2013). *UK Metric Association*. <http://ukma.org.uk/first-kg-prototype>. Accessed August 2016.

Zimbardo, P. (2008). “The Lucifer Effect: Understanding How Good People Turn Evil.” *Random House Trade*. p.5. ISBN: 9780812974447.

Zimmermann, H. (2001). “Fuzzy Set Theory - And Its Applications.” 4th Ed. *Springer Science & Business Media*. New York. p.1-12, 116. DOI: 10.1007/978-94-010-0646-0.

Zimmermann, H. (June 2010). “Fuzzy Set Theory.” *Wiley Interdisciplinary Reviews: Computational Statistics*. Vol 2, Issue 3, p.317–332. DOI: 10.1002/WICS.82.

REFERENCES - IMAGES

"'Composition VII' by Theo van Doesburg." (March 2008). [Image]. Retrieved November 2016 from: <https://commons.wikimedia.org/wiki/File:Theo_van_Doesburg_Composition_VII_(the_three_graces).jpg>, <http://creativecommons.org/publicdomain>.

"'Girl with a Pearl Earring' by Vermeer." (October 2014). [Image]. Retrieved November 2016 from: <https://commons.wikimedia.org/wiki/File:Meisje_met_de_parel.jpg>, <http://creativecommons.org/publicdomain>.

Pray, D. "'Levitated Mass' by Heizer." [Image]. Retrieved November 2016 from: Miranda, Carolina. (September 2014.) "'Levitated Mass,' Doug Pray's rock doc on LACMA's epic boulder." *Los Angeles Times*. Arts & Culture section. <http://www.latimes.com/entertainment/arts/miranda/la-et-cam-levitated-mass-documentary-michael-heizer-rock-lacma-20140903-column.html>.

"'The Gleaners' by Millet." (July 2012). [Image]. Retrieved November 2016 from: <https://commons.wikimedia.org/wiki/File:Jean-Fran%C3%A7ois_Millet_-_Gleaners_-_Google_Art_Project_2.jpg>, <http://creativecommons.org/publicdomain>.

Unna, J. (July 2008). "'David' by Michelangelo." [Image]. Retrieved November 2016 from: <https://commons.wikimedia.org/wiki/File:'David'_by_Michelangelo_JBU0001.JPG>, <https://creativecommons.org/licenses/by/3.0>.

“‘White Paintings’ by Robert Rauschenberg.” [Image]. Retrieved November 2016 from: Bershidsky, Leonid. “Why Pay $15 Million for a White Canvas?” *Bloomberg*. November 2014. <http://www.latimes.com/entertainment/arts/miranda/la-et-cam-levitated-mass-documentary-michael-heizer-rock-lacma-20140903-column.html>.