TOK Exhibition Commentary

"Shades of Certainty"

IA Prompt: "To what extent is certainty attainable"

Theme: Knowledge and the Knower

Word count: 950

Epistemic certainty is the absence of rational doubt in a belief, unlike psychological certainty, which is a personal belief that may lack rational justification (Reed). This commentary focuses on the attainability of epistemic certainty.

Object 1: A picture of "The Dress"

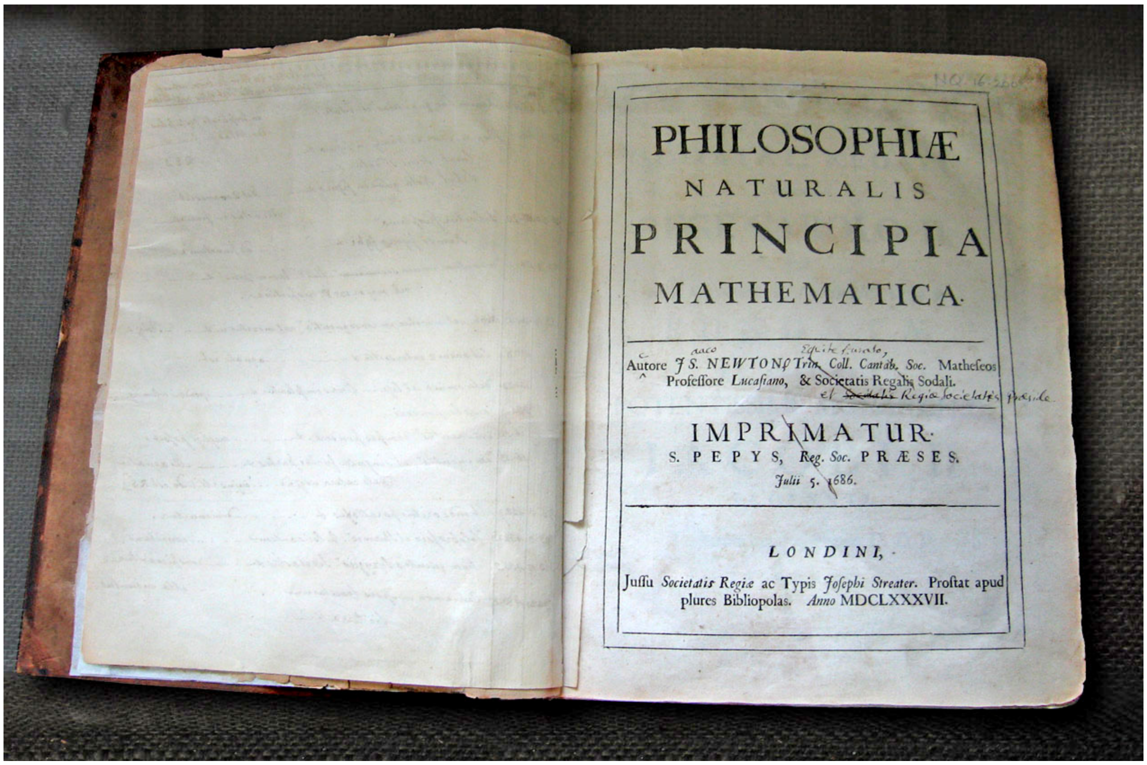
Image credit: Cecilia Bleasdale, Wikimedia Commons

This is a photograph of a dress sold by retailer Roman Originals, posted on Tumblr in 2015 by Caitlin McNeill. The image became viral on the internet and arguments ensued regarding the colour of the dress. Some people perceived it as White-Gold, whilst others perceived it as Blue-Black (BBC).

One argument against the attainability of certainty for knowledge gained via observation is the fallibility of human perception. Due to the unusual lighting conditions in which the photograph was taken, it tricks the brain into perceiving the image incorrectly (Pound 1:41). When processing the input from our eyes, the brain takes shortcuts based on the lighting and context instead of directly processing the object. While this usually works, in some circumstances, such as this picture, the brain fails to paint an accurate picture of reality. Therefore, there is always a rational reason to doubt our brain's perception of reality hence certainty can never be fully achieved via direct observation using our senses.

Moreover, people perceive the dress differently depending on the ambient lighting conditions or the type of device they view the photo from. This further demonstrates how the context in which something is perceived can trick our perception. Differences in individual brains at a neurological level also shape what colour one sees in the dress, showing how our perception of reality is subjective and not objective like the actual reality, making conclusions we draw from our sensory perception uncertain.

To conclude, *The Dress* highlights the fallibility and subjectivity of human perception and hence the inherent uncertainty in beliefs formed based on observations.



Object 2: Principia by Isaac Newton

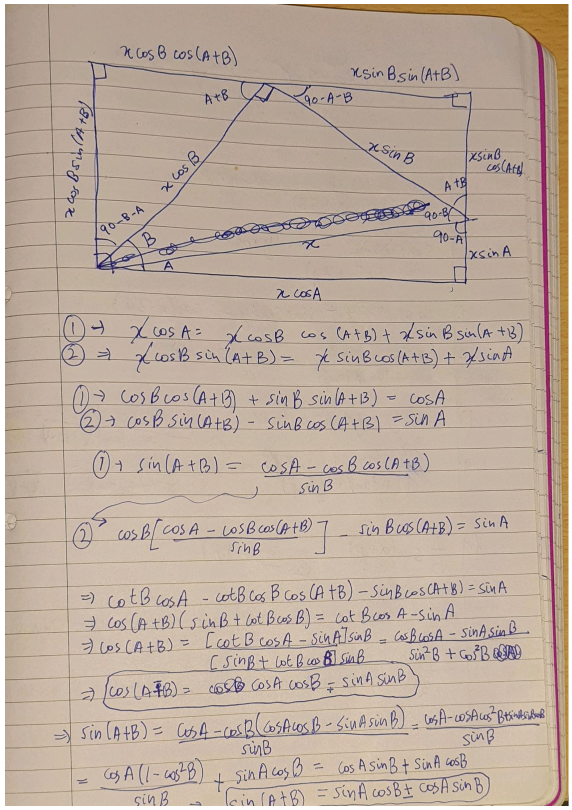
Image credit: Wikimedia Commons, Andrew Dunn, Creative Commons CC0 1.0 Universal Public Domain Dedication

My second object is a photograph of the title page of the first edition of a book written by Sir Issac Newton published in 1687 titled *Philosophiæ Naturalis Principia Mathematica*. In this book, Newton expounded his laws of motion and universal gravitation. He was certain that time passed uniformly for all observers which formed the basis for his laws (Knudsen and Hjorth 30). However, later Einstein proved that Newton’s assumption was false and his laws did not model objects that move extremely fast or are in the presence of strong gravitational fields (Crowell).

Newton's laws were based on inductive or *a posteriori* reasoning. Using experimental data and observations, Newton concluded that his laws are universal and true because they could explain everything that he could observe at the time. While he was psychologically certain of this, there was always a rational reason to doubt this belief. Since he had only checked a certain subset of objects to verify his laws, there was always a possibility that they were not universal, which turned out to be true.

Newton's laws are still used in calculations of planetary motion, eclipses and trajectory of satellites but are inaccurate in certain situations such as triangulation using GPS satellites. This demonstrates how *a posteriori* knowledge can be more certain when the context in which it was observed and tested is considered.

Beyond the fundamental issue of induction, inductive reasoning can also be limited by the quantity or quality of available data. For example, in Newton's time, it was impossible to keep track of time accurately to the nanosecond which led him to believe that time is absolute. However, because of the invention of atomic clocks, it became possible to find that time is actually relative. This shows how with more accurate data and sampling, inductive reasoning can achieve certainty to a greater extent but never completely.



Object 3: A picture of my proof for the sum angle formulae

Image credit: Self clicked

My third object is a photograph of my proof for the sine and cosine of the sum of two angles in terms of the sine and cosine of the individual angles that I derived in my Mathematics AA class. To construct this proof, I used a deductive or *a priori* argument in order to conclude that this formula must hold for all angles. This is in contrast to my first two objects, in which knowledge was gained *a posteriori* (Baehr).

This formula is certain to be true to a large extent because it does not rely on observations of the real world or inductive reasoning. Rather, it follows *logically* from the axioms, definitions, and previously proven theorems in mathematics, such as the fact that all angles in a triangle add up to

180 degrees. Because each step of the proof hinges on pure logic and reasoning and not on intuition or observations of the angles of triangles in real life, the proof is necessarily devoid of any complexities, biases or uncertainties that arise when observing and analysing real-world phenomena.

Moreover, trigonometric formulae and identities were found and proven independently across civilizations and cultures, including the ancient Greeks, Babylons, Indians and Egyptians (Boyer 158). This shows how mathematical truths like my formula transcend beyond cultural, geographical or temporal factors and apply universally to all cultures and people, making them more certain.

However, it is impossible to be completely certain even in mathematics. In 1931, Kurt Gödel showed that it is impossible to be certain that a mathematical system is consistent (i.e. contains no logical contradictions) (Raatikainen section 2). Hence, it is possible, although highly improbable, that my theorem is not true because of a potential inconsistency in our mathematical system.

From my objects, it is clear that certain types of knowledge are more certain than others. Proven mathematical or logical statements can be considered certain or near certain, whereas knowledge gained by personal experience or observations generalized using inductive reasoning is generally more uncertain, but can also achieve a high degree of certainty in certain circumstances.

Works cited

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