# 10 Elements of Clear Thinking Cheat Sheet

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## Introduction

Much learning in business and life occurs simply by observation. Automatic learning (knowledge gained without awareness) underlies habituation and classical conditioning. Automatic learning process can entice people into biased learning. Good statistical thinking can improve our logical and problem solving skills. Statistics is the art of making numerical guesses about puzzling questions (Wheelan, 2013).

Source: https://www.psychologytoday.com/us/blog/science-choice/201803/10-elements-clear-thinking

## 1. Solving the right problem

The hardest part of a problem solving is the understanding precisely what is the problem. Problem has to be actionable (e.g., being stuck in a wrong job or relationship). If it's not actionable, then, it's a gravity problem (Burnett & Evans, 2016). Gravity problem is a situation (a circumstance) or a fact of life (e.g., growing old). It is not a problem that can be solved. The only response to a gravity problem is acceptance

## 2. Form a hypothesis

The first step in statistical thinking is the formation of a hypothesis (an educated guess). For example, we hypothesize the following relationship: children who grew up with lots of books in their home tend to do better in school. The aim is to falsify the initial hypothesis by observations and experiments. If we fail to reject the null hypothesis, we accept it by default.3

## 3. The underlying theory

Every observation has more than one interpretation. Observations do not usually announce their meaning and often invite an incorrect interpretation. So we need a few guiding theory that permit selection of one account over another. For example, research shows that the education and income of a student's parents have a significant impact on student achievement.

## 4. Association is not the same as causation

A cause is something that produces an effect. For example, surrounding children with many books does not necessarily make them to read. The two variables are positively correlated.

## 5. Confounding factor

A confounder is a third variable that you did not account for it. These variables distort the true causal link. In the previous example, both variables (the presence of books and academic performance) are likely caused by a third variable, which is parental education.

## 6. Reversion to the mean

## 7. Probability is not deterministic

Our intuition does not grasp the nature of randomness. We see patterns where none may really exist. For example, if a coin comes up heads five times in a row, people will have a powerful sense that the next flip is more likely to come up tails than heads. Each flip is an independent event. Similarly, a flood this year says nothing about whether a flood will happen next year.

## 8. Prepare for the worst-case scenario

The greatest risks are the ones that we can hardly imagine they could happen. The philosopher Taleb (2012) recommends that in order to make decision you need to focus on the consequences (which you can know) rather than the probability (which you can't know). The more uncertainty you face in the future, you will do well by having options. Chance favors the preparedness. An important strategy for the military is to invest in preparedness, not in prediction

## 9. Belief updating

We seem to use perception (the way things appear) to guide our actions (Siegel, 2017). Consider this prejudicial thinking. A teacher perceives female students being weak in math. Consequently, he will expect and demand less of her, and he will perceive her performance as being worse than a male student. Perceptual judgment is a form of belief. If our prior beliefs influence our experience, our experience can go on to strengthen those very beliefs. Failure to update prior beliefs explains wishful thinking..

## 10. Generalization

Much of scientific research is aimed at uncovering the causes of illness at the population level. Ultimately, we want to understand why illness occurs in individuals (why individual A became unhealthy?). One cannot necessarily conclude the same relationship from the group level to the individual level. Statistics never delivers absolute certainty. Instead, facts are known with degrees of confidence.

Past performance is no guarantee of future performance. Statistical thinking tells us that any outlier is likely to be followed by outcomes that are more consistent with the long-term average. This phenomenon is known as reversion to the mean or what is normal. This explains why the baseball rookie of the year so often is a disappointment the second year. If we consider the performance as a continuous variable subject to mean and variance, we will experience distributed performances with extreme values. Any number of other things could be operating to push performance level up or down..