

A PRACTICAL GUIDE TO CRITICAL THINKING

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This paper presents a concise introduction to critical thinking. It is intended as a handy tool to help anyone develop sound reasoning and arguments, or to evaluate the validity of any claim.

Introduction

There have been many definitions of critical thinking. From a practical perspective, it may be defined as:

A process by which we use our knowledge and intelligence to effectively arrive at the most reasonable and justifiable positions on issues, and which endeavors to identify and overcome the numerous hindrances to rational thinking.

Not everyone values the need for critical thinking. Often, being methodically objective is viewed as cold, sterile, and worst of all, boring. To those who say "Have faith and let your feelings guide you to the truth," or "Don't let facts get in the way of an inspiring or interesting story," these words will probably not resonate. But for those who truly understand and appreciate the importance of critical thinking, this paper, including the attached tables, can become a useful reference for daily life.

Just because you are intelligent or have great knowledge does not mean you can think critically. A profound genius may have the most irrational of beliefs or the most unreasonable of opinions. Critical thinking is about **how** we use our intelligence and knowledge to reach objective and rationale viewpoints. Opinions and beliefs based on critical thinking stand on firmer ground compared to those formulated through less rational processes. Additionally, critical thinkers are usually better equipped to make decisions and solve problems compared to those who lack this ability.

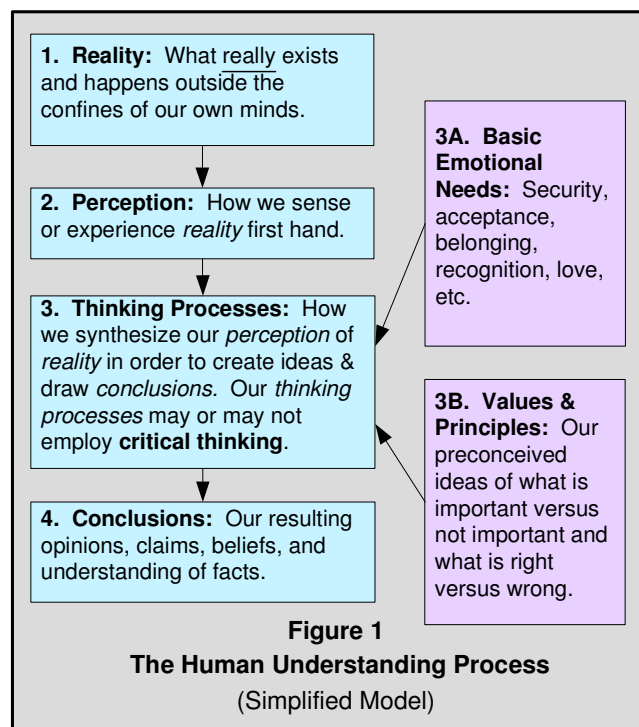


Figure 1 presents a very simplified model of the human understanding process. Basically, our *thinking processes* (Step 3) synthesize our *perceptions* (Step 2) of *reality* (Step 1) in the context

of our *basic emotional needs* (Step 3A) and our *values and principles* (Step 3B) in order to reach *conclusions* (Step 4) about anything in life. Critical thinking is just one sub-process of the thinking processes step that people may or may not employ in order to reach conclusions.

Critical thinking is more than thinking *logically or analytically*; it also means thinking *rationally or objectively*. There is an important distinction. Logic and analysis are essentially philosophical and mathematical concepts, whereas thinking rationally and objectively are broader concepts that also embody the fields of psychology and sociology. These latter two areas address the complex effects of human behavior (e.g., hindrances) on our thinking processes.

Becoming an accomplished critical thinker can be considered a five-step process:

- Step 1: Adopt the Attitude of a Critical Thinker
- Step 2: Recognize and Avoid Critical Thinking Hindrances
- Step 3: Identify and Characterize Arguments
- Step 4: Evaluate Information Sources
- Step 5: Evaluate Arguments

Each of these steps is described separately below.

What Critical Thinking Is Not

Thinking critically is **not** thinking negatively with a predisposition to find fault or flaws. It is a neutral and unbiased process for evaluating claims or opinions, either someone else's or our own.

Critical thinking is **not** intended to make people think alike. For one reason, critical thinking is distinct from one's *values or principles* (see Figure 1), which explains why two people who are equally adept at critical thinking, but have different values or principles, can reach entirely different conclusions. Additionally, there will always be differences in *perception* and *basic emotional needs* (see Figure 1) which prevent us from all thinking the same way.

Critical thinking does **not** threaten one's individuality or personality. It may increase your objectivity, but it will not change who you are.

It is **not** a belief. Critical thinking can evaluate the validity of beliefs, but it is not a belief by itself – it is a *process*.

Critical thinking does **not** discourage or replace feelings or emotional thinking. Emotions give our lives meaning, pleasure, and a sense of purpose. Critical thinking cannot possibly fulfill this role. Still, emotional decisions that are *also* critical decisions (such as deciding to get married or have children) should embody critical thinking.

Critical thinking does **not** blindly support everything based on science. For example, our culture is full of bogus scientific claims that are used to market everything from breakfast cereal to breast enhancement pills.

It is also important to understand that arguments based on critical thinking are **not** necessarily the most persuasive. Perhaps more often than not, the most persuasive arguments are those designed to appeal to our basic human/emotional needs rather than to our sense of objectivity. For that reason, it is common for highly persuasive

arguments by politicians, TV evangelists, and sales people, among others, to *intentionally* lack critical thinking. (See pertinent examples in tables 1 through 4.)

Step 1: Adopt the Attitude of a Critical Thinker

The first step to becoming a proficient critical thinker is developing the proper attitude. Such an attitude embodies the following characteristics:

- *Open-mindedness*
- *Healthy skepticism*
- *Intellectual humility*
- *Free thinking*
- *High motivation*

The first two characteristics may appear contradictory, but they are not. The critical thinker must be willing to investigate viewpoints different from his or her own, but at the same time recognize when to doubt claims that do not merit such investigation. A critical thinker must be neither dogmatic nor gullible. Being both *open-minded* and *skeptical* means seeking out the facts, information sources, and reasoning to support issues we intend to judge; examining issues from as many sides as possible; rationally looking for the good and bad points of the various sides examined; accepting the fact that we may be in error ourselves; and maintaining the goal of getting at the *truth* (or as close to the truth as possible), rather than trying to please others or find fault with their views. Too much skepticism will lead one to doubt everything and commit oneself to nothing, while too little will lead one to gullibility and credulousness.

Having *intellectual humility* means adhering *tentatively* to recently acquired opinions; being prepared to examine new evidence and arguments even if such examination leads one to discover flaws in one's own cherished beliefs; to stop thinking that complex issues can be reduced to matters of 'right & wrong' or 'black & white', and to begin thinking in terms of 'degrees of certainty' or 'shades of grey'. Sometimes 'I don't know' can be the wisest position to take on an issue. As Socrates noted: *Arrogance does not befit the critical thinker.*

A critical thinker must also have an independent mind, i.e., be a *free thinker*. To think freely, one must restrain one's desire to believe because of social pressures to conform. This can be quite difficult or even impossible for some. One must be willing to ask if conformity is motivating one's belief or opinion, and if so, have the strength and courage to at least temporarily abandon one's position until he or she can complete a more objective and thorough evaluation.

Finally, a critical thinker must have a natural curiosity to further one's understanding and be *highly motivated* to put in the necessary work sufficient to evaluate the multiple sides of issues. The only way one can overcome the lack of essential knowledge on a subject is to do the necessary studying to reach a sufficient level of understanding before making judgments. This may require the critical thinker to ask many questions, which can be unsettling to those asked to respond. A critical thinker cannot be lazy.

Step 2: Recognize & Avoid Critical Thinking Hindrances

Each day of our lives we become exposed to things that hinder our ability to think clearly, accurately, and fairly. Some of these hindrances result from unintentional and natural human limitations, while others are clearly calculated and manipulative. Some are obvious, but most are subtle or insidious. Armed with the proper attitude (from Step

1), a critical thinker must next understand how to recognize and avoid (or mitigate) the gauntlet of deception that characterizes everyday life. These hindrances can be divided into four categories, presented in tables at the end of this paper:

- Table 1: Basic Human Limitations
- Table 2: Use of Language
- Table 3: Faulty Logic or Perception
- Table 4: Psychological and Sociological Pitfalls

Each table provides: a) a listing of hindrances applicable to that category; b) a concise definition of each hindrance; c) illustrative examples; and d) tips to avoid or overcome such hindrances.

Basic Human Limitations (Table 1) applies to everyone, including the most proficient critical thinkers. These limitations remind us that we are not perfect and that our understanding of facts, perceptions, memories, built-in biases, etc., preclude us from ever seeing or understanding the world with total objectivity and clarity. The best we can do is to acquire a *sufficient* or *adequate* understanding depending on the issue at hand.

The *Use of Language* (Table 2) is highly relevant to critical thinking. The choice of words themselves can conceal the truth, mislead, confuse, or deceive us. From ads which guarantee easy weight loss to politicians assuring prosperity for everyone, a critical thinker must learn to recognize when words are not intended to communicate ideas or feelings, but rather to control thought and behavior.

Misconceptions due to *Faulty Logic or Perception* (Table 3) or *Psychological and Sociological Pitfalls* (Table 4) can also lead one to erroneous conclusions. A critical thinker must understand how numbers can be used to mislead; perceptions can be misinterpreted due to psychological and sociological influences; and reasoning can be twisted to gain influence and power.

Step 3: Identify & Characterize Arguments

At the heart of critical thinking is the ability to recognize, construct, and evaluate *arguments*. The word *argument* may be misleading to some. It does **not** mean to quarrel, complain, or disagree, even though the word is often used informally in that context. In the context of critical thinking, an argument means the presentation of a *reason(s)* to support a *conclusion(s)*, or:

$$\textit{Argument} = \textit{Reason} + \textit{Conclusion}$$

Argument Example:

Don't Trust John	because	he's a politician.
Conclusion	Indicator	Reason

There must be one or more reason statements and one or more conclusion statements in every argument. Depending on usage and context, reasons are synonymous with:

premises, evidence, data, propositions, proofs, and verification. Again, depending on usage and context, conclusions are synonymous with: *claims, actions, verdicts, propositions, and opinions.*

A critical thinker must learn to pick out arguments from verbal or written communication. Sometimes arguments will have *indicators* such as ‘since’, ‘because’, ‘for’, ‘for the reason that’, and ‘as indicated by’ to separate the *conclusion* statement(s) from the *reason* statement(s) that follows (see above example). At other times, arguments will have *indicators* such as ‘therefore’, ‘thus’, ‘so’, ‘hence’, and ‘it follows that’ to separate the *reason* statement(s) from the *conclusion* statement(s) that follows. In some cases there will be no indicator words at all; the context alone will indicate if a statement is intended as a reason, a conclusion, or neither.

Formal logic divides arguments into *inductive* and *deductive* arguments. While critical thinking is an informal application of logic, the critical thinker should at least understand the fundamental differences between the two forms. If one thing *follows necessarily* from another, this implies a deductive argument. In other words, a deductive argument exists when ‘B’ may be logically and necessarily inferred from ‘A.’ For example, if one makes the statement “All bachelors are unmarried (‘A’)” and “John is a bachelor (‘B’)”, then one can deductively reach the conclusion that John must be unmarried.

However, most arguments that one encounters in daily life are inductive. Unlike deductive arguments, inductive arguments are not ‘black and white’, because they do not prove their conclusions *with necessity*. Instead, they are based on *reasonable grounds* for their conclusion. A critical thinker should understand that no matter how strong the evidence in support of an inductive argument, it will never prove its conclusion by *following with necessity* or with absolute certainty. Instead, a deductive argument provides only proof to a *degree of probability or certainty*.

Arguments presented by courtroom attorneys are good examples of inductive arguments, whereupon a defendant must be found guilty *beyond a reasonable doubt* (equivalent to *reasonable grounds*). It is always possible that an inductive argument that has sound reasons will have an erroneous conclusion. For example, even though a jury finds a defendant guilty *beyond a reasonable doubt*, there is always a possibility (even if remote) that the defendant had not committed the crime. The critical thinker should assess the cogency of inductive arguments. An argument is cogent if, when the premises are all true then the conclusion is *probably* true. That is, one should assess an inductive argument in terms of degrees of probability rather than absolute ‘right & wrong’ or ‘black & white’. This applies **even if** a ‘yes/no’ or ‘either/or’ decision must be made or judgment must be rendered on the argument.

Step 4: Evaluate Information Sources

Most arguments reference facts to support conclusions. But an argument is only as strong as its weakest link. If the facts supporting an argument are erroneous, so will be the argument. A critical thinker must have a sound approach for evaluating the validity of facts. Aside from one’s personal experiences, facts are usually acquired from information sources such as *eyewitness testimony* or people claiming to be *experts*. These sources are typically cited in the media or published in reference books.

In a society where entertainment and amusement have become lifelong goals, it is often difficult to find unbiased and objective information on a subject. For example, the mass media has found “what if” journalism sells very well: *What if* the President did some horrible thing; *What if* the Secretary was motivated by some criminal behavior, etc. It is common to see reputable journalists reporting on inflammatory speculation as if it was

an important news event. How can we expect to cut through the advertising, hype, spin, innuendos, speculation, distortions, and misinformation overloads on TV, radio, newspapers, magazines and the internet, in order to ascertain what is factually correct? Even some reputable publishers seem to have more interested in selling books or periodicals than confirming the truth of what they publish. So how are we to know which information sources to trust?

While there is no simple answer, a critical thinker should look for information sources which are *credible*, *unbiased*, and *accurate*. This will depend on such things as the source's *qualifications*, *integrity* and *reputation*. In order to assess these conditions, the critical thinker must seek answers to the following types of questions:

1. Does the information source have the necessary qualifications or level of understanding to make the claim (conclusion)?
2. Does the source have a reputation for accuracy?
3. Does the source have a motive for being inaccurate or overly biased?
4. Are there any reasons for questioning the honesty or integrity of the source?

If any of the answers are “no” to the first two questions or “yes” to the last two, the critical thinker should be hesitant about accepting arguments which rely on such sources for factual information. This may require additional investigation to seek out more reliable information sources.

Information sources often cite survey numbers and statistics, which are then used to support arguments. It is *extremely* easy to fool people with numbers. Since the correct application of numbers to support arguments is beyond the scope of this paper, it is important that a critical thinker become educated in the fundamental principles of probability and statistics before believing statistical information supporting an argument. One does not need to be a math major to understand these principles. Some excellent books exist for the layman, such as *How to Lie With Statistics* by Darrell Huff, and *Innumeracy: Mathematical Illiteracy and Its Consequences* by John Allen Paulos. There are a few right ways and many wrong ways to sample populations, perform calculations, and report the results. If a source is biased because of self-interest in the outcome, it more often than not used one of the wrong ways. Perhaps the most important question the critical thinker should ask of any statistical result is: Were the samples taken representative of (a good cross section of) the entire target population? Also see the *Clustering Illusion* and *Law of Truly Large Numbers* in Table 3.

Step 5: Evaluate Arguments

The last step to critical thinking, evaluating arguments, is itself a three-step process to assess whether: 1) assumptions are warranted; 2) reasoning is relevant and sufficient, and 3) relevant information has been omitted. Each step is described below.

Assumptions. Assumptions are essentially reasons implied in an argument that are taken for granted to be true. Using our earlier argument example, “Don’t trust John because he’s a politician”, the implied assumption is that politicians cannot be trusted. The first step to evaluating arguments is to determine if there are any assumptions, and whether such assumptions are warranted or unwarranted. A *warranted assumption* is one that is either:

- 1) *Known* to be true; or
- 2) Is *reasonable* to accept without requiring another argument to support it.

An assumption is *unwarranted* if it fails to meet either of the two above criteria.

Regarding the first criterion, it may be necessary for the critical thinker to perform independent research to verify what is “known to be true.” If the critical thinker, despite such research, is unable to make a determination, he or she should *not* arbitrarily assume that the assumption is unwarranted. Regarding the second criterion, a critical thinker normally evaluates the *reasonableness* of assumptions in relation to three factors: a) one’s own knowledge and experience; b) the information source for the assumption; and c) the kind of claim being made.

If an argument has an unwarranted assumption, and if this assumption is *needed* to validate the argument’s conclusion, the critical thinker has good cause to question the validity of the entire argument. Some of the hindrances listed in the tables, especially Tables 3 and 4, provide the basis for many unwarranted assumptions.

Reasoning. The second step to evaluating arguments is to assess the *relevance* and *sufficiency* of the reasoning (or evidence) in support of the argument’s conclusion. It is helpful to think of “relevance” as the *quality* of the reasoning, and “sufficiency” as the *quantity* of the reasoning. Good arguments should have both quality (be relevant) and quantity (be sufficient).

It is generally easier (although not always) to pick out reasoning that is *relevant* (i.e., on the subject or logically related) than it is to determine if the reasoning is *sufficient* (i.e., enough to validate the argument). So how can one evaluate the sufficiency of reasoning (evidence) to support a conclusion? The term *reasonable doubt*, as used in a court of law, is considered a good guideline. But how does one go about determining reasonable doubt? Unfortunately, there is no easy answer, but here are some criteria. First, it is important to maintain the attitude of a critical thinker (from Step 1) and be aware of critical thinking hindrances (from Step 2). Second, ask yourself the purpose or consequences of the argument being made. This will sometimes determine how much (sufficiency) evidence is required. Third, become aware of contemporary standards of evidence for the subject. For example, you could not judge the sufficiency of evidence for a scientific claim unless you were knowledgeable of the methods and standards for testing similar scientific claims. Finally, the sufficiency of evidence should be in proportion to the strength to which the conclusion is being asserted. Thus, evidence that is not sufficient to support a strong conclusion (Example: John *definitely* bought the painting) may be sufficient to support a weaker conclusion (Example: John *may* have bought the painting). In these examples, if the evidence was limited to a photograph of John at an art store on the same day the painting was purchased, this evidence would not be sufficient to prove the stronger conclusion, but it may be sufficient to prove the weaker conclusion.

When evaluating multiple pieces of evidence, both pro and con, how does one *weigh* the evidence to determine if, overall, the argument is cogent? Again, there is no hard and fast rule. All else being equal, the more reliable the source (from Step 4), the more weight should be given to the evidence. Additionally, more weight should generally be given to superior evidence in terms of its relevance and sufficiency to validate the argument, all else being equal.

Many of the hindrances listed in Tables 3 and 4 provide examples of irrelevant or insufficient reasoning.

Omissions. A cogent argument is one that is complete, in that it presents *all* relevant reasoning (evidence), not just evidence that supports the argument. Arguments that omit relevant evidence can appear to be stronger than they really are. Thus, the final step to evaluating arguments is attempting to determine if important evidence has been

omitted or suppressed. Sometimes this happens unintentionally by carelessness or ignorance, but too often it is an intentional act. Since it is usually unproductive to confront arguers and ask them to disclose their omissions, the critical thinker's best course of action is usually to seek opposing arguments on the subject, which could hopefully reveal such omissions. It is a rare arguer who actively seeks out opposing views and treats them seriously, yet that is precisely what a critical thinker must do when developing his or her own arguments.

Many of the hindrances listed in Tables 1 through 4 allow one to become easily fooled by not taking into consideration possible omissions that could invalidate an argument's conclusion.

Argument Checklist

Having understood the above five-step process, a critical thinker may wish to use the following checklist when evaluating important arguments:

1. Is there any ambiguity, vagueness, or obscurity that hinders my full understanding of the argument?
2. Does the argument embody any hindrances (see Tables 1 through 4)?
3. Is the language excessively emotional or manipulative (see language hindrances, Table 2)?
4. Have I separated the reasoning (evidence) and relevant assumptions/facts from background information, examples, and irrelevant information?
5. Have I determined which assumptions are warranted versus unwarranted?
6. Can I list the reasons (evidence) for the argument and any sub-arguments?
7. Have I evaluated the truth, relevance, fairness, completeness, significance, and sufficiency of the reasons (evidence) to support the conclusion?
8. Do I need further information to make a reasonable judgment on the argument, because of omissions or other reasons?

Tables

Table 1
Hindrances Due To
Basic Human Limitations

Hindrance	Definition	Example	Critical Thinking Tip
Confirmation Bias & Selective Thinking	The process whereby one tends to notice and look for what confirms one's beliefs, and to ignore, not look for, or undervalue the relevance of what contradicts one's beliefs.	If one believes that more murders occur during a full moon, then one will tend to take notice of murders that occur during a full moon and tend <i>not</i> to take notice of murders that occur at other times.	Obtain and objectively evaluate <u>all</u> relevant information and sides of an issue before passing judgment.
False Memories & Confabulation	Being unaware that our memories are often "manufactured" to fill in the gaps in our recollection, or that some memories of facts, over time, can be unconsciously replaced with fantasy.	Police officers should <i>not</i> show a photo of a possible assailant to a witness prior to a police lineup, or the actual memory of the witness may be unconsciously replaced.	Put more reliance on proven facts than memory recollection or testimonies from others. Know your own memory limitations.
Ignorance	The lack of essential background knowledge or information on a subject prior to making a judgment.	One may be convinced a "yogi" has the power to levitate objects, but does not see the thin wire attached to them.	Perform appropriate research on multiple sides of issues to obtain all pertinent evidence, before reaching conclusions.
Perception Limitations	Being unaware of our own perception limitations that can lead to misconceptions about reality.	Looking up at the stars at night and perceiving they are as close as the moon and planets.	Recognize that "seeing is not always believing" because of our sensory limitations. Know when & how to verify your observations with other sources.
Personal Biases & Prejudices	We each have personal biases and prejudices, resulting from our own unique life experiences and worldview, which make it difficult to remain objective and think critically.	Some people are biased against claims made by scientists because their worldview appears too cold and impersonal.	Resist your own biases by focusing on the facts, their sources, and the reasoning in support of arguments.
Physical & Emotional Hindrances	Stress, fatigue, drugs, and related hindrances can severely affect our ability to think clearly and critically.	Air traffic controllers often have difficulty making good judgments after long hours on duty	Restrain from making critical decisions when extremely exhausted or stressed.
Testimonial Evidence	Relying on the testimonies and vivid anecdotes of others to substantiate one's own beliefs, even though testimonies are inherently subjective, inaccurate, unreliable, biased, and occasionally fraudulent.	Dramatic stories of Bigfoot sightings do not prove the existence of Bigfoot.	Resist making judgments based on testimonies alone. Extraordinary claims generally require extraordinary evidence.

Table 2
Hindrances Due To
Use of Language

Hindrance	Definition	Example	Critical Thinking Tip
Ambiguity	A word or expression that can be understood in more than one way.	From the statement “Lying expert testified as trial”, is the expert a liar or is the person an expert on telling when someone is lying?	If the intended meaning of an ambiguous word or expression cannot be determined, avoid making judgments.
Assuring Expressions	Using expressions that disarm you from questioning the validity of an argument.	Expressions such as “As everyone knows...”, and “Common sense tells us that...”	Disregard assuring expressions and instead focus on facts & reasoning that support arguments.
Doublespeak Euphemisms	The use of inoffensive words or expressions to mislead, disarm, or deceive us about unpleasant realities.	Referring to a policy of mass murder as “ethnic cleansing” or the inadvertent killing of innocent people as “collateral damage.”	Look beyond the emotive (emotional) content and recognize the cognitive (factual) content of euphemistic words and expressions.
Doublespeak Jargon	The use of technical language to make the simple seem complex, the trivial seem profound, or the insignificant seem important, all done intentionally to impress others.	Referring to a family as “a bounded plurality of role-playing individuals” or a homeless person as a “non-goal oriented member of society.”	Recognize the cognitive (factual) content of jargon words and expressions.
Emotive Content	Intentionally using words to arouse feelings about a subject to bias others positively or negatively, in order to gain influence or power.	Naming detergents “Joy” and “Cheer” (positive), not “Dreary” and “Tedious” (negative). The military using the phrase “neutralizing the opposition” (less negative) rather than “killing” (negative).	Learn to recognize and distinguish the emotive (emotional) content of language. Try to focus on reasoning and the cognitive (factual) content of language when evaluating arguments.
False Implications	Language that is clear and accurate but misleading because it suggests something false.	The dairy industry cleverly expresses fat content as a percentage of weight, not of calories. Thus 2% “low” fat milk really has 31% fat when fat is measured as a percentage of calories.	Understand not only the facts, but also their relevance and context.
Gobbledygook	The use of confusing non-technical language to mislead or deceive.	A company using lengthy and intimidating language to simply express that if your check bounces, your receipt is voided.	Recognize the cognitive (factual) content of gobbledygook words and expressions.
Hedging & Weasel Words	Language that appears to commit one to a particular view, but because of its wording, allows one to retreat from that view.	President Clinton’s claim that he did not have “a sexual relationship” with Monica Lewinski, in which he later explained that “engaging in sexual acts” was not “a sexual relationship.”	Be on the lookout for hedging language that suppresses facts supporting an argument.
Judgmental Words	Stating opinions as though they were facts, so the audience does not have to “bother” judging for themselves.	The President took <i>justifiable</i> pride in signing the peace treaty.	Distinguish what is <i>fact</i> from what is <i>opinion</i> in any statement or argument.
Meaningless Comparisons	Language that implies that something is superior but retreats from that view.	An ad that claims a battery lasts “up to” 30% longer, but does not say it <u>will</u> last 30% longer, and if it did, longer than what?	Avoid making judgments if it is not exactly clear what is being compared.
Vagueness	Language which is less precise than the context requires.	If someone needs to be paid back tomorrow, and the borrower says “I’ll pay you back <i>soon</i> ”, the borrower’s response was too vague.	Be aware of the consequences of imprecise claims based on vagueness.

Table 3
Hindrances Due To
Faulty Logic Or Perception

Hindrance	Definition	Example	Critical Thinking Tip
Ad Hoc Hypothesis	A hypothesis, which cannot be independently tested, is used to explain away facts that refute a theory or claim.	Psi researchers often blame the “hostile thoughts” of onlookers for adversely affecting instruments measuring the alleged existence of psychic powers	Put low reliance, or reserve judgment on, claims that cannot be independently tested.
Apophenia & Superstition	Erroneous perception of the connections between unrelated events.	Irrationally believing that how one wears their hat while watching a football game can influence the score.	Recognize the difference between <i>cause & effect</i> versus <i>unrelated coincidence</i> .
Argument from Ignorance	A logical fallacy claiming something is true because it has not been proven false.	Believing that there must be life on Mars because no one has proved that there is not life on Mars.	Do not believe a proposition simply because it cannot be proven false.
Begging the Question	A fallacious form of arguing in which one assumes to be true something that one is trying to prove.	A man claiming that paranormal phenomena exists because he has had experiences that can only be described as paranormal.	Recognize when an argument assumes to be true something it is attempting to prove. When this occurs, seek alternative explanations.
Clustering Illusion & Texas Sharpshooter Fallacy	The erroneous impression that random events that occur in clusters are not random.	In ESP experiments, a “water witcher” using dowsing may find water at a slightly higher-than-chance rate over a brief period of time, and mistakenly assume this proves dowsing really works.	Understand the basic principles of probability & statistics. Recognize when numbers are being used correctly & objectively versus incorrectly & with bias.
False Analogies	Making illogical analogies to support the validity of a particular claim.	Arguing that two children sharing the same bedroom is wrong because double-celling of criminals in a penitentiary can lead to bad behavior.	Learn to recognize the faulty assumptions behind false analogies.
Forer Effect	The tendency to accept vague personality descriptions that can be applicable to most people as uniquely applicable to oneself.	Astrology readings, intended for people of a specific sign, can be applicable to most individuals. This effect usually works in conjunction with ‘Self-Deception’ and ‘Wishful Thinking.’	Critically evaluate if personality characterizations are truly unique to you, or could apply to most people.
Gambler’s Fallacy	The fallacy that something with fixed probabilities will increase or decrease depending upon recent occurrences.	The misconception that picking lottery numbers that have not yet been picked will increase your chances of winning.	Learn to recognize and distinguish events that have <i>fixed</i> versus <i>variable</i> probabilities.
Irrelevant Comparisons	Making a comparison that is irrelevant or inappropriate.	Making a claim that Printer A makes better copies than Printer B, while ignoring the important fact that only Printer B can also fax, copy, and scan.	Be sure to compare “apples with apples.”

Table 3
Hindrances Due To
Faulty Logic Or Perception

Hindrance	Definition	Example	Critical Thinking Tip
Law of Truly Large Numbers	A failure to understand that with a large enough sample, many seemingly unlikely coincidences are in fact <i>likely</i> coincidences, i.e., likely to happen.	The alleged uniqueness of the number 11 to the September 11 can mathematically shown to be not unusual at all, and merely a game to play with people's minds.	Understand the basic principles of probability & statistics. Recognize when numbers are being used correctly & objectively versus incorrectly & with bias to support an argument.
Non Sequitur	Reasons given to support a claim that are irrelevant.	To say "I am afraid of water, so I will take up flying."	Learn to recognize when arguments are supported by irrelevant reasons.
Pareidolia	A type of misperception involving a vague stimulus being perceived as something clear, distinct, and highly significant.	Most UFO, Bigfoot, and Elvis sightings.	Recognize that a vague perception of a strange event can have many possible explanations. Seek alternative explanations that are <i>more likely</i> rather than more emotionally appealing.
Post Hoc Fallacy	The mistaken notion that because one thing happened after another, the first event caused the second event.	Believing that beating drums during a solar eclipse will cause the sun to return to the sky.	Try to identify the known or possible causal mechanisms of observed effects, starting with those that are more likely.
Pragmatic Fallacy	Arguing something is true because "it works," even though the causality between this something and the outcome are not demonstrated.	After using a magnetic belt for awhile, a woman notices her back pain is less, even though there may be a dozen other reasons for the reduced back pain.	Try to identify known or possible causal mechanisms for observed effects, starting with those that are <i>more likely</i> , not more emotionally appealing.
Regressive Fallacy	Failing to take into account the natural and inevitable fluctuations of things when assessing cause and affect.	Assuming a man's neck pain consistently fluctuates over time, he will most likely try new remedies when the pain is at its worst point, then perhaps incorrectly assume that the pain got better because of the new remedy.	Try to identify and understand recurring behavioral patterns before making judgments about recently observed events.
Slippery Slope Fallacy	An argument that <i>assumes</i> an adverse chain of events will occur, but offers no proof	"Because regulators have controlled smoking in public places, their ultimate goal is to control everything else in our lives."	Evaluate the logic supporting an alleged adverse chain of events.

Table 4
Hindrances Due To
Psychological and Sociological Pitfalls

Hindrance	Definition	Example	Critical Thinking Tip
Ad hominem Fallacy	Criticizing the <i>person</i> making an argument, not the argument itself.	"You should not believe a word my opponent says because he is just bitter because I am ahead in the polls."	Focus on reasons & facts that support an argument, <i>not</i> the person making the argument. Independently verify supporting facts if the source is in question.
Ad populum, Bandwagon Fallacy	An appeal to the <i>popularity</i> of the claim as a reason for accepting the claim	Thousands of years ago the average person believed that the world was flat simply because most other people believed so.	A valid claim should be based on sound arguments, not popularity.
Communal Reinforcement	The process by which a claim, independent of its validity, becomes a strong belief through repeated assertion by members of a community.	The communally reinforced yet mistaken belief that one can get rid of cancer simply by visualization and humor alone.	Do not follow the crowd simply because it gives you a feeling of acceptance and emotional security. Think for yourself.
Emotional Appeals	Making <i>irrelevant</i> emotional appeals to accept a claim, since emotion often influences people more effectively than logical reasoning.	Advertisements that appeal to one's vanity, pity, guilt, fear, or desire for pleasure, while providing no logical reasons to support their product being better than a competitor.	If an argument requires a logical reason to support its claim, do not accept emotional appeals as sufficient evidence to support it.
Evading the Issue, Red Herring	If one has been accused of wrongdoing, diverting attention to an issue <i>irrelevant</i> to the one at hand.	The President making jokes about his own character in order to disarm his critics & evade having to defend his foreign policy.	Learn to recognize evasion, which implies a direct attempt to avoid facing an issue.
Fallacy of False Dilemma, Either/or Fallacy	Intentionally restricting the number of alternatives, thereby omitting relevant alternatives from consideration.	"You are either with us, or with the terrorists!"	Seek opposing arguments on the subject which may reveal the existence of other viable alternatives.
Irrelevant Appeal to Authority	An attempt to get a controversial claim accepted on the basis of it being supported by an admirably or respectable person	"Since the Pope thinks capital punishment is morally justified, it must be morally justified."	Recognize that any appeal to authority is irrelevant to providing logical grounds and facts to support an argument.
Lawsuit Censorship	Repressing free speech and critical thinking by instilling fear through the threat of lawsuits.	Journalist Andrew Skolnick was sued for his investigative reporting of Maharishi Mahesh Yogi and his Transcendental Meditation Movement.	If a counter-argument is not readily available, don't assume it does not exist - it could be suppressed by special interests.
Moses Syndrome, Suggestibility, Conformity, & Deferring Judgment	Promises of happiness, security, power, wealth, health, beauty, etc., made again and again in a confident manner, by charismatic people with prestige, tend to be believed uncritically and without argument or proof.	Hitler convinced an entire country to follow his dream of making Germany great, which included the subjugation and massacring of Jews. Also, Jim Jones of the <i>Peoples Temple</i> doomsday cult convinced 914 of its members to commit suicide.	Resist the human tendency to believe a charismatic leader simply because he/she appeals to your basic human needs. Seek alternate views & reliable sources for facts and objective reasoning to support arguments.

Table 4
Hindrances Due To
Psychological and Sociological Pitfalls

Hindrance	Definition	Example	Critical Thinking Tip
Poisoning the Well	Creating a prejudicial atmosphere against the opposition, making it difficult for the opponent to be received fairly.	"Anyone who supports removing troops from Iraq is a traitor!"	When evaluating an argument, focus on the argument, not prejudicial remarks.
Political Censorship	Repressing free speech, distorting facts, or "cherry picking" facts to support a biased political viewpoint or dogmatic belief.	When politicians intentionally provide inadequate or distorted facts on a particular issue, then conclusions reached by the public may be biased or faulty.	Learn all sides of an issue. People can present deceptively logical arguments that are built upon the selective choosing of facts.
Positive Outcome Bias	The tendency for researchers and journalists to publish research with positive outcomes between two or more variables, while not publishing research that shows no effects at all.	The media will publish results showing a nutritional supplement can reduce anxiety, but will not publish other results showing the same supplement has no affect on reducing anxiety.	Put more reliance on claims which use methods that seek to eliminate positive outcome bias. Seek information from sources that do not have a biased interest in the results.
Shoehorning	The process of force-fitting some current event, after the fact, into one's personal, political, or religious agenda.	Jerry Falwell and Pat Robertson claimed that American civil liberties groups, feminists, homosexuals and abortionists bear partial responsibility for September 11 because their immoral behavior has turned God's anger toward America.	Understand the motives or agenda of people or organizations prior to making judgments on their arguments.
Sunk-Cost Fallacy	The psychological phenomenon of continuing to hold on to a hopeless investment for fear that what has been invested so far will be lost.	Lyndon Johnson continued to commit many thousands of U.S. soldiers to Vietnam even after he was convinced the U.S. could never defeat the Viet Cong.	Do not allow your feelings of fear & disgrace of taking a loss cause you to take even a bigger loss.
Wishful Thinking & Self Deception	The process of misinterpreting facts, reports, events, perceptions, etc, because we want them to be true.	94% of university professors think they are better at their jobs than their colleagues.	Understand that our individual view of what we think is true can be strongly biased by our needs, fears, ego, world view, etc.