Critical Thinking and Informal Logic: Neuropsychological Perspectives

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Abstract: This article challenges the common view that improvements in critical thinking are best pursued by investigations in informal logic. From the perspective of research in psychology and neuroscience, human inference is a process that is multimodal, parallel, and often emotional, which makes it unlike the linguistic, serial, and narrowly cognitive structure of arguments. Attempts to improve inferential practice need to consider psychological error tendencies, which are patterns of thinking that are natural for people but frequently lead to mistakes in judgment. This article discusses two important but neglected error tendencies: motivated inference and fear-driven inference.

Résumé: Nous mettons en question le point de vue courant que l'amélioration de la pensée critique se réalise le mieux par l'enseignement de la logique non formelle. Selon les recherches en psychologie et en neuroscience, l'inférence consiste de plusieurs procédés parallèles souvent affectifs, ce qui diffère de la structure cognitive linguistique, successive, et étroite des arguments. Les tentatives d'améliorer les inférences doivent tenir compte des tendances psychologiques à commettre des erreurs qui sont le résultat des façons de penser naturelles qui induisent souvent les gens à former des mauvais jugements. On discute de deux erreurs importantes mais négligées : les inférences influencées par la motivation, et celles influencées par la peur.

Keywords: Argument, critical thinking, emotion, fear-driven inference, inference, logic, motivated inference, neuroscience, psychology.

1. Introduction

The investigation of critical thinking includes the systematic attempt to improve people's ability to form beliefs and make decisions. It is widely taken for granted among philosophers that such improvement is best accomplished by the study of argument as pursued within the fields of formal and informal logic. This article draws on findings in psychology and neuroscience to challenge this assumption. Because human inference is very different from linguistic argument, we can get a better under-

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standing of the failures of thinking by attending to psychological processes than by analyzing logical fallacies, only a few of which are relevant to the kinds of thinking errors that people actually make.

I begin with a discussion of how, from a neurocognitive perspective, inference is very different from argument. I argue accordingly that rationality should be understood as a matter of making effective inferences, not just good arguments. Correlatively, irrationality involves making erroneous inferences for reasons that go well beyond the employment of fallacious arguments. Rather, inferential mistakes arise from a host of psychological error tendencies (biases). This article will concentrate on two error tendencies that have been largely neglected in informal logic: motivated inference and fear-driven inference. The second of these has also been ignored in psychological discussions of inferential errors, even though it is common in many domains such as interpersonal relationships, health, politics, and economics. After an assessment of the relevance of psychology to the enhancement of scientific literacy, I conclude with a brief discussion of how the study of argument can be socially useful.

2. Inference and argument

When I first started teaching informal logic in the late 1970s, I had the common hope that I would be helping students to improve their thinking. Now as then, the need for critical thinking is acute. A large proportion of the North American population believes that global warming is not a problem, that humans did not evolve from apes, that the moon landing was a hoax (Plait 2002), and even that the earth is the center of the universe. People also make many bad decisions, such as smoking, overeating, paying exorbitant interest on their credit card purchases, and voting for politicians who do not act in their interests. Enterprises such as informal logic, critical thinking, and scientific literacy aim at improving such kinds of theoretical inferences (about what to believe) and practical inferences (about what to do). I shall argue, however, that evidence from psychology and neuroscience reveals that standard approaches are based on misconceptions about the nature of inference and argument. By inference I mean the activity of forming mental representations such as beliefs and decisions.

Here is what seems to me to be a common view in philosophy about the relation between critical thinking and informal logic:

(1) arguments are the basis for belief formation and decision making;
(2) good arguments are the basis of rational belief formation and decision making; and
(3) fallacious arguments are the causes of defects in beliefs and decisions.

These three assume that inferences are based on arguments, so that it should be possible to improve human inference by increasing people's ability to construct and evaluate good arguments while avoiding fallacious ones. Rationality primarily involves using good arguments and identifying bad ones.

The point of this article is to defend an alternative view based on evidence that inference is in fact very different from argument, so that critical thinking needs to proceed in ways that are much more informed by psychological research than by informal logic. In place of fallacies, many of which are arcane and rarely committed by people in real situations, the study of critical thinking can consider error tendencies to which people are actually prone, as shown by empirical investigation.

In the philosophical tradition, an argument consists of a set of claims in which the premises offer reasons for a conclusion (Govier 2005; for a broader view of argument, see Johnson 2000). Since Aristotle invented the syllogism, arguments have been laid out in the form of a set of sentences from which a conclusion is derived, either deductively with no loss of certainty or inductively (ampliatively). Typically, arguments are linguistic entities, consisting of a set of sentences that are laid out serially, in step by step fashion: *premise 1, premise 2, ... premise n*; therefore *conclusion*. If inference were the same as argument, it would have the same serial, linguistic structure.

However, there is ample evidence from cognitive psychology and neuroscience that human inference is actually parallel rather than serial, multimodal rather than just language-based, and as much emotional as cognitive. Here "parallel" means that the brain carries out many processes simultaneously, "multimodal" means that the representations used by the brain include non-linguistic ones such as visual images, and "emotional" means neural processes that integrate evaluations with physiological perceptions. These expositions assume, as do almost all psychologists and neuroscientists, that mental processes are brain operations; detailed defense of this assumption can be found in Thagard (2010a).

It would take much more than an article to defend thoroughly the claims that inference is parallel, multimodal, and emotional, but support for them can be found in any recent textbook in cognitive psychology and cognitive science (e.g. Smith and Kosslyn 2007; Thagard 2005b). The fact that inference is

parallel rather than serial can be seen first from the operation of the human brain, which involves around 100 billion neurons firing asynchronously. Conscious thinking is largely serial because the limitations of working memory only allow people to form one thought at a time, but the formation of these thoughts is the result of a massively parallel process that integrates many sources of information (see e.g. Rumelhart and McClelland 1986; Thagard 2000).

Some philosophical recognition of the parallel nature of inference is shown in the discussion of *conductive* arguments (Govier 2005), which assemble multiple sources of information. From a psychological perspective, all inference is conductive, operating in parallel to lead to the assembly of many sources of information into a coherent conclusion. As Gilbert Harman (1973) pointed out long ago, even a deductive argument does not suffice to justify making an inference. Believing that *if p then q*, and *p*, need not lead you to believe that *q*, if you already have reasons to doubt that *q*. In that case, you need to question your belief in *if p then q* and *p*, rather than blithely inferring *q*. Inference in such cases requires a more complex process of belief revision based on coherence, rather than merely following the deductive pattern (Thagard 2000; Thagard and Findlay 2011).

The sources of information that justify inferences often involve linguistic processing, but they also often require processing of information in multiple other modalities, including vision, sound, touch, taste, smell, and kinesthetic sensations. There has been some recognition of this fact in the informal logic literature on visual argument (e.g. Groarke 1996), but I think it would be better to use the term "visual inference" rather than argument in order to avoid the serial, linguistic connotations of argument. Psychological evidence that thinking is multimodal can be found in the work of psychologists such as Barsalou (1999, 2009).

In inference, emotion is just as important as cognition, because the brain uses emotions to attach values to representations, which are crucial for decision making and even important for deciding which beliefs are worth forming (Thagard, 2006, 2010a). Emotion is not just an add-on or distraction to cognition, but an integral part of how the brain controls the flow of information (Clore and Palmer 2009).

The evidence that inference is multimodal, parallel, and emotional as well as cognitive has serious implications for the study of critical thinking. Instead of assuming that inference is and should be based on serial, linguistic arguments, we need to consider the complex processes that sometimes enable people to

succeed at producing reliable beliefs and effective decisions, yet sometimes mislead people into erroneous beliefs and disastrous decisions. From this perspective, rationality is not simply a matter of using good arguments and avoiding fallacious ones, but rather a matter of adopting patterns of thinking and behavior that best satisfy legitimate goals concerning what to believe and what to do.

In addition to fallacies, we need to consider inferential error tendencies: thinking patterns to which people are naturally prone but which often lead to false beliefs and actions contrary to people's best interests. In the appendix, I list more than fifty such error tendencies derived from the psychological literature, all of which I have found relevant to teaching critical thinking. In this article, however, I will focus on just two error tendencies, motivated inference and fear-driven inference. The first of these is well known in the psychological literature but largely neglected in philosophical treatments of critical thinking; the second is little discussed in both psychology and philosophy, despite its prevalence in erroneous thinking.

3. Motivated Inference

Motivated inference occurs when people distort their judgments because of their underlying personal goals (Kunda, 1990, 1999). It is an emotional bias that undercuts rationality, and can be observed in many kinds of interpersonal and practical judgments. It would be highly misleading to depict motivated inference as a sort of fallacious argument akin to wishful thinking, of the form: I want X, therefore X is true. Few people are that that simple-minded, not even the proponents of the *The Secret* (Byrne 2006) who propose that just wanting something can enable you to get it. Motivated inference is more complex than wishful thinking because it involves selective recruitment and assessment of evidence based on unconscious processes that are driven by emotional considerations of goals rather than purely cognitive reasoning.

Here are some examples of motivated inference found in diverse domains:

Romantic relationships: my lover treats me poorly, but he/she will change.

Parenting: my child hates school, but will settle down and straighten out eventually.

Medicine: this pain in my chest must be indigestion, not a heart attack.

Politics: the new leader will be the country's savior, bringing hope and change.

Sports: our team has been losing, but we're going to play great today.

Research: the article I'm writing is my best ever and will get into a top journal.

Law: the evidence against my hero is serious, but he couldn't have done it.

Religion: life is hard, but my caring God will lead me to eternal bliss.

Economics: this rapid economic growth is a sign of a new kind of economy, not a bubble.

In all of these cases, inference is based on limited evidence but seems plausible to people because the conclusion fits well with their goals such as being loved, healthy, successful, happy, or rich. Of course, the conclusions of motivated inference may occasionally turn out to be true, because sometimes lovers do change, children do straighten out, and so on. But motivated inference is based on wishes, not facts.

It would be pointless to try to capture these inferences by obviously fallacious arguments, because people are rarely consciously aware of the biases that result from their motivations. Mathematical decision theory makes a sharp distinction between probabilities and utilities; but, in the human brain, the processes for assessing beliefs and values overlap substantially (Harris, Sheth, and Cohen 2008). Psychologists have documented many phenomena that are best explained by noting that emotion affects people's judgements about risk and credibility. See, for example Loewenstein, Weber, Hsee, and Welch (2001) on risk as feelings, Slovic, Finucane, Peters, and MacGregor (2002) on the affect heuristic, and Schwartz and Clore (2003) on mood as information. Hence motivated inference naturally results from unconscious mental processes, rather than from explicit reasoning.

Overcoming people's motivated inferences is therefore more akin to psychotherapy than informal logic. Rather than laying out premises and conclusions, remediation of motivated inference requires identification of conscious and unconscious goals that can explain why people are inclined to adopt beliefs despite a preponderance of evidence to the contrary. For example, I have used a psychological theory of motivated inference implemented as a computer model to explain the prevalence of religious belief (Thagard 2005a), the opposition to Darwin's theory of evolution (Thagard and Findlay 2010) and the persistence of skepticism about global warming (Thagard and Findlay 2011). Because the evidence for God and the evidence against Darwin and global warming are insufficient to support reason-

able belief, their attractiveness can best be explained by motivated inference.

Due to their unconscious, parallel nature, motivated inferences are often better displayed using diagrams rather than a series of statements. Figure 1 shows part of the cognitive and emotional structure of the view held by right wing politicians and oil company executives that scientific concerns about climate change are exaggerated. Most scientists have concluded on the basis of substantial evidence that global warming is caused by human production of greenhouse gases, but the skeptics deny this interpretation of the evidence. According to the analysis in figure 1, this denial results, not from any identifiable argument, but from a mixture of evidence and emotional motivations such as avoiding restrictions on oil companies and limiting government activity. Then climate change skepticism results from emotional coherence, not fallacious arguments. Hence in cases such as the politically-motivated denial of climate change and the religiously-motivated denial of the theory of evolution by natural selection, critical thinking requires a psychological understanding of motivated inference more than a logical understanding of the structure of argument.

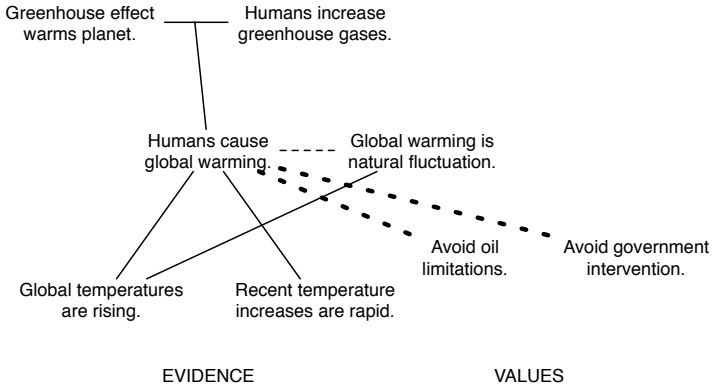

Figure 1. View of the controversy over climate change including emotional constraints as well as explanatory ones. The solid lines indicate positive constraints based on explanatory relations and the thin dotted line indicates a negative constraint based on incompatibility. The thick dotted lines indicate negative emotional constraints. Reprinted from Thagard and Findlay (2011).

Although there has been substantial research on motivated inference in psychology, it rarely is considered in textbooks on critical thinking and scientific literacy. Even more neglected is

another kind of emotion-related inference that derives from fear rather than desire.

4. Fear-Driven Inference

In *fear-driven inference,* people believe something, not just despite the fact they fear it to be true, but partly *because* they fear it to be true (Thagard and Nussbaum forthcoming). Motivated inference leads people to believe what they desire because it fits with their goals, but fear-driven inference seems paradoxical because people end up believing what they are afraid of. How can anyone be that stupid?

Easily. Here are important domains in which people (including the author of this paper) sometimes succumb to fear-driven inference.

Romantic relationships: my lover looks distant, so he/she must be having an affair.

Parenting: I haven't heard from my teenager for a few hours, so he's probably in trouble.

Medicine: this rash means I have leprosy or some other serious disease.

Politics: today's tough times result from an international conspiracy.

Sports: my team is hopeless.

Research: the editor's delay in responding to my article means he/she hates it.

Law: the courts are so biased that I'm bound to be convicted.

Religion: it is predetermined that God will punish me eternally.

Economics: the economy is doomed to perpetual recession and depression.

What I am calling "fear-driven inference" has occasionally been noticed before: Mele (2001) calls it "twisted self-deception", and Elster (2007) calls it "countermotivated" inference. But this kind of inference does not seem to have been investigated by experimental psychologists or writers on critical thinking.

Fear-driven inference is doubly irrational, from both a practical and theoretical perspective, because it gives the thinker unhappiness as well as erroneous beliefs. It is even less suited to argument-based analysis than motivated inference, because it results from complex psychological processes that are emotional and parallel, not just linguistic, serial, and conscious. Thagard and Nussbaum (forthcoming) propose that fear-driven inference results from a process they call *gut overreaction*, in which an amplifying feedback loop between judgments and emotions can

lead both to excessively positive assessments and to excessively negative ones. Fearing that something is true (e.g. that you have a disease) can lead you to focus so much on the reasons for it (e.g. a rash, which might be transitory) that the mere arousal associated with the belief is mistaken for evidence that it is true.

How can people be susceptible to both motivated and fear-driven inference? The first makes people overly optimistic, while the latter makes people overly pessimistic. Which direction someone is biased at a particular moment can depend on several factors, including personality, mood, and evidence. Some people may be more naturally inclined toward motivated inference if they have high self-esteem and a positive outlook on life. On the other hand, people inclined to depression and low self-esteem may be more inclined to fear-driven inference. Apart from personality factors, all people have variations in moods, and those in a happy mood at a moment may tend toward motivated inference, while those in a negative mood may tend toward fear-driven inference. Finally, the accumulation of evidence may produce a swing from motivated inference to fear-driven inference when people lose the ability to sustain an excessively rosy view of the world. For example, in the economic crisis of 2008, investors quickly switched from an overoptimistic view to an excessively pessimistic one, causing a sharp drop in the stock market. Going in the other direction, events such as the Arab spring of 2011 can lead people to swing from a pessimistic view about the possibilities of democratic change towards an overly exuberant one concerning the possibility of revolution.

Thagard and Nussbaum (forthcoming) conjecture that fear-driven inference arises for much the same reasons as motivated inference. In the brain, there is no firewall between cognition and emotion, with many interconnections among the brain areas responsible for belief assessment and option evaluation. These interconnections have been crucially effective for enabling organisms to operate efficiently to survive and reproduce, but may lead to errors in the more complex world that people now inhabit. Valuing a situation as extremely desirable or undesirable may produce a high degree of attention that is easily confused with a high degree of credibility.

As with motivated inference, the best way to avoid destructive fear-driven inference is more akin to psychotherapy than informal logic. People need to be aware of natural tendencies to exaggerate dreadful possibilities, and to ask themselves how much evidence actually exists for what they fear. The result should be increased ability to distinguish between arousal and credibility. Hence critical thinking can be improved, one hopes, by increasing awareness of the emotional roots of many inferences.

5. Cognitive-Affective Maps

Such roots can be explored using a technique for analyzing the emotional character of conflicts called cognitive-affective maps, or CAMs (Thagard 2010b, Findlay and Thagard forthcoming; Thagard 2011, forthcoming-a). Cognitive maps (also called concept maps) have been used for decades to display the conceptual structure of important issues, but they do not display the large emotional, value-laden component of most disputes. In areas from social policy to environmental ethics, cognitive-affective maps can be a useful tool for helping people to understand the emotional roots of controversies. Psychologists use the term "affect" to encompass emotions, moods, and motivations.

Consider, for example, debates about whether people ought to be vegetarians. It is no doubt possible to analyze such debates as consisting of arguments pro and con, and when I teach environmental ethics I consider and evaluate such arguments. But the reasons that lead people to become vegetarians reside in systems of interconnected values more than sentential structures. Figure 2 illustrates a pro-vegetarian view of the world including both positive values (indicated by ovals) and negative values (indicated by hexagons). The thickness of the lines in the ovals and hexagons represents the strength of the values. The supportive connections between concepts are indicated by solid lines, and the conflictive connections are indicated by dotted lines. By mapping the kinds of values shown in figure 2, one gets an understanding of the emotional coherence of the position, which can easily be contrasted with a more mainstream view that eating meat is not only acceptable but desirable.

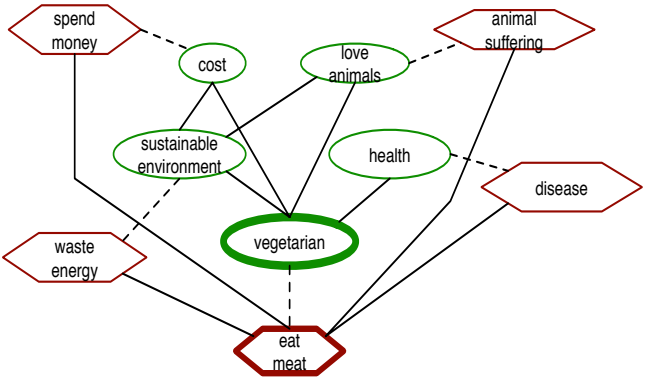

Figure 2. Cognitive-affective map showing the emotional values that support being a vegetarian. Ovals are positive values,

hexagons are negative values, solid lines are supportive connections, and dotted lines indicate incompatibility.

Figure 2 captures some of the main reasons why people become vegetarians, including love of animals and concerns with health, cost of eating, and maintenance of sustainable environments. Such CAMs provide a concise picture of the overall values, both positive and negative, that support vegetarianism: vegetarians tend to be people who care about animals, health, and the environment, and dislike animal suffering, sickness, and degrading the environment. Figure 2 can naturally be fleshed out into a set of arguments for why one ought to be a vegetarian, but such arguments conceal that for many people deciding to become a vegetarian is as much an emotional process as a purely cognitive one (Rozin, Markwith, and Stoess 1987). Figure 2 illustrates how vegetarianism can be an emotionally coherent position. (For the theory of emotional coherence, see Thagard 2000, 2006).

CAMS are easy to draw, and are made even easier by a software program called EMPATHICA that is freely available at

http://watarts.uwaterloo.ca/~pthagard/empathica.html.

This program encourages people to draw CAMs not only of their own values but also of the values of people with whom they disagree, with the aim of increasing empathy in the sense of mutual understanding of emotional attitudes. The aims of critical thinking should include not only improving the deliberations of individuals but also improving social processes of conflict resolution, and EMPATHICA is intended to be a step in that direction.

In a discussion of political ideologies, I have recently extended the CAM methodology to include non-linguistic representations such as pictures and sounds (Thagard, forthcoming-a). A more emotionally evocative version of figure 2 could be produced by adding pictures of valued objects such as cute baby seals that are associated with love of animals, as well as pictures of disgusting scenes such as slaughterhouses. Sounds are also relevant, such as the haunting communications of whales in contrast to the painful wails of confined cows.

6. Scientific Literacy

Campaigns for scientific literacy are often led by scientists or sociologists who are unaware of the psychological complexity of scientific knowledge. In addition to basic information about scientific theories, spreading scientific ways of thinking needs to include an understanding of the nature of scientific concepts and

other representations, as well as an appreciation of the motivational obstacles to science. As McCauley (2011) argues, religious thinking, which has existed as long as human civilization, is much more natural for people than scientific thinking, which only became systematic and sophisticated in the 17th century. I think that scientific literacy is an important part of critical thinking, because it is impossible to make reasonable judgments about such issues as the environment, technology, and economic development without appreciation of the content and methods of science.

The neuropsychological approach to critical thinking that I have been advocating has an analogous contribution to make to the project of scientific literacy, which needs to attend to: the structure of scientific knowledge, the nature of scientific thinking, and the sources of resistance to science, either in general or with respect to particular doctrines such as evolution and global warming. Scientific knowledge consists not only of sets of linguistic propositions, but also of conceptual systems organized by kind and part-whole relations (Thagard 1992). Moreover, much scientific information is visual, as evident in the diagrams, photographs, graphs, and maps found in many articles and textbooks. Finally, scientific method is not fully captured by linguistic prescriptions, but can also involve procedural knowledge about how to use instruments and conduct experiments (Sahdra and Thagard 2003). Hence the encouragement of scientific literacy needs to be based not on the study of critical thinking in the tradition of informal logic, but rather on the cognitive science of science, which has an extensive literature (e.g. Carey 2000, Chi 2005, Vosniadou 2008, Thagard forthcoming-b, Nersessian 2008).

7. Conclusion

Because of the distinguished history running from Aristotle to Frege to Russell to contemporary formal logic, philosophers have tended to take deductive reasoning as the central model for inference. This model applies well to mathematical proofs, but has little relevance for understanding how people acquire beliefs and produce decisions. Research on informal logic comes closer to capturing how reasoning operates in many domains besides mathematics, but mostly retains the assumption that arguments are serial and linguistic. Nevertheless, I do not mean to suggest that the study of argument is useless. Inferences do not have the same psychological structure as arguments, but arguments are an important part of communication of the evidential considera-

tions that go into good inferences. Contrary to Mercier and Sperber (2011), I do not think that reasoning has a primary biological function just to convince people. Rather, I see arguments as a cultural development that may serve multiple purposes, including both the selfish goal of getting the agreement of others and the social goal of transmitting information that everyone needs for forming reliable beliefs and making good decisions. The role of arguments in fixing beliefs and shaping decisions is thus psychologically indirect but socially significant.

Hence educators concerned with improving critical thinking should by all means continue to help students understand the difference between good and bad arguments. However, from a neuropsychological perspective, they should view the understanding of arguments as only part of the laudable enterprise of improving thought. Arguments provide a comprehensible way of structuring and communicating evidence, but their psychological impact depends on translating them into the kinds of multimodal, parallel, coherence-based considerations that produce inferences. Moreover, when arguments fail to convince, we should rarely look for the explanation in terms of the traditional fallacies, but rather in terms of the multitude of error tendencies that psychological research has shown to operate in human thinking. Similarly, the pursuit of scientific literacy needs to adopt a psychologically rich view of the structure of scientific knowledge and reasoning, along with a deeper understanding of the cognitive and emotional barriers to good scientific thinking. The poet Yeats said that education is not the filling of a pail, but the lighting of a fire. I take this to mean that all learning requires motivation, not just information acquisition. Correlatively, overcoming false beliefs and bad decisions is not the emptying of a pail, but the extinguishing of some fires and the lighting of others. Critical thinking requires the motivation to use what is known about cognitive and emotional mental processes to improve inferences about what to believe and what to do.

Appendix: 53 Error Tendencies

An error tendency is a pattern of thinking that is natural for people but frequently leads to errors in judgments about what to believe or decisions about what to do. The following list is from my old course on critical thinking, which provides further notes, http://cogsci.uwaterloo.ca/courses/phil145.html. The list derives primarily from Gilovich (1991), Schick and Vaughan (1999), Russo and Schoemaker (1989), and Bazerman (1994). It includes a few familiar fallacies, e.g. post hoc propter hoc, but mostly is based on the psychological literature.

A. 29 Error Tendencies That Affect Inferences About What To Believe

Clustering illusion: Tendency to see non-existent patterns in random events.

Representativeness: Tendency to use assessments of similarity in statistical and causal reasoning.

Spurious causal theories: Tendency to use unsupported causal theories in place of careful statistical and causal reasoning.

Regression fallacy: Tendency for people's predictions to ignore that many statistical effects regress to the mean.

Vividness: Tendency for information that is particularly salient or emotionally charged to be given undue influence.

Confirmation bias: Tendency to seek information that supports your views and to ignore information that contradicts them.

The problem of absent data: Tendency to be over-confident about conclusions despite the absence of relevant information.

Self-fulfilling prophecies: Tendency for expectations to affect the world in ways that make the expectation true.

Gambler's fallacy: Tendency to view chance as a self-correcting process in which a deviation in one direction is corrected in the opposite direction, e.g. expecting tails after a string of heads.

Ambiguity: Tendency to interpret ambiguous (more than one meaning) information in ways that fit our preconceptions.

Vagueness: Tendency to interpret vague (no clear meaning) information in ways that fit our preconceptions.

Asymmetric recall: Tendency to remember only one side of a situation, e.g. the unpleasant side.

Overconfidence in your judgment: Tendency to fail to collect key factual information because of being too sure of assumptions and opinions.

Insufficient anchor adjustment: Tendency to let an arbitrary starting point bias a final answer.

Hindsight bias: Tendency to misremember your earlier attitudes based on later knowledge of outcomes.

Motivated inference: Tendency to reach conclusions unduly influenced by favorable personal goals.

Fear-driven inference: Tendency to reach conclusions because of arousal produced by fear.

Sharpening and leveling in communication: Tendency to distort information in social contexts because of simplifying, faulty memory, or reformulating what was told.

Motivated communication distortions: Tendency to distort information in social contexts for purposes of entertainment, informativeness, or self-interest.

False consensus: Tendency to overestimate the extent to which other people agree with you.

Groupthink: Tendency for people working in groups to reach uncritical conclusions.

Pluralistic ignorance: Tendency not to realize that other people have beliefs similar to yours.

Bogus authority: Tendency to believe authorities when they are speaking outside their areas of expertise.

Intuition: Tendency to form beliefs based on a feeling or sixth sense, without evaluation of evidence.

Mystical experience: Tendency to form beliefs on the basis of an ineffable, personal, direct experience of reality.

Denying the evidence: Tendency to reject evidence rather than to abandon a favored hypothesis with which the evidence conflicts.

Hasty generalization: Tendency to make a judgment about a group of things on the basis of evidence concerning only a few members of that group.

Conjunction fallacy: Tendency to conclude that a conjunction (A&B) is more probable than one of the conjuncts (A). This occurs when the other conjunct (B) is highly representative or available.

Post hoc ergo propter hoc: Tendency to infer that two events are causally related just because one happened after the other.

B. 24 Error Tendencies That Affect Inferences About What To Do

Plunging in: Beginning to gather information and reach conclusions without thinking the issue through or thinking about how the decision should be made.

Frame blindness: Tendency to solve the wrong problem because your mental framework prevents you from seeing the best options and important objectives.

Inconsistent weighting of costs: Tendency to understand costs and losses differently in different situations, even when the costs and losses should be the same.

Sunk costs: Tendency to make decisions on the basis of past investment rather than expected future value.

Framing losses as more important than gains: Tendency to become risk seeking in order to avoid losses.

Bad metaphors or analogies: Tendency to frame a decision using metaphors or analogies that give a misleading understanding of the problem situation.

Lack of frame control: Tendency to define the problem in only one way or to be unduly influenced by the frames of others.

Overconfidence in judgment: Tendency to be too sure of assumptions and opinions, leading to decisions made without collecting key information.

Shortsighted shortcuts: Tendency to make decisions based on information acquired through lazy thinking strategies such as availability, anchoring, and confirmation bias.

Shooting from the hip: Tendency to make decisions intuitively based on information in your head rather than following a systematic procedure for choosing such as a subjective linear model.

Group failure: Tendency to assume that groups will make good choices automatically and to fail to manage the group decision-making process in ways that will produce better decisions.

Fooling yourself about feedback: Tendency to fail to learn from experience because of motivated inference or hindsight bias.

Not keeping track: Tendency not to keep systematic records that would make it possible to learn from past decisions.

Failure to audit your decision process: Tendency not to monitor your decision making in an organized fashion that would identify errors.

Mythical fixed pie: Tendency in negotiation to assume that your interests completely conflict with the other party's interests.

Framing in negotiation: Tendency to distort negotiation by framing in terms of gains and losses.

Excessive escalation of conflict: Tendency to make increasingly extreme demands on the other party rather than seeking a settlement.

Negotiator overconfidence: Tendency to overestimate the strength of your own negotiating position.

Neglecting the cognitions of others; Tendency to focus on your own interests and forget about the interests and plans of the other party.

Neglecting fairness: Tendency to ignore issues of fairness and concern for others.

Winner's curse: Tendency in competitive bidding for the winner to pay too high a price.

Risky shift: Tendency for individuals in groups to produce riskier decisions than would the individuals alone.

Tragedy of the commons: Tendency for pursuit of individual goals to lead to depletion of shared resources.

Failure to cooperate: Tendency to maximize individual interests instead of cooperating with others.

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