ISSA Proceedings 2006 – Fallacies As Violations Of Rationality Norms. An Interdisciplinary Approach

Introduction

Douglas Walton promoted the thesis that there is a dilemma of fallacy analysis (1995, 269-272) implying that "fallacy" oscillates helplessly between an EITHER (intentional deception) and an OR (suffering passively the occurrence of erroneous inferences). We shall argue that there is no such dilemma: The so called two horns of the dilemma are actually quite naturally connected as complementary elements, an involuntary and an voluntary element with the voluntary element presupposing the involuntary. The involuntary element captures cases where someone suffers a fallacy because of a local malfunctioning of his or her mind. The voluntary element (cor)responds to this and exploits it: Someone who knows such a pattern of malfunctioning exploits it to influence another mind in his or her favor.

And this is the point where rationality standards come in: They express norms of mental functioning that help to avoid the costs of fallacious mental processing concerning judgments, inferences, problem solving, arguments, or decision making.

Following rationality standards offers the opportunity to improve one´s own mental processing by one´s own efforts of rational self-control. And the same holds in cases where other humans try to exploit the fallacy proneness of the own mind to their advantage. Consequently, we do not restrict the analysis of fallacy to the analysis of fallacious arguments, but regard a wider realm of mental processes including problem solving, probability judgments and decision making.

And in referring to mental processes, we do not restrict ourselves to rational thinking in the narrow sense of consistency-rationality, but, instead, follow Aristotle´s tri-dimensional access to the mind comprising the dimensions of *logos, pathos*, and *ethos*. We understand mental processes as relying on three components: a logical, an emotional, and a social-interactive component,

representing the interconnection of minds. In this paper we will explore four different rationality standards, each with its own norms concerning mental processes, and the corresponding norm violations, the fallacies.

1. *Fallacies of bounded rationality*

The focus here is on individual decision making or problem solving in a specific task environment beyond social interaction. In this section, we consider, as a prototype, a fallacy which is related to two basic patterns of demonstrative syllogisms, the modus ponens and the modus tollens:

Modus ponens
IF A THEN B
A true

_____
B true

Modus tollens
IF A THEN B
B false

_____
A false

Fallacy of affirming the consequent
IF A THEN B
B true

_____
A true

The fallacies of §§ 5 and 7 in Aristotle´s Rhetoric book II, ch. 24 belong to this fallacy type:
§5: Dionysius is a thief, for he is a bad man. This is fallacious because not every bad man is a thief. There are alternative possibilities and signs of being a bad man which are ignored or excluded here without further legitimacy. This illicit move makes the conclusion fallacious. §7: Someone who dresses up and roams at night is an adulterer because adulterers are of this type.

How can we remedy this fallacy beyond retreating to the principles of apodeictic reasoning? Let us first follow the path of Georg Polya, a Hungarian born Stanford mathematician, in his classic book on mathematical problem solving (Polya 1945/

1988). He offers a formal solution concept for the fallacy by introducing the formal model of a heuristic syllogism. Heuristic syllogisms derive conclusions from signs. They are indispensable for any problem solving and discovery.

Polya chose a very nice example to illustrate the discovery point (Polya 1945/ 1988, p.181) –concerning the discovery of America by Columbus and his crew:

IF we are approaching land, we often see birds.
Now we see birds.
Therefore, *probably*, we are approaching land.

Without inserting the *probably* we would fall back into the fallacy of affirming the consequent. Polya regards two patterns of heuristic syllogisms:

(I) IF A THEN B
B true

_____
A probably true

(II) IF A THEN B
B true

_____
A more credible

Heuristic reasoning based on heuristic syllogisms has the following properties:
– it is non-demonstrative
– it lacks the certainty of demonstrative syllogisms
– it is indispensable for acquiring new knowledge and characteristic of knowledge related to the physical and social world beyond formal logic and mathematics.

Heuristic reasoning is embedded into Polya´s concept of bounded rationality. Heuristic syllogisms reveal the meaning of bounded rationality (Polya 1945/ 1988, p.189): Conclusion and premises differ in their logical levels: the conclusion is less determined, not fully supported by the premises. The conclusion resembles a force with a direction and a magnitude. The direction is from less to more knowledge, but its strength – the question *how much more* credible the conclusion is – remains open, and is, therefore, a matter of debate between different parties. Heuristic syllogisms lack certainty whereas demonstrative syllogisms are certain as soon as the premises are accepted.

According to Polya, bounded rationality is something intermediate between complete certainty and complete uncertainty, but, nevertheless, tied to a special type of formal reasoning structured by syllogistic patterns which support great discoveries without being error proof. The consequence of Polya´s bounded rationality concept for fallacy analysis is this: Our fallacy prototype is not only fallacious with regard to the consistency-rationality standard of formal logic, but also with respect to the bounded rationality standard of heuristic reasoning. The heuristic syllogism itself is non-fallacious although it violates modus ponens.
A second approach to bounded rationality, heuristic reasoning, and the dissolution of our prototype fallacy is offered by Gerd Gigerenzer, a leading German psychologist. To portray his approach, we adapt Gigerenzer´s heuristic *Take the Best* (Gigerenzer 2000, 171-197) to Polya´s example.
The key idea of this heuristic is to provide a list of *cues* (signs in Aristotle´s and Polya´s terms) and rank order them according to relevance. *Take the Best* prescribes to choose the first ranking cue (the best, the most relevant) and forget the rest. The quality or validity of the list and the quality of *Take the Best* depends significantly on the domain specific experience or expertise of its users. The more elaborate the expertise, the better the results, i.e. the better the match between the conclusion of the *Take the Best*-based heuristic syllogism and the domain event which the conclusion aims to estimate.

To exemplify this, let us go back to Polya´s example. He mentions the following cues (signs): Highly significant birds like sandpipers, birds in general, characteristic appearances of the sea near the shore, objects floating in the water. Suppose the crew experts had ordered the cues according to updated degrees of certainty:
(1) highly significant birds like sandpipers
(2) birds in general
(3) objects floating in the water
(4) characteristic appearances of the sea near the shore

Based on this ranking, we insert *Take the Best* into the heuristic syllogism to legitimise the conclusion, we have:

IF we are approaching land, we often see birds.
Now we see sandpipers.
Therefore, we are approaching land.

This corresponds to the general formal pattern:

IF A THEN B
B true
_____ ¬*Take the Best* (B true and the most relevant cue)
A [*true – with subjective certainty*]

Without the insertion of Take the Best, the heuristic syllogism would be fallacious. Within the new context, our prototype fallacy would become a fallacy with regard to Gigerenzer´s concept of bounded rationality. It rests on three columns (Gigerenzer 2002, p.38):

(1) Psychological limitations of human information processing as time, memory, knowledge.
(2) Domain specificity: the application of heuristics requires a domain specific knowledge base. Heuristics are essentially domain specific tools (expressed by the list of cues in our example and the comparative evaluation of the relevance of each as captured by the rank ordering; for both, expert knowledge is crucial). And consequently,
(3) ecological rationality as rationality standard with its criterion of *matching.* It refers to the matching between heuristics and environmental, domain specific structures, in short, to their goodness of fit to the domain of application.

Gigerenzer´s approach is completely in line with Polya´s fundamental insight that heuristic reasoning is inevitably weaker than demonstrative, but a priori non-fallacious. It is an indispensable tool for all problem solving – in science as well as in everyday life.

2. *Fallacies of social rationality (1): rhetorical rationality*
In the first section, we dealt with heuristic reasoning, which is – according to Polya – basic to plausible reasoning but not identical with it. He regards plausible reasoning as an extension. An extension of what? Following Aristotle´s stance in the Rhetoric, we would say: besides the logical component, plausibility rests on emotional and ethotic factors as well. This enlargement makes sense and is necessary with regard to the focus of rhetorical rationality. Here, the focus is on influencing the decision making of another party (audience) via (re)presentational means (verbal and non-verbal). Logos, pathos, and ethos provide appropriate factors of exerting influence. The corresponding rationality criterion,

simultaneously the criterion of successful influencing, is yesable plausibility. The "yesable"-component addresses the characteristic social-interaction level of rhetorical rationality.

In the following, we develop over- or underestimation, over- or underrepresentation of significance or weight(s) as the fallacy criterion corresponding to rhetorical rationality. We start with the following insight: The specific weakness of plausible reasoning, as compared to apodeictic reasoning, is characterized by the fact that it admits degrees of plausibility ranging over the whole interval [0, 1] with 0=F and 1=T. Thus, there is an incentive to strengthen one´s own argument. The aim is to get as near as possible to the 1-pole, to reach the highest possible degree of plausibility. Knowledge of mechanisms and strategies of weight induction will offer substantial support for reaching this aim. This knowledge may be used in a fallacious or a non-fallacious way.

Weight induction mechanisms are not only necessary for effective plausible reasoning, but also for the effective verbal and non-verbal (re)presentation of one´s case in front of an audience. Both together offer basic strategies of how to act successfully on other people´ s minds and, thus, help the orator to get the desired YES, the approval for his position from his audience. We want to analyse and demonstrate by examples how fallacies arise out of weight induction and weight distribution mechanisms.

An important class of fallacious weight inducing mechanisms are three heuristics studied by Daniel Kahneman, a 2004 Nobel prize winner in economics, and his colleague Amos Tversky. All three heuristics distort human judgment formation by inducing the mind in a systematic and predictable way to attach significant weight to the wrong things. The three heuristics at issue are representativeness, availability, and adjustment and anchoring. Representativeness concerns probability estimation based on similarity judgments, availability concerns frequency or probability estimations based on the ease of memory access to relevant occurrences, adjustment and anchoring capture the dominant weight of initial values or starting points on estimations, however arbitrarily they were chosen. These heuristics are of the uttermost importance in cognitive psychology and behavioural economics. Before going into further detail here, we will start our discussion with a classical source of studying fallacies due to weight distribution: Aristotle in the second book of his Rhetoric (Ch. 24, §3).

By analysing fallacies due to fallacious combinations of what is separate and fallacious separation of what is combined at Rhetoric II 24.3, Aristotle deals with

linear distributions of weight. As ‘combination’ he regards sequences, enumerations, sums, and classes of elements.

The principle of linearity governing those combinations of elements has the following form:
The weight of the sum (combination) is equal to the sum of the weights of the elements. According to the linearity principle, a sequence of letters does not make a word, or the *enumeration* of 30 tyrants which Thrasybulos has deposed amounts to the deposition of 30 tyrannies, or, *adding* one dose of a medicine to a first dose yields a wholesome total. But this principle is fallacious, in general. Actually, taking non-linearity into account, it is not absurd to conclude that, if two halves are good separately, they are bad when combined, because quantity may change quality.

Further, the argument of Euthydemus is presented concerning the difference between class/ prototype and a representative of it:
If I know the *trireme*, and if I know the Piraeus, then I know the trireme in the Piraeus.
BUT: The *trireme in the Piraeus* is a particular trireme, a representative, whereas the trireme of the premise designates a class or a prototype. Thus, if I know what a trireme (a trireme in general) is and if I know the Piraeus as a place, I do not know that a specific representative of *trireme* or which particular representative is in the Piraeus. There is a gap between class and representative that the argument ignores. This makes it fallacious.

Now, let us return to Kahneman and Tversky´s approach. We will present only one heuristic in more detail and demonstrate how it is supposed to work by introducing the famous Linda experiment. We will embed the heuristic and the example into our distribution-of-weights perspective. Representativeness is characterised by the authors thus:
For example, when A is highly representative of B, the probability that A originates from B is judged to be high. On the other hand, if A is not similar to B, the probability that A originates from B is judged to be low (Tversky & Kahneman 1982, p. 4).
…This approach to the judgment of probability leads to serious errors, because similarity, or representativeness, is not influenced by several factors that should affect judgments of probability (Tversky & Kahneman 1982, p. 4).

The Linda or conjunction fallacy experiment (Tversky & Kahneman 1983, p. 299). The following story was presented to the participants:
Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in antinuclear demonstrations.
Then the participants were asked to judge which of the two alternatives was more probable:
Linda is a bankteller (A)
Linda is a bankteller and is active in the feminist movement (A&B)

The story doesn´t mention A and offers information only representative of and relevant for B. Thus, by this mode of representation, weight is attached to B only. The question dissects the complete information set A&B into A and A&B. The correct estimation would follow the conjunction rule of probability theory. It states that the probability for the combined event A&B to happen is *smaller* than the probability for alternative A alone (or alternative B alone): p(A&B) £ p(A). But the reaction of most of the participants revealed an estimation contrary to the conjunction rule by fallaciously inverting the relation, yielding p(A&B) ³ p(A).

Let´s try to reconstruct this fallacy from a rhetorical point of view. We are defending the thesis that the fallacious estimation corresponds to the weight distribution of the story. The story told is irrelevant to A and relevant to B only. It distributes weights by making A insignificant and B significant for the addressees. The question, then, asks the participants to compare the probability of the combination of an insignificant A and a significant B to the probability of the insignifcant A alone. It´s the distribution of weights which induces the majority of the participants to estimate that the combination of an insignificant A and a significant B is *more* probable than the insignifcant A. Thus, they are induced to a fallacious recombination of A and B to AorB with AorB representing the combination either A happens or B happens or A&B happen. Now the disjunction rule of probability theory applies to solving the estimation task yielding p(AorB) ³ p(A).

The story provides information together with a distribution of weights such that the participants are induced – by experimentalists who act like orators – to base the required probability estimation on similarity judgments, the similarity between the story´s Linda portrait and being active in the feminist movement, instead of the laws of probability theory. According to our approach, the

experiment provides an example for the postulated interdependence of voluntarily and involuntarily committed fallacies. Fallacies due to weight distribution may be traced back to the roots of information processing:

David Marr, the famous MIT computer scientist, studies weight distribution at the roots of information processing. His thesis is that we cannot represent anything without distributing weights. We cannot avoid to place one aspect in the foreground, another in the background, to accentuate x, to neglect y:
A representation *is a formal system for making explicit certain entities or types of information, together with a specification of how the system does this. And I shall call the result of using a representation to describe a given entity a description of the entity in that representation* (Marr 1982, 20).
For example, if one chooses the Arabic numeral representation, it is easy to discover whether a number is a power of 10 but difficult to discover whether it is a power of 2. If one chooses the binary representation, the situation is reversed. Thus, there is a trade-off; any particular representation makes certain information explicit at the expense of information that is pushed to the background and may be quite hard to discover. This issue is important, because how information is represented can greatly affect how easy it is to do different things with it (Marr 1982, 21).

What do we learn from this? We learn that choosing a representation to present information is basically fallacy prone because it relies on the distribution of weights. This is a fundamental insight for an orator to make use of: a serious use or a fallacious use.

3. *Fallacies of consistency-rationality*
The focus here is on contradiction-free thinking (judging & reasoning) with formal consistency as the rationality criterion. Treating consistency-rationality as the only rationality model provides the corresponding fallacy criterion.
To show how consistency-rationality may become fallacious, we follow an argument and example provided by Amartya Sen, a Nobel prize winner in economics (Sen 1993, 498-503). The consistency requirement is represented by an axiom of mathematical decision theory, the axiom of independence of irrelevant alternatives. It states: If you choose an alternative from a larger set, say y out of {x, y, z}, then you choose y also from the subset {x, y}.
Consider now the following everyday situation which confronts you as a rational decision maker with the prospect of committing a fallacy: You are invited for

dinner together with other guests. For desert, a platter with cakes is passed around. Your neighbor having the choice between apple pie, strawberry cake and nothing, chooses apple pie – leaving you with a choice between strawberry cake and nothing. At your neighbor´s position you would have chosen the strawberry cake, an easy choice. But the situation is different now at your actual position. How would you decide? If you regard yourself as a rational decision maker, you follow the axiom of independence of irrelevant alternatives and decide for the strawberry cake. But if you obey the politeness standards to be followed in this circle, you decide to follow the convention of leaving the last cake for the next person and choose to have nothing. You prefer to reinforce your image as an educated person.
This decision can de regarded as a second order decision between different rationality standards. But if you are a 100%-adherent of the ideal of consistency-rationality, you don´t see the need for a second order decision. You blindly follow your ideal – and commit a fallacy, the fallacy of implementing a rationality model where it is not appropriate.

The same type of fallacy would be committed by a mathematician who would argue like an orator when doing mathematics or an orator who tried to follow the standards of mathematical reasoning, of "apodeictic" reasoning in Aristotelian terms. To be aware of the second order choice of appropriate standards and of the fallacies originating from being blind to it lie at the roots of understanding genuine rhetorical rationality standards, as Aristotle points out in the following lines from his *Nicomachean Ethics* (EN 1094b 23-27):
*[f]or it is the mark of an educated mind to expect that amount of exactness in each type of knowledge which the nature of the particular subject admits. It is equally unreasonable to accept merely probable conclusions from a mathematician and to demand strict demonstration (apodeixis) from an orator (*Rackham`s transl., modified; similarly *Rhetoric* 1355a24-29; see Rapp´s comment on this (Rapp 2002, vol.2, p.58)). The uneducated mind commits fallacies of the type discussed. The underlying mind set falls victim to conflicts of rationality standards which the educated mind is able to avoid or to decide with prudence.

4. *Fallacies of social rationality (2): dialogical or dialectical rationality*
The focus here is on joint – in the sense of simultaneous competitive and cooperative – problem solving or decision making by exchanging moves and

countermoves in a dialogical setting.
At the logical level this involves dialogue formats as rule settings for the exchange of objections as feasible moves and countermoves. Examples of this are Critical Discussion, Negotiation, Quarrel, Inquiry, Information-Seeking Dialogue (Walton 1995, Ch. 4, 98-116), and Debate.
At the level of social-interaction we find acceptability-driven moves and countermoves. The rationality criterion here is mutual acceptability of procedural moves and of the termination of discourse. Both the process of solving a joint problem and its outcome have to be mutually acceptable. This criterion is weaker than *mutually advantageous*, because the (rational) loser of a game (a debate, for example) will regard the loss not as advantageous, but as acceptable if the rules of the game have been respected. *Mutually advantageous* implies *mutually acceptable*, but the converse does not hold in general.
Fallacious under this model of rationality is any move of a dialogue party that is mutually unacceptable given the acceptability standards of the underlying format. If an unacceptable move is detected, the person having committed the fallacy must correct or withdraw it if this is demanded and if he or she wants to stay in the game. Acceptable moves within one format may not be acceptable within another, and vice versa: Ad hominem arguments or threats are fallacious within the critical discussion format, for example, but feasible within the negotiation format or the debate format.

The diversity of the formats is due to different mixtures of cooperative and competitive interaction modes in talk exchange. Because of the mixed motive structure of their interactions, it does not seem far fetched to regard all formats as mixed-motive games, in a game theoretical sense (Murnighan 1991, p.16). Debate is more contentious, more competitive, critical discussion is more cooperative, negotiation admits equal significance of both.
Fallacies negate the general dialogical/ dialectical rationality criterion of mutual acceptability as specified by the format of a given dialogue game. Fallacies within a given format come to the mind as something that is not acceptable and should be corrected.
Thus, there is an obligation on the part of rule violators to correct or withdraw their fallacious moves. Let´s have a look at a specific example to understand what this means. Negotiation games are games with a complicated structure. They are mixed motive games being cooperative and competitive simultaneously. Each negotiator is interested in creating an as large as possible joint gain, a big pie.

This disposes him to cooperate. But he is also interested in gaining an as large as possible piece of this pie for himself. That disposes him to compete. Drawn in opposite directions simultaneously, each party faces the typical negotiator´s dilemma as it was called (Lax & Sebenius 1986, 29-45, Ch.2). This dilemma is the structural source of a bundle of deliberate fallacies, of concealing information, of deceiving and misleading the other side by misrepresentation of one´s own true interests, of hardball and intransigence tactics – all these moves are fallacious because they serve the motive of competition at the cost of the motive of cooperation – resulting in an inefficient outcome which is disadvantageous for both.

But there are lots of involuntary fallacies as well: mental fallacies of misinterpretations and inferences concerning the other side´s intentions or behavior, or judgmental overconfidence in one´s own judgments, or confusing one´s own perspective with objective reality as in wishful thinkung, or presupposing that it is the other side who commits this fallacy and not oneself, or the so called loss aversion which may distort the assessment of compromises and, thus, their acceptance. Often, these involuntary fallacies are interrelated with those of the voluntary type just discussed. Arrows et al. 1995 contains a collection of fallacies of both types under the label of *barriers* to conflict resolution.
The deliberate as well as the involuntary fallacies, diverse as they are, share one common feature: they all represent mutually unacceptable moves which direct the negotiation process to inefficient, mutually disadvantageous outcomes which every rational player of the game would like to avoid or to correct.

Conclusion
Walton, to return to the thrust of our introduction, resolves the dilemma that characterizes his understanding of fallacy by asserting that the occurrence of a fallacy needs to be identified with the misuse of an argumentation technique (1995, 272). But we have argued here that the deeper problem is not the technique being used but the underlying model of rationality involved and the norms that govern those models. As people behave “irrationally” in regard to those norms (or as others exploit the potential for such irrational behaviour) fallacies are seen to arise. A consequence of our account, because of the wider notion of rationality involved (than is normally seen in treatments of fallacy) is that our understanding of ‘fallacy’ is itself a wider notion consistent with the wider understanding of ‘argument’ that attaches to rhetorical argumentation.

Some people may object that ‘fallacy’ should only be used to describe problematic *arguments* of a certain type. But as we have shown, this is also a prejudice derived from looking at fallacies from the perspective of only one model of rationality (admittedly, the model of rationality dominant in the logical tradition).**[i]** But in the face of growing empirical evidence from sources like the fields of cognitive and evolutionary psychology or behavioural economics, which conflict with or put into question the assumptions of the traditional model, we must be prepared to reconsider the ‘standard’ of rationality and our ideas of what is reasonable.

Another feature of our account to which objection might be made is its apparent “psychologism.” The definition of fallacy that Hamblin (1970, p.12) famously attributes to Aristotle sees a fallacy as an invalid argument that seems valid but is not. While our account does not restrict itself to arguments, it does accept the importance of the “seeming.” This essentially extends the discussion to people’s cognitive processes and psychological responses complementing the concern with objective ‘forms’ or schemes of invalid patterns that exist independent of any minds.

Ralph Johnson (1996, p.186), for example, professes a preference for purging the concept of fallacy from its Aristotelian roots and retaining only enough of its history to connect it to the idea of a logically incorrect argument. And he does this exactly because of the psychological features interwoven in those roots. In fact, a key criterion of Johnson’s revitalization of fallacy theory is the purging of all subjective and psychological nuances, that is, all references to appearance (1995, p.115). His principal concern in rejecting this feature is what he takes to be the vagueness involved of deciding whether or not a piece of reasoning is a fallacy. If it is just a matter of appearance, then a defective argument may appear as good reasoning to one person and bad reasoning to another. Johnson believes that the “badness” of the reasoning is an objective fact about it, independent of any subjective judgment. Undoubtedly, there are invalid patterns of reasoning due to objective, impersonal standards. And patterns which are invalid with regard to one standard are valid with regard to another. Heuristic syllogisms, for example, violate the rationality standard of formal logic, but are valid with regard to the bounded rationality standard. Besides this, there is the psychological problem of falling from correct standards of reasoning into the use of defective patterns. There are two different modes of use: the involuntary and the deliberate. The analysis of the trapped mind choosing fallacies unconsciously is the subject of

psychology. The analysis of the strategic mind choosing fallacies to gain an advantage is the subject of rhetoric and dialectic.
Thus, to our minds, the approach Johnson advocates is itself too restrictive and largely reflective of the "standard model of rationality" that has dominated the tradition. In looking at the different models of rationality to which coherent understandings of fallacy can be attached, we have given ample reasons for moving beyond this kind of restriction. Moreover, restricting discussions of fallacy to logically incorrect arguments overlooks the way fallacies arise in contexts governed by other rationality norms, e.g. the rhetorical.

Crucial to a full understanding of fallacies are the confusions that arise when people work with and operate under different norms of rationality. It is because some errors *seem* correct, are similar to good reasoning, that mistakes can be made. And fully appreciating those confusions and mistakes requires us to consider the full range of consideration that goes into judgments that are made in situations of uncertainty. These include considerations of the weight given to ethos and pathos, as well as logos. Rather than purging fallacy theory of its Aristotelian roots, we should be revisiting those roots and reinterpreting them in light of the insights that have been drawn from work in contemporary cognate fields.

NOTE
[i] In fact, even within that dominant tradition, theorists have struggled to deal with certain historical fallacies like 'Many Questions' and the petitio principii, the first of which is not an argument and the second of which is not obviously invalid. Our account has the merit of explaining such odd examples.

REFERENCES
Aristotle. (1959/ 1964). Aristotelis *Ars Rhetorica.* Recognovit brevique adnotatione critica instruxit W. D. Ross. Oxford: Clarendon Press.
Aristotle. (1894/ 1990). Aristotelis *Ethica Nicomachea.* Recognovit brevique adnotatione critica instruxit I. Bywater. Oxford: Clarendon Press.
Aristoteles. (2002). *Rhetorik.* Übersetzt und erläutert von Ch. Rapp. 2 vols. Berlin: Akademie Verlag.
Aristotle. (1926). *The "Art" of Rhetoric.* Translated by J.H. Freese. Loeb Classical Library.
Aristotle. (1991). *On Rhetoric.* Newly translated with Introduction, Notes, and Appendices by G. A. Kennedy. New York/ Oxford: Oxford University Press.

Edition. Cambridge, Mass.: Harvard University Press.
Aristotle. (1926). *The Nicomachean Ethics.* Translated by H. Rackham. Loeb Classical Library Edition. Cambridge, Mass.: Harvard University Press.
Arrow, K. & R. H. Mnookin, L. Ross, A. Tversky, R.Wilson (Eds.). (1995) *Barriers to Conflict Resolution.* New York/ London: W.W. Norton.
Cope, E. M. (1877). *The Rhetoric of Aristotle with a Commentary*. Revised and edited by J. E. Sandys. 3 vols. Cambridge: At the University Press.
Gigerenzer, G. (2000). *Adaptive Thinking. Rationality in the Real World.* Oxford/ New York: Oxford University Press.
Gigerenzer, G. (2002). The adaptive toolbox. In: G. Gigerenzer & R. Selten (Eds.), *Bounded Rationality. The Adaptive Toolbox* (pp. 37-50, Ch. 3), Cambridge, Mass./ London: MIT Press.
Hamblin, C.L. (1970) *Fallacies*. London: Methuen.
Johnson, R.H. (1996). *The Rise of Informal Logic.* Newport News, Virginia: Vale Press.
Johnson, R.H. (1987/1995). The blaze of her splendours: Suggestions about revitalizing fallacy theory. *Argumentation* 1, 239-53. Excerpted in H.V. Hansen & R.C. Pinto (Eds.), *Fallacies: Classical and Contemporary Readings* (pp. 107-119), University Park, Pennsylvania: Penn State University Press.
Kahneman, D. & A. Tversky (1996). On the reality of cognitive illusions. *Psychological Review* 101, 582-591.
Lax, D.A. & J.K. Sebenius (1986). *The Manager as Negotiator.* New York/ London: Free Press.
Marr, D. (1982). *Vision. A computational investigation into the human representation and processing of visual information*. San Francisco: Freeman.
Murnighan, J.K. (1991). *The Dynamics of Bargaining games.* Englewood Cliffs, N.J.: Prentice Hall.
Polya, G. (1968). *Patterns of plausible inference.* Princeton, N.J.: Princeton University Press.
Polya, G. (1945/ 1988). *How to Solve it. A New Aspect of Mathematical Method.* Princeton, N.J./ Oxford: Princeton University Press.
Sen, A. (1993). Internal consistency of choice. *Econometrica* 61, 495-521.
A. Tversky & D. Kahneman. (1982). Judgment under uncertainty: Heuristics and biases. In: D. Kahneman, A. Tversky & P. Slovic (Eds), *Judgment under uncertainty: Heuristics and biases* (pp. 3-20, Part I, Ch.1), Cambridge, UK: Cambridge University Press.
Tversky, A.& D. Kahneman (1983). Extensional versus intuitive reasoning: The

conjunction fallacy in probability judgment. *Psychological Review* 90, 293-315.
Walton, D. (1995). *A Pragmatic Theory of Fallacy.* Tuscaloosa/ London: University of Alabama Press.