Informal reasoning fallacies: answered and unanswered questions from a decision-making perspective

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Abstract: Informal reasoning fallacies are unfair deceptive ways of persuading somebody of a particular argument or point of view that is not valid or plausible. Although previous research has shed light on some aspects of argumentative flaws, the knowledge of fallacious reasoning principles is still insufficient, raising questions critical to the informed decision-making process. The present paper gives an overview of the findings for the following questions: first, are informal reasoning fallacies rare? Second, are people able to identify fallacious reasoning? And third, is the ability to identify fallacious reasoning sufficient to prevent their effect? Occurring in various situations from politics through healthcare to advertising and everyday life, fallacious reasoning remains a challenge for both cultivating the ability to identify misleading arguments and further research into this issue.

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1   Introduction

A business college student wrote a seminar paper on cash versus compliments. To support her conclusions, she used statements such as 'currently, it is a time when we cannot use compliments to pay bills' or 'manager is not a Hitler'. There is no doubt that the compliments cannot pay the bills. However, it is not specific for the current time; it was never possible. There is no point in emphasising time in this particular argument. However, statements of this type occasionally occur. Reasons for their use range from a lack of better arguments to seeking to strengthen the existing ones and inability to evaluate them critically. The above example of a student's argumentation does not contribute to the correct decision as to whether 'cash or compliments'.

The quality of the decision-making depends on relevant data and good arguments. The ability to evaluate them is crucial in many areas such as healthcare (Cummings, 2020), academia (Münchow et al., 2019) and science, the judiciary and even everyday life (Hahn, 2020). Irrational choices and judgements can result from poor or even fallacious reasoning. The issue of reasoning fallacies is part of a more general sphere of logical reasoning and judgement and decision-making with bounded rationality. Numerous authors are engaged in its research and discussions (e.g., in this journal, Albar and Jetter, 2013; Caputo, 2014; Downen et al., 2019; Sikder, 2008; Sjoberg, 2007).

Unfortunately, business decisions are frequently "based on hope or fear, what others seem to be doing, what senior leaders have done and believe has worked in the past, and their dearly held ideologies - in short, on lots of things other than the facts" [Pfeffer and Sutton, (2006), p.5]. Supporting the conclusion by arguments such as 'it used to work in the past' or 'everyone is doing it', etc., may seem convincing. Nevertheless, they are not valid. In other words, they are fallacies, specifically informal reasoning ones (cf., Walton, 2010), referring to everyday reasoning under conditions where not all information and premises are explicitly given in advance (Galotti, 1989).

Registering the current information disorder, watching political skirmishes, learning and teaching critical thinking – questions arise about informal reasoning fallacies. Are they commonly used or scarce examples of argumentation? Are people able to identify them, i.e., do they get to know that the argument is fallacious? Is its very identification a guarantee that it will not motivate people's actions and conduct? And what exactly is the power and persuasiveness of fallacious reasoning? The aim of this paper is to summarise the existing knowledge on the issue and to draw attention to the unanswered questions opening up areas for further research.

2   Informal reasoning fallacies

Fallacious reasoning is not a recent phenomenon, its roots going back to antiquity. Aristotle was the first to systematically identify fallacies in argumentation in his *Sophistical Refutations* (part of Organon; *De Sophisticis Elenchis* in Latin), dividing them into two groups – those dependent on language and non-linguistic ones. He laid the foundations for research and education in the field of argumentation and his legacy is still critically studied and discussed (cf., e.g., Hintikka, 1987, 1997; Woods and Hansen, 1997).

Naturally, since the time of Aristotle, the number of reasoning fallacies recognised by the theory of logic has increased significantly. A comprehensive list of rhetorical and

logical thinking manipulations and errors is available, for example, on the website Information is Beautiful (run by McCandless, n.d.). They are clustered into the following six categories:

- Appeal to the mind: Appeal to anonymous authority, appeal to authority, appeal to common practice, appeal to ignorance, appeal to incredulity, appeal to money, appeal to novelty, appeal to popular belief, appeal to probability and appeal to tradition.

- Appeal to emotions: Appeal to consequences of a belief, appeal to fear, appeal to flattery, appeal to nature, appeal to pity, appeal to ridicule, appeal to spite and appeal to wishful thinking.

- Faulty deduction: Anecdotal evidence, composition, division, design fallacy, gambler's fallacy, hasty generalisation, jumping to conclusions, middle ground, perfectionist fallacy, relativist fallacy, spotlight, sweeping generalisation and undistributed middle.

- Manipulating content: Ad hoc rescue, biased generalising, confirmation bias, false dilemma, lie, misleading vividness, red herring, slippery slope, suppressed evidence and unfalsifiability.

- Garbled cause and effect: Affirming the consequent, circular logic, cum hoc ergo propter hoc, denying the antecedent, ignoring a common cause, post hoc ergo propter hoc and two wrongs make a right.

- On the attack: Ad hominem, burden of proof, circumstance ad hominem, genetic fallacy, guilt by association and straw man.

The above list is a popularising practical overview that does not distinguish between formal and informal reasoning, inductive and deductive argumentation, and between soundness and validity of the argument, as should be done from a strictly academic point of view (see Boongaling, 2016).

Tait (2009) categorises fallacies into three groups – material, psychological and logical – without claiming the strict exactness of this division. The material category comprises the golden mean, false cause, weak analogy and false dichotomy, the psychological group consisting of ad populum, ad hominem, red herring and straw man arguments, logical fallacies covering affirmation of the consequent, begging the question, suppressed quantification and non-sequitur techniques.

The above set of categories documents the number and variety of modes of fallacious reasoning. The overlap between these theoretical concepts and real life as well as other contextual factors deserves particular attention.

3   Are informal reasoning fallacies a rare occurrence?

Academic research and fact-checking, including specialised websites, provide enough evidence that informal reasoning fallacies are a common practice. Perhaps, the most striking are argumentation fouls of politicians, Donald Trump being a frequently cited never-drying well of examples. One example for all – Trump's remark to the address of his fellow candidate in the Republican primaries Carly Fiorina: "Look at that face! Would anyone vote for that?" (Pasha-Robinson, 2017) – as a flagrant attack on a person

(ad hominem) instead of an argument-based discussion. For more Donald Trump's and other politicians' fallacies, see Blassnig et al. (2019), Sullivan (2018) and Zhou (2018).

Fallacious reasoning is common in advertising. Examples of slippery slope argumentation are humorous commercials on Direct TV showing that cable TV inevitably leads to a series of disasters, such as an eye injury during a squash game, getting beaten up and left in a roadside ditch, etc. Barroso (2019) analyses the reasoning fallacies used in commercials as a way to evoke emotions, namely pity, fear, flattery, joy and enthusiasm. Tait (2009) gives examples of justifying deceptive reasoning spotted while watching TV. One particular case of a false dichotomy: "Is it a good thing that Saddam Hussein is no longer in power?" "Yes?" "Then clearly you support the invasion of Iraq."

There are also some works focused on fallacious reasoning in a medical context. Fallacious arguments are used, for example, in relation to the initiation and cessation or reduction of the dose of antipsychotics in dementia (Donyai, 2017). The recognised fallacies varied, frequently employed ones being false dichotomy, appeals to popularity, tradition, fear and emotion, false dichotomy and slippery slope. The debate on proton therapy, Hofmann (2009) points out, contains flawed arguments both for and against. In the field of anaesthesia, various fallacies were identified by Gibbs (2010). Biased arguments also appear in the discussion on climate change (Cook et al., 2018), the authors focusing exclusively on those denying human influence.

Students' reasoning fallacies were studied, for example, by Selpia and Setyarini (2020). English language students were asked to analyse non-linguistic consequences of the given text. The experiment showed that, apart from some unclassifiable unsound arguments, the students could not avoid excessive generalisations in particular, while not resorting to the expected appeal to fear and straw-man fallacies.

As follows from the foregoing, informal reasoning fallacies are a relatively common occurrence. They appear in argumentation in a wide range of occasions and issues. It has been known since ancient times that they are manipulative techniques, going against logical reasoning. The frequent use of informal reasoning fallacies poses the question of people's ability to recognise them.

4 Are people able to identify fallacious reasoning?

As described previously, theories of logic and argumentation take into account fallacious rhetorical devices, agreeing on their unreasonableness and unfairness. Classical argumentation theories being normative (Lillo-Unglaube et al., 2014), the question of the gap between the norm and actual behaviour emerges. Van Eemeren et al. (2010) raise the question of whether the theoretically untrained lay public would also consider fallacies to be unreasonable.

To identify an informal reasoning fallacy means to be able to realise that there is something wrong with the argument, not necessarily determining its type. There is a considerable body of research on factors affecting the ability to identify fallacies in reasoning (e.g., Lee and Chan, 2017; Neuman et al., 2006; Neuman and Weizman, 2003; Ricco, 2007; Weinstock et al., 2006). It is tested experimentally, usually performing the assessment of arguments in dialogue scenarios (used by Lee and Chan, 2017; Neuman et al., 2006; Neuman and Weizman, 2003; Ricco, 2007; Weinstock et al., 2004). Neuman and Weizman (2003) published the results of a test in which participants responded to

model conversations between two people, being asked whether the argument raised was problematic, and if so, to explain what the problem was. The percentage of participants who were able to identify fallacies in individual scenarios ranged from 9% to 60%. A smaller proportion of participants able to detect and explain the fallacy in the experiment – namely from 8% to 21% – was found by Lee and Chan (2017).

Caution is to be exercised regarding the conclusions about this type of experiment. Rather than the percentage of respondents able to recognise fallacies, the proportion of those able to report an argumentation problem if asked seems more relevant. Neuman and Weizman (2003) admit that the number of participants who reported a problem was higher than the number of those who could provide its adequate explanation. The difference may be due to people's tendency to replace difficult questions with simpler ones (Tetlock and Gardner, 2016; Vrbová et al., 2018).

Song et al. (2017) employed a different experimental approach. The participants (eighth graders) were asked to critique (in writing) arguments used in a letter to the editor. The well-written critique (yielding the highest possible score) was supposed to include identification and clear explanation of most of the reasoning problems, identification of the inaccurate information and clear expression of the ideas. Most of the participants (84%) failed to reach the excellent score. Compared to the previously mentioned experimental design, the text input for participants to be analysed was noticeably longer, containing more argument fallacies.

Researchers examine the relation between the ability to identify fallacious reasoning and other capabilities, skills and behaviours. Generally, reasoning fallacies violate the argumentative logic, its rationality corresponding to the so-called system 2 reasoning, conscious, rule-based and deliberate processes (Godden, 2015). The ability to capture underlying structural features of an argumentative text is related to a greater capacity to identify an argument committing a fallacy (Neuman and Weizman, 2003). Understanding the deeper layers of the text means grasping its meaning and message, not just remembering superficial features such as the names and occupations of the speaking characters, the location or the subject of the debate. A general ability to identify informal reasoning errors is also related to the level of epistemic understanding and cognitive skills (Calvillo et al., 2020; Lee and Chan, 2017; Weinstock et al., 2006).

The broader context in which the argument takes place is a significant factor exposing its possible fallaciousness (van Eemeren and Houtlosser, 2007; Walton, 1992b). Unlike a non-reasoned dialogue showing careless thinking of speakers (in a quarrel or a debate), the contextualised reasoned dialogue makes it easier for participants to reject the legitimacy of fallacious arguments (Neuman et al., 2006). The contextual factor did not have such an effect in the scenario with a religious subtext claiming that God exists. Different responses suggest that the participants judged the text on the basis of their faith rather than on purely logical grounds.

The tendency to judge arguments according to their consistency with one's own beliefs instead of their logical validity – the so-called belief bias – also affects the susceptibility to fallacious reasoning. An area with a strong belief bias is politics. Conservative-minded people accept different arguments than those who embrace liberal principles, while both groups also hold views whose validity is questionable (Calvillo et al., 2020; Diana et al., 2019). Similarly, the perspective of a proponent or opponent of an argument affects the ability to identify faulty one. Participants less likely marked the argument as fallacious when asked to adopt the perspective of its proponent (Neuman et al., 2006).

There is still a lack of research comparing different types of fallacious reasoning according to how difficult it is to identify them. Obviously, the identification of fallacies depends on their type and individual dispositions – the skills of informal reasoning and knowledge of the topic as stated by Neuman and Weizman (2003). According to the authors, the type of fallacy referred to as ad ignorantiam (argument from ignorance) is the easiest to identify; it is not difficult to recognise when the speaker attacks the proponent instead of arguing the case. It is possible – unlike logical fallacies related to the causes of the problem – even without knowledge of the topic.

While general forms of fallacies are commonly known and analysed, this is not always the case for their specific real life manifestations (Donyai, 2017; Walton, 2010). The specific formulation of the argument is thus of utmost importance as indicated by the above experiments as well as by the research on wording and framing. For example, the choice of words such as war or fight by a company's CEO affects the ethical attitudes of employees (Gubler et al., 2015). The verbs save and die influence the decision-making in a positive and negative sense, respectively (Tversky and Kahneman, 1981). The level of fallaciousness can then vary depending on the way the arguments are worded.

Corner et al. (2011) illustrate the differences providing the following examples of a slippery slope argument:

1   If we allow gay marriage, then in the future people will want to marry their pets.

2   If voluntary euthanasia is legalised, then in the future there will be more cases of 'medical murder'.

3   If we accept voluntary ID cards in the UK, we will end up with compulsory ID cards in the future.

Surprisingly, there are situations in which the above statements are not informally fallacious. In addition to slippery slope, 'acceptable' instances can also be found for begging-the-question and appeal-to-ignorance fallacies (Hahn and Oaksford, 2007). Ad ignorantiam is a fallacy declaring statement as true because it is not known to be false (Walton, 1996). Despite being traditionally considered fallacious, non-fallacious arguments from ignorance also occur. "We can reason as follows: since the schedule did not indicate that the train stops at Schipol, we can infer that it does not stop at Schipol" (Walton, 1992a). Argumentum ad ignorantiam is generally correct if the knowledge-base is closed and a search of this base is exhaustive (Cummings, 2014).

Any conclusions about the ability to identify informal reasoning fallacies can be only tentative, since current research does not cover the entire spectrum of their types. The fallacies examined so far are as follows: ad hominem, ad populum, ad ignorantiam; post hoc ergo propter hoc, false cause, appeal to popular belief, begging the question (circular reasoning) and slippery slope (Neumann et al., 2006; Neuman and Weizman, 2003; Ricco, 2007).

To sum up, the ability to identify fallacious reasoning seems rather limited, its critical reflection also lacking a deeper and broader scope. Thus, there is considerable room for improvement in handling both practical life situations and theoretical research issues. Thanks to the research, we know, that it is useful to study argumentation norms; the awareness of argumentation standards, for example, leading to better identification of faulty arguments. However, space for future research opens up to address the limitations related to the experimental question wording and the ambiguity of fallacies and their comparison with non-fallacious arguments.

5   Is the ability to identify reasoning fallacies sufficient to prevent their effects?

There are argumentation and critical thinking courses designed to train the participants to recognise fallacious reasoning which is a condition for improving the decision-making process (Bazerman and Moore, 2012). However, the question remains as to the relevance of the identified unfair arguments in making one's own decisions, and whether there is another reason why it is desirable to recognise fallacies, if not just to exclude them from the rational evaluation of the pros and cons. The general concept of errors in rationality is captured well in (Kahneman, 2011).

Specifically, the opinion that the ability to identify fallacious reasoning is not sufficient to dismiss the argument when making decisions is supported by the research on far transfer and disclosed conflicts of interest. The discussion on far transfer, as the concept of transfer of learning and knowledge to contexts and situations other than the original ones is complicated, as Barnett and Ceci (2002) note, due to the different dimensions along which the transfer takes place, being affected by the argumentative content and context. Kassai et al. (2019), on the other hand, conclude from the training of children's cognitive skills (working memory, inhibitory control and cognitive flexibility) that there is no convincing evidence of far transfer. An improvement in a trained component does not necessarily have far transfer impacts on the untrained one. Fallacy recognition and avoidance requiring multiple skills.

People try in vain to ignore the information they have received. A trial experiment compared three conditions under which evidence was denied or supplied to jurors, differing in the way of handling information on the defendant's insurance and affecting jury award verdicts (Broeder, 1959). The first condition: an uninsured defendant – 33,000 USD award; the second condition: an insured defendant – 37,000 USD award, the third condition: an insured defendant – 46,000 USD award, but in a situation where the information should have been disregarded, an objection having been raised. Despite having been instructed to ignore the insurance information, the jury was 'blindfolded to verdict consequences', the resulting award being considerably higher than in the former two cases.)

Moreover, people usually do not reject recommendations, as would be appropriate, from someone who might be biased because there is a conflict of interest. Biased advisors in the conflict of interest feel morally justified to push their advice (Cain et al., 2005). This also seems to be the case for fallacies. Expecting opponents to know how to identify them may lead to the belief that it is all right to use fallacious arguments and transfer the responsibility to others.

Theoretical attention paid to judgemental biases and errors in decision-making does not in itself preclude their occurrence (Kahneman et al., 2011). Anchoring, cognitive bias based on the first piece of information offered when making judgements, serve as an example that people cannot avoid these common human tendencies even if they have been warned in advance (Wilson et al., 1996).

Based on the above findings, it cannot be argued that the recognition of fallacious reasoning in itself makes people fallacy-resistant. One must be proactive and use the proper techniques, such as argument analysis and structuring employing the rules of logic. Upon the specific techniques to avoid these biases, can be easily adoptable ones: actively searching for opposing information as proved on the example of anchoring (Downen et al., 2019), or ask a third party for intervention (Caputo, 2016).

6   Discussion

The effects of informal reasoning fallacies on informed decision-making have not yet been fully clarified. Previous research findings provide only a partial understanding of the issue given some reported problems such as questionable ways of investigating the ability to identify fallacious discourse which is often ambiguous.

These limitations, at the same time, provide the stimulus for future research of fallacious informal reasoning and its consequences in the decision-making process. Experimental studies should avoid the issues with a strong belief bias (Neuman et al., 2006), apply the within subject design (Barbosa and Jiménez-Leal, 2017), and present the outcomes of argument evaluation tasks using both pro and con versions (Oaksford and Hahn, 2004).

A frequent topic of research is the concept of the argument from ignorance. Cummings (2014) designed the experiment to test the ability to judge an argument, manipulating closure and search conditions to make them more robust, i.e., towards the full closure of the knowledge-base and its exhaustive search. The results of the experiment corroborate the hypothesis that the argument with incomplete closure and limited search should have a lower acceptance rate than the ones with complete closure and exhaustive search.

Another question arises on the power of fallacious reasoning to reverse the decisions. Bizer et al. (2009) conducted research into the straw man technique effectiveness to affect choices and judgements. Experiment participants expressed preferences for the two ministerial candidates on a scale between the extremes of support of each. When the candidate came from a different region than the participant, the straw man argument was more persuasive, the results suggesting a significant difference in the power of this logical fallacy depending on the personal relevance of the topic. On the available experimental evidence, it can be concluded that even if one succumbs to a fallacy, its impact on decision-making is rather limited. Nonetheless, the authors of the study, along with other researchers, admit that the relation between the experimental findings and the respondents' ability to recognise and deal with informal fallacious reasoning remains an open subject for further analysis.

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