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Belief vs. Logic: An Experimental Study on the Effect of Epistemic Authority on Belief Bias

Matúš Grežo
Institute of Experimental Psychology of the Centre of Social and Psychological Sciences, Slovak Academy of Sciences, Bratislava, Slovak Republic

Belief bias is a tendency of people to accept logical conclusions because they are believable and not because they are necessarily true. The aim of the present experimental study was to examine the effect of perceived epistemic authority on the occurrence of belief bias in deductive syllogistic reasoning. In addition, personal need for structure was expected to moderate this effect. A total of 404 participants were randomly assigned to five groups and presented with a scenario of two individuals discussing the topic of racism. Thereafter, they were presented a profile of one discussant in which the epistemic authority was manipulated. To measure belief bias, participants evaluated the validity of 12 syllogisms (six conflict and six non-conflict) that were constructed as the discussant's argumentation. The effect of epistemic authority on belief bias was not shown to be significant and personal need for structure did not moderate this effect. Our findings suggest that, unlike informal reasoning, formal deductive reasoning may be protected from the possible negative effects of epistemic authority.

Key words: epistemic authority, personal need for structure, belief bias, deductive reasoning, syllogisms

Introduction

In modern society, the recognition and acceptance of epistemic authority – the trust and credibility placed in experts in their respective fields – have long formed the basis for people's acquisition of knowledge and their formation of beliefs. Currently, however, we are witnessing a massive erosion of the epistemic authority of traditional authorities (Reed & Reed, 2022) as well as the rise of alternative sources of information (Vogler et al., 2024). These sources often present themselves as true experts in the field, whose aim is to correct the traditional experts or mainstream sources of information by providing opposing narratives, explanations and argumentations

Correspondence concerning this article should be addressed to Matúš Grežo, Institute of Experimental Psychology of the Centre of Social and Psychological Sciences, Slovak Academy of Sciences, Dúbravská cesta 9, 841 04 Bratislava, Slovak Republic. E-mail: matus.grezo@savba.sk

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(Funk et al., 2023). This puts pressure on people to be able to objectively assess the validity and credibility of information without relying on the (potentially misleading) signs of epistemic authority.

The fact that people tend to rely on external sources of information, such as experts, to obtain new information and form their belief system is not a new finding. However, as Kruglanski et al. (2005) suggest, over-reliance on sources with high perceived epistemic authority may be associated with biased reasoning and uncritical acceptance of information. Although the literature shows that people often fall for simple cues about the credibility of a source in informal reasoning, the evidence is not consistent when it comes to formal deductive reasoning.

To address this gap, the present study combines the theory of epistemic authority (Kruglanski et al., 2005) and lay epistemic theory (Kruglanski, 2010) with the belief bias research paradigm (Evans et al., 2022). The aim of this study is twofold. First, it experimentally examines whether epistemic authority may lead to belief bias. For these purposes, we employed formal syllogistic reasoning tasks. Following the critique of the lack of ecological validity of categorical syllogisms used in previous studies, we created a scenario with two individuals discussing the topic of racism and created a set of categorical syllogisms that were presented as arguments of one of these discussants. Epistemic authority was manipulated by the description of credibility of the discussant.

Second, the study aims to investigate individual differences in the possible misleading role of epistemic authority in deductive reasoning. In particular, we examine personal need for structure as a moderator of the effect of epistemic authority on belief bias. Since personal need for structure has been shown to be associated with simplified reasoning in complex and uncertain situations (e.g., Bar-Tal et al., 1999; Grežo & Sarmány-Schuller, 2015), it could be responsible for the need and desire to tune out complex reasoning regarding the validity of syllogisms and, instead, rely on the epistemic authority of the discussant, potentially leading to more pronounced belief bias.

The study contributes to the debate on the epistemic crisis that has become a public and academic concern in most Western societies (Neuberger et al., 2023). As we are witnessing historical changes in the way people acquire and generate knowledge (Dahlgren, 2018), the ability to evaluate information objectively and not fall for potentially misleading and manipulative sources of information seems more important than ever. With this in mind, the study aims to provide evidence as to whether our deductive reasoning is protected from the potentially distorting effects of perceived epistemic authority of a source. Moreover, by incorporating the personal need for structure, the study also helps to understand whether there are vulnerable individuals who are more susceptible to this bias, and whether the need for structure helps to explain these individual differences.

Theoretical Background

Searching for Credible and Trustworthy Sources of Information

According to the theory of epistemic authority (Kruglanski et al., 2005), people have a natural tendency to seek epistemic certainty, which is a sense of confidence in their beliefs and knowledge. The theory posits that human knowledge is socially constructed and that individuals often rely on external sources of information such as experts. These authorities possess specialized knowledge or expertise on a particular domain, and their opinions and

statements carry weight in shaping people's beliefs and determine their decisions and actions (Kruglanski et al., 2005). The concept of epistemic authority is a very similar term to source credibility, which combines perceived expertise and trustworthiness (Kruglanski et al., 2009). In particular, when people encounter new information or face uncertainty, they evaluate the credibility of the source. If the source is deemed to be credible, the information is more likely to be accepted and incorporated into the individual's belief system.

The theory of epistemic authority complements Kruglanski's (2010) lay epistemic theory. The latter posits that when people face an uncertain situation, they begin to acquire information by generating hypotheses on the situation and search for evidence to confirm their hypotheses and achieve cognitive closure (Kruglanski, 1989). People differ in how much energy and time they are willing to invest in this process and when they decide to stop generating hypotheses and searching for evidence. Importantly, epistemic authority serves as a stopping mechanism of this process. In other words, individuals may use the credibility of an expert to stop and discontinue their epistemic search and, instead, rely on the information provided by the expert (Kruglanski et al., 2009).

Importantly, Kruglanski et al. (2005) suggest that the effect of epistemic authority may be so impactful that the information provided by a highly credible source may be perceived as indisputable, which may result in uncritical acceptance of the information. Research in the areas of epistemic authority, source credibility, and persuasion provides extensive empirical support of the idea that the ascribed epistemic authority of a source indeed affects the perceived credibility, persuasiveness and acceptance of messages, argumentation and communication provided (e.g., Ilić & Damnjanović, 2021; Lombardi et al., 2014; Petty & Briñol, 2008; Pornpitakpan, 2004; Wilson & Sherrel, 1993; Herne et al., 2022).

Deductive Reasoning, Belief Bias, and Their Relation with Epistemic Authority

The literature shows that in informal reasoning people can fall for simple cues about the credibility of a source. In this type of reasoning, problems are often unstructured and have no definitive solution (e.g., controversial social issues). The premises in informal reasoning are uncertain and can be questioned and thus the conclusion drawn from these premises can be contradicted by the new evidence (Teig & Scherer, 2016). Since there is no true and justified conclusion, people can only judge the quality and strength of the arguments put forward. This opens up the possibility that the arguments of a source ascribed a higher epistemic authority are perceived as more convincing or reliable. However, people are not always confronted with informal arguments, but sometimes face logical argumentation that requires formal deductive reasoning. In such reasoning, the premises are taken as established and true, so people must be able to judge whether the conclusion is objectively valid and follows from the premises.

A widely used methodological standard with which to examine people's deductive reasoning is the use of categorical syllogisms (Evans et al., 2022). A typical syllogism consists of two statements, known as premises, and a conclusion. A goal of an individual in these tasks is to evaluate the validity of the conclusion, i.e., whether it logically follows from the two premises. Importantly, the conclusion can be constructed in such a way that it does not logically follow premises but provides a statement that is consistent with real-world knowledge and, thus, appears to be believable. In such a case, the invalid believable syllogism is often endorsed as logical-

ly valid because an individual relies on his or her beliefs instead of following formal logic. The tendency to accept believable conclusions and reject non-believable conclusions regardless of their objective validity is widely known as belief bias (Evans et al., 1983).

Research over the past several decades provides compelling evidence that people's deductive abilities are not free from the possible flaws resulting from their beliefs (Evans et al., 2022). Literature documents that people are prone to accepting believable conclusions more than unbelievable ones, irrespective of their logical validity (Trippas et al., 2017). This bias has been shown to be more present for invalid than for valid conclusions (e.g., Evans et al., 1983), while various contextual and personal factors have been examined as its determinants (e.g., Schubert et al., 2021; Trippas et al., 2015; Trippas et al., 2017).

Given the broadness of the research on the determinants of belief bias, it seems surprising that the evidence on whether the epistemic authority of a source may determine the occurrence of belief bias is very scarce and inconsistent. To our best knowledge, there have been only three attempts to address the possible association. A study conducted by Bettinghaus et al. (1970) showed that the credibility of the source alone did not have a significant impact on people's performance in syllogistic reasoning. In contrast, building on the limitations of Bettinghaus et al.'s study, Copeland et al. (2011) clearly showed significant effect – describing the source of a syllogism as either expert or honest caused people to be more prone to perceiving the logically invalid conclusions to be valid. Finally, the study carried out by Boucher (2014) aimed to replicate Copeland et al.'s findings, but found the effect only among those individuals scoring low on cognitive reflection.

The three studies mentioned above do not provide conclusive evidence on the effect of epistemic authority on belief bias. Moreover, the three studies might have some limitations regarding their experimental manipulation, such as using real life persons (Bettinghaus et al., 1970) or lacking comprehensive manipulation checks of whether the epistemic authority was successfully induced (Boucher, 2014; Copeland et al., 2011). Building on these gaps and limitations, we aim to examine the effect of epistemic authority on belief bias again. Due to the inconclusiveness of previous studies, we formulate the following research question: Does epistemic authority affect the susceptibility to belief bias in deductive syllogistic reasoning?

Personal Need for Structure as a Possible Determinant of the Effect of Epistemic Authority on Belief Bias

There is compelling evidence that people's cognitive styles play an important role in their susceptibility to belief bias (e.g., Bettinghaus et al., 1970; Schubert et al., 2021; Stanovich & West, 2000; Trippas et al., 2015). The explanation for this relationship lies in the notion that having cognitive capacity to solve deductive tasks is not sufficient; individuals also have to be willing to engage in this analytical process (Trippas et al., 2015). The present study focuses on personal need for structure – a cognitive style that has been found to shape people's knowledge generation and information processing. In particular, it reflects people's disposition on how much energy and time they are willing to invest in searching for evidence to support their hypotheses on events. It is defined as a tendency to minimize unambiguity and seek a sense of order (Neuberg & Newsom, 1993). People high in personal need for structure seek stability, order and predictability in their environment. They prefer simple and clear rules, guidelines and routines that provide them with a sense of

organization and certainty and navigate them through the world.

There are two main reasons to believe that the personal need for structure can moderate the effect of epistemic authority on belief bias. First, according to lay epistemology, this trait determines a person's tendency to quickly "freeze" upon already held belief, i.e., a state of reluctance to recognize other possible alternatives to a currently held hypothesis (Freund et al., 1985). Indeed, Kruglansky and Freund (1983) and Freund et al. (1985) have shown that people with a high personal need for structure are more prone to epistemic freezing, as evidenced by three distinct phenomena: primacy effect in impression formation, ethnic stereotyping, and numerical anchoring. In all these three phenomena, people acquire early impressions/information and it is up to them whether they "freeze" upon this information or re-evaluate their beliefs under new information. In the context of our study, the initial information about a source's epistemic authority may lead people high in personal need for structure to "freeze" upon the initial belief about a source's credibility and reinforce the belief bias. In other words, they may view believable conclusions as more valid if the argumentation comes from a source with high epistemic authority. A recent study supports this notion by showing that when people high in need for cognitive closure ascribed an advisor high epistemic authority, they were more likely to change their opinions and choices according to their advice (Pica et al., 2021).

Second, the studies show that people high in need for structure tend to rely on simplified non-systematic and heuristic cognitive processes (Bar-Tal et al., 1999; Grežo & Sarmány-Schuller, 2015), prefer simple structuring in social interactions and refuse to actively experiment and acquire information on the environment (Neuberg & Newsom, 1993; Schaller et al., 1995). They prefer to use holistic and rapid processing, black-and-white type of solutions and over-simplified dichotomizations (Bar-Tal et al., 2019). These tendencies result in a lower ability to integrate multiple pieces of information at once (Sarnataro-Smart, 2013) or lower understanding of complex tasks (Wojtowicz & Wojtowicz, 2015). In contrast, individuals with low PNS prefer systematic and effortful processing and tend to search, evaluate and integrate relevant information in an unbiased manner (Bar-Tal et al., 2019). In the context of our study, the initial perception of a source's epistemic authority may serve as a simplifying strategy for people with a high personal need for structure. Rather than effortfully processing the deductive argumentation and evaluating the validity of the conclusion, individuals with a high need for structure may use a simplifying strategy to rely on their impression of credibility to avoid the cognitively demanding process and reduce aversive feelings of uncertainty. Consequently, they may be more inclined to evaluate believable conclusions as valid if the argumentation comes from a source with high epistemic authority.

Thus, based on these two reasons, we hypothesize that personal need for structure moderates the effect of epistemic authority on belief bias. In particular, the effect is expected to be stronger for individuals high in personal need for structure.

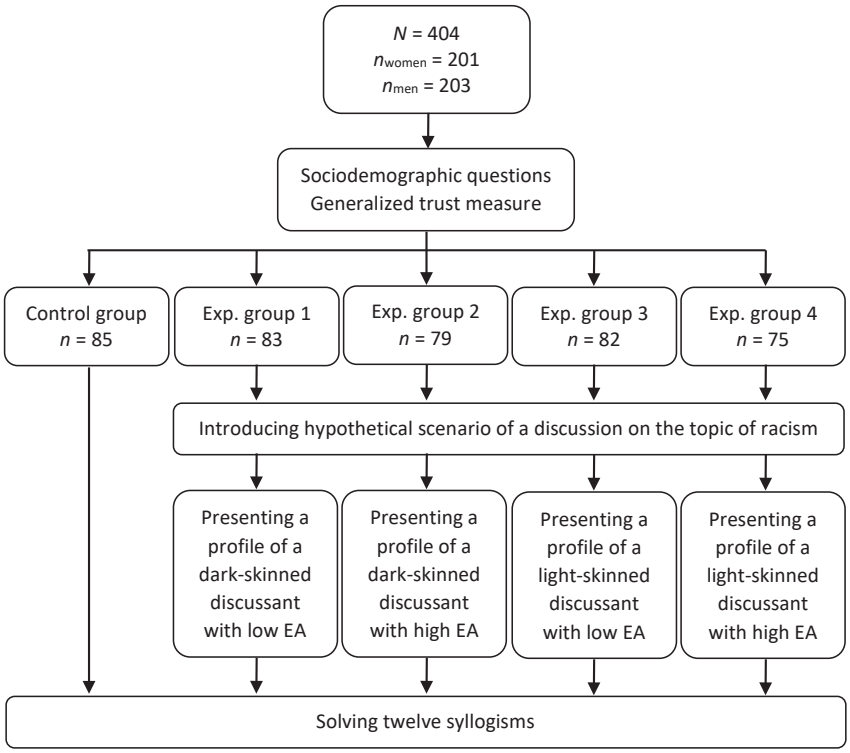
Methods

Participants and Procedure

Based on an a priori power analysis (effect $f = .25$, $\alpha = .05$, 95% power; for more details, see supplementary materials at the Open Science Framework repository https://osf.io/yxtgb/?view_only=6bc4a71874ab46d0bec0f86452ab7bdb), a sample of 404 Slovaks

(201 men, 203 women) aged 18 to 81 years (M = 45.60, SD = 15.2) was recruited by a public research agency to participate in an online experiment conducted on Qualtrics. We used a non-probability quota sampling method to obtain a gender-balanced adult population from all regions of Slovakia. Since our experimental manipulation involved manipulating the skin color of the discussant (see section Experimental manipulation), we specified as inclusion criteria that participants had to be light-skinned and have Slovak nationality. The dataset is available at the Open Science Framework repository.

A computerized web experiment was used for data collection. Before signing an informed consent form, participants received general information on the purpose of the study and on their right to remain anonymous and to terminate participation at any time. Participants first answered sociodemographic questions and the scale measuring their generalized trust. They were then randomly assigned to one of five groups (four experimental and one control group). Participants in the four experimental groups were presented with a following hypothetical scenario:



Note. The figure illustrates the sequence of experimental procedures. Exp. Group – experimental group, EA – epistemic authority.

Figure 1 Experimental procedures.

The "World Conference Against Racism" (WCAR) took place from 10 to 15 December 2019. The conference is held annually in 170 countries around the world to present the latest results in the field of racism research, but especially to discuss controversial racist incidents and racism issues that resonate in societies (racial attacks, racial discrimination, migration and racism).

In Slovakia, the conference in Bratislava was devoted to discussing the recent publicized physical attack by a group of Roma men who beat up a young firefighter in the village of Važec. This discussion involved two discussants with differing views on the incident – one defending the group of Roma men and the other defending the young firefighter. The discussion lasted 75 minutes and brought several emotionally tense situations. Both discussants presented a number of logical arguments to support their own views in the discussion.

After reading the scenario, participants were instructed that they will be presented with a profile of one of the two discussants and then will evaluate the validity of 12 arguments he used during the discussion. These 12 arguments were presented in a form of categorical syllogisms that were used for measuring belief bias. The control group received neither a scenario nor a profile and only evaluated the syllogisms immediately after completing the scale measuring generalized trust. For better understanding, we display the experimental procedures in Figure 1.

Experimental Manipulation

The four experimental groups differed in which specific profile of the discussant they were presented with. Firstly, building on the studies by Copeland et al. (2011) and Boucher (2014), we created two sets of information about the discussant in which we manipulated epistemic authority in relation to the topic of racism. Specifically, we have manipulated the signs of trustworthiness by presenting information about discussant's competence in the field of racism, his benevolence and facial expression (Table 1).

Secondly, because previous studies have found that people have higher epistemic trust in in-group members than in out-group members (see Balliet et al., 2014), we have also decided to use the two sets of information about the discussant along with the photo that would show whether he is dark-skinned (and thus out-group) or light-skinned (and thus in-group). The photos used in our study were selected from the standardized Face Stimulus Set (Conley et al., 2018). We chose photos of two men, one light-skinned and one dark-skinned, and for both we chose one photo expressing happiness and one expressing anger. We have thus created a total of four profiles: 1) a dark-skinned man with low epistemic authority, 2) a dark-skinned man with high epistemic authority, 3) a light-skinned man with low epistemic authority and 4) a light-skinned man with high epistemic authority. The complete method with created profiles is available at https://osf.io/yxtgb/?view_only=6bc4a71874ab46d0bec0f86452ab7bdb).

Instruments

Belief Bias

Taking into account the limitations of previous studies (see Bettinghaus et al., 1970; Boucher, 2014; Copeland et al., 2011), we created a set of 12 AII-type syllogisms (see Akama et al., 2020) that were constructed and formulated as arguments of the discussant whose profile was shown to participants. In particular, we created six non-conflict items (three valid believable and three invalid unbelievable) and

Table 1 *Information used for the manipulation of epistemic authority*

Signs of trustworthiness	High epistemic authority profile	Low epistemic authority profile
Competence	Achieved degree: • Mgr. and PhD. degree Occupation: • ethnologist Expertise in racism: • having a doctorate in ethnology and cultural anthropology • member of a board of the organization "People Against Racism" • coordinator of anti-extremism policies • involved in Unicef project on racism • participating in conferences and discussion on racism	Achieved degree: • No degree achieved Occupation: • unemployed Expertise in racism: • graduated from the secondary industrial school of mechanical engineering • presenting controversial racial opinions on Internet • member of a board of the xenophobic organization "Against You" • blogger pointing to the negative effects of Roma assimilation • A signatory of a petition against migrants
Benevolence	Information on helping ethnic groups by involving in education and inclusion of Roma children	Information on activities against inclusion and pointing to the negative effects of Roma assimilation
Facial expression	Happiness	Anger

six conflict items (three valid unbelievable and three invalid believable). Each syllogism was unique and participants were not presented with multiple variants of the same syllogism. We present an example of a syllogism whose conclusion is invalid and believable (the full list of syllogisms is available at https://osf.io/yxtgb/?view_only=01c8e5b4e256488ea9981f5d333707ec):

Premise 1: All voters of extremist parties have radical views.

Premise 2: Some racists have radical views.

Conclusion: Some voters of extremist parties are racists.

Participants' task was to assess the validity of conclusions by indicating whether they logically follow from the two premises or not. Thus, from each participant, we acquired responses about whether each of the 12 conclusions was perceived being 0 = logically invalid or 1 = logically valid. The use of four types of syllogisms (VB – valid believable, VU – valid unbelievable, IB – invalid believable, IU – invalid unbelievable) allowed us to measure belief bias through the widely used interaction index (see Evans et al., 1983). In particular, for all these four categories of syllogisms, we firstly computed how many syllogisms participant evaluated as logically valid. Since three syllogisms were used in all four categories, the score ranged from 0 to 3 for each category. Thereafter, these scores of validity were then computed using the formula (VB - IB) - (VU - IU), in order to calculate the interaction index. The higher the interaction index, the more participants emphasized validity over believability. A negative index indicates that participants rated believable syllo-

gisms as more valid than valid syllogisms and, thus, exhibited belief bias.

Personal Need for Structure

The Personal Need for Structure scale (Thompson et al., 1989) was used to measure personal need for structure. The scale consists of 12 statements (e.g., "*I enjoy having a clear and structured mode of life*") assessed on a six-point Likert scale ranging from 1 = strongly disagree to 6 = strongly agree. The scale measures two factors: desire for structure and response to a lack of structure. A high overall score indicates a strong tendency to prefer certainty and to avoid ambiguous situations. The test of internal consistency showed acceptable reliability (ω = .81).

Manipulation Check and Control Variable

To check whether the experimental manipulation of epistemic authority was successful, participants in experimental groups completed an adapted version of the Trusting beliefs scale (McKnight et al., 2002) to measure the perceived trustworthiness of a discussant. The scale consists of 11 statements that were adapted to ask about the perceived benevolence, integrity, and competence of a discussant (e.g., "*In general, the discussant is very knowledgeable about the racism issue*") assessed on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. The test of internal consistency showed excellent reliability (ω = .94).

Finally, since generalized trust may affect the beliefs about discussant's trustworthiness (e.g., McKnight et al., 2002), we controlled for its effect. We used a General trust scale proposed by Yamagishi and Yamagishi (1994) to measure generalized trust. The scale measures generalized beliefs in the benevolence of human nature and consists of six statements (e.g., "*Most people are basically honest*") assessed on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. The test of internal consistency showed acceptable reliability (ω = .80).

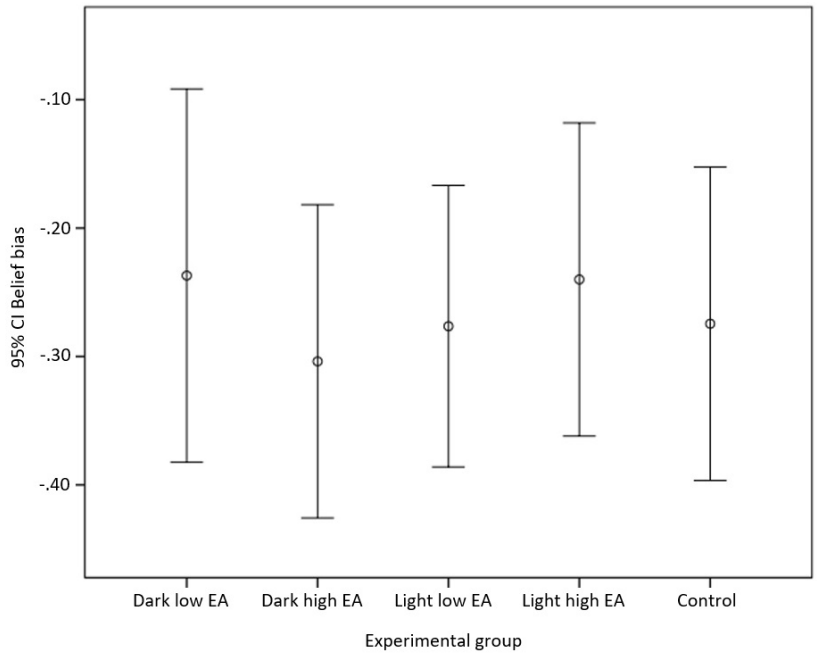
Results

Before examining the effect of epistemic authority on belief bias, we conducted two manipulation checks that showed that the epistemic authority manipulation was successful (see supplementary materials at https://osf.io/yxtgb/?view_only=6bc4a71874ab46d0bec0f86452ab7bdb).

The Effect of Epistemic Authority on Belief Bias

We examined the effect of epistemic authority on belief bias by comparing the average scores in the interaction index for the four experimental groups and the one control group. One-way ANOVA showed non-significant differences in the average scores in the interaction index between the groups ($F(4, 399) = .20$, $p = .94$, $\eta^2 = .002$). The average scores in the interaction index and their 95% confidence intervals for the five groups are presented in Figure 2. It is worth noting that the average scores of all groups had a negative value, indicating that all groups manifested belief bias.

The classical one-way ANOVA resulted in a p-value of .94, which indicates that the null hypothesis, according to which there are no differences between the groups, cannot be rejected. Therefore, we performed the equivalence test using Bayesian one-way ANOVA, which provides information on whether the model with epistemic authority predicts the observed data better than the null model. The Bayes factor indicated extremely strong evidence for H0, BF01 = 146.27, meaning that



Note. The figure presents means and their 95% confidence intervals for the belief bias in four experimental groups and the control group. Dark low EA – dark-skinned discussant with low epistemic authority, Dark high EA – dark-skinned discussant with high epistemic authority, Light low EA – light-skinned discussant with low epistemic authority, Light high EA – light-skinned discussant with high epistemic authority.

Figure 2 Average scores in the interaction index for five groups.

the data were approximately 146 times more likely under H0 than under H+ (see the classification scheme proposed by Wagenmakers et al., 2018). This is an extremely strong indication that the average scores of the interaction index were equal in all groups.

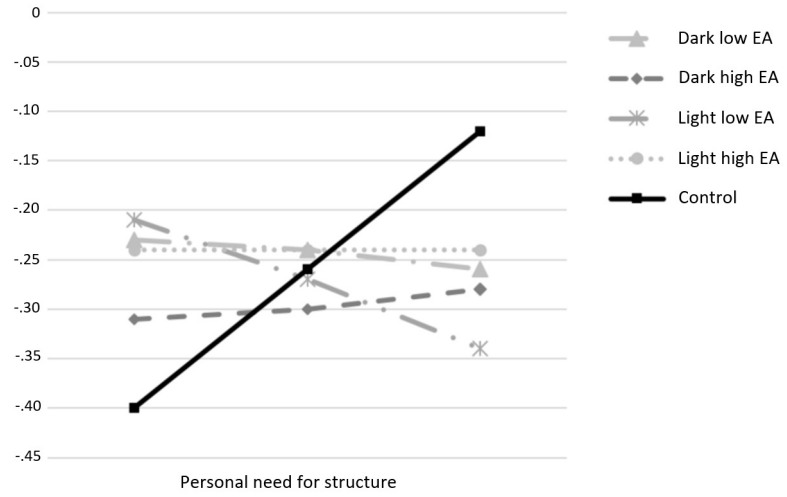
The Moderating Role of Personal Need for Structure

We performed a simple moderation analysis using SPSS macro PROCESS version 3.4 Model 1 (Hayes, 2018) with a bootstrap based on 5000 iterations and a Cribari-Neto heteroskedasticity-consistent estimator to investigate whether personal need for structure moderates the effect of epistemic authority on belief bias. The moderation model was tested with generalized trust that was entered so as to control for its effect. The overall moderation model was not statistically significant ($F(10, 393) = 1.02$, $p = .43$, $R^2 = .02$) and the only predictor significantly predicting belief bias was generalized trust (Table 2). The interaction between personal need for structure and epistemic authority added only negligible explained variance to the model ($F(4, 393) = 1.50$, $p = .20$, $\Delta R^2 = .02$). The conditional ef-

Table 2 *Direct effects and interaction between epistemic authority and personal need for structure on belief bias*

Variable	*b*	*SE*	*t*	*p*	*95% CI [LL, UL]*
Dark low EA	-.24	.75	-.33	.74	[-1.71, 1.23]
Dark high EA	.27	.73	.37	.72	[-1.18, 1.72]
Light low EA	-.11	.73	-.15	.88	[-1.54, 1.32]
Light high EA	-.97	.78	-1.23	.22	[-2.51, .57]
PNS	<-.01	.01	-.15	.88	[-.03, .02]
Dark low EA x PNS	<.01	.01	.26	.80	[-.03, .03]
Dark high EA x PNS	-.01	.01	-.42	.68	[-.04, .02]
Light low EA x PNS	<.01	.01	.16	.87	[-.03, .03]
Light high EA x PNS	.02	.02	1.25	.21	[-.01, .05]
Generalized trust	-.02	.01	-2.18	.03	[-.03, -.001]

Note. Dark low EA – dark-skinned discussant with low epistemic authority, Dark high EA – dark-skinned discussant with high epistemic authority, Light low EA – light-skinned discussant with low epistemic authority, Light high EA – light-skinned discussant with high epistemic authority, PNS – personal need for structure



Note. The figure shows how the effect of the belief bias occurs at three levels of low, medium and high personal need for structure in four experimental groups and one control group. Dark low EA – dark-skinned discussant with low epistemic authority, Dark high EA – dark-skinned discussant with high epistemic authority, Light low EA – light-skinned discussant with low epistemic authority, Light high EA – light-skinned discussant with high epistemic authority.

Figure 3 Conditional effects of personal need for structure on belief bias across five groups.

fects of personal need for structure on belief bias in the five groups (Figure 3) were statistically non-significant ($p > .30$).

Discussion

Epistemic Authority Does Not Affect Belief Bias

Our findings suggest that the epistemic authority of the source is not an important factor for belief bias. Our results are consistent with the study by Bettinghaus et al. (1970), which found no significant effect. Boucher (2014) also found no significant effect across the research sample. The only study that has so far found a significant effect in the entire sample is that of Copeland et al. (2011) and even this study found a rather small effect. Combining this empirical evidence, it seems that the theory of epistemic authority (Kruglanski et al., 2005) may have only a very limited ability to explain belief bias. Although epistemic authority was found to affect the perceived credibility, persuasiveness and acceptance of provided messages and information (e.g., Ilić & Damnjanović, 2021; Lombardi et al., 2014; Petty & Briñol, 2008; Pornpitakpan, 2004; Wilson & Sherrel, 1993), deductive reasoning seems to be robust against this effect.

The question remains as to why deductive reasoning may be free from possible effects of epistemic authority, while informal reasoning is not. One possible explanation may lie in the distinction between *believing* and *knowing* (see Fiedler & Bless, 2000). In particular, the epistemic authority of a source may affect the creation or adoption of beliefs or the acceptance of information because in these situations an individual does not possess perfect knowledge on the topic or there may not even exist a single objective truth. In these situations, an individual takes a certain risk in adopting the proposed idea, goal or argument. In other words, an individual takes "the truth and validity of social communication for granted" (Fiedler & Bless, 2000, p. 144), which is directly and closely related to the perceived validity and credibility of the source. In contrast, deductive reasoning is rather concerned with *knowing* than believing. Syllogistic tasks are rather performance tasks; there exists a one correct answer regarding whether or not the conclusion logically follows from the premises. Irrespective of the source of these tasks, one is required to focus more on "solving" the task, i.e., rely on his or her knowledge and abilities. Although the theory of epistemic authority (Kruglanski et al., 2005) might suggest that relying on a credible source could be a simple strategy with which to stop the complex process of deductive reasoning, people seem to rely mostly on the actual believability of the conclusion without taking the epistemic authority of the source into account.

Personal Need for Structure Does Not Determine the Effect of Epistemic Authority on Belief Bias

To our best knowledge, the present study was the first to hypothesize that personal need for structure may moderate the effect of epistemic authority on belief bias. However, this hypothesis was not supported and the effect of epistemic authority on belief bias was not significant across all levels of personal need for structure. This finding suggests that cognitive struggles with complex tasks among people with high personal need for structure (Sarnataro-Smart, 2013; Wojtowicz & Wojtowicz, 2015) may not apply to tasks for deductive reasoning. Although syllogistic tasks may be cognitively difficult, those with high personal need for structure did not tend to terminate their reasoning by relying on the epistemic authority of the source more than did those

with low levels. Moreover, the increase in personal need for structure was not even associated with the increased susceptibility to belief bias. Our findings, thus, do not correspond to previous studies indicating that cognitive styles determine belief bias (e.g., Bettinghaus et al., 1970; Schubert et al., 2021; Stanovich & West, 2000; Trippas et al., 2015).

The reason for our findings could, again, lie in the specific nature of the deductive reasoning. In particular, people high in personal need for structure tend to lessen their cognitive load through either avoidance strategies or structuring information into simplified forms (Neuberg & Newsom, 1993). These strategies may be easy to use in common everyday social interactions or situations in which an individual is supposed to adopt or form an opinion or belief. In deductive reasoning, however, the application of these strategies may be limited. In addition, the syllogistic tasks are clear and explicit; thus, they may not invoke feelings of uncertainty and people's desire to avoid or terminate their reasoning. Therefore, even though people high in personal need for structure may have a tendency to use simplified heuristic strategies in uncertain situations (e.g., Grežo & Sarmány-Schuller, 2015), they might not feel the pressure to rely on the authority or believability of conclusions merely to quickly end their deductive reasoning. However, since this was the first attempt to examine the association between personal need for structure and deductive reasoning, future research is required to validate our rather speculative explanations.

Practical Implications

Although the present study has rather theoretical contributions, our findings may also provide some implications to practice. Given the epistemic crisis we face in the current "post-truth" era (Neuberger et al., 2023), it is essential for people to correctly evaluate the validity of information in order to avoid falling for potentially misleading and manipulative sources of information. Uncritical reliance on the epistemic authority of a source may be especially problematic, since public authorities (e.g., politicians, media) often try to increase their perceived epistemic authority merely to gain or preserve their dominant position in the field (Riaz et al., 2016). Unfortunately, some of them promote their dominant position through exploiting the public's fear or feelings of threat, leading to hate and prejudice in the society (e.g., Kende & Krekó, 2020). Fortunately, our findings show that our deductive reasoning may be protected from the possible negative effects of both epistemic authority and personal need for structure. However, the less promising message is that, irrespective of the epistemic authority of a source and the personal need for structure, people's deductive abilities generally seem to be very vulnerable to belief bias, since all of our experimental groups were falling to this bias.

Limitations and Future Directions

Despite our best efforts, this study has some limitations. Given the relative novelty of the topic, our study was somewhat specific and narrowly focused, necessitating further research in other areas and contexts. In particular, the sample included only light-skinned people and was thus specific in terms of in-group/out-group manipulation. Furthermore, the experiment was conducted in a specific context of racism. This might represent an emotionally charged content for some people. Unfortunately, we did not measure participants' emotional experience during the experiment. Previous studies have shown that negative emotions can attenuate belief bias during logical reasoning (e.g., Goel & Vartanian, 2010). Although we registered belief bias

in our study, which might indicate that there were no negative emotional reactions to the experimental content, we are not sure whether this was the case and emotions actually did not play a significant role in the null effect of epistemic authority on belief bias. Future studies could therefore provide further evidence using emotionally neutral or positive content.

The limitations also concern the method of measuring deductive reasoning. In particular, our set of syllogisms included only the AII structure type, and the syllogisms that we created might still have been too difficult to understand. Although we aimed to create syllogisms that were as clear and short as possible, they were concerned with the abstract content of racism, which might be more overloading for participants in comparison to classical syllogisms using animals, plants or other concrete concepts. Importantly, using such a restricted set of syllogisms does not allow generalizing our findings to the whole of deductive reasoning. Future studies may try to replicate our findings using other types of syllogisms (see Akama et al., 2020) within different topics. Finally, creating the syllogisms in the context of racism might be the cause of some specific factors, such as personal values, attitudes or political orientation, being partly responsible for our results. Since syllogistic reasoning could be influenced by these factors (e.g., Čavojová et al., 2018), we should control for these effects. Possibly, individuals with liberal or anti-racist attitudes would show a stronger belief bias when confronted with the arguments of a discussant described as an expert on racism fighting this issue in society. Conversely, individuals with conservative or even racist attitudes might show lower belief bias and be insensitive to such an authority. Therefore, future research utilizing such ecologically valid syllogisms should take these factors into account.

Conclusion

Several years ago, Trippas et al. (2015) examined how an analytical cognitive style and cognitive abilities relate to formal deductive reasoning. Their findings are aptly described in the title of the study, formulated as "Better, but still biased […]." They found that an analytical cognitive style and cognitive abilities help to reduce but not entirely eliminate belief bias. Analogous to the title of their study, our findings could be formulated as "Neither better nor worse, just robustly biased." The promising finding of our study is that perceived epistemic authority and personal need for structure did not contribute to the occurrence of belief bias. The gloomy message, however, is that belief bias seems to be a robust pervasive phenomenon and that the majority of individuals seem to fall prey to this bias.

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Author's ORCID
Matúš Grežo
https://orcid.org/0000-0002-3537-2862

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