The debiasing effect of counterfactuals

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Abstract:
People are not fully rational and their decisions are affected by factors such as situational context, emotions, and cognitive capacity. Often, the decision-making situation is unclear, and we do not have enough relevant information. In this case we use shortcuts, which can lead to cognitive biases. Cognitive biases can affect our decision-making processes, and we are not able to make the decision in an unbiased way. They are present in a wide range of situations, and they can affect our job, relationships, and decisions about investments. Subsequently, we can often regret our decisions. Our regret is not the only reason for debiasing. A biased decision-making process can also affect the lives of other people, as a direct result of our wrong decisions. The fact that groups and organizations (Kramer, 1994), forensic specialists (Kassin, Dror, & Kukucka, 2013), investors (Baker & Nofsinger, 2002) lawyers (Wistrich & Rachlinski, 2013) or doctors (Bornstein & Emler, 2001) sometimes make their decisions in a biased way can directly affect decisions about guilt/innocence, in/appropriate treatments and influence everything from our finances to our health. That is the real reason for debiasing. Larrick (2004) defined three kinds of debiasing. The first type of debiasing interventions are motivational practices such as incentives or accountability. The second type of debiasing interventions involves cognitive methods like considering the opposite method, training or counterfactual priming. The third type of debiasing interventions are modern technologies such as the pros and cons lists or group decision-making. We assume that effective debiasing of cognitive biases should be based on cognitive debiasing interventions. The aim of our study was to investigate the effectiveness of counterfactual priming, as a cognitive intervention, in reducing three cognitive biases: confirmation bias, as the tendency to search for information in line with our assumptions, the status quo bias, as the preference of the current state, and the attribution effect, as the tendency to attribute behavior based more on personality than on situational context. Counterfactual priming should create the “what would happen if” kind of thinking. The participants (N = 202) of our between-subject experiment were recruited online. They solved two tasks on cognitive biases: one before (control group) and one after (experimental group) the experimental manipulation. Before the second task, they read a counterfactual scenario (Galinsky & Moskowitz, 2000) as the experimental manipulation. The counterfactual scenario was about Jane, who could have won a trip to Hawaii, had she not changed her seat. After the concert, Jane is thinking about her gains and losses because of changing the seat. For each bias we used the typical research method. The confirmation bias method was inspired by Snyder and Swann (1978), Strachanová and Valuš (2019) and involved a social domain of speed dating, where participants chose from a list of questions to test their hypothesis about the introversion of a fictitious person. 131 participants, 64 from the control group and 67 from the experimental group, solved the confirmation bias task. Participants had to imagine that Teresa is preparing for speed dating and she will have only a few minutes to get to know the fictitious person better so she should choose/prepare questions she would like to ask on the speed date. Participants got the list of questions (5 neutral, 5 extroverted, 5 introverted) and chose the questions Teresa should ask on the speed date in order to determine her assumption. In line with Strachanová and Valuš (2019), we used the fundamental attribution error. This task was solved by 133 participants, from which 71 were in the control group and 62 in the experimental group. Participants had to evaluate the cause of behavior (situation/personality) of a fictitious co-worker, following a short scenario involving the co-worker. Participants answered using the Likert scale, assessing whether the reason for the co-worker’s behavior was a situational circumstance or his/her personality. The status quo bias task was inspired by Samuelson and Zeckhauser (1988) and used in line with
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Dudeková, Kostovičová and Konečný (2017). The task for the status quo was solved by 140 participants, from which 67 were in the experimental group and 73 in the control group. Participants had to choose one of the three investment portfolios, of which one was the default option (status quo) - participants had to imagine that they had inherited property and had to decide whether to keep the investment method as before or change it. We investigated the debiasing effect of counterfactuals on three cognitive biases (status quo, attribution effect, confirmation bias). Although in the confirmation bias participants in the experimental group asked fewer questions regarding introversion, this result was not statistically significant; in the cumulative confirmation bias score counterfactual priming did not decrease this tendency. Similarly, counterfactual priming did not decrease the status quo bias or the fundamental attribution error. In sum, our results show no debiasing effect of counterfactuals in cognitive biases. We discuss the two functions of counterfactuals. Counterfactuals can be upward and downward. Upward counterfactuals have a preparative function, thus thinking of a better result can make us feel bad, but it can improve our results in the future. Downward counterfactuals have an affective function, which can improve coping mechanisms and well-being. It means that counterfactuals can comfort us, but they can cause anxiety and regret as well. Roese (2004) says that downward counterfactuals cause a more positive effect compared to upward counterfactuals. This means that success behavior is influenced by the direction of counterfactuals. The author says that downward counterfactuals (thinking about alternatives worse than reality) make people feel better and upward counterfactuals (thinking about alternatives better than reality) can improve performance. We used mixed counterfactuals in our counterfactual scenario and we primed participants to think about what they lose and what they gain from situations. Subsequent research should examine the effect of counterfactual thinking separately for upward and downward counterfactuals to see its effect on cognitive biases. There are limitations of our research. We did not consider cultural differences in cognitive biases because they are not well-examined. Therefore, in the future a pre-test for cognitive biases methods should be carried out in order to see its functionality in Bulgaria, and the sample size should be bigger. Our research brings new evidence in cognitive biases and debiasing by counterfactual thinking and it expands the field for future research.

Keywords:
Cognitive biases. Counterfactual thinking. Priming. Debiasing. Status quo. Fundamental attribution error. Confirmation bias.

Introduction

Judgment and decision-making are a key part of our lives. Normative models are based on the assumption that the decision-maker has information about all the alternatives and their consequences, rationalizes, tries to maximize benefits, and their preferences are in line with their maximization (Bačová, 2011). However, in solving problems, judging and making decisions in real life, man is not "homo economicus". As a result of mental heuristics – heuristics – often exhibit various cognitive aberrations, the elimination of which is usually difficult. In our work we will deal with three selected cognitive biases; the consequences of which can be serious and far-reaching, especially the possibilities of their minimization.

Although there are many cognitive biases, in this study we are going to investigate the confirmation bias, the status quo bias and the attribution effect. A person with a confirmation bias tends to seek, remember, and interpret data in accordance with the original belief (Nickerson, 1998). For example, if a person disapproves of compulsory vaccinations, they search for information on the Internet not in favor of vaccination and not discussing its benefit, and this prevents them from getting a real overview of the subject and from choosing to make informed choices. Furthermore, people who tend to maintain the status-quo prefer the original option (default), despite having information that makes this option less advantageous than others (Samuelson & Zeckhauser, 1988). An example is a person who refuses to switch banks, even though they know that other banks offer much more favorable terms. And thirdly, the attribution effect manifests itself as a tendency to attribute the causes of events to individual characteristics rather than situational circumstances (Jones & Harris, 1967). For example, if our friend does not succeed in a job interview, we assume that they did not do well or make a good
impression, instead of coming to the conclusion that they could not have succeeded, despite being well prepared and making a good impression, because of the competition from other candidates.

In recent decades, a large part of research in the psychology of decision-making (Kray & Galinsky, 2003; Galinsky & Moskowitz, 2000; Kahn, Luce, & Nowlis, 2006; Kray, Galinsky, & Wong, 2006; Markman, Lindberg, Kray, & Galinsky, 2007; Morewedge, Yoon, Scopelliti, Symborski, Korris, & Kassam, 2015; Strachanová & Valuš, 2019) has been focused on the reduction of cognitive biases – “Debiasing”. Larrick (2004) defined interventions based on motivational practices (incentives, accountability), cognitive methods (counterfactual priming, considering the opposite, training) or modern technologies (pros and cons list, group decision-making). However, extensive studies have led to ambiguous results, when much of the effort to reduce biases has not led to sufficient success, or the methods only function for some variations or to a limited extent (Larrick, 2004). In this research we are going to focus on counterfactual thinking as a cognitive debiasing strategy.

Counterfactual thinking is a mental representation of possible alternatives in the past that are different from the alternative that actually occurred. These are either alternatives better than those that actually occurred or worse than those that actually occurred (Ruiselová, 2009). Therefore, counterfactual priming is based on the consideration of “what would happen if”, that is, considering the alternative development of events. There exist two kinds of counterfactuals: upward and downward. Counterfactual thinking has a functional and dysfunctional side. The functional side is the simulation of the direction and it has an affective (downward counterfactuals – improving of coping mechanisms and well-being) and preparative (upward counterfactuals – thinking of a better result can make us feel bad, but in can improve our results in the future) function (Markman, Karadogan, Lindberg, & Zell, 2009). As part of our underlying studies, Kray and Galinsky (2003) found that triggering the counterfactual mindset improves group decision-making in the context of issues where consideration of the various alternatives is crucial. Galinsky and Moskowitz (2000) used the method of counterfactual priming in the framework of three individual problems for decision-making and problem solving. They found that priming helped reduce the confirmation bias and improved success in solving a puzzle, for the success of which creative thinking was the key. However, counterfactual priming has exacerbated performance in the role of deductive reasoning. Effectiveness of counterfactual priming was also tested by Markman et al. (2009). They found that counterfactual mind-set enhanced performance in analytical tasks and also in creative generation tasks. Strachanová and Valuš (2019) used counterfactual priming on three tendencies – selectively seeking hypothesis-confirming evidence, ignoring alternative explanations, and unwillingness to reconsider the default option. In their study counterfactual priming reduced the tendency to ignore an alternative explanation and hypothesis-confirming evidence. We assume these tendencies to be similar to the status quo bias, confirmation bias, and fundamental attribution error.

**Aims, hypotheses and questions**

Based on the theoretical and methodological backgrounds, we set the following goals and hypotheses to be verified.

**Objective 1:** Test the effect of counterfactual priming on selected cognitive biases.

**Research Hypothesis 1:** Counterfactual priming reduces the confirmation bias.
Research Hypothesis 2: Counterfactual priming reduces the status quo bias.

Research Hypothesis 3: Counterfactual priming reduces the attribution effect.

Methods

Participants and research design

Results of Markman et al. (2009) found effect sizes of counterfactual priming from $d = 0.5$ to $d = 0.97$. We defined the sample size in line with their results of effect size $d = 0.5$. We used G-power for calculating the sample size with the smallest effect size of interest $d = 0.5$ and power 0.80; thus the total sample size was calculated to be at least 102 participants. Using Bonferroni correction, we accepted the limit for the $p$ value of 0.016. Participants were recruited online by the snowball method. We collected responses from 213 participants, but we excluded ($n = 11$) participants with incomplete questionnaires, those who responded „no“ in the attention check and participants aged under 18 years. Our final database contained the responses of 202 people from Bulgaria, who passed the control question for attention and met the age limit of at least 18 years. 28.7% of the sample was male ($n = 58$) and 71.3% female ($n = 144$). The age of participants ranged from 18 to 69 years ($M = 31.06$, $SD = 11.172$). The group was composed of students and graduates of natural and technical disciplines 29.2% ($n = 59$), 37.6% of participants ($n = 76$) studied or graduated from socio-professional departments, and the remaining 33.2% ($n = 67$) were students or graduates of other disciplines (such as art, and sports).

The effect of counterfactual priming on cognitive biases was investigated through a between-subject 3x2 experiment (Figure 1). The experimental intervention was counterfactual priming, so participants completed one of the two types of tasks before counterfactual priming (control group) and the third task was solved after counterfactual priming (experimental group). Therefore, participants were randomly assigned to one of the six control groups (before counterfactual priming – 1A to 3B), or one of the three experimental groups (after counterfactual priming – 1, 2, 3). Specifically, a participant who solved the task for Fundamental attribution error received tasks in the control groups Confirmation bias or Status quo bias. If the participant solved tasks in the status quo control group (1B), they were part of a control group and also a participant in 2B in the experimental group with the status quo task (3A and 3B). So in our between-subject experimental design we had balanced sample sizes of the control and experimental groups.
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**Materials**

The counterfactual scenario was based on the model of the initial study by Galinsky and Moskowitz (2000) and adjusted based on the results of the pre-survey. It involved Jane, who attended a concert, and due to a change of seat, did not win a trip to Hawai. The scenario ended with a reflection of what Jane would have gained if she had resisted changing her seat, and what, on the contrary, would have happened if she had not resisted.

The main stimulus material was 3 problems with cognitive deviations, in addition to which we included the filler tasks.

The problem of the confirmation bias was social (Snyder & Swann, 1978; Strachanová & Valuš, 2019). „Teresa is a single woman without a partner, who is invited by a friend to participate in speed dating (SD = quick date, acquaintance with multiple singles). Teresa is an introvert, who likes spending time at home with a book or a movie and for a partner she would like someone with similar preferences. In the corridor she notices a man who stands alone, scrolls through newspapers and does not seem to want to socialize. Teresa knows that she has only a minute to get to know the person in question and wants to prepare 5 questions because she will not have the opportunity to ask more. She wonders if she correctly assessed this man to be like her - not a social type, but rather an introvert. Which of the following questions should she ask?“ In the context of the so-called "Speed-dating", participants had to choose 5 questions from 10 questions to verify their hypothesis. Half of the questions were in agreement with the assumption, half against it. The propensity for confirmation bias was -5 to +5.

The role of fundamental attribution error (Strachanová & Valuš, 2019), from the work area, consisted of evaluating a colleague: „At work, you have a new colleague with whom you have not yet been able to get acquainted. You know he is very experienced, he performs above average, seems to be highly motivated, he meets deadlines. Sometimes he seems to be friendly and laidback, willingly helping his colleagues. In other cases he is gloomy and closed, and stays away from people. He becomes moody and unpredictable, and his other colleagues do not particularly like him. One day, you have to stay late at work, and you accidentally hear a part

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**Figure 1: Experimental Design**

![Experimental Design Diagram](image-url)
of a conversation of this colleague with his mother. You find out that his mother is very sick, and he has to take care of her, which is not easy. A few days later, the leader of your work team contacts you and asks you to evaluate your new colleague. “The reasons for the moody behavior of colleagues could be attributed to situational circumstances (0) or personality dispositions (6) on a 7-point Likert scale. There were three questions following the fundamental attribution error task, two of them were distractors and one (question about the reason for co-worker’s behavior) measured fundamental attribution error.

As part of the status quo bias (Samuelson & Zeckhauser, 1988; Dudeková, Kostovičová & Konečný, 2017) from the financial domain, participants, after reading information that they have inherited a portfolio from a distant relative, have to consider what to do with the remaining part of the money. Do they stick with the original option or choose another? „Imagine that you have inherited a portfolio from a distant relative, the bulk of which is invested in a medium-risk company A. You have to consider what to do with the remaining part of the money. Do you stick with the original option or do you choose another? Select one option:

a) Original option – a medium-risk Company A. Forecast for the next 3 years: the chance that your stock will rise by 30% is 0.5, the chance that its value will remain the same 0.2 and the risk that its value will fall 20% is 0.3.

b) Investing in a High-Risk Company B. Forecast for the next 3 years: the chance that the value of your shares doubles is 0.4, the chance that their value will remain the same is 0.3 and the risk that their value will fall by 40% is 0.3.

c) Investing in a low-risk company C. Forecast for the next 3 years: the chance that your shares will rise by 20% is 0.7, the chance that their value remains the same 0.2 and the risk that their value will fall by 5% is 0.1. “ Participants expressed the preference for new financial product (0) or default option (1).

**Procedure**

In the online questionnaire, participants first filled out the socio-demographic data (age, gender, focus of current or completed studies). They then solved the task of one of the three cognitive biases. Subsequently, they read the counterfactual scenario and solved another task of three cognitive biases. Participants with missing values were deleted from the analysis. Data were analyzed in statistical program SPSS. After checking the normality (Kolmogor-Smirno, Shapiro-Wilko, skewness and curtosis), if unconfirmed normality was found, we analyzed cardinal variables using the non-parametric Mann-Whitney U-test. For the nominal variables we used Pearson's Chi square.

**Results**

We focus on the results of the main part of the analysis.

**Status quo bias**

The task for status quo bias was solved by 140 participants. Keeping the previous option of investment was chosen by 25.4% (n = 17) members of the control group (n = 67) and 26.0% (n = 19) members of the experimental group (n = 73), which represents an insignificant difference, \( \chi^2 (1) = 0.008; p = 0.929; V = 0.007. \)
**Fundamental attribution error**

The task for fundamental attribution error was solved by 133 participants. Participants in the control group (n = 71) assumed that the reason for the co-worker’s behavior is the situation (Mdn = 6; IQR = 2) just like the participants (n = 62) in the experimental group (Mdn = 6; IQR = 2). We rated 1-3 as "personality dispositions", 4 as "even" and 5-7 as "situational circumstances". Within the representation of these categories, the control and experimental groups were not significantly different, χ² (2) = 5.733; p = 0.057; V = 0.208.

**Confirmation bias**

The task for confirmation bias was solved by 131 participants. Participants in the control group (n = 64) asked on average 0.39 (SD = 1.715) questions concerning introversion. Participants in the experimental group (n = 67) asked on average 0.25 (SD = 1.941) questions concerning introversion. In the cumulative confirmation bias score there was no statistically significant difference between the control and the experimental group U = 2012.0; p = 0.552; rm = 0.003.

**Discussion**

In the work we dealt with the reduction of three cognitive biases by counterfactual priming. Our findings did not support the assumption that counterfactual priming reduces the tendency to confirmation bias (Hypothesis 1). Although participants in the experimental group asked on average fewer questions concerning introversion, the difference was not statistically significant. As far as research issues are concerned, we found that priming did not reduce the attribution effect (Hypothesis 3) and did not affect the status quo bias (Hypothesis 2) either.

Regarding the status quo bias, support for the counterfactual mindset did not play a role in the hypothetical decision about investment, similar to the results found by Strachanová and Valuš (2019). The first explanation is in line with our previous findings concerning the domain specificity of counterfactual thinking (Strachanová & Grežo 2018). Secondly, Montibeller and von Winterfeldt (2015) recommend, as a useful debiasing strategy in status quo bias, showing the logic of symmetry of gains and losses. It is also necessary to point out that the preference for voluntary vaccination does not mean the refusal to vaccinate, and therefore, the preference for the "default" option, despite arguments in favor of the alternative, cannot be described as an irrational choice.

A counterfactual mindset helped people to consider neither the possibilities that support the original assumption nor the opposing alternatives, and neither did it neglect the role of situational factors in assessing the behavior of others. Confirmation bias as well as fundamental attribution error are strategy-based biases (Arkes, 1991), therefore, it would be appropriate to focus on further biases from this category and the impact of the counterfactual priming on other research efforts. Priming is a cognitive debiasing strategy (Larrick, 2004), the effectiveness of which could be supported by other strategies, such as incentive action (Tetlock, 1992). Another explanation of the dysfunction of counterfactual priming is discussed by Markman, Karadogan, Lindberg and Zell (2009). They write about two functions of counterfactual thinking: it comforts and inspires a person or it can cause anxiety and feelings of depression. Roese (2004) distinguish two ways of counterfactuals: upward and downward and says that downward counterfactuals cause a more positive effect in comparison with upward counterfactuals and
that the direction of counterfactuals can influence success behavior. He says that downward counterfactuals make people feel better and upward counterfactuals can improve performance. Our counterfactual scenario primed participants to think about what they lose and what they gain from situations, so it means we used a mixed counterfactual scenario. Further research should compare the debiasing effect of both (upward and downward) counterfactual scenarios but separately, in order to see its debiasing effect in different cognitive biases.

The limitations of our research are multiple. One of them is the sample size could be bigger in order to capture a smaller effect size than 0.5. Another limitation is that we omitted doing pre-testing tasks for cognitive biases measures in Bulgaria, so we did not consider cultural differences (Leung, 1989; Choi & Nisbett, 1998) in cognitive biases, which are not well-examined. Our experiment brings new evidence in investigating the debiasing effect of counterfactual priming in Bulgaria and gives space for another field of investigation in a little-explored area.

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