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Undoing the past in order to lie in the present: counterfactual thinking and deceptive communication

Raluca A. Briazu, Clare R. Walsh, Catherine Deeprose and Giorgio Ganis

School of Psychology, Cognition Institute,

Plymouth University, Plymouth, U.K.

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Corresponding author:

Raluca Briazu

School of Psychology, Plymouth University, Plymouth, Devon, UK.
Email: raluca.briazu@plymouth.ac.uk

Abstract

This paper explores the proposal that there is a close link between counterfactual thinking and lying. Both require the imagination of alternatives to reality and we describe four studies which explore this link. In Study 1 we measured individual differences in both abilities and found that individuals with a tendency to generate counterfactual thoughts were also more likely to generate potential lies. Studies 2 and 3 showed that counterfactual availability influences people's ability to come up with lies and the extent to which they expect others to lie. Study 4 used a behavioural measure of deception to show that people tend to lie more in situations also known to elicit counterfactual thoughts. Overall, the results show that the imagination of alternatives to the past plays an important role in the generation of lies. We discuss the implications for the fields of counterfactual thinking and deception.

Keywords: Counterfactual thinking, lying, deception, social cognition

1. Introduction

Reconsidering our past decisions by wondering what could have been had we chosen differently is a common feature of human thought. The process of undoing past events is termed counterfactual thinking and is characterised by the mental simulation of alternatives to reality. By imagining how things could be different, counterfactual thinking helps us learn from past mistakes, set goals for the future and solve problems (Epstude & Roese, 2008; Smallman & Roese, 2009). Our aim in this paper is to test the idea that imagining alternatives to the past may also be an important part of the process of generating lies[1].

Although the link between counterfactuals and deception has received little attention, some research points towards a positive association between these two processes. Like counterfactuals, lying about the past requires the generation of alternatives to reality which in both cases is achieved through mentally altering previous events (Debey, De Houwer, & Verschuere, 2014; Malone, Adams, Anderson, Ansfield, & DePaulo, 1997) and in both cases these changes tend to be minimal (Byrne, 2016; Vrij, Granhag & Mann, 2010).

Additionally, separate studies in the two areas suggest that the generation of both counterfactuals and deceit rely on the same core component processes of executive function such as inhibitory control and working memory (Drayton, Turley-Ames, & Guajardo, 2011; Gombos, 2006). Age related changes to these executive functions are associated with a decrease in the frequency we engage in both deception and counterfactual thinking (Debey, De Schryver, Logan, Suchotzki, & Verschuere, 2015; Walsh, Deeprose & Briazu, 2016). This can be linked to prefrontal lobe function as populations characterised by prefrontal cortical impairment, such as Parkinson's disease patients, have impairments in both processes (Abe et

[1] The terms lies and deception will be used interchangeably

al., 2009; McNamara, Durso, Brown, & Lynch, 2003). Counterfactual thinking therefore may represent an important process in the generation of lies.

Yet, despite the commonalities between counterfactual thinking and deception, few studies have assessed the potential link. So far studies show that counterfactual reflection can influence the perception of dishonesty (Miller, Visser & Staub, 2005) and the likelihood of engaging in future unrelated unethical acts (Gaspar, Seabright, Reynolds & Yam, 2015). Shalvi, Dana, Handgraaf and De Dreu (2011) also showed that observed alternatives can influence subsequent deception. In their study, participants were asked to declare the outcome of a die roll which only they could see and which determined the value of a monetary prize. Although they were asked to report only the outcome of their first die roll, when they were allowed to roll additional times, participants were more likely to lie. The observation of alternative desirable die rolls (higher than the one initially obtained) brought to mind events that almost happened, thus allowing participants to justify their deception. However in this study, individuals observed additional die rolls and therefore were not required to mentally simulate alternatives whereas most counterfactual thoughts occur automatically through the mental imagination of alternatives (Byrne, 2005).

Therefore the question remains, are counterfactual thoughts and deception associated? If so, how does the stimulation of alternatives to past events influence subsequent deceptive communication? The present work aims to answer these questions by examining the link between counterfactuals and lies using measures which allow for the direct assessment of both processes. By manipulating factors known to stimulate the mental representation of counterfactuals we developed both scenario-based and behavioural measures to assess whether the predisposition to engage in counterfactual thinking is associated with the propensity to deceive (study 1) and to further examine whether changing the availability of counterfactual alternatives impacts on individuals subsequent deceptive responses (study 2

and study 4) and inferences about the likelihood that someone will lie (study 3). Overall the current paper aims to clarify the relationship between imagining alternatives to the past and deceptive communication.

2. Study 1

Our first study focused on the relationship between counterfactuals and deception using an individual differences approach. People differ in the ability and degree to which they engage in counterfactual thought (Allen, Greenlees, & Jones, 2014) and deception (Johnson et al., 2005). As counterfactual thinking and deception have not been assessed simultaneously, we wanted to assess whether these tendencies are related within a single study. We tested people's spontaneous tendency to produce counterfactual thoughts and deception, and also their ability to generate these when cued. If counterfactual thinking and deception share the same underlying processes, then we should find a positive association between the spontaneous tendency to think counterfactually and lie and between the ability to generate counterfactuals and lies when cued. Spontaneous and cued generations are governed by different mechanisms (Gomez-Belderrain, Garcia-Monco, Astigarraga, Gonzalez & Grafman, 2005) therefore we did not expect these to be associated.

2.1. Method

2.1.1. Participants

The participants were 81 undergraduate students who received course credit for their participation. One participant did not complete all the tasks and was therefore excluded from the analysis. The remaining participants (60 female) ranged in age from 18 to 40 years (M = 20.23, SD = 3.20).

2.1.2. Materials and Procedure

Two scenarios were developed based on factors known to affect the mutability of events (e.g. Byrne, 2002; Kahneman & Miller, 1986; Roese & Olson, 1995). Counterfactuals are more likely to follow negative outcomes (Roese, 1997), therefore each scenario described events during which participants were asked to imagine making a series of decisions which lead to an unexpected and bad outcome. Each scenario was followed by questions probing whether participants would be inclined to lie about elements included in the scenarios. As deceptive responses depend on the potential outcome for the liar (ten Brinke & Porter, 2012), one of the scenarios involved a low risk deception opportunity (lying to a neighbour) whilst the other was of higher risk (i.e. lying to the police).

In the 'moving town' scenario, adapted from McEleney and Byrne (2006), participants were asked to imagine moving to a new town and making decisions which result in difficulties meeting new friends. These decisions included: moving town, going to a movie rather than a neighbour's party and buying a new stereo rather than joining the gym with a work colleague.

The 'car incident' scenario was developed specifically for this study. Participants were asked to imagine making a series of decisions which lead to a minor car accident. These included going shopping to a supermarket rather than the corner shop, responding to a phone call whilst driving instead of ignoring it and driving down a new route rather than a more familiar one.

Participants were given a 12 page booklet and responded to all questions in writing. They first received the scenarios in a counterbalanced order. After each one, *spontaneous counterfactual thinking* was elicited by giving them 5 minutes to write a diary page about their imagined experience. After completing both diary pages, we asked questions assessing dishonesty. To measure *spontaneous deception*, participants received two questions for each

scenario. For the ‘moving town’ scenario, participants had to write down anything they would say to their neighbour when meeting them after the party they had failed to attend. They were also asked to write any specific reason they would give for not attending the party. For the ‘car accident scenario’, participants had to write down anything they would say to the police if they were to come to their door and ask about the car accident and anything they would say to the police when questioned whether they had specifically seen anyone damaging the car. No time limit was imposed for answering these questions. *Cued deception* was measured by asking participants to write down all the things they could say if they wanted to mislead the neighbour or police. Finally, *cued counterfactuals* were measured by directly asking how things might have happened differently in each scenario. Throughout the study participants were allowed to look back at the scenarios as often as they wished.

2.1.3. Coding

Spontaneous counterfactuals were coded from the diary page text by two independent raters. Counterfactuals were defined as thoughts about how events in the scenario could have been different (McEleney & Byrne, 2006), for instance, *‘If only I had gone shopping another time, I wouldn’t have hit the car*’. Inter-rater reliability was high for both spontaneous (r = .95) and cued counterfactuals (r = .96). All discrepancies were resolved by discussion.

For spontaneous deception, participants coded their own statements in order to ensure that their deception was intentional and that potentially ambiguous statements (i.e., comments relating to the participant’s own traits and past experiences) could be coded correctly. At the end of the study participants were instructed to look over their written statements in response to the two questions and code each sentence as either a lie or a truth according to the following definition of deception previously used by Serota, Levine, and Boster (2010):

> *'Most people think a lie occurs any time you intentionally try to mislead someone. Some lies are big while others are small; some are completely false statements and others are truths with a few essential details made up or left out. Some lies are obvious, and some are very subtle. Some lies are told for a good reason. Some lies are selfish, other lies protect others. We are interested in all these different types of lies.'*

Participants' classification of sentences into lies and truths was double-checked by one coder against the scenarios themselves. A lie was correctly classified as such only if it contradicted the events as described in the scenarios. Items which were ambiguous, e.g. 'I would be too anxious to go to the party on my own', were assumed to be correctly identified by the participant. Two participants mistakenly classed a truth as a lie and one participant incorrectly classed a statement which contradicted the events as described in the scenario as a truth. These inaccuracies were corrected by the coder. For each scenario, spontaneous and cued deception measures constituted the combined number of unique lies across the open and closed ended questions.

2.2. Results

Outlying cases with z > 3.20 were removed from each of the outcome variables before any other analysis was performed (Tabachnick & Fidell, 2001). Based on this, a total of two participants were excluded, one from each of the outcome variables (less than 2.5% of data in each analysis).

2.2.1. Association between scenarios

Participants responded similarly to both scenarios. We found positive correlations between the two scenarios for measures of spontaneous and cued counterfactuals (r_s = .31,

p = .005; r_s = .33, p = .003 respectively) and for measures of spontaneous and cued lies (r_s = .26, p = .023; r_s = .49, p < .001 respectively). Based on these results we combined the equivalent counterfactual and deception variables.

2.2.2. Association between counterfactual thinking and deception

Table 1 shows the mean number of counterfactuals and lies generated across the two scenarios as well as the correlation between the variables of interest. As predicted, participants who spontaneously generated counterfactuals were more likely to generate spontaneous lies (r_s = .24, p = .034). Similarly, there was a correlation between the number of counterfactuals and lies when both were directly solicited (r_s = .23, p = .042).

Table 1. The mean number of counterfactuals and lies generated in the two combined scenarios together with correlation between these variables

	Range	M (SD)	Correlations r_s		
			1	2	3
1. Total Spontaneous CF	0 to 6	1.73 (1.61)			
2. Total Cued CF	2 to 13	7.10 (2.15)	.06		
3. Total Spontaneous Lies	0 to 9	2.73 (2.00)	**.24***	.14	
4. Total Cued Lies	2 to 15	8.31 (2.56)	-.09	**.23***	.04

The items in bold are our key comparisons. The * indicates that p < .05.

To ensure that this relationship is due to the availability of alternatives and not simply due to writing fluency, we also performed the above correlations partialling out the number of words participants wrote in the diary task. These results were equivalent to the ones previously presented: (r_s = .25, p = .016) and (r_s = .23, p =. 024) for spontaneous and cued thoughts respectively, indicating a relationship independent of verbal fluency.

As predicted, Table 1 also highlights that there was no association between cued and spontaneous generations for either counterfactual statements or deceptive statements. Furthermore, we found no association between cued generations of counterfactual statements and spontaneous deception, or between spontaneous generations of counterfactual statements and cued generations of lies. These findings provide new insight into our understanding of the cognitive factors that permit the construction of deceitful statements..

3. Study 2

Results from our first study show that individuals with a tendency to think counterfactually tend to generate more lies. In Study 2 we examined the link between counterfactuals and deception by testing whether changing the availability of counterfactual alternatives also influences the tendency to lie. We know that our intrinsic honesty is compromised by characteristics of the environment and of the situation we find ourselves in. In environments where the prevalence of rule violation is high people tend to lie more (Gachter & Schultz, 2016), and dishonesty is enhanced if the degree to which the truth needs to be altered is small (Hilbig & Hessler, 2013).

The characteristics of a particular situation also affect the generation of counterfactual thoughts. If the situation is unusual, we tend to think about what would usually happen (Kahneman & Miller, 1986), and when we encounter a near-miss, we tend to think about what almost happened (Kahneman & Tversky, 1982). If generating counterfactuals is an important component in deception, we would expect to find more lies in these situations where counterfactuals are readily available. Study 2 investigated this specific hypothesis using two versions of the scenarios used in the first study, one with a highly available counterfactual alternative and one without. We expected that people will generate more lies

when the events are presented as either unusual or as if they almost didn't happen, due to the increased availability of counterfactuals.

3.1. Method

3.1.1. Participants and Design

One hundred and twenty-two participants (53 female) were recruited online. They ranged in age from 18 to 50 years (M = 24.38, SD = 6.65). The study had a between subjects design and participants were randomly assigned to the low counterfactual condition (n = 60) or to the high counterfactual condition (n = 62). An a priori power analysis showed that 59 participants per condition should have 80% power to detect an effect size Cohen's d of 0.50. We collected data until the close of the day on which the actual sample size reached or exceeded 59 in each condition.

3.1.2. Materials and Procedure

We constructed high counterfactual and low counterfactual versions of the scenarios used in study 1. Participants received either both high counterfactual versions or both low counterfactual versions in a counterbalanced order. As before, participants were asked to imagine themselves in the scenario. To make the differences more salient, each scenario contained only one explicit decision and the two versions of the scenarios differed only in the mutability of that decision. For the 'moving town' scenario, participants were solely presented with the decision to go the cinema rather than the neighbour's party. In the low counterfactual version, the decision to go to the cinema was portrayed as routine (i.e. something done on a regular basis), whilst in the high counterfactual version, the decision to go to the cinema was described as exceptional (i.e. something never done).

After reading the scenario participants had to write down anything they would say to the neighbour if asked why they failed to attend the party. To measure cued deception, they were then asked to list all the lies they could tell the neighbour in that instance.

For the 'car accident' scenario, we manipulated the counterfactual salience of the accident by altering the perceived closeness of the event. In the low counterfactual version, the car that was hit had been parked there for a long time, whilst in the high counterfactual version, the car had only parked there minutes before. After reading the scenario participants had to write anything they would say to the police when they were asked whether they knew anything about the car accident. Following this question participants were also directly asked to list as many lies as they could think of, in order to mislead the police.

Finally, participants completed self-report measures of counterfactual thinking and deception. The Schwartz Regret Scale (Schwartz et al., 2002) and the self-report measure used in Gomez-Beldarrain et al. (2005) study were used to assess aspects of counterfactual thinking and the Serota et al. (2010) measure was used to assess the number of lies participants told in the past 24 hour.

3.1.3. Coding

Two independent raters coded the number of deceptive responses given in response to each of the two scenarios. Deceptive responses were coded based on the same definition used in Study 1 (Serota et al., 2010). Each lie was given a score of 1 and inter-rater reliability was high for both spontaneous (r = .94) and cued deception (r = .96).

3.2. Results

Outlying cases with z > 3.20 were removed from each of the outcome variables before any other analysis was performed (Tabachnick & Fidell, 2001). Based on this, for the spontaneous deception outcome variable, two participants were removed from the low

counterfactual condition and three participants were excluded from the high counterfactual condition, for the cued generations, two participants were removed from the low counterfactual condition (less than 4.06% of data in each analysis).

3.2.1. Baseline counterfactual and deception tendencies

The two groups did not differ in their baseline tendencies to engage in counterfactual thinking as measured with the Schwartz scale (M = 21.97 in the Low CFT condition vs M = 21.35 in the High CFT condition, U = 1776.0, p= .560) or as measured with the Gomez-Belderrain scale (M = 17.54 in the Low CFT condition vs M = 16.66 in the High CFT condition, U = 1742.0, p = .450). Similarly the two groups also did not differ in their in their natural propensity to deceive as indexed by the number of lies they had told in previous 24 hours (M = 4.75 in the Low CFT group vs M = 3.33 in the High CFT group, U = 1625.0, p = .355).

3.2.2. Deception Scores

As shown in Table 2, participants in each condition responded similarly to both scenarios. Based on these results and in a similar manner to study 1 we added the scores for both scenarios in order to analyse the overall deception scores.

Table 2. Mean number of spontaneous deceptive responses per scenario in each condition

	Moving town scenario	Car incident scenario	Z value	P value
Low CFT	.75 (.75)	.71 (.56)	-.405	.686
High CFT	.92 (.78)	1.03 (.73)	-.680	.497

A comparison between the two conditions revealed that participants in the High CFT condition spontaneously produced more lies (M = 1.93, SD = 1.19) than participants in the Low CFT condition (M = 1.47, SD = .92; U =1347.0, p = .025, r = .21). The two groups did

not differ however in cued generations in the Low CFT condition or (M = 4.17, SD = 2.05) in the High CFT condition (M = 3.90, SD = 2.13; U = 1658.0, p = .366). These results show that people tend to be able to generate more lies when a counterfactual alternative is readily available.

4. Study 3

Counterfactuals can influence the way in which we judge others. The contrast between what actually happened and what could have happened can give rise to conclusions about what caused the event and can in turn influences the ascriptions we make in regards to other people's intentions, traits or emotions (Gavanski & Wells, 1989, Kahneman & Tversky, 1982; Knobe, 2010). For example, imagine hearing about Ben, who was attacked while out running. If he took a new route that day then people may readily imagine a scenario in which he took his usual route and wasn't attacked. Exceptional events such as this are often the focus of counterfactual thoughts and as a result are often blamed for unwanted outcomes and can amplify emotional reactions (Kahneman & Miller, 1986). The salience of what could have happened which is brought through by unusual events and near-misses has the ability to bias our judgements.

It then follows, that, if as suggested by our previous studies, lies are more likely in situations where counterfactuals are more readily available, then such circumstances should also influence our perceptions of *other's* intentions to lie. Therefore, the current study tested whether people will also be judged as more likely to lie in situations where counterfactual alternatives are more salient. Miller et al. (2005) have already shown that we tend to judge others as more dishonest if we ourselves imagine how they would have done so under different circumstances. However, in the current study we were interested to see whether

there is a relationship between the protagonist's own counterfactual thoughts and the likelihood that they will be judged as deceptive.

The study was modelled on the Counterfactual Inference Test (CIT; Hooker, Roese & Park, 2000), a multiple choice test used to measure individual's tendency to use available counterfactuals in making affective judgements. In this study, we examined whether available counterfactuals are also used to make judgements about the likelihood that someone will lie.

4.2. Method

4.2.1. Participants

A total of 102 participants (43 female) were recruited and performed the study online. They ranged in age from 18 to 43 (M = 23.71, SD = 5.49).

4.2.2. Materials and Procedure

We generated six scenarios and as in Experiment 2, we used unusual events and near-misses to elicit counterfactual thinking. Each scenario described similar events experienced by two actors which led to the same negative outcome. For half of the scenarios, one action was exceptional and the other routine, for example:

John crashes his dad's car while driving on his usual way home. Bob crashes his dad's car whilst trying a new way home.

The other three scenarios also contained two similar events but one was a near miss whereas the other was not, for example:

Adele and Rachel are taking part in an experiment. They are given a die and told that if they roll a six three times they will win ten pounds. The experimenter cannot see the actual die rolls. Adele rolls two sixes, Rachel rolls one six.

The scenarios also included a third party which could subsequently be the target of an act of deception. In the examples above the third party is the dad and the experimenter respectively. The scenarios were presented twice in two separate blocks. A full set of scenarios are presented in appendix A. The counterfactual questions were administered in one block and the deception questions were administered in a separate block. The two blocks were separated by a set of questionnaires which were not of interest to this study. The order of the blocks was randomised as were the order of the items within the blocks and the order of the response options.

To assess whether participants attributed more counterfactual thoughts to the protagonist that experienced the unusual event or the near-miss, all items asked the following question:

Who spends more time thinking about how things could have been different?

The questions which assessed participants' inferences about the protagonists' honesty all had the following structure:

Who is more likely to lie to x about y?

where x denotes the target of deception in the scenario, and y was the outcome. For the first example above, the question was:

Who is more likely to lie to their dad about crashing the car?

All questions had three response options which were identical for each section. One option was the protagonist associated with the target counterfactual event, another one referred to the alternative protagonist in the scenario and a third final option was 'Same/can't tell'. For the above item the target response option was 'Bob'.

4.2.3. Pilot Study

To check if the new items elicited counterfactual inferences, we pilot-tested the counterfactual questions on a sample of 28 participants. For each item, the majority of participants (68% to 92%) selected the response option that referred to the target counterfactual response. A chi-square analysis for each item revealed that this pattern was significant (χ^2 (2) = 14.48, 21.44, 25.04, 38.96, 29.12, 13.76; all *p*'s <.001). These preliminary results suggest that all items elicited counterfactual inferences in the majority of participants.

4.3. Results

Results were checked for outliers but none were identified therefore all data was included in the analysis. Data was normally distributed therefore we used parametric analysis. Table 3 shows the percentage of participants choosing each response options for the six items. We were specifically interested in the endorsement rates for the target counterfactual options versus the non-target alternative response. Participants were significantly more likely to choose the target option than the non-target option in response to both the counterfactual (67% vs.7%; $\chi^2(1)= 293.13$, $p < .001$) and deception questions (51% vs.13%; $\chi^2(1)= 135.64$, *p*

< .001). This pattern occurred for the counterfactual question in all six scenarios and for the deception question in all scenarios except scenario 6 (see Table 3).

Table 3. Percentage of participants endorsing each response option for the six scenarios.

Scenario No.	Questions	CFT response	Alternative response	Same/ can't tell
1	• Counterfactual	60%	8%	32%
	• Deception	50%	5%	45%
2	• Counterfactual	76%	4%	20%
	• Deception	68%	9%	23%
3	• Counterfactual	80%	10%	10%
	• Deception	76%	11%	19%
4	• Counterfactual	71%	5%	24%
	• Deception	36%	17%	47%
5	• Counterfactual	71%	6%	23%
	• Deception	60%	11%	29%
6	• Counterfactual	44%	10%	46%
	• Deception	21%	27%	52%
Total	• Counterfactual	67%	7%	26%
	• Deception	51%	13%	36%

One explanation for the exception in item 6 may be that the causal link between the event which could be undone (i.e. getting off at the unusual vs usual bus stop) and the

outcome (forgetting the package on the bus) was weaker in comparison to the other items. This highlights the fact that additional factors may be needed for individuals to use counterfactuals to lie.

The results also showed a positive correlation between counterfactual and deception judgements ($r = .39$, $p < .001$). When participants that endorsed the target option for the counterfactual question, they tended to do so for the deception question also.

Overall these results are consistent with the results of our previous studies and suggest that people use counterfactual inferences in order to make judgements relating to dishonesty.

5. Study 4

Our previous studies used a scenario based methodology to assess whether people are more likely to generate lies in situations which tend to elicit counterfactual thoughts. Participants easily and readily engaged with the scenarios as evidenced by their inclusion of names and description of feelings. However, in real life situations, interpersonal deception is dynamic and requires quick responses (Buller & Burgoon, 1996). The current study therefore aimed to test the effect of counterfactual availability on lying in this context.

We wanted to design a paradigm in which we could directly manipulate counterfactual alternatives and where we could directly assess decisions to lie at an individual level. Based on the deception decision task developed by Gneezy, Rockenbach and Serra-Garcia (2013), we designed a game in which participants could lie in order to increase their own benefits with no costs to themselves but potentially at a cost for another. To manipulate counterfactual availability, participants played a game with multiple trials in which they lost by a narrow or wide margin. If deception is influenced by thoughts of how things could have happened differently, people should lie more often in instances where the desired outcome was narrowly missed than in situations where the desired outcome was completely missed.

5.1. Method

5.1.1. Participants

Sixty one participants took part in this study (53 females). Participants ranged in age from 18 to 50 years (M = 21.31, SD = 6.62). All participants were undergraduate students at Plymouth University who received course credit for their participation.

5.1.2. Materials and Procedure

Participants had 24 trials on a slot machine game and their aim was to accumulate as many points as possible. The slot machine had two columns of spinning numbers. Participants pressed a button to stop the numbers spinning and they won if the sum of the numbers matched a target number (ranging from 1-8) which was presented at the top of the screen (see figure 1).

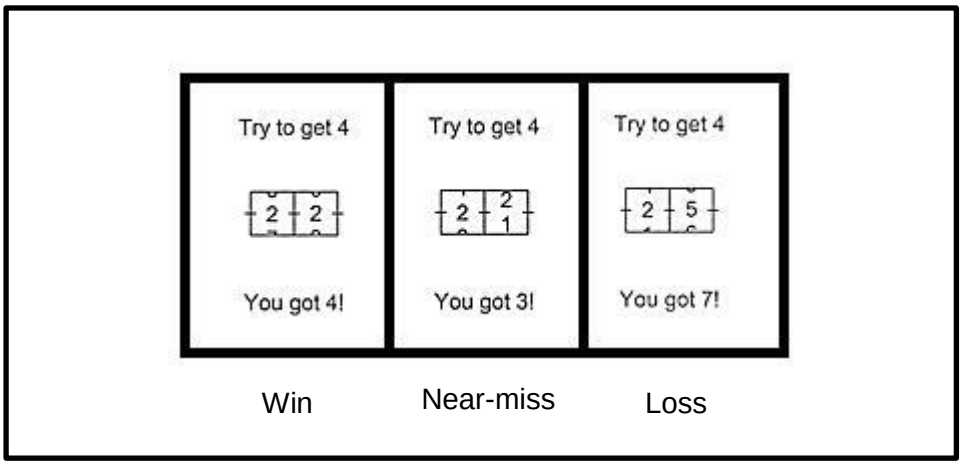

Figure 1. Pre-determined numbers in each condition for target number 4.

There were three types of trials: win, near-miss and loss and each participant received 8 trials of each type. In the *win* condition, the slot machine always stopped on two numbers which correctly added up to the target number. In the *near-miss* condition, one column stopped between two numbers. Participants were told if this happened, then the lower number

would count. In all cases, if the higher number was added to the second number, then the total would have matched the target (see figure 1 for an example). In the *loss* condition, one of the numbers on the slot machine was higher than the target number by one point and the sum of the two numbers was greater than the target by 2 or 3. For similarity with the near-miss condition, on half of the trials one of the columns on the slot machine stopped in between two numbers.

At the end of each trial, the sum of the two numbers was displayed on the screen (see figure 1). In addition, the screen turned green if they won and red if they lost. Participants were then presented with a screen asking them to report whether they had won. They clicked 'Y' for yes and 'N' for no and they received one point each time that they clicked 'Y', regardless of whether they actually won on that trial.

The study was carried out in small groups and participants were told it involved a multi-player game. They were competing against a fictitious player B and the one who accumulated the most points in the slot machine game would win a prize of 15 minutes of participation credit. To encourage participants to tell the truth, they were also told that the game included a third player, C, who could win a prize by judging whether the other players were truthful about their reported wins. They were told that to help participant C, they should tell the truth because previous studies show that this is what they are likely to assume. The full instructions are presented in supplementary materials. To enhance belief in the two fictitious players, participants had a chance to send a short message to them before the game began. In return they also received two messages. The message from participant B read: 'Good luck, but I will try to win this', and the message from participant C read: 'Please let me win, be truthful'. The game commenced after the two messages were displayed.

5.3. Results

Overall, 19 participants (31.1%), were truthful on all trials, and only 8 (13.1%) lied on all trials in which they would have gained from lying. The remaining 34 participants (55.7%) lied on some trials but not others. Most importantly, as predicted, participants lied significantly more in the near-miss condition (M = 3.21, SD = 3.10) than in the loss condition (M = 2.77, SD = 2.83), $t(60) = -2.395$, $p = .020$, d=.31. The result is consistent with our earlier findings which show that counterfactual availability increases the accessibility of lies and in addition shows that individuals will use these lies when given the opportunity.

6. General Discussion

The current paper is the first to directly investigate the influence of counterfactual thinking on deceptive communication. Study 1 showed that individuals with an inclination and ability to think counterfactually are more likely to generate lies. Our results also showed that when counterfactual alternatives are highly available, people are more likely to generate lies (Study 2), to judge that others will lie (Study 3) and to lie to others (Study 4). Overall, the findings from all of the four studies support the positive link between counterfactual thinking and deception and demonstrate that merely imagining an alternative scenario is sufficient to encourage deception.

Counterfactual thoughts represent an account of what might have been and therefore provide a salient alternative which could be used to generate a lie. But, in our studies participants didn't solely use the content of their counterfactual thoughts in generating deceptive responses; therefore the effect of counterfactual thoughts on deceptive communication may be in part through a content-neutral pathway (Epstude & Roese, 2008). Content neutral effects emerge when counterfactual thoughts ignite attentional and cognitive

processes that further influence behaviour independent of the specific information and meaning contained in the original thought. One possibility is that thinking about how a specific event could have been different increases the general availability of alternatives to past events which in turn aids the generation of lies. This is congruent with research which suggests that imagined events enable people to behave as though these were real, even when participants know they were not (Shidlovski, Schul & Mayo, 2014). A potential explanation for this is that lying about imagined events, which are already active in working memory, is cognitively less demanding and thus easier. As noted earlier, working memory is one of the executive functions used in counterfactual thinking and deception (Walsh et al, 2016; Gombos, 2006).

Another executive function which may contribute to the association between deception and counterfactuals is cognitive flexibility, namely the ability to switch between multiple representations. This ability is necessary for counterfactual thought (Guajardo, McNally & Wright, 2016), and it might also help participants to report an experience in different ways, a skill crucial for effective lying (Leins, Fisher & Vrij, 2012).

Creativity has been associated with deception (Gino and Ariely, 2012; but see Niepel, Mustafic, Greiff & Roberts, 2015) and certain types of counterfactual thoughts (Markman, Lindberg, Kray & Galinsky, 2007) and therefore could provide another possible explanation for why individuals who tend to think counterfactually also tend to lie. However, many counterfactual thoughts and lies are not creative (e.g., those that remove an event from a scenario; Gaut, 2003), and therefore this is unlikely to be the full explanation for the results.

Beyond the cognitive links, counterfactual thinking may help to justify deception because events that could have been true may seem more plausible. For example, Shalvi et al. (2011) found that lies about the outcome of a die roll tended to be regarded as less unethical when the lie matched an alternative observed roll. Lies that only differ a little from the truth,

also feel more honest and are judged as more justifiable by others (Lelieveld, Shalvi, & Crone, 2016). Similarly, Schweitzer and Hsee (2002) found that car sellers were more likely to give an exaggerated estimate of the unknown mileage of a car when the estimate fell within a range of possible values. Therefore those who think that things happened nearly as they desired might lie about it more because they believe this is admissible to themselves as well as others.

An additional motivational mechanism to be considered is affect. Counterfactual thoughts are known to elicit a wider range of affective reactions, such as guilt and shame (Neidenthal, Tangney & Gavansky, 1994). Although evidence about affect and subsequent deception is mixed, some studies also suggest that increased post-transgressional guilt can lead to an increase in subsequent deception (DePalma, Madey & Bornschein, 1995). Thus, it could be that counterfactually derived affect also plays a role in the relationship between counterfactuals and deception. All of the hypotheses highlighted above should be investigated in the future.

Independent of the mechanisms that characterise this relationship, our results have implications for the fields of both counterfactual thinking and deception. Firstly, they provide insight into the possible functions of counterfactual thinking. Its primary function is thought to be in helping people to learn from past mistakes and develop intentions for the future (Epstude & Roese, 2008). However, people often generate counterfactuals focussing on uncontrollable events which cannot be used to improve on the past (Ferrante, Girotto, Straga & Walsh, 2013) suggesting that counterfactual thinking may also serve other functions. Our findings suggest that one of those functions is to enable people to deceive. Given that lying can constitute an important phenomenon in interpersonal relationships, with some regarding it as a ‘social lubricant’ (Vrij, 2007), our results highlight the importance of counterfactual thinking for social functioning. The idea is consistent with findings that reasoning serves the

social function to persuade others (Mercier & Sperber, 2011). Secondly, these findings also contribute to the field of deception by helping to identify the processes that underlie it (Gamer & Ambach, 2014). Our current findings suggest that counterfactual thinking is one of those mechanisms. Our study also contributes to the emerging discussion regarding the role of individual differences in lying behaviour. Understanding the elements that characterise a frequent liar is of great relevance to the field of human communication. Currently, most theories of deception specify the role of basic cognitive processes such inhibitory control, working memory and response monitoring (e.g. Walczyck, Roper, Seeman and Humphrey, 2003; Vendemia, Schillaci, Buzan, Green, & Meek, 2009) however studies such as the current one emphasise that in order to develop deception theories we need to also model the interplay between such general mechanisms and individual characteristics.

In conclusion, we provide the first direct link between people's tendency to think about alternatives to the past and lying. As a result we have new insight into how individual differences in the tendency to generate counterfactuals may influence people's behaviour. Furthermore this research also identifies an additional cognitive process involved in deception. Overall, we have provided an initial step towards understanding the link between imagination and lying.

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Appendix A

1. Adele and Rachel are taking part in an experiment. They are given a die and told that if they roll a six three times they will win ten pounds. The experimenter cannot see the actual die rolls. Adele rolls two sixes, Rachel rolls one six.

Counterfactual: Who spends more time thinking about how things could have been different?

Deception: Who is more likely to lie to the experimenter about the number of sixes they threw?

2. Alison and Sarah's parents ask them to be home in time for an important delivery after work. On her way, Alison stops off for a coffee for half an hour, something she usually does on her way home. Sarah also stops off for a coffee for half an hour on her way home although this is something she normally never does. Both of them arrive home just before the delivery was due only to discover that it arrived 5 minutes early and they missed it.

Counterfactual: Who spends more time thinking about how things could have been different?

Deception: Who is more likely to lie to their parents about stopping on the way home?

3. Jenny and Jacqui want to impress their friends by winning a game. In order to win the game they need to achieve a total score of 20 points. Jenny loses the game by 1 point. Jacqui loses the game by 10 points. Jenny and Jacqui's friends don't know what the score actually was.

Counterfactual: Who spends more time thinking about how things could have been different?

Deception: Who is more likely to lie to their friends about winning the game?

4. The day before their friend's birthday Jack and Ed remember that they forgot to send them a birthday card. The last official collection of the post for the day is at 5pm. Both run to the post office but they get there late at 5:15. Jack finds out that the mail had been collected in time 15 min earlier. Ed finds out that the post was collected late, just one minute before they arrived.

Counterfactual: Who spends more time thinking about how things could have been different?

Deception: Who is more likely to lie to their friend about posting the letter on time?

5. John crashes his dad's car while driving on his usual way home. Bob crashes his dad's car whilst trying a new way home.

Counterfactual: Who spends more time thinking about how things could have been different?

Deception: Who is more likely to lie to their dad about crashing the car?

6. Steve and Aaron are asked by a friend to safeguard a valuable object for them. On his way home Steve gets off the bus at his usual bus stop but once the bus is gone realises that he forgot the object on the bus. On his way home Aaron gets off at a different stop from the one he usually gets off at and once the bus is gone realises that he forgot the valuable object on the bus.

Counterfactual: Who spends more time thinking about how things could have been different?

Deception: Who is more likely to lie to their friend about losing the item?

Appendix B

Please read carefully, you may earn an extra ½ point depending on the decisions you and the other participants make!

During this study you will play a game with two others in this room. You will never know who the others are, and they will never know who you are. If you win the extra ½ will be added to your account after the end of the study.

Due to the seat you have chosen, you will be person A. At the beginning of the game you will randomly be matched with two other people called person B and person C. The aim of the game is for you to gain more points than person B. Only ONE of you will get to win the extra ½ point. The winner will be the person who wins the most points. Points are earned in the following way:

In each of the 24 rounds you will be given a number. In order to gain a point, you need to spin a slot machine and get the two numbers on the machine to add up to the target number. For example, if you are assigned a 2, you need to spin either a 0 and a 2 OR a 1 and a 1. If the numbers that you spin don't add up to the target number, you get no points. Also, if the slot machine stops in between numbers, the smaller number of the two will count. In each round, the computer will display the sum of the numbers you scored, and colours will indicate whether the round was lost or won, red for a loss, green for a win.

At the end of each round, you will be asked to report whether you won or lost the round. CRUCIALLY, clicking 'Y' (for yes), will ALWAYS gain you a point (even if the two numbers do not add up to the target number). However, by clicking 'Y' when the numbers do not add up to the target number you will be negatively impacting person C.

This is because person C will get to win ½ point only if they correctly identify the truthfulness of your messages. If you report a win and this is false, and person C chooses to class it as truthful, they lose a point. From our previous studies we know that the only sure way to help person C win is to be truthful, this is because in most cases person C will most likely start with the assumption that the other players will tell the truth. However, this could affect your own win.

In summary, you have to compete against player B, and win more points in order to win the extra participation point, however you can also help or hinder participant C's chances of winning depending on the messages you choose to send.

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