Counterfactual Promises and Threats

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Abstract

We examine counterfactual conditionals about promises, such as 'if you had tidied your room then I would have given you ice-cream' and threats such as 'if you had hit your sister then I would have grounded you'. Reasoners tend to understand counterfactual conditionals of the form, 'if A had been then B would have been' by thinking about the conjectured possibility, 'A and B', and also the presupposed facts 'not-A and not-B'. We report the results of an experiment that indicates reasoners may understand counterfactual inducements somewhat differently by thinking about just the presupposed facts: not-A and not-B. We discuss the implications of the results for accounts of the mental representations of promises and threats

Conditional Inference

When thinking about the past people often think about how things could have turned out differently, e.g., 'if I had left earlier I would have arrived on time for the talk' (e.g., Kahneman & Tversky, 1982; Byrne, 2002). Counterfactual thoughts are implicated in emotions such as regret and social ascriptions such as blame, and they play a role in learning (Roese, 1994), reasoning (Johnson-Laird & Byrne, 1991) and problem solving (Ginsberg, 1986). Counterfactual conditionals have been studied by philosophers (e.g., Stalnaker, 1968), linguists (Angeliki & Dirven, 1997), psychologists (Kahneman & Miller, 1986) and in artificial intelligence (Costello & McCarthy, 1999).

Counterfactual thoughts often focus on how an action could have changed an outcome, e.g. 'if I had arrived earlier I could have prevented the accident'. Little is known about how people reason about past actions and their outcomes. We address actions and their outcomes by examining inducements, i.e., threats and promises. Threats and promises draw attention to an action and its consequence. When a speaker utters a threat, he or she tries to dissuade the hearer from taking an action, and emphasises its negative consequence. When a speaker utters a promise, he or she tries to persuade the hearer to take an action, and emphasises its positive consequence. The aim of this paper is to investigate how people reason about past actions and their positive and negative outcomes and to do so we focus on counterfactual conditionals about promises and threats and we examine the inferences that people make from them

First, we outline the way in which people understand factual and counterfactual conditionals about neutral matters, e.g. 'if Rosanna was in Dublin then Tony was in Vancouver'. Second, we consider how people understand factual and counterfactual conditionals about promises and threats. Third, we discuss the results of an experiment that compared inferences from factual and counterfactual promises and threats.

Factual Conditionals

Suppose you are told 'if Rosanna was in Dublin then Tony was in Vancouver'. And suppose you discover that Tony was not in Vancouver. What can you conclude? People find this 'modus tollens' inference difficult to make. About half of the participants given these premises in experiments conclude that nothing follows. The other half concludes that Rosanna was not in Dublin (see Evans, Newstead & Byrne, 1993). What sorts of mental representations and cognitive processes underlie the inference? One view is that people make conditional inferences by recovering the abstract logical form of the premises, 'if A then B' and 'not-B', and they access a mental repertoire of formal rules of inference to construct a derivation or proof of a conclusion (Braine & O'Brien, 1998). The 'modus tollens' inference is difficult on this account because people do not have an inference rule directly corresponding to it and so they must construct an indirect derivation. Another view is that people make conditional inferences by accessing domain-specific schema which contain content-sensitive rules about certain situations, such as permission situations, or causal situations (Fiddick, Cosmides & Tooby, 2000). The 'modus tollens' inference is difficult on this account because its neutral content does not readily map onto any of the domain-specific schema. A third view is that people make conditional inferences by imagining possibilities (Johnson-Laird & Byrne, 2002). The conditional is consistent with several possibilities, for example, Rosanna is in Dublin and Tony is in Vancouver (A and B), Rosanna is not in Dublin and Tony is not in Vancouver (not A and not B), and Rosanna is not in Dublin and Tony is in Vancouver (not A and B). A key principle of this account is that people keep in mind only true possibilities. They do not keep in mind the false possibility, Rosanna is in Dublin and Tony is not in Vancouver (A and not B). A second key principle of this account is that people keep in mind few possibilities,

because of the constraints of working memory. They may understand the conditional by thinking initially about just a single possibility, Rosanna is in Dublin and Tony is in Vancouver (A and B). Their interpretation is not entirely conjunctive however, and they may make a mental note that there may be alternative possibilities to this one (see Table 1 below).

Table 1: Initial and explicit possibilities for the conditional 'if A then B'

Initial Possibilities	Explicit Possibilities
A and B	A and B
…	Not A and not B
	Not A and B

Key: The three dots indicate a mental footnote that there may be alternative possibilities

The 'modus tollens' inference is difficult on this account because the information that Tony was not in Vancouver does not fit in with the single possibility that people have thought about initially to understand the conditional. To make the inference, people must 'flesh out' their understanding of the conditional to think about the alternative possibilities. When they think about the possibility that Rosanna is not in Dublin and Tony is not in Vancouver, they can match the information that Tony is not in Vancouver to the information in this possibility and conclude that Rosanna is not in Dublin.

Counterfactual Conditionals

What mental representations and cognitive processes underlie counterfactual conditionals such as 'if Rosanna had been in Dublin then Tony would have been in Vancouver'? The model theory provides the only corroborated account of counterfactual conditionals (Byrne & Tasso, 1999). The subjunctive mood of the counterfactual conveys the presupposition that in fact Rosanna was not in Dublin (not A) and Tony was not in Vancouver (not B) (Fillenbaum, 1974). According to the model theory, people keep in mind two possibilities from the outset to understand the counterfactual conditional, the conjecture, 'Rosanna was in Dublin and Tony was in Vancouver' (A and B) and the presupposed facts 'Rosanna was not in Dublin and Tony was not in Vancouver' (not-A and not-B) (see Table 2). In fact, people often interpret that someone uttering the counterfactual 'if A had been then B would have been' means to imply 'not-A' and 'not-B' (Thompson & Byrne, 2002). They are readily primed to read more quickly the negative conjunction 'not A and not B' when they have first read a counterfactual compared to when they have first read a factual conditional (Santamaria, Espino, & Byrne, in press).

The model theory predicts that reasoners should be able to make the inferences that require access to the not-A and not-B possibility more readily from counterfactuals compared to factual conditionals. For example, people should be able to make the otherwise difficult 'modus tollens' inference, given the counterfactual conditional. The prediction has been corroborated (Byrne & Tasso, 1999). Byrne & Tasso (1999) found that reasoners make more 'modus tollens' inferences from counterfactual than factual conditionals. This finding is difficult for other theories of reasoning to explain. For example, according to formal rule theories (e.g., Braine & O'Brien, 1998) the logical structure of factual and counterfactual conditionals is the same (i.e., if A then B). Therefore, this theory is unable to explain the difference in the rate of 'modus tollens' inferences from factual and counterfactual conditionals.

Table 2: Initial possibilities for a factual and a counterfactual conditional

Factual 'if A then B'	Counterfactual 'if A had been then B would have been'
A and B	Conjecture: A and B
…	Facts: Not A and not B
	…

Four sorts of inferences from conditionals are usually examined (see Table 3). Two are negative, the 'modus tollens' (MT) inference, typically endorsed between 40% and 80% of the time, and an inference known as the 'denial of the antecedent' (DA), typically endorsed between 23% and 75% of the time (Evans, et al., 1993). Given 'Rosanna was not in Dublin' many people infer that 'Tony was not in Vancouver'. To make the inferences, reasoners must think about the negative possibility (not-A and not-B). People make more of these negative inferences from a counterfactual than from a factual conditional, which corroborates the suggestion that they think about the negative possibility more readily for the counterfactual than the factual.

Table 3: Four inferences from 'if A then B'

	Affirmative	Negative
Forward	A, therefore B (MP)	not A, therefore not B (DA)
Backward	B, therefore A (AC)	not B, therefore not A (MT)

Two other inferences are affirmative. The 'modus ponens' (MP) inference is to infer 'Tony was in Vancouver' from the information that 'Rosanna was in Dublin' and this inferences is endorsed almost universally (Evans, el al., 1993). The affirmation of the consequent (AC) inference is to infer 'Rosanna was in Dublin' from the information that 'Tony was in Vancouver' and is typically endorsed between 23% and 75% of the time (Evans, et al., 1993). To make the inferences, reasoners must think about the affirmative possibility (A and B). As predicted they make the same frequency of the inferences that require access to the

affirmative possibility which corroborates the suggestion that they think about the affirmative possibility for both the counterfactual and the factual.

The differences for factual and counterfactual conditionals have been observed for conditionals about neutral matters, and also for conditionals about causal matters, such as 'if the butter had been heated it would have melted' and definitional matters, such as 'if the animal had been warm-blooded it would have been a mammal' (Thompson & Byrne, 2002). The content of a conditional has a great influence on the inferences that people make from it (Evans, Newstead & Byrne, 1993). Recent research on counterfactual conditionals suggests that their content also influences the inferences that people make from them (Quelhas & Byrne, 2003). Our aim is to examine the inferences that reasoners make from counterfactual conditionals about threats and promises, which have never been examined before.

Promises and Threats

Promises and threats are inducements to act. Promises and threats are a type of speech act (Searle, 1969) in that the hearer must understand the intention of the speaker. Because language is intentional behaviour it may be considered to be a form of action. When a speaker utters a promise, they are performing an act, the act of promising. Promises and threat regularly occur in everyday language in a variety of situations.

What sorts of inferences do people make from promises and threats? People tend to make the four inferences (outlined in Table 3) very often from factual conditionals about promises and threats such as 'if you wash the car then I will let you borrow it later' (Newstead, Ellis, Evans & Dennis, 1997). People may make inferences readily from such conditionals because the speaker has a high degree of control over the outcome (e.g., a parent has the power to reward or punish the child's action) (Evans & Twyman-Musgrove, 1998). People tend to make more inferences from promises and threats for which the speaker has a high level of control over the outcome (e.g., if you wash the car then I'll let you borrow it later) compared to promises and threats for which the speaker had a low level of control over the outcome (e.g., if you wash the dishes then Mum will give you some money) (Evans & Twyman-Musgrove, 1998).

We developed an account of the possibilities that reasoners must keep in mind to understand factual promises and threats and counterfactual promises and threats. We outline the account and it's predictions for factual promises, factual threats, counterfactual promises and counterfactual threats, in that order.

The intention of the speaker differs for promises and threats. For promises the intention of the speaker is to encourage the action by offering a reward, e.g. 'if you are good then I will buy you ice-cream'. The intention is made explicit: the speaker wants the hearer to be good. We expect that for the hearer to understand a promise, they must keep in mind the action (being good), and the outcome (ice-cream) (Egan & Byrne, 2006). They may keep in mind a single possibility, corresponding to what is mentioned in the conditional, being good and getting ice-cream (A and B). Accordingly, we predict that people will make more affirmative inferences (MP and AC) than negative inferences (MT and DA) from factual promises.

For threats the intention of the speaker is to discourage an action by punishing it, e.g. 'if you are bold then I will ground you'. The intention is implicit: the speaker wants the hearer *not* to be bold. We expect that for the hearer to understand a threat they must also keep in mind the opposite of what the speaker has said, that is, the negated action (not being bold) and the negated outcome (not being grounded) (Egan & Byrne, 2006). They may keep in mind not only the affirmative possibility but also the negative one, corresponding to the opposite of the elements mentioned in the conditional, not being bold and not being grounded (not-A and not-B). Accordingly we predicted that participants should endorse similar rates of affirmative (MP and AC) and negative (MT and DA) inferences for factual threats.

Promises and threats are generally uttered by a speaker in an attempt to manipulate the future behaviour of the hearer. But counterfactual conditionals about promises and threats are different. A counterfactual conditional about a promise, e.g., 'if you had been good I would have given you ice-cream' conveys the presupposed facts that you were not good and I did not give you ice-cream. The counterfactual conditional conveys the presupposition that the behaviour that the speaker wanted to promote has not occurred (you were not good) and the positive outcome did not occur either (no ice-cream). The counterfactual conditional about a promise refers to a past action and outcome and so it is at best an indirect attempt to manipulate future behaviour. For counterfactual conditionals about promises (e.g. if you had been good then I would have given you ice-cream) we expect that people will think about two possibilities: the conjecture mentioned in the conditional (e.g. be good and get ice-cream) and the presupposed facts (e.g. not being good and not getting ice-cream). We predicted that people would make the same frequency of affirmative (MP and AC) and negative (MT and DA) inferences from counterfactual conditionals about promises.

Likewise, a counterfactual conditional about a threat, 'if you had been bold then I would have grounded you' conveys the presupposed facts that you were not bold and I did not ground you. The behaviour the speaker wanted to prevent has not occurred (you were not bold) and the negative outcome did not occur either (no grounding). Nonetheless counterfactual conditionals about promises and threats may continue to have illocutionary force with regard to future behaviour. For counterfactual conditionals about threats (e.g. if you had been bold then I would have grounded you) we expect that people will think about two possibilities: the conjecture (be bold and get grounded) and the presupposed facts (not being bold and not getting grounded). We predicted that people would make the same

frequency of affirmative (MP and AC) and negative (MT and DA) inferences from counterfactual conditionals about threats.

Table 4. Summary of proposed possibilities people keep in mind for factual and counterfactual promises and threats

	Promise	Threat
Factual	A and B	A and B
	…	Not A and not B
		…
Counter	A and B	A and B
-factual	Not A and not B	Not A and not B
	…	…

In the experiment we test these four sets of predictions regarding the possibilities reasoners keep in mind for factual and counterfactual promises and threats. We also explore the function of counterfactual promises and threats in relation to their potential influence on future behaviour.

A Comparison of Inferences from Promises and Threats

We gave 68 participants a set of 24 problems. Each problem consisted of a conditionals premise (e.g., Laura's mother said to her "If you mow the lawn then I will pay you 10 euro") a minor premise (e.g., Laura mowed the lawn) and a set of three conclusions participants could chose from (e.g., Therefore (a) Laura's mother paid her 10 euro; (b) Laura's mother did not pay her 10 euro; (c) Laura's mother may or may not have paid her 10 euro).

Each participant received a set of problems with either factual or counterfactual conditionals (or one of two control conditionals – for more details see Egan & Byrne, 2006). The content of the problems was based on parents promising their children a reward or threatening them with a punishment. Each set of problems contained 12 promises (e.g. if you fold the clothes then I will take you to the carnival) and 12 threats (e.g. if you leave food on your plate then I will make you load the dishwasher). Each type of inference (MP, MT, DA, AC) was presented three times for both promises and threats (i.e. 4 inferences x 3 instances x 2 inducement types (promises/threats) = 24 problems).

We tested the participants individually and presented the problems on Macintosh computers using SuperLab 1.75. Participants pressed the space bar to view each new piece of information (the conditional, the minor premise, the conclusion set), and each remained on screen to be joined by the additional information. Participants were advised that they could take as long as they needed to complete the task but that they were being timed.

Once the 24 inference problems were completed participants were presented with a prediction task to explore the function of counterfactual inducements. This task consisted of two problems: one counterfactual promise and one counterfactual threat. For example, participants were presented with a counterfactual promise such as *Gemma's father said to her "if you had been bold then I would have grounded you"* and were then asked *Do you think that if Gemma is bold tomorrow then her father ground her?* Participants could select an answer from the options 'yes', 'no' and 'can't tell'.

The participants were recruited from Dublin University's psychology department's participant panel (members of the general public recruited through newspaper advertisements) and they were assigned at random to the factual (n = 16) or counterfactual (n = 19) groups, or to one of two controls: past factual (n = 17) or the present subjunctive (n = 16) (see (Egan & Byrne, 2006, for these results).

Inferences Endorsements

The results supported our predictions for factual promises and threats (see Table 5). Overall people made reliably more affirmative inferences than negative inferences (95% versus 69%) for factual promises. The result corroborates the suggestion that reasoners initially keep in mind a single possibility (A and B) when they understand a factual promise. As predicted for factual threats however there were no reliable differences in the frequency of affirmative and negative inferences (83% versus 77%). This result supports our suggestion that reasoners keep in mind two possibilities (A and B, and not-A and not-B) when they understand a factual threat.

For both counterfactual promises and threats we predicted that there would be no differences between the affirmative and negative inferences. Unexpectedly, the results did not support this prediction. The results showed that people made more negative than affirmative inferences from both counterfactual promises (86% versus 66%) and counterfactual threats (86% versus 67%). The result may indicate that people initially keep in mind a single possibility, the presupposed facts (not A and not B), when thinking about a counterfactual inducement. They do not keep in mind from the outset the conjecture mentioned in the conditional (A and B).

Table 5: Percentages of inferences endorsed from factual and counterfactual promises and threats

		MP	AC	MT	DA	*Affirm-ative*	*Neg-ative*
Factual	Promise	94	96	69	69	*95*	*69*
	Threat	88	77	75	79	*83*	*77*
Counter	Promise	67	65	89	82	*66*	*86*
factual	Threat	65	68	84	88	*67*	*86*

The prediction task explored the function of counterfactual inducements and the role they may play in conversation.

The majority of people said they could not tell whether or not the child would still be punished tomorrow and there was no difference in the rates between promises (63%) and

threats (57%) (see Table 6). However, for a threat a sizeable minority (32%) thought that the child would be punished if they were bold tomorrow, twice as many as thought that the child would still be given a reward tomorrow in the case of a counterfactual promise (15%, e.g., if you had mowed the lawn then I would have paid you 10 euro).

Table 6: Percentages of responses on the prediction task

	Yes	No	Can't tell
Threat	32	11	57
Promise	15	22	63

Promises and threats are typically phrased with a present tense antecedent and a future tense consequent and their function is to manipulate the future behaviour of the hearer by rewarding or punishing an action or non action (e.g., if you are bold then I will ground you). However, counterfactual promises and threats cannot directly manipulate future behaviour because they are in the past tense and the action or non-action is presupposed to have already taken place (e.g. if you had been bold…). Although counterfactual inducements are in the past tense, it appears that they may still play a role in influencing the future actions of the hearer, and this effect seems to be slightly stronger for counterfactual threats than promises.

It may be that in uttering a counterfactual threat (e.g., if you had been bold then I would have grounded you) a parent wants to draw a child's attention to what nearly happened (e.g., being grounded) in case the child does not realise the potential outcome of being bold. The aim of this utterance may be to serve as a warning to the child in a future situation. A similar account may be provided for counterfactual promises (e.g., if you had mowed the lawn then I would have paid you 10 euro) although our experiment suggests that their influence on future behaviour is not as strong as counterfactual threats. Nonetheless, it may be that counterfactual promises serve as a general guide to future behaviour (e.g., be good and you will be rewarded) rather than as a specific instruction (e.g., if you mow the grass tomorrow then I will pay you 10 euro). It may be that a parent's aim when uttering a counterfactual promise is to draw the child's attention to the missed opportunity, or perhaps to make them feel guilty about not helping out with chores for example. The negative feelings of regret and guilt might make the child more likely to help out in future.

Conclusions

The results of the experiment support the idea that people understand and reason differently from factual promises and threats. Reasoners make more affirmative inferences than negative inferences from promises, but they make the same frequency of affirmative and negative inferences from threats. Our findings support the suggestion that reasoners initially keep a single affirmative possibility in mind (A and B) from the outset for factual promises but two possibilities in mind (A and B, not A and not B) from the outset for factual threats. Although linguists (e.g., Fillenbaum, 1976) have drawn distinctions between promises and threats (e.g., in their natural rephrasing) previous psychological research has focused more on comparing reasoning from promises and threats to other types of contents (e.g., advice) rather than to each other (e.g., Newstead *et al.*, 1997; Evans & Twyman-Musgrove, 1998; Ohm & Thompson, 2004). This experiment provides a first indication that there may be important differences between promises and threats in the inferences that individuals are willing to draw from them.

Counterfactual conditionals about promises and threats are understood differently from factual conditionals about promises and threats. We found that people tend to make more negative inferences than affirmative inferences from them. The result indicates that people may tend to think about a single possibility, the negative one (not-A and not-B). One suggestion is that reasoners focus on the negative possibility because it refers to the presupposed factual situation that is implied by the counterfactual conditional to have actually happened (e.g., Thompson & Byrne, 2002). Perhaps the use of a realistic content such as inducements encourages people to focus more on what actually happened (not A and not B) rather than on the counterfactual conjecture (A and B).

Our exploration of inducements has provided the first account of counterfactual promises and threats and shows that people keep similar possibilities in mind for both, based on what is presupposed by the conditional (i.e., not A and not B). We have also provided an account of factual promises and threats. For factual promises reasoners seem to initially keep just an affirmative possibility in mind (A and B) but for factual threats they keep both an affirmative and a negative possibility in mind (A and B, not A and not B) from the outset. Our research has also revealed that counterfactual inducements may have a role to play in influencing future behaviour. Many judgements and decisions to act in everyday life are based on whether or not the outcome will be beneficial or detrimental. Hence, and understanding of reasoning about promises and threats may have important implications for how people reason in their daily lives.

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