
Counterfactual and Prefactual Conditionals

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Abstract We consider reasoning about prefactual possibilities in the future, for example, “if I were to win the lottery next year I would buy a yacht” and counterfactual possibilities, for example, “if I had won the lottery last year, I would have bought a yacht.” People may reason about indicative conditionals, for example, “if I won the lottery I bought a yacht” by keeping in mind a few true possibilities, for example, “I won the lottery and I bought a yacht.” They understand counterfactuals by keeping in mind two possibilities, the conjecture, “I won the lottery and I bought a yacht” and the presupposed facts, “I did not win the lottery and I did not buy a yacht.” We report the results of three experiments on prefactuals that examine what people judge them to imply, the possibilities they judge to be consistent with them, and the inferences they judge to follow from them. The results show that reasoners keep a single possibility in mind to understand a prefactual.

Counterfactuals and Prefactuals

Hypothetical thought is a key characteristic of human endeavour. The ability to plan and speculate is important for political and social advancement as well as scientific discovery (Johnson-Laird & Byrne, 1991). Hypothetical ideas often rest on thoughts of “if...” and conditional reasoning occupies centre stage in the study of deduction. Many studies of conditional reasoning examine the inferences that reasoners make from conditionals, for example:

If there was water on Mars then the planet was capable of sustaining life. (1)

People readily make the modus ponens inference from “there was water on Mars” to “the planet was capable of sustaining life” (Evans, Newstead, & Byrne, 1993). Many make the affirmation of the consequent inference, from “the planet was capable of sustaining life” to “there was water on Mars.” People find it harder to make the modus tollens inference, from “the planet was not capable of sustaining life” to “there was no water on Mars,” and the denial of the antecedent

inference, from “there was no water on Mars” to “the planet was not capable of sustaining life.”

Studies of conditional inference have been limited by two factors. First, most have focused on the indicative or “certain” mood as in example 1. But people generate counterfactual conditionals in the subjunctive or “speculative” mood, for example:

If there had been water on Mars then the planet would have been capable of sustaining life. (2)

Thinking about what might have been is common in everyday life, especially after bad outcomes (see Byrne, 2002 for a review). Counterfactuals can help people to prevent bad outcomes from re-occurring, and to feel better (Roese & Olson, 1995). Second, most studies have focused on conditionals about the present or past (Evans et al., 1993). But people often engage in conditional reasoning when they generate hypotheses or predictions about the future. There have been few studies that focus on future tense conditionals, but one recent study indicates that reasoners make the same inferences from past and future conditionals (Schaeken, Schroyens, & Dieussaert, 2001). In fact, many “what if...” speculations are not only about the future but are also in the “uncertain” subjunctive mood. Our aim in this paper is to consider such “prefactuals”, for example:

If water were discovered on Mars in the future, then people would inhabit the planet one day. (3)

We will report the results of three experiments on how people understand and reason from prefactuals. First we sketch an explanation of how people reason about indicative conditionals and counterfactuals.

Indicative and Counterfactual Conditionals

One view is that people reason from conditionals, for example:

If Mark used tomatoes in the sauce then Fred used basil (4)

by keeping in mind possibilities (Johnson-Laird & Byrne, 1991, 2002). They think about true possibilities, for example, “Mark used tomatoes and Fred used basil.” They do not think about false possibilities, for example, “Mark used tomatoes and Fred did not use basil” (Johnson-Laird & Byrne, 2002). They think about just a few true possibilities. They are aware that there may be alternatives and their interpretation is not merely conjunctive. However, they do not think about the alternatives from the outset. They keep in mind few possibilities because of the limits of working memory (Johnson-Laird & Byrne, 1991).

Reasoners can think about other true possibilities. On one common interpretation, the biconditional, they consider two possibilities to be true. “Mark used tomatoes and Fred used basil,” and “Mark did not use tomatoes and Fred did not use basil.” On another, the conditional, they consider a third possibility to be true as well, “Mark did not use tomatoes and Fred did use basil.” They may come to other interpretations, given different contents and contexts. The possibilities they keep in mind are guided by a set of simple principles, for example, they keep in mind true possibilities, and few possibilities (Johnson-Laird & Byrne, 2002).

Reasoners can make inferences by keeping in mind possibilities. They make *modus ponens* because the information, “Mark used tomatoes,” matches the single possibility they have kept in mind to understand the conditional. There is no counterexample. There is no possibility in which the premises are true, “if Mark used tomatoes then Fred used basil, Mark used tomatoes,” and the conclusion false, “Fred used basil.” Reasoners sometimes make the affirmation of the consequent inference because the information, “Fred used basil,” matches the single possibility they have in mind. But there is a counterexample, on the conditional interpretation. The possibility, “Mark did not use tomatoes and Fred used basil,” rules out the conclusion, “Mark used tomatoes.” Reasoners who consider this possibility resist the inference.

The negative inferences are more difficult. The information, “Fred did not use basil,” does not match the single possibility that people have in mind. Many reasoners say nothing follows. To make *modus tollens*, they must consider other true possibilities, for example, “Mark did not use tomatoes and Fred did not use basil.” The information, “Fred did not use basil,” matches the second possibility, and there is no counterexample. Likewise, the information, “Mark did not use tomatoes,” does not match the information in the initial possibility and some reasoners say nothing follows. If they think about the second possibility, they will make the denial of the antecedent inference. But there is a counterexample, on the conditional interpre-

tation. The possibility, “Mark did not use tomatoes and Fred used basil,” rules out the conclusion, “Fred did not use basil.” Reasoners who consider this possibility resist the inference.

Alternative explanations of how people reason from conditionals are available. One is that people translate the conditional into an abstract form, for example, “if A then B” (Braine & O’Brien, 1998; Rips, 1994). To make the inference from “A” to “B,” they match the premises, “if A then B, A” to their mental store of formal inference rules. Another alternative is that people translate the conditional to a domain-specific schema, for example, “if the cause occurs then the effect occurs.” To make an inference, they access the domain-specific rules of inference and match the premise, “the cause occurs” to deduce the conclusion, “the effect occurs” (Fiddick, Cosmides, & Tooby, 2000; Holyoak & Cheng, 1995). However, these alternatives have not provided a corroborated explanation for how people reason about counterfactuals, to which we now turn.

An indicative conditional, for example, “if Oswald did not kill Kennedy, then someone else did” seems to mean something very different from the counterfactual, “if Oswald had not killed Kennedy, then someone else would have” (e.g., Lewis, 1973). The differences led philosophers to suggest an analysis in terms of possible worlds (e.g., Stalnaker, 1968). The differences may indicate that reasoners construct a richer representation of alternative possibilities for counterfactuals (Johnson-Laird & Byrne, 1991). When people understand a counterfactual, for example:

If Mark had used tomatoes in the sauce then Fred would have used basil (5)

they keep in mind more than the single possibility for the indicative conditional. Both conditionals are in the past tense, but the counterfactual is in the subjunctive mood. When people understand the counterfactual they think about the conjecture, “Mark used tomatoes and Fred used basil,” but also about the presupposed facts, “Mark did not use tomatoes and Fred did not use basil” (Johnson-Laird & Byrne, 1991). They keep track of the status of the possibilities, noting that one corresponds to the conjecture, and the other to the presupposed facts.

Evidence from various sources corroborates this suggestion. When people read counterfactuals such as the one in Example 5, and then were given a surprise recognition test, they judged that they had been given assertions such as “Mark did not use tomatoes” and “Fred did not use basil” (Fillenbaum, 1974). When reasoners were asked to say what someone uttering the

counterfactual meant to imply, they judged the person meant to imply “Mark did not use tomatoes” and “Fred did not use basil” (Thompson & Byrne, 2002). When people read a short story that contained a conditional, they read the conjunction, “Mark did not use tomatoes and Fred did not use basil,” far more quickly when they were primed first with the counterfactual compared to when they were primed with the indicative conditional (Espino, Santamaria, & Byrne, 2004). Because reasoners keep in mind several possibilities to understand the counterfactual, they make different inferences from it. They make more of the negative inferences, *modus tollens* and denial of the antecedent, from counterfactuals (Byrne & Tasso, 1999). They make the same frequency of the affirmative inferences, *modus ponens* and affirmation of the consequent, from counterfactuals and indicative conditionals, which indicates that they do not keep in mind the negative possibility alone.

People generate not only counterfactual thoughts about the past, but also prefactual thoughts about what might happen in the future (e.g., Roese & Olson, 1995). Prefactuals can vary in how uncertain their antecedents and consequents are, for example, “if I were to win the lottery in the future I would buy a yacht” versus “if I were to die in the future my family would receive money from my insurance policy.” But little is known about prefactuals. We report the results of three novel experiments that examine them.

Experiment 1: Prefactual Implications

Are conditionals about the future understood differently from conditionals about the present or the past? For indicative conditionals, the answer is, no. Reasoners make the same inferences from conditionals when they are in the past tense, for example, “if Alicia was in Athlone then Laura was in Limerick,” the present tense, for example, “if Alicia is in Athlone then Laura is in Limerick,” or the future tense, for example, “if Alicia is in Athlone tomorrow then Laura will be in Limerick” (Schaecken, Schroyens, & Dieussaert, 2001). Reasoners keep in mind a single possibility to understand an indicative conditional, regardless of its temporal perspective.

But for subjunctive conditionals, the answer is unknown. Reasoners make the same inferences from subjunctive conditionals in the past tense, for example, “if Alicia had been in Athlone then Laura would have been in Limerick,” or the present tense, for example, “if Alicia were in Athlone then Laura would be in Limerick” (Byrne & Tasso, 1999). They are understood by keeping in mind two possibilities, the conjecture and the presupposed facts. Do people keep in mind two possibilities to understand a prefactual, for exam-

ple, “if Alicia were in Athlone tomorrow then Laura would be in Limerick?” We suggest, not. The prefactual does not convey any presupposed facts, and so reasoners should not keep in mind the negative possibility. Our suggestion is that reasoners understand a prefactual by keeping in mind a single possibility, “Alicia is in Athlone and Laura is in Limerick.” The use of the subjunctive mood ensures that they note the status of the possibility as a conjecture. They understand the prefactual by keeping in mind the same possibility as for the future indicative conditional. They keep track of the conjectural status of the possibility only for the prefactual, and so prefactuals may appear more uncertain or improbable.

In our first experiment, we examined what people believed a prefactual to imply. We gave participants the following task:

If I were to win the lottery tomorrow then I would buy a yacht.
What if anything do you think is implied by this sentence?
Please tick as many options as you think appropriate.

We provided them with a range of options:

- (a) I will win the lottery tomorrow.
- (b) I will not win the lottery tomorrow.
- (c) I will buy a yacht.
- (d) I will not buy a yacht.
- (e) Nothing is implied.

We examined fantasy-type realistic contents, for example, “if I were to win the lottery tomorrow I would buy a yacht,” as well as more neutral contents, for example, “if Alicia were in Athlone tomorrow then Laura would be in Limerick.”

Method

Procedure. The problems were presented in a booklet. The participants were tested in groups and the experimenter read the instructions aloud and answered any questions the participants had. Participants were advised they could take as long as they needed to complete the task.

Participants. The participants were 79 undergraduate psychology students from Dublin Business School’s School of Arts who participated voluntarily. There were 63 women and 16 men and their average age was 26 years, ranging from 18 to 41 years. They were assigned at random to the indicative ($n = 43$) or the prefactual group ($n = 36$).

Materials and design. Participants were given six problems, three based on neutral contents about

actions, ingredients, and locations, and three based on realistic content: “If I were to win the lottery tomorrow then I would buy a yacht,” “if I were to die tomorrow, then my family would have enough life insurance,” and “if I were to become a film star tomorrow then I would move to Hollywood.” The two sorts of contents were presented in blocks with half of the participants receiving one sort first and the other half the other sort first. The problems within each block were presented in a different random order to each participant. The options were presented in a random order for each problem with the exception that “nothing is implied” was always last.

We gave one group of participants an indicative set, based on future indicative conditionals, for example, “if I win the lottery tomorrow then I will buy a yacht,” and the second group received a prefactual set based on future subjunctive conditionals, for example, “if I were to win the lottery tomorrow then I would buy a yacht.”

Results and Discussion

The pattern of judgments for indicative and prefactual conditionals was similar, as Table 1 shows. We examined the results in an ANOVA with the between-participant factor of mood (indicative, prefactual) and the within-participant factors of content (neutral, realistic) and possibility (*P*, *not-P*, *Q*, *not-Q*, nothing). The Greenhouse-Geisser correction was used when the assumption of sphericity was not met and all tests reported are one-tailed.

The ANOVA showed main effects of both content, $F(1,77) = 8.50$, $MSE = 2.72$, $p = .01$, and possibility, $F(1.56,119.98) = 62.44$, $MSE = 206.688$, $p = .00$, but not of group, $F(1,77) = 1.61$, $MSE = 1.79$, $p = .10$. There was a reliable interaction of content and possibility, $F(1.65,127.36) = 3.93$, $MSE = 4.72$, $p = .01$, but group did not interact with content, $F(1,77) = .09$, $MSE = .03$, $p = .38$, or possibility, $F(4, 308) = .64$, $MSE = .82$, $p = .32$.

To test our predictions, we carried out planned comparisons on the nonsignificant three-way interaction, $F(4,308) = .05$, $MSE = .02$, $p = .50$, (see Winer, 1971 for the legitimacy of such comparisons). The only difference was that participants tended to judge that *p* was implied more often for neutral content than for realistic content, and this difference occurred for the indicative conditionals, 22% versus 5%, $t(42) = 3.52$, $p = .00$, and the prefactuals, 26% versus 13%, $t(35) = 2.17$, $p = .02$. The result shows that reasoners judge that “if Alicia were in Athlone tomorrow then Laura would be in Limerick” implies “Alicia will be in Athlone tomorrow” more often than they judge that “if I were to win the lottery tomorrow then I would buy a yacht” implies “I will win the lottery tomorrow.” There

TABLE 1
Percentages of Implications in Experiment 1

		p	q	not-p	not-q	Nothing
Indicative	Realistic	5	28	9	5	73
	Neutral	22	26	6	6	64
	Overall	14	27	7	6	69
Prefactual	Realistic	13	33	16	8	68
	Neutral	26	31	12	10	59
	Overall	19	32	14	9	63

TABLE 2
Percentages of Interpretations in Experiment 1

		Affirmative possibility	Negative possibility	Nothing implied
Indicative	Realistic	23	9	62
	Neutral	22	3	69
	Overall	22	6	66
Prefactual	Realistic	24	9	58
	Neutral	20	2	67
	Overall	22	5	62

were no other reliable differences, and the judgments of what the conditional implies were very similar for the indicative and prefactual groups, and also for the neutral and realistic contents, as Table 1 shows.

We also classified participants’ responses as indicating an “affirmative-possibility” interpretation when they chose the options corresponding to *p* or *q* or both (and no other option), and we classified them as having a “negative-possibility” interpretation when they chose the options corresponding to *not-p* or *not-q* or both (and no other option) (see Thompson & Byrne, 2002). They were classified as having correctly answered “nothing is implied” if they selected only that option, and the majority of participants’ judgments corresponded to this option, (64%), as Table 2 shows. Most of the remainder were “affirmative-possibility” interpretations (22%). As we expected, there were very few interpretations in the “negative-possibility” category (6%).

As Table 2 shows, the interpretations were similar for indicative and prefactual conditionals. The high percentage of judgments that “nothing is implied” for future indicative conditionals (66%) is similar to the high percentage of such judgments for past indicative conditionals in other studies (54% in Experiment 1, Thompson & Byrne, 2002). The equally high percentage of judgments that “nothing is implied” for prefactuals (63%) is quite different from the percentage of such

judgments for counterfactuals (30% in Experiment 1, Thompson & Byrne, 2002). The judgments of what prefactuals imply are more similar to judgments about what indicative conditionals imply than to judgments about what counterfactuals imply.

Do people keep in mind two possibilities to understand a prefactual, for example, "if I were to win the lottery tomorrow I would buy a yacht?" We suggest they do not, and the results of the experiment corroborate our view that the prefactual does not convey a presupposed negated antecedent and consequent. Reasoners do not keep in mind the negative possibility, "I do not win the lottery and I do not buy a yacht." Instead, they appear to understand a prefactual by keeping a single possibility in mind, "I win the lottery and I buy a yacht." Our next experiment examines the possibilities that reasoners judge to be consistent with a prefactual.

Experiment 2: Prefactual Possibilities

The aim of the second experiment was to examine the possibilities that reasoners judge to be consistent with prefactuals, for example, "if Linda were in Cork tomorrow then Cathy would be in Galway." Each problem consisted of a conditional premise, followed by one of four possibilities:

Linda was in Cork and Cathy was in Galway.
 Linda was not in Cork and Cathy was not in Galway.
 Linda was not in Cork and Cathy was in Galway.
 Linda was in Cork and Cathy was not in Galway.

We asked participants to judge whether each possibility was consistent with the conditional, or inconsistent with it, or irrelevant.

In this experiment, we examined prefactual and future indicative conditionals, and we compared them to counterfactual and past indicative conditionals. We have suggested that reasoners keep in mind a single possibility to understand the prefactual but two possibilities to understand the counterfactual. We expected that they would judge as consistent the negative possibility, "Linda was not in Cork and Cathy was not in Galway," for the counterfactual more than the prefactual. We concentrated on neutral content, since there were few differences between it and realistic content in the previous experiment.

Method

Procedure. The participants were tested individually or in groups of two or three participants. The 24 problems were presented on Macintosh computers using SuperLab 1.75. The instructions were presented on the computer and included an example problem and three

practice problems (based on conjunctions and disjunctions of shapes) to familiarize them with the task presentation and keyboard response options. Participants were advised they could take as long as they needed and that they were being timed. Participants pressed the space bar to view each new piece of information (the conditional, the possible situation, and the consistency judgment), and each remained on screen to be joined by the additional information. They pressed one of the keys labeled "a" "b" or "c" to indicate their judgment. These keys were in the centre of the keyboard and corresponded to the T, G, and B keys.

Participants. The participants were 46 undergraduate psychology students from Trinity College, Dublin University, who took part voluntarily in return for course credits. There were 33 women and 13 men and their average age was 20 years (range 18-27 years).

Materials and design. As in the previous experiment, we included three sorts of neutral content: ingredients, locations, and actions. We gave one group of participants a set of problems based on indicative conditionals, and the other group received subjunctive conditionals. Each set contained 24 problems, 12 in the past tense and 12 in the future tense. Each possibility ($p \ \& \ q$, $not-p \ \& \ not-q$, $not-p \ \& \ q$, $p \ \& \ not-q$) was presented once for each content (i.e., 4 possibilities \times 3 contents = 12 problems). To control for content effects, the contents were assigned to the problems at random twice to make two different sets of problems. The order of the problems was controlled in the same way as the previous experiment.

Results and Discussion

The results corroborated our suggestion that people keep in mind the negative possibility $not-p$ and $not-q$ for counterfactuals but not for prefactuals. We analyzed the results in an ANOVA on the possibilities that participants selected as "consistent." The factors were group (indicative, subjunctive), tense (future, past) and possibility ($p \ \& \ q$, $not-p \ \& \ not-q$, $not-p \ \& \ q$, $p \ \& \ not-q$), with repeated measures on the last two factors. It showed a main effect of possibility, $F(1,38,60.78) = 213.42$, $MSE = 175.15$, $p = .00$, 1-tailed, and none of tense, $F(1,44) = 1.36$, $MSE = .27$, $p = .13$, or group, $F(1,44) = .53$, $MSE = .53$, $p = .24$. Tense interacted with group, $F(1,44) = 3.49$, $MSE = .70$, $p = .03$, but not with possibility, $F(1.77, 77.78) = 1.01$, $MSE = .31$, $p = .18$. Group and possibility also did not interact, $F(3,132) = .40$, $MSE = .33$, $p = .38$.

To test our predictions, we carried out a series of planned comparisons on the nonsignificant three-way interaction, $F(3,132) = 1.03$, $MSE = .19$, $p = .19$. They

TABLE 3
Percentages of Consistent Possibilities in Experiment 2

		not-p & not-q	p & q	p & not-q	not-p & q
Indicative	Past	55	99	0	1
	Future	57	99	1	3
Subjunctive	Counterfactual	67	99	0	12
	Prefactual	55	94	3	6

showed that participants judged the *not-p and not-q* possibility to be consistent more often for the counterfactual than for the prefactual, although the 12% difference was marginal (67% vs. 55%, $t(22) = 1.62$, $p = .06$), and the test had 80% power to detect a difference of .10. There was no such difference for indicative conditionals (55% vs. 57%, $t(22) = .23$, $p = .41$), and the test had 80% power to detect a difference of .11. There were no reliable differences between counterfactuals and prefactuals for the comparisons of *p and q*, *p and not-q* or *not-p and q*, as Table 3 shows.

The experiment supports the suggestion that people keep in mind the *not-p and not-q* possibility when they think about a counterfactual more often than when they think about a prefactual. Our final experiment examines the inferences that reasoners make from prefactuals.

Experiment 3: Prefactual Inferences

The aim of the final experiment was to examine the inferences reasoners make from prefactuals. We gave participants problems of the following sort:

If Linda were in Cork tomorrow then Cathy would be in Galway.

Cathy was not in Galway.

What, if anything, follows?

Therefore (a) Linda was in Cork

(b) Linda was not in Cork

(c) Linda may or may not have been in Cork.

Once again, we examined prefactual and indicative future conditionals, and compared them to counterfactual and indicative past conditionals. Because reasoners understand the prefactual by keeping in mind a single possibility, we expected they would make the same frequency of inferences from prefactuals as from indicative future conditionals. In contrast, they understand the counterfactual by keeping in mind two possibilities and so we expected they would make more of the negative inferences from the counterfactual compared to the past indicative conditional. We

expected they would make the same frequency of affirmative inferences from both.

Method

Participants. The participants were 40 members of the psychology department's participant panel (members of the general public recruited through newspaper advertisements). They were paid 8 euro for their participation. There were 29 women and 11 men and their average age was 54 years (range from 27 to 74 years). Age details were not available for two participants.

Materials, design, and procedure. Each problem consisted of a conditional and a categorical premise corresponding to modus ponens (Linda was in Cork), affirmation of the consequent (Cathy was in Galway), denial of the antecedent (Linda was not in Cork), and modus tollens (Cathy was not in Galway). We gave one group subjunctive conditionals and the other indicative conditionals. Each set contained 24 problems, 12 in the past tense and 12 in the future tense. The same sorts of content were used as in the previous experiment, and similar controls for content assignment and order were employed. The procedure was also similar to the previous experiment. Once again, 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.

Results and Discussion

We analyzed the results in an ANOVA on the endorsements with the between-participant factor of group (indicative, subjunctive) and the within-participant factors of tense (future, past) and inference (modus ponens, tollens, denial of the antecedent, and affirmation of the consequent). It showed a main effect of inference, $F(3,114) = 17.81$, $MSE = 20.35$, $p = .00$, but none of tense, $F(1,38) = .01$, $MSE = .01$, $p = .46$, or group, $F(1,38) = .37$, $MSE = 1.25$, $p = .27$. Tense did not interact with group, $F(1,38) = .79$, $MSE = .80$, $p = .19$, or inference, $F(2.20,83.75) = .33$, $MSE = .20$, $p = .37$. Group and inference did not interact, $F(3,114) = .66$, $MSE = .75$, $p = .29$.

To test our predictions, we carried out planned comparisons on the nonsignificant three-way interaction, $F(3,114) = .30$, $MSE = .13$, $p = .41$. As we expected, participants did not make more negative inferences from prefactuals compared to future indicative conditionals: modus tollens (57% vs. 63%, $t(38) = .51$, $p = .31$) and denial of the antecedent (62% vs. 57%, $t(38) = .39$, $p = .35$), and these tests had 80% power to detect a difference of .11 and .10, respectively. There were no

TABLE 4
Percentages of Conclusions Endorsed in Experiment 3

		Modus tollens	Denial of the antecedent	Modus ponens	Affirmation of the consequent
Past	Indicative	53	55	92	72
	Counterfactual	73	57	98	73
Future	Indicative	57	62	95	73
	Prefactual	63	57	95	75

differences for modus ponens (95% in both cases, $t(38) = .00, p = .50$), and affirmation of the consequent (73% and 75%, $t(38) = .14, p = .44$), and these tests had 80% power to detect a difference of .03 and .09, respectively.

In contrast, participants tended to make more of the negative inferences from the counterfactuals than the indicative conditionals, as Table 4 shows. However, the result for modus tollens was only marginally reliable (73% vs. 53%, $t(38) = 1.51, p = .07$), and there was no difference for the denial of the antecedent (55% vs. 57%, $t(38) = .12, p = .45$), and these tests had 80% power to detect a difference of .11 and .08, respectively. Unexpectedly, they made more modus ponens from counterfactuals (98% vs. 92%, $t(28.05) = 1.80, p = .04$), and there was no difference for the affirmation of the consequent (72% vs. 73%, $t(38) = .14, p = .46$), and these tests had 80% power to detect a difference of .03 and .10, respectively.

We expected that participants would make more of the negative inferences from the counterfactual than the past indicative conditional, because they have kept in mind the negative possibility from the outset. The results show they make 20% more modus tollens inferences, but only 2% more denial of the antecedent inferences. Previous studies have found the difference to be somewhat labile (Byrne & Tasso, 1999) perhaps because neutral content does not evoke a counterfactual interpretation as often as causal or definitional content (Thompson & Byrne, 2002). The finding that participants made 6% more modus ponens inferences from counterfactuals, and this difference is reliable, is surprising. Nonetheless, the results are broadly consistent with earlier findings that participants make more negative inferences from counterfactuals compared to indicative conditionals (Byrne & Tasso, 1999; Thompson & Byrne, 2002). More importantly, the results show that reasoners do not make more negative inferences from prefactuals compared to future indicative conditionals.

General Discussion

Prefactual conditionals are curious. People keep in mind the same possibilities initially to understand a

prefactual, for example, “if I were to become a movie star tomorrow I would move to Hollywood” as they do to understand the corresponding future indicative conditional, “if I become a movie star tomorrow I will move to Hollywood.” They think about just a single possibility, “I become a movie star and I move to Hollywood.” They can think about other possibilities if need be, but their initial representation keeps just this possibility in mind. We have corroborated this suggestion in three experiments using three different tasks known from previous research to differentiate between indicative and subjunctive conditionals in the past tense (e.g., Thompson & Byrne, 2002). The first experiment showed that reasoners judge that someone uttering a prefactual means to imply the same thing as someone uttering a future indicative conditional. The second experiment showed that reasoners judge the same sorts of possibilities to be consistent with a prefactual as with a future indicative, and the negative possibility is judged to be consistent with a counterfactual more often than a prefactual. The third experiment showed that reasoners make the same frequency of inferences from a prefactual as from a future indicative, and they do not make more of the negative inferences from prefactual conditionals, unlike counterfactual conditionals.

A prefactual does not presuppose any facts, for example, “I do not become a movie star and I do not move to Hollywood.” In this respect, prefactuals are very different from counterfactuals. What does the subjunctive mood add to a future tense conditional? The “uncertain” mood can cue reasoners to understand that the status of the affirmative possibility for the prefactual is conjectural. As a result, a prefactual may seem to be more uncertain than a future tense conditional. Prefactuals may be well suited to conveying unlikely possibilities such as speculations and fantasies, whereas future tense conditionals may be better suited to plans and predictions. Their understanding and use is deserving of future study.

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Sommaire

Les auteurs se penchent sur le raisonnement concernant des possibilités préfactuelles (exemple : si je devais gagner à la loterie l'an prochain, j'achèterais un yacht) et les possibilités contrefactuelles (exemple : si j'avais gagné à la loterie l'an dernier, j'aurais acheté un yacht.). Les individus raisonnent aussi à l'indicatif conditionnel (exemple : si j'ai gagné à la loterie, j'ai acheté un yacht) en gardant à l'esprit quelques possibilités réelles (exemple : j'ai gagné à la loterie et j'ai acheté un yacht). Ils comprennent les contrefactuels en gardant à l'esprit deux possibilités, la conjecture (j'ai

gagné à la loterie et j'ai acheté un yacht) et les faits présumés (je n'ai pas gagné à la loterie et je n'ai pas acheté de yacht). Les auteurs rendent compte des résultats de trois expériences sur les possibilités préfactuelles visant à examiner ce que les individus considèrent que ces dernières sous-entendent, les possibilités qu'ils jugent conformes à elles et les inférences qui s'ensuivent à leur avis. Les résultats indiquent que les raisonneurs gardent à l'esprit une seule possibilité afin de comprendre un préfactuel.