



Persuasion and the contexts of dissuasion: Causal models and informal arguments

David W. Green

To cite this article: David W. Green (2008) Persuasion and the contexts of dissuasion: Causal models and informal arguments, *Thinking & Reasoning*, 14:1, 28-59, DOI: [10.1080/13546780701527690](https://doi.org/10.1080/13546780701527690)

To link to this article: <https://doi.org/10.1080/13546780701527690>



Published online: 06 Jan 2008.



Submit your article to this journal [↗](#)



Article views: 157



View related articles [↗](#)



Citing articles: 1 View citing articles [↗](#)

Persuasion and the contexts of dissuasion: Causal models and informal arguments

David W. Green
University College London, UK

This paper develops the view that in arguing informally individuals construct a dual representation in which there is a coupling of arguments and the structure of the qualitative (mental) causal model to which these refer. Invited to consider a future possibility, individuals generate a causal model and mentally simulate the consequences of certain actions. Their arguments refer to the causal paths in the model. Correspondingly, faced with specific arguments about a policy option they generate a model with particular causal paths and mentally simulate the outcomes. The results of Experiment 1 are consistent with this notion. Decisions on the percentage of funds to be allocated to genetically modified (GM) crop research depended on the structure of the arguments elicited in response to imagining a future state of affairs. Specifically, the presence of a dissuasive argument eliminated the impact of any persuasive argument. The non-monotonic properties of everyday informal argument can then be seen as a corollary of change to causal structure in the model. The dual representation view predicts that the impact of a dissuasive argument will depend on the structure of the causal model. Experiment 2 tested and confirmed this prediction by requiring individuals to judge the relative persuasiveness of two cases referring either to a model with two independent causal paths or to a model in which one causal path depended on the other. In contrast to Experiment 1, prior opinion on GM crop research did not affect allocation decisions. An advisory role in contrast to a participant role may encourage a more decontextualised mode of thinking. According to the dual representation view, ease of mental simulation should exert wide-ranging effects on judgements and the rhetoric of arguments should also be important. The paper concludes with a discussion of some of these expectations.

Correspondence should be addressed to David W. Green, Department of Psychology, University College London, Gower Street, London WC1E 6BT, UK.
E-mail: d.w.green@ucl.ac.uk

I thank Jonathan Evans for emphasising to me the connection between the work of Green et al. (2006) and that of Thompson et al. (2005). I also thank David Lagnado for comments on earlier version of this manuscript, Nigel Harvey for locating work on advice giving, and the Editor, David Over, and three anonymous referees for their constructive comments.

In many everyday discussions and decisions, there is no existing solution and it may be impossible to specify the full set of options and probabilities allowing classical models of choice to apply (e.g., Shafir, Simonson, & Tversky, 1993). In some cases decision heuristics can be applied (Gigerenzer, 1999) but in controversial matters, and when thinking about future states of affairs, individuals must think hypothetically (Evans, 2003). In doing so, they may argue informally. Yet despite the importance of informal argument psychological research has overwhelmingly focused on decontextualised inference tasks (see Thompson, Evans, & Handley, 2005). This paper focuses on the structure of informal arguments in the context of individual thinking. It excludes psycholinguistic and discursive processes involved when two or more individuals argue together (see, for example, Rips, 1999; Walton, 1989) but the pragmatics of discourse remain relevant.

When individuals think hypothetically about some future state of affairs, they seek to identify an action or policy that is more likely than some other action to bring about some desired state of affairs. Encouraging individuals to think along certain lines by a conditional argument is a common rhetorical device. Thompson et al. (2005) showed that individuals can identify such arguments (e.g., "If the Kyoto accord is ratified there will be a downturn in the economy") and understand their import even if they do not agree with them, as indicated by asking them to adopt their own perspective on the issue compared to the writer's perspective. They termed a persuasive argument in favour of a policy or action "a persuasion". They identified it as a conditional statement in which the consequent refers to a desirable state of affairs (a benefit) and the antecedent refers to a hypothetical course of action asserted to produce it. They identified "a dissuasion" as a conditional statement in which the consequent refers to an undesirable state of affairs (Thompson et al., 2005, p. 240, provides a full definition adapted from Bonnefon & Hilton, 2004).

In an experimental context, individuals may be encouraged to think along certain lines by a prompt and, on the assumption that they comply, the effects of their thinking should be observed on their opinions or decisions. Extending earlier work by McCloy and Byrne (2002) to controversial policy issues (e.g., the electronic tagging of children, whether the UK should join European monetary union), Green, Applebaum, and Tong (2006) showed that opinions about a policy were significantly influenced by the nature of the prompt designed to elicit hypothetical thinking. Opinion became significantly more in favour of a policy given a counterfactual prompt such as "if only action X were to be taken" compared to a semifactual prompt such as "even if policy X were to be taken". In the case of a counterfactual prompt, individuals are led to identify a benefit associated with a policy. Their thinking can be construed as a persuasion; i.e., conditional argument of the form "If policy X were adopted there may

be a benefit". In the case of a semifactual prompt, they are led to identify a cost associated with the policy, i.e., a dissuasion. Here, their thinking might be construed as a conditional argument of the form "Even if policy X were adopted, there may be a cost". Effectively, the prompt is the antecedent and the listed thought the consequent. A counterfactual prompt, then, is designed to generate a persuasion. A semifactual prompt is designed to generate a dissuasion.

What is involved in the process of thinking about a future possibility in this way? Koehler (1991) reviewed research showing that imagining a possibility increased confidence in the truth of that possibility and noted that a further requirement to provide reasons why some future state of affairs might arise did not enhance the effect (Carroll, 1978). Koehler (1991) argued that the act of imagining served to organise relevant evidence (it created a frame of reference) and made certain features salient thereby increasing the fit with the background knowledge. He noted the connection with the views of Pennington and Hastie (1993) who proposed that in understanding evidence in a (mock) trial individuals construct a narrative of events that serves to make sense of the material. A more general view, and one that emphasises causal structure, is that individuals construct a mental (i.e., qualitative) causal model when they envisage a future possibility (e.g., Green & McCloy, 2003; see Johnson-Laird, 1983, for the general notion of a mental model, especially chapter 15, and Sloman & Lagnado, 2005, for the notion of a causal model intended here). Causal, rather than correlational, representations are well suited for reasoning about situations and for acting in the world because they indicate what is needed to change matters (see Pearl, 2000). Individuals mentally run or simulate their causal model to examine its outcome (see Kahneman & Tversky, 1982; Green et al., 2006). On the basis of the model they generate specific arguments. In other words they construct a dual representation: a mental causal model and arguments referring to it. These representations can be described as an argument model (Green, 1996a, 2000, 2007; Green & McCloy, 2003).

In the case of a counterfactual prompt individuals generate a persuasion and in the case of semifactual prompt, a dissuasion. The degree of belief in a conditional such as "If we fund research into GM crops sufficiently then there will be benefits for the population" will then reflect their estimate, based on their mental simulation, of the conditional probability of the consequent given the antecedent (see Evans & Over, 2004; Evans, Handley, & Over, 2003; Oaksford & Chater, 2003; Politzer, 2005, for work on the claim that the probability of a conditional is equivalent to the conditional probability of the consequent given the antecedent). In the context of a policy they should be more willing to endorse it and to allocate funds to it if they believe as a result of the mental simulation that the action will lead to a benefit. Such an expectation relies on the principle of

consequentialism (Bonnefon & Hilton, 2004; Over, Manktelow, & Hadjichristidis, 2004) that an action should be taken if its consequences are good and avoided if they are not.

However, the notion of a causal model predicts that decisions will depend on the structure of the model and the precise nature of the arguments it generates. Inviting individuals to think about a possibility does not fully constrain how they do in fact think, any more than reading a conditional statement does so. In particular, they may envisage factors that could prevent the intended benefit (a disabling condition, Cummins, 1995) that would be expressed as a dissuasion. The studies by Green et al. (2006), the earlier paper by McCloy and Byrne (2002), and the paper by Thompson et al. (2005) did not address this question. Experiment 1 does so by scoring the content of elicited arguments and examining the impact on a decision of generating opposing arguments. The basic prediction is that the generation of an opposing argument (e.g., a dissuasion) will limit, perhaps block, the effect of a persuasive argument. This prediction follows because individuals revise their belief in the efficacy of the action. Belief change, as Politzer and Carles (2001) argued, is part of the general area of reasoning under uncertainty. People are more or less confident in the truth of a real-world conditional and when the grounds for the premise are made uncertain, a conclusion from that premise also becomes less certain (Cummins, 1995; Politzer & Carles, 2001; Stevenson & Over, 1995).

According to the notion that individuals envisage a (mental) causal model when they think hypothetically, the precise impact of a disabling factor should depend on the nature of the causal model. Experiment 2 addresses this question by manipulating the nature of the model and the corresponding arguments. Individuals judged the impact of a dissuasive argument (referring to the disabling of a causal path) in one of two persuasive contexts: one where the two causal paths are independent of one another and one where the second causal path depends on the first that is disabled. In everyday contexts, an undermining, dissuasive argument may in turn be discounted (see, for example, Rips, 1999). Experiment 2 examines how judgements of the relative persuasiveness of two cases shift with such undermining and discounting.

The manipulations used in this experiment rely on the fact that when individuals issue a conditional statement, the addressee assumes that the tacit and necessary conditions for the conditional to apply, actually hold (Politzer, 2005, p. 7). That is, individuals bring to bear their understanding of the pragmatics of utterances. The consequence of challenging this *ceteris paribus* assumption is well demonstrated by the suppression effect. In the case of a deductive argument, valid modus ponens inferences can be suppressed by an additional premise that challenges the applicability of the first premise (see Byrne, 1989; Stevenson & Over, 1995).

Both experiments use realistic material and therefore permit an exploration of the effects of prior opinion on the arguments generated and the decisions reached. Prior research indicates that individuals may have difficulties decoupling their opinions from the evaluation of claims and arguments and that they tend to generate hypotheses in a biased manner (e.g., Baron, 1995; Kuhn, 1991; Perkins, 1985; Stanovich & West, 2007; Toplack & Stanovich, 2003). Experiment 1 permits an examination of any effects of myside bias on argument generation. The prediction that encouraging individuals to think along certain lines will lead them to construct a certain causal model and generate arguments of a certain type (persuasions or dissuasions) presumes that the bulk of individuals will engage in one-sided thinking. If they do so, and assuming a range of prior opinion, then the instructions must lead them to overcome any myside bias when the instructions run counter to their prior opinion. What of those individuals who do generate opposing arguments and so do potentially engage in two-sided thinking? One possibility is that these individuals have more extreme prior opinions.

As a separate issue, both Experiments 1 and 2 allow an examination of the extent to which prior opinion affects the decisions individuals take. The basic expectation was that prior opinion should play a more important role in Experiment 1 where individuals are invited to imagine themselves as members of a committee making a decision, compared to Experiment 2 where they imagine themselves advisors to a committee and estimate the response of that committee.

EXPERIMENT 1

Green et al. (2006) showed that thoughts elicited in response to a counterfactual or to a semifactual prompt modified prior opinion on a controversial policy (e.g., the electronic tagging of children). The present study examines the effects of such prompts in a different context and tests the prediction that the structure of the arguments and the correlating causal model affects decision. As previously, the supposition was that individuals will persuade themselves to a point of view and that this viewpoint will affect their decision. Thompson et al. (2005, p. 240) identify the illocutionary force of persuasions and dissuasions as persuading others to a point of view and contrast this with inducements and advice that seek to persuade individuals to a course of action (p. 240). Here I hold that viewpoint provides the grounds for action by the individual too.

Participants imagined they were a member of a committee charged with allocating funds to different types of research in the context of rapid climate change. They were invited to continue the thought expressed either by the counterfactual prompt "If we were to fund research into GM

(genetically modified) crops sufficiently..." or by the semifactual prompt "Even if we were to fund research into GM (genetically modified) crops sufficiently...". Individuals were free to list as many or as few thoughts as they wished in order to minimise any influence of the ease of generating thoughts that can undermine the effects of what is generated (see Sanna & Schwartz, 2003). After listing their thoughts, individuals decided on a percentage of funds to allocate to GM crop research.

The expectation was that the majority of participants will envisage arguments congruent with the prompt (i.e., identifying benefits to the research in the case of the counterfactual prompt and costs in the case of the semifactual prompt). That is, they would generate arguments on one side of the issue only. However, some participants will also envisage arguments incongruent with the prompt. In response to a counterfactual prompt, a participant might doubt the value of the research (i.e., envisage a dissuasion). In response to a semifactual prompt, a participant might envisage a benefit to the research (i.e., a persuasion in favour of the research). On this basis, the experiment tests the prediction that it is the structure of the arguments that determines the funding decision. The prediction was that the effects of the prompt conditions will interact with the congruency of the arguments: the difference between the conditions in the percentage of funds allocated to GM crop research will be greater for participants with solely congruent arguments compared to those with incongruent arguments. In fact, if incongruent arguments reflect a causal path that disables another path in the causal model, it should abolish any effect of the prompt.

Given that individuals are thinking about a controversial issue their prior opinions might affect their allocation decisions even if the majority of individuals engage in thinking along the lines of the prompt. If so prior opinion will be a significant covariate. Conceivably those who do generate incongruent arguments will do so because their prior opinions are more extreme. If there is evidence of myside bias in the present experiment, then individuals much less in favour of GM crop research should list a dissuasive argument when prompted to think about the potential benefits. Correspondingly, individuals much more in favour of GM crop research should list a persuasive argument when prompted to think about the potential costs.

Prior research that has contrasted the effect of a counterfactual or semifactual prompt (e.g., Green et al., 2006; McCloy & Byrne, 2002) also required participants to rate their regret that the target action was taken or not taken. Certainly anticipated regret forms the core of some theories of decision-making (e.g., Loomes & Sugden, 1982) and has been viewed as an important factor linking intention to behaviour (e.g., Hetts, Boninger, Armor, Gleicher, & Nathanson, 2000; Richard, de Vries, &

van der Pligt, 1998). Conceivably, it is this explicit requirement to rate regret that mediates the effects of the prompts. To check this possibility, the study varied whether participants rated or did not rate their regret at not giving sufficient funds to GM crop research before they made their allocation decisions. If the explicit requirement to rate regret is key, then there will be an interaction between the factors of prompt condition and regret. The absence of any such interaction is of course compatible with the notion that individuals routinely consider regret in reaching their decisions but testing a routine role of regret in decision making was not part of this experiment.

Method

Participants. A total of 172 adult volunteers who were applicants for a degree place at University College London participated. There were 41 males and 130 females (1 missing datum) aged from 18 to 40 with a mean age of 18 years.

Design. The between-subjects design consisted of two elicitation conditions (counterfactual prompt and semifactual prompt) crossed with rated regret (rating of regret versus no rating of regret). Participants were allocated at random to a condition and were run in groups of varying size.

Materials. The materials for the study were assembled into a three-page booklet that covered opinion on controversial issues, the elicitation task, and, where relevant, instructions on rating regret, and the allocation task.

Opinion on controversial issues. The first page of the booklet required participants to rate their opinion on "Research into genetically modified crops" together with five other controversial issues. They did so in response to the question "How strongly do you feel about the following?...". Participants rated their opinion by ringing one number on a 6-point scale running from 1 (completely against) to 6 (completely for). The topics covered topics concerning interventions to do with the natural world and human affairs. Examples of the other topics are: "the continuation of research into human cloning", "the building of more nuclear power stations", the promotion of free trade amongst nations". The topics were presented in a fixed order with the question on research into genetically modified crops as the fourth question so as to avoid drawing participants' attention to the target issue.

Table 1 reports mean and standard deviations for each of the controversial issues both for Experiment 1 and Experiment 2. The structure of the opinion data will be commented on in the General Discussion. As can be

TABLE 1
Opinion ratings in Experiments 1 and 2

<i>Controversial issue</i>	<i>GM crop research M (SD)</i>	<i>Human cloning M (SD)</i>	<i>Nuclear power M (SD)</i>	<i>Electronic tagging M (SD)</i>	<i>UK joining EMU M (SD)</i>	<i>Free trade M (SD)</i>
Experiment 1	4.20 (1.35)	3.22 (1.56)	2.65 (1.18)	2.94 (1.64)	3.16 (1.72)	4.75 (1.05)
Experiment 2	3.88 (1.35)	3.21 (1.61)	2.86 (1.19)	2.84 (1.54)	3.24 (1.55)	4.87 (1.10)

Mean opinion ratings (*SD*) on six controversial issues in Experiment 1 and in Experiment 2 where the 6-point scale runs from 1 (completely against) to 6 (completely for).

seen, for the sample in Experiment 1, opinion towards GM crop research was mildly favourable. Parenthetically, rated opinion on this issue seems consistent with opinion poll data and research data on GM foods in Britain, which found attitudes to be ambiguous (Spence & Townsend, 2006).

Analysis showed no difference in the prior opinions on GM crop research of those assigned to the various conditions of the experiment ($F < 1$ or $p > .20$, for both main effects and their interactions). Subsequent partitioning of the data according to the prompt condition and the type of arguments generated (see section on Scoring the content in Results) also showed no differences in prior opinion ($F < 1$ or $p > .20$ for the main effects and the interaction). In detail, for those given a counterfactual prompt, prior opinion on GM crop research averaged $M = 3.94$ (1.39) for those generating solely Congruent arguments and $M = 3.78$ (1.44) for those generating Incongruent arguments, $F < 1$. In the semifactual condition, there was also no difference in prior opinion about GM crop research for those who listed only Congruent arguments compared to those who listed Incongruent arguments: $F < 1$: $M = 4.17$ (1.48) for Congruent and $M = 4.22$ (1.20) for Incongruent arguments, respectively.

Elicitation task. The second page of the booklet presented the instructions for the prompt conditions. Instructions for the two conditions were identical except for the penultimate sentence. The sentence for the semifactual condition is in brackets:

Please imagine the following future event: a committee you sit on has already specified funds for research into reducing amounts of greenhouse gases entering the atmosphere. You have to decide about funding for other projects. You start to think about the consequences of climate change over the next 20 years in terms of farming and feeding the world's population. You start to think about the need to develop crops that can grow in different conditions. If we were to fund research into genetically modified crops sufficiently... (*Even if we were to fund research into genetically modified crops sufficiently...*) How would you complete this line of thinking? Please write your thoughts down here.

Regret instructions. For those required to rate regret, instructions occurred at the bottom of the second page of the booklets, i.e., before individuals made their allocation decisions. They read as follows:

How much would you regret not giving sufficient funds for research into genetically modified crops? Please circle one number on the following scale

Not at all 1 2 3 4 5 6 7 8 9 A great deal

Allocation task. The third page of the booklet required individuals to allocate funds between GM crop research and other areas of research. The instructions read as follows:

Public funds into reducing greenhouse gases entering the atmosphere have already been allocated to support research over the next 20 years. Of the remaining funds what percentage would you allocate to work on

- A. the genetic modification of crops _____ %
B. other areas of research _____ %

Please insert a percentage for each one such that the total sums to 100.

Procedure. Individuals completed the three-page booklet at their own pace and completed each page before turning to the next. The booklet formed part of a set of independent paper–pencil tasks illustrating work of the department.

Results and discussion

Overall effects of the prompt conditions on funding allocation. The first analysis of variance examined funding allocations as a function of prompt condition (counterfactual vs semifactual) and regret condition (explicit rating of regret vs no rating of regret). Prior opinion on GM crop research (indicated on a 6-point scale with 1 as completely against and 6 as completely for) was treated as a covariate. As predicted, there was an overall effect of prompt condition on the allocation of funds. Participants given a counterfactual prompt allocated a significantly higher percentage of funds to GM crop research than those given a semifactual prompt, $F(1, 167) = 6.27$, $MSE = 307.27$, $p < .025$, ($M = 34.76$, $SD = 19.16$, counterfactual prompt; $M = 28.70$, $SD = 16.22$, semifactual prompt). There was no effect of explicitly rating regret before the allocation task ($F < 1$) and no significant interaction of this factor with prompt condition, $F(1, 167) = 1.53$, $p = .22$. An explicit judgement of regret is therefore

not necessary for inducing an effect of the prompt and subsequent analyses pool over this factor. Of course this result does not imply that individuals do not routinely reflect on regret they might feel. Finally, there was a significant effect of prior opinion on funding allocation, $F(1, 167) = 4.53$, $p < .05$. The more favourable they were to such research before the task, the greater the proportion of funds allocated. Crucially, however, the effects of prior opinion were significantly moderated by the invitation to argue along certain lines. These results indicate that in the main individuals did not decouple their prior opinions when making their allocation decisions but do suspend any inclination to argue solely in accord with their prior opinion. In order to determine whether the data conform to the prediction that it is the structure of the elicited arguments that is critical, the next sections consider the nature of these arguments.

Prompt condition, arguments, and funding allocation. In order to examine the effects of self-generated persuasions and dissuasions, listed thoughts were scored into arguments congruent or incongruent with each prompt condition. The impact of the type of argument on funding allocations was then assessed in a second analysis of variance.

Scoring the content. Two independent judges, blind to the condition, coded the content of each response in terms of four categories (benefit of GM crop research; doubts about value of GM crop research; research focus with no evaluation of benefits; miscellaneous). Table 2 provides descriptions of the four categories and examples of each. A single category covered the content of the majority of responses. For instance, responses either mentioned the benefits of GM crop research or doubts about GM crop research or just focused on how the research might be done. Where an individual provided responses in a number of categories each was scored. The judges agreed on the codings of 168/172 of individual responses (97.6%) and resolved disagreement through discussion. Table 2 indicates the percentage of responses falling under the different categories.

Analysis of arguments. On the basis of the agreed codings, responses were scored for purposes of analysis into four categories (see Table 3). Responses were scored as *Congruent* with the counterfactual prompt if they identified benefits of GM crop research and contained no doubts about its benefit. They were scored as *Congruent* with the semifactual prompt if they expressed doubts about GM crop research and contained no statements of benefit. In contrast, responses were scored as *Incongruent* with the counterfactual prompt if some or all of the comments were against GM crop research (e.g., "superior crops to those already present could be created. This can be a great advantage for third world countries [...] GM crops can

TABLE 2
Categories

<i>Coding category</i>	<i>Research benefits</i>	<i>Research doubts</i>	<i>Research focus</i>	<i>Miscellaneous</i>
Description	GM crop research will help, such research will help if global warming tackled	GM crop research is unlikely to help/will not help	Who should be involved, how it should be conducted	No mention of GM crops or of directly related benefits or doubts, blank script
Percentage of responses	29.8	43.1	18.2	8.9
Examples	A wider variety of crops, may reduce levels of poverty in third world countries; help improve how long crops last	Many people would not want to consume GM crops; the more one modifies the genetics of a plant, the less natural variation there is	Appoint people with necessary expertise to carry out the research safely; how to test to make sure safe for consumption by humans, animals and birds, especially focussing on long-term effects	Give farmers and fruit growers an incentive to grow organic products, how would we inform public about the need eventually to rely only on genetically modified crops

Descriptions of the categories with examples from the two conditions in Experiment 1 together with the percentage of arguments coded within each category. In this table a given individual could contribute arguments coded under a number of categories.

TABLE 3
Funding allocations and responses

Prompt condition	Argument type																							
	Congruent with prompt condition				Incongruent with prompt condition				Research evaluation				Miscellaneous											
	M		SD		n		%		M		SD		n		%		M		SD		n		%	
Counterfactual	39.31	(21.98)	36	43	29.13	(17.94)	23	28	26.88	(8.92)	16	19	46.25	(14.07)	8	10								
Semifactual	28.26	(17.07)	54	61	32.74	(16.01)	23	26	23.75	(12.17)	8	9	21.25	(8.54)	4	4								

Mean percentage funding allocations (M , SD in brackets) together with the number (n) and percentage of responses (%) as a function of prompt condition and argument type (congruent with prompt condition, incongruent with prompt condition, research evaluation and miscellaneous) in Experiment 1. Individuals counted in the Research evaluation or Miscellaneous columns made no other responses that could be scored as congruent or incongruent with the prompt condition.

also affect other food chains as they are all interlinked, also crops may produce harmful waste than can do more harm than good overall”). They were scored as *Incongruent* with the semifactual prompt if some or all of the comments were in favour of GM research (e.g., “There would still be the associated stigma of using and eating GM crops despite this it could be highly beneficial to many countries and societies . . .”). Responses scored as *Research focus*, only had comments about how the research should be conducted or who should be involved. Responses scored as *Miscellaneous* had no comments in any other category.

Responses Congruent with the prompt accounted for 52% (90/172) of all responses. Responses Incongruent with the prompt accounted for the next highest proportion, 27% (46/172). Responses adopting a Research focus accounted for 14% (24/172) of all responses. Finally, 7% (12/172) of responses were Miscellaneous.

Effects of prompt condition and argument type on funding allocation. Table 3 reports the number of individuals with the different types of argument under each prompt condition together with the mean percentage of funding allocations (and their standard deviations).

There are some differences in the numbers contributing to each type of argument in the two prompt conditions, $\chi^2(3, N=172)=7.49, p=.06$. Although the counterfactual prompt elicited a smaller percentage of Congruent responses and a greater percentage of Research focus responses compared to the semifactual prompt, Incongruent responses are equally frequent for the two prompts (28% for the counterfactual prompt and 26% for the semifactual prompt). And, in fact, the rank order of the number of responses in each category is identical for the two prompts (Congruent > Incongruent > Research focus > Miscellaneous).

Inspection of the first two columns of Table 3 indicates that more funds were allocated given a counterfactual prompt compared to a semifactual prompt when individuals generate only Congruent arguments (i.e., persuasions given a counterfactual prompt and dissuasions given a semifactual prompt) but, consistent with prediction, this difference disappeared when they generated Incongruent arguments. Analysis of the funding allocations for Congruent and Incongruent responses for each prompt condition confirmed that prompt condition interacted with the congruency of the argument, $F(1, 132)=4.72, MSE=341.553, p=.032$, with no main effects of either prompt condition, $F(1, 132)=1.22, p=.27$, or congruency of argument, $F < 1$. (The pattern and significance of these effects remained when prior opinion was included as a covariate.) Planned follow-up tests showed, as predicted, that there was a highly significant effect of prompt condition for Congruent arguments, $F(1, 88)=7.17, MSE=367.727, p=.009$, with an 11 percentage points difference between individuals in the two prompt conditions. In contrast, for Incongruent arguments, as

expected, there was no significant difference between the prompt conditions, $F(1, 44) < 1$.

Given a dissuasive argument, funding decisions seem largely unaffected by the presence of a persuasive argument. To clarify the pattern, responses were rescored as benefit-only arguments (i.e., counterfactual congruent responses or persuasions, scored +1); doubt-only arguments (i.e., semifactual congruent responses or dissuasions, scored -1); and mixed (i.e., incongruent responses, e.g., a dissuasion and a persuasion, scored 0). In line with the analysis reported above, there was a main effect of the type of argument, $F(2, 133) = 4.01$, $MSE = 340.11$, $p = .02$. Bonferroni tests confirmed a significant difference in funding allocation between persuasion only and dissuasion only arguments ($p = .018$) and no difference between dissuasion only and mixed responses ($p = 1.0$). The difference between the persuasion only and mixed responses only approached significance ($p = .13$). Further analysis of the mixed responses is reported below.

Responses coded in the Miscellaneous category patterned in the same way as Congruent responses and showed a significant increase in percentage of funds allocated under the counterfactual compared to semifactual prompt, $F(1, 10) = 10.38$, $MSE = 160.625$, $p = .009$.

Precisely how individuals perceived or framed their task was also important. If they focused exclusively on how to obtain the requisite data (a Research focus) then there was no difference between the prompt conditions in the allocation of funds, $F < 1$.

One-sided thinking and myside bias. Arguments scored as Congruent ($n = 90$) are one-sided arguments—individuals produce a persuasion given a counterfactual prompt ($n = 36$) and a dissuasion given a semifactual prompt ($n = 54$). Arguments scored as Incongruent ($n = 46$) covered individuals who generated a persuasion and a dissuasion and those who generated a single argument incongruent with the prompt (e.g., a dissuasion in the case of a counterfactual prompt.) Of the 46 individuals producing incongruent arguments, 22 produced a persuasion and a dissuasion (i.e., a two-sided argument) and 24 produced one or the other (i.e., a one-sided argument). Overall, then two-sided arguments are a clear minority (16.2%: 22/136). These data do not imply that individuals could not generate two-sided arguments if requested. However, they do suggest the rhetorical power of a counterfactual or semifactual conditional to achieve persuasive effects at least in the short term.

Analysis of the funding decisions for those giving Incongruent responses showed that funds allocated did not differ as a function of prompt condition, number of arguments (one versus two) or the interaction of these factors (all F s < 1). Nonetheless it is of interest to see whether prior opinion was a factor in the generation of an incongruent response. As indicated in

the Method section, there was no overall difference in the prior opinions on GM crop research of those who generated solely Congruent arguments as opposed to those who generated an Incongruent argument. However, perhaps those producing one-sided incongruent arguments had more extreme prior opinions. If so, prior opinion should be more in favour of GM crop research for individuals arguing for a benefit of GM research given a semifactual prompt compared to those arguing for benefit given a counterfactual prompt. They were slightly more in favour (+0.64 scale points) but this difference was not significant, $F(1, 46) = 2.32$, $MSE = 1.58$, $p = .13$. Similarly, prior opinion was somewhat more against GM crop research ($-.67$ scale points) for those doubting its value given a counterfactual prompt compared to those doubting its value given a semifactual prompt. But again this difference was not significant, $F(1, 64) = 2.05$, $MSE = 2.133$, $p = .16$. For those generating two arguments (one persuasion and one dissuasion) prior opinion did not differ from that of those generating congruent responses in either prompt condition (both F s < 1).

It remains conceivable on the basis of these data that individuals with marginally more extreme opinions may override the lure of the prompt and so demonstrate a type of myside bias by generating a single-sided argument incongruent with the prompt. However, in such circumstances, the data indicate that there is no difference in the amount of funds allocated between single-sided benefit arguments and single-sided doubt arguments. Such a result contrasts with effects of generating single-sided arguments that are congruent with the prompt. In such circumstances there is a marked effect: more funds are allocated given a single-sided benefit argument. It seems, then, that the prompt exerted an effect even for those generating incongruent responses. It may have created a point of reference (cf. Koehler, 1999): prompting the possibility of benefits in the case of a counterfactual prompt and misgivings in the case of a semifactual prompt.

In summary, prior opinion on GM crop research helped to predict the percentage of research funds but there was an additional effect of the prompt such that those envisaging persuasions allocated more funds than those envisaging dissuasions but only when no undermining argument was present. Such a result is consistent with the notion that it is the structure of self-generated argument that is a key predictor of decisions. A stronger test of the view that it is the structure of arguments that is important is to manipulate the nature of this structure. Experiment 2 addresses this question.

EXPERIMENT 2

The precise effect of a dissuasive argument should depend on the argument structure and the causal model to which it refers. This expectation is

tested most simply by asking participants to consider arguments with the relevant properties, rather than by asking them to produce such arguments.

Prior research indicates that undermining a prior argument leads individuals to revise their decisions and to revise them again when the undermining argument is itself discounted (Green, McClelland, Muckli, & Simmons, 1999; Experiment 3). Such a situation is not uncommon in everyday contexts (see, for example, Rips, 1999, and Politzer, 2005, for a discussion of relevant pragmatic issues). However, the study by Green et al. did not vary the structure of the argument and so does not provide a test of the prediction that the impact of an undermining argument (a dissuasion) depends on the structure of the argument up to that point.

In the present study participants imagined themselves as advisors to a political committee required to allocate funds to GM crop research. Their task was specific: to pick the case that the committee would find most persuasive. That is, individuals judged how persuasive others would find the case. Consider these two summary cases for GM crop research that differ only in their second argument:

Case A:

Research into GM crops will lead to new varieties of rice that can grow in saltier conditions overcoming the threat of less fresh water for farming and so ensuring supplies of rice. GM crop research will also create new varieties of vegetables with increased resistance to damaging pests decreasing the use of harmful pesticides and so boosting resistance to disease in humans.

Case B:

Research into GM crops will lead to new varieties of rice that can grow in saltier conditions overcoming the threat of less fresh water for farming and so ensuring supplies of rice.

Such crops will mean that people on the coastal plains can continue to farm and live there and this will reduce the risk of war with nearby groups as they will not need to move in order to survive.

In case A, the first and second arguments are independent in that the survival benefits identified in the second argument depend on new varieties of vegetables being created and not on new varieties of rice being created. The arguments identify a causal model with two independent causal paths. In case B, on the other hand, the second argument is dependent on the first in that the survival benefits identified only arise if new varieties of rice are created. In this case, realising the benefits of the second causal path depends on the first as an enabling condition. A dissuasion undermining the first argument should therefore weaken case B relatively more than case A (see van Eemeren, & Grootendorst, 1992, pp. 76–85 for a discussion of argument structure).

In order to examine the impact of a dissuasion in different persuasive contexts, participants first judged the relative strength of the two cases. After doing so they learn that the government has stipulated that funding depends on practical results within 5 years, and read an undermining argument that technical difficulties make it unlikely that salt-tolerant varieties will be available within 5 years. They then rated their relative preference for the two cases again. The prediction was that those participants initially preferring the dependent argument case would markedly shift preference in favour of the independent argument case. In contrast, those preferring the independent argument case might be minimally influenced. The undermining argument reduces the strength of the independent argument case too and so individuals might consider that they have less reason to prefer it and so reduce the extremeness of their judgements.

This prediction derives from the fact that the two cases refer to two different causal models. It is therefore not predictable from the belief-adjustment model of Hogarth and Einhorn (1992) that does not characterise the nature of the representations involved.

In order to examine the effects of a discounting argument, participants made a further preference judgement having learned that the technical difficulty can be overcome. In such circumstances, any marked shift in preference is likely to be reversed. However, the previous judgement may function as an “anchor” (e.g., Tversky & Kahneman, 1974; see also Hogarth & Einhorn, 1992) and restrict the extent of adjustment back to the original rating. If this is so, undermining and discounting arguments will induce less extreme preferences.

The experimental technique relies on the fact that individuals show different initial preferences for the two argumentative cases that have the same policy goal. Prior research using simple inferences and artificial material (e.g., Osherson, Smith, Wilkie, Lopez, & Shafir, 1990) indicates that individuals consider independent arguments as providing better support for an inductive conclusion. However, to my knowledge, that has not been demonstrated for real-world arguments. Judgements for real-world arguments may reflect different assumptions about how arguments are appraised (e.g., Kuhn, 1991; Weinstock, Neuman, & Tabak, 2004) or different views or construals of the concerns of those taking policy decisions deriving, in part perhaps, from differences in the models of the world evoked in the participants by the different arguments.

Prior research (e.g., Kray & Gonzalez, 1999) indicates that in giving advice individuals emphasise just one dimension of choice and that the dimension chosen can differ between individuals. It seemed reasonable to expect, then, that individuals would show different initial preferences. Clearly, in order to infer that the impact of dissuasive argument depends on the structure of the argument to that point, initial preference for the two

cases needs to be equally strong (i.e., a comparable number need to select each of the two cases initially and their perceptions of the strength of the cases should be comparable). Given these conditions, the experiment provides a fair test of the core predictions.

On the basis of the results of Experiment 1, final judgments of the strength of a case should predict estimates of the proportion of funds allocated by the committee. Participants were asked to rate how much funds allocated should increase if the stronger rather than the weaker case was presented (see Bühner, Cheng, & Clifford, 2003; also Collins & Shanks, 2006, for use of a counterfactual question to assess the strength of a causal relation). As a final question they also judged how likely it is that lives that would not be saved if GM crop research did not go ahead, will be saved if it does.

Experiment 1 showed that prior opinion on GM crops affected funding allocations. It was an open question as to whether or not prior opinion would affect allocation estimates in the present study. Conceivably, when individuals adopt an advisory role and focus on how much more funding should be given when the more persuasively stronger case is presented, their prior opinion on GM crop research will not be predictive. Such a result will help identify a boundary condition for the effects of myside bias.

Method

Participants. A total of 85 adult volunteers (12 male, 68 females, 5 missing), who were applicants for a degree place in the Psychology Department, University College London. They ranged in age from 17 to 46 years with a mean age of 18 years.

Design. The experiment was a within-participants design in which participants judged the relative strength of two cases for funding (an independent argument case and a dependent argument case). The two cases shared a common first argument and differed in their second argument. The relationship between the first and second argument created the contrast between the independent argument case and the dependent argument case. The second argument was independent of the first in the former but dependent on it in the latter. The order of presenting the independent argument and dependent argument case was counterbalanced over participants.

Two variants were created. One is presented below (see Materials) and the other, partially derived from it, is presented in the Appendix. The variant ensured that any effects generalised to new content. Specifically, it ensured they were not a product of the content common argument or of the dependent arguments (see Appendix for details). Half the participants read one variant and half read another. Analysis of the key data (the preference

decisions, funding allocations, proportion of lives saved) revealed no main effect of version nor of order of presentation nor any interaction between these factors (either $F < 1$ or $p > .18$) and so these design factors are not further reported.

The relative preference for a case was judged on three occasions in a fixed order. The first occasion followed after individuals rated their opinion on six controversial issues and read the two cases. The second occasion followed their reading of the undermining argument. The third occasion followed the reading of the discounting argument.

After the final preference rating individuals answered two counterfactual questions: one concerned the additional funds that should be allocated if the stronger argument was presented compared to the weaker. The second asked individuals to judge how likely it was that lives would be saved if GM research went ahead compared to if it did not.

Materials and procedure. The materials were presented in a three-page booklet covering opinion on controversial issues, the preference rating task and the allocation and prediction tasks.

Opinion on controversial issues. As in Experiment 1, individuals rated their opinion on six controversial issues that included their opinion on GM crop research (see Table 1 for summary data). Again the primary purpose was to avoid drawing attention to this issue. The mean and standard deviation is very similar indicating a mildly favourable opinion for the sample as a whole. After completing their ratings, they turned to the next page of the booklet.

Preference rating task. The instructions for the preference task were as follows:

Please imagine the following future event: you are an advisor to a committee of politicians concerned with the consequences of climate change for your country. The committee has already allocated public funds to reduce the amount of greenhouse gases entering the atmosphere. There is also a need to develop new crops to feed and to protect the country's population. The committee has to decide how much funding to allocate to research into genetically modified (GM) crops. The amount allocated will depend on the strength of argument for this type of research. Any unallocated sums will be returned for use elsewhere. You read two short summaries of the research proposed into genetically modified (GM) crops. Your task is to recommend the version to be seen by the committee that makes the strongest case for funding. The versions below share one argument but differ in their second argument. There are various parts to this task and we'd like you complete each one before reading on—thank you.

The next section on the same page presented the two cases (the independent argument case and the dependent argument case) and individuals

rated their preference of one over another. In this example, the independent argument case is presented as version 1 and the dependent argument case is presented as version 2. For clarity's sake, the three preference ratings are listed under separate headings here:

First preference rating: initial cases

Version 1

Research into GM crops will lead to new varieties of rice that can grow in saltier conditions overcoming the threat of less fresh water for farming and so ensuring supplies of rice.

GM crop research will also create new varieties of vegetables with increased resistance to damaging pests decreasing the use of harmful pesticides and so boosting resistance to disease in humans.

Version 2

Research into GM crops will lead to new varieties of rice that can grow in saltier conditions overcoming the threat of less fresh water for farming and so ensuring supplies of rice.

Such crops will mean that people on the coastal plains can continue to farm and live there and this will reduce the risk of war with nearby groups as they will not need to move in order to survive.

Which version has the stronger argument in your view? Please circle one number on the following scale.

Version 1
has much stronger
arguments

Neither version
has stronger
arguments

Version 2
has much stronger
arguments

5 4 3 2 1 0 1 2 3 4 5

Second preference rating: undermining argument. Having completed their first preference rating participants then read the following information on the same page:

The government has recently insisted that no GM crop research programme can be funded unless it is reasonably certain that it will produce results within 5 years. You learn from another document available to committee members that:

Technical difficulties identified by research groups in the country indicate that new salt-tolerant varieties of rice crop are unlikely to be available within five years.

Individuals then rated their relative preference for the two versions in response to the question: “*Which version now has the stronger argument in your view?*”

The effects of undermining and discounting on case preference. The primary goal of the experiment was to examine how rated argument preference for the two types of case (an independent argument case and a dependent argument case) varied as function of an undermining dissuasion and a further argument that discounted that undermining argument. To explore this question, participants made preference judgements on three occasions using an 11-point scale with zero as the mid-point. In order to analyse the preference data, individuals were divided into those whose first preference was for the dependent argument case and those whose first preference was for the independent argument case. Two participants gave a first preference rating of 0 and so were excluded from this analysis. Comparable numbers preferred one case over another and there was no difference in absolute preference for those endorsing the dependent

argument case ($n = 45$), $M = 3.07$ (1.12) compared to those endorsing the independent argument case ($n = 38$), $M = 3.13$, (0.91), $F < 1$. In other words, for the sample as a whole, the two cases are of comparable perceived strength. Nor was initial preference related to prior opinion on GM crops ($F = 1.51$, $MSE = 1.85$, $p = .22$). In short, the initial preference data allow a fair test of the core predictions.

For purposes of analysis, preference for the dependent argument case is designated negative and preference for the independent argument case is designated positive so the 11-point scale runs from -5 through 0 to $+5$. The prediction was that the effects of undermining and discounting should be much greater for those who preferred the dependent argument case. Undermining the first argument should strongly shift preference towards the independent argument case. Discounting should induce a shift back. Table 4 displays the mean preference ratings and shift values for both cases as a function of undermining and discounting arguments. A shift in preference towards the independent argument case is indicated by a positive value. A shift in preference towards the dependent argument case is indicated by a negative value.

Inspection of Table 4 shows that when the first argument is undermined, those whose first preference was the dependent argument case shifted in favour of the independent argument case and shifted back towards dependent argument case when the undermining was discounted. In

TABLE 4
Experiment 2 mean case preference ratings

First preference	Initial [*]	Argument		Shift differences	
		Undermining	Discounting	Undermine ¹	Discount ²
Dependent argument case ($n = 45$)	-3.07 (1.12)	$+0.26$ (2.43)	-1.98 (2.30)	$+3.33$ (2.79)	-2.24 (3.65)
Independent argument case ($n = 38$)	$+3.13$ (0.91)	$+2.18$ (2.48)	$+2.21$ (2.21)	-0.95 (2.36)	-0.03 (2.39)

Experiment 2 mean case preference ratings (standard deviations) in response to undermining and discounting arguments together with mean shift differences for those preferring either the dependent argument case or the independent argument case as their first preference. Preference for the independent argument case is scored as positive.

*The mean values here reflect the assignment into those preferring a dependent argument case and those preferring an independent argument case.

¹Difference between the initial preference rating and the rating following the undermining argument.

²Difference in preference rating following the undermining argument and the discounting argument.

contrast, for those whose first preference was the independent argument case, undermining led to a small shift in favour of the dependent argument case and discounting led to no overall shift.

Analysis confirms these impressions. A mixed-factor ANOVA with the between-participants factor of first preference (dependent argument case/ independent argument case) and the within-participants factor of type of shift (undermine shifts vs discount shifts) showed a significant interaction between first preference and type of shift, $F(1, 81) = 25.44$, $p < .001$, $MSE = 15.861$. Subsequent t -tests confirmed that both shifts were significant for those whose first preference was the dependent argument case: undermine shift, $t(44) = 6.48$, $p < .0001$ and discount shift, $t(44) = -4.23$, $p < .001$. For those whose first preference was for the independent argument case, only the undermine shift was significant: undermine shift, $t(37) = -2.48$, $p = .018$, and discount shift $t = 0$.

Both main effects were also significant: shift type, $F(1, 81) = 12.34$, $p = .001$ and first preference, $F(1, 81) = 17.95$, $p = .001$. Undermining led to an overall positive shift ($M = +1.04$) and discounting to an overall negative shift ($M = -1.14$). Those preferring the dependent argument case showed a mean positive shift ($M = .367$) whereas those preferring the independent argument case showed a mean negative shift ($M = -.474$). There was no difference in the absolute amount of shift ($t < 0$) as a function of first preference. The average shift in preference between the first and third preference was 1.01 (1.70) scale points, $t(82) = 5.42$, $p < .001$. These results mean that undermining and then discounting reduced the extremeness of initial preferences and did so to the same extent for each type of argument. This finding helps explain why undermining led to a shift even for those preferring the independent argument case. On the face of it, it might seem that individuals only considered the impact of the undermining argument on their own case and ignored its greater impact on the other case. But clearly individuals did recognise that the impact was greater for the dependent argument case. In effect, the undermining argument meant that individuals could not take for granted the tacit and necessary conditions for the conditional arguments to hold (Politzer, 2005) and they became sensitised to the potential vulnerability of their preferred case.

Causal effect of argument preference. A subsidiary goal was to check the prediction that rated case preference affected estimates of the amount of funds that should be allocated, given the stronger rather than the weaker case is presented, and to examine the impact, if any, of prior opinion on GM crop research on these estimates. In order to examine this prediction, ratings for the third (and final) preference judgement were converted to absolute values. Individuals ($n = 8$) who considered that neither case was stronger

than the other (i.e., gave a zero rating) were excluded. Multiple regression analyses showed, as expected, that absolute final preference predicted the proportion of funds allocated and the perception of how many lives would be saved if GM crop research went ahead compared to if it did not ($t = 4.61$, $p < .001$ and $t = 2.91$, $p = .005$, respectively), but prior opinion on GM crops was not predictive in either case ($t = 1.40$, $p = .16$ and $t = 1.16$, $p = .25$, respectively).

In summary, Experiment 2 tested the prediction that the impact of a dissuasive argument would depend on the prior persuasive context and in particular on the structure of the causal model referred to by the persuasive arguments. As predicted, a dissuasive argument undermining the argument in common between the two cases altered preference substantially for those preferring the dependent argument case. A further argument undermining the dissuasive argument shifted preference back. The net effect of dissuasive and undermining arguments was to reduce the extremeness of preference judgements as if individuals had become sensitised to the vulnerability of their preferred case to dissuasive arguments. In estimating funding allocation, only rated preference for a case was predictive. Individuals believe therefore that if the argumentatively stronger of two cases is presented that others will be swayed as a function of the strength of the case. However, in contrast to Experiment 1, where individuals imagined themselves to be actual members of the committee, prior opinion on GM crops was not predictive.

GENERAL DISCUSSION

Review of main findings

Everyday informal arguments between individuals involve a process of argument and counter-argument. In an attempt to persuade others of a point of view or to an action devoted to achieving a goal, individuals may prompt individuals to think about future states of affairs (Thompson et al., 2005). What is involved in this process? Individuals may come to change their beliefs but the belief-updating model of Hogarth and Einhorn (1992) is silent on the nature of the representation constructed and cannot predict the consequences of the argumentative responses individuals may make. The theoretical proposal adopted here makes such predictions possible by treating arguments as representing causal paths in a mental causal model. According to the proposal, when individuals are prompted to think about a future state of affairs, they construct a mental causal model and assess whether a particular state of affairs is probable given certain prior actions. Whether individuals will endorse a particular point of view will depend on the causal model they generate. If they envisage a factor that disables a

causal path in their model then they may be less willing to endorse the proposed action and propose a dissuading argument. These considerations suggest that individuals construct a dual representation: a representation of the structure of arguments and the paths in a causal model to which they refer (Green, 1996a, 2000, 2007; Green & McCloy, 2003). On this view, the non-monotonic properties of everyday arguments arise from changes to the causal structure of envisaged models.

The results of Experiment 1 were consistent with this notion. Individuals imagined themselves to be members of a research committee allocating funds. Those who were invited to complete the counterfactual prompt: "If we were to allocate sufficient funds to GM crop research..." allocated a higher proportion of the research budget to such research than those invited to complete the semifactual thought: "Even if were to allocate sufficient funds to GM crop research..." except when they envisaged an undermining argument, for example, a dissuasive argument in the context of counterfactual prompt. On a methodological note, the observed effects were not mediated by the requirement to rate regret at not allocating sufficient funds. This result leaves open the question whether individuals routinely anticipate regret at not doing something as part of their decision making.

Theoretically, the impact of a dissuasive argument should depend on the persuasive context or structure of the causal model. Experiment 2 tested this prediction by manipulating the nature of the causal model referenced by a dissuasive argument. The results confirmed the prediction. Individuals judged that an independent arguments case was less affected by an undermining, dissuasive argument than a dependent arguments case. In the independent arguments case, the second of two arguments was independent of the first. That is, each argument referred to a model in which there were two separate causal paths leading to desired goal. In the dependent argument case, the causal path referenced by the second argument depended on the first causal path. In consequence, an argument that undermined the common first argument (i.e., disabled the causal path it referenced) severely weakened the dependent arguments case and individuals who preferred the dependent arguments case initially strongly shifted preference in favour of the independent arguments case. When the dissuasive argument was itself discounted their preference for the dependent arguments case rebounded.

Reading undermining and discounting arguments did not lead individuals to reinstate their initial preferences. On the contrary, judgements become less extreme. Such an outcome is consistent with the broad notion that individuals adjust preferences from successive anchors (cf. Hogarth & Einhorn, 1992; Tversky & Kahneman, 1974). Research on the cognitive process of adjustment (e.g., Epley & Gilovich, 2006) has focused on point estimates of observable events or facts (e.g., the freezing point of vodka). In the case of self-generated rather than experimenter-provided anchors there

is evidence of a process of adjustment (Epley & Gilovich, 2006). However, the preference ratings in the present study are not point estimates and so it is not clear whether the same process applies. Less extreme judgments may instead reflect a recognition that the preferred case is vulnerable to a dissuasion. More generally, the process of adjusting from an anchor is silent on the different effects of undermining and discounting on the independent and dependent argument case and so these results cannot be explained by the belief-adjustment model of Hogarth and Einhorn (1992). Instead, they are better set in the context of research on reasoning under uncertainty in which confidence in the truth of a conditional changes in the light of further information and, in particular, when that information (a dissuasion here) undermines the tacit but necessary conditions for a conditional to hold (Politzer, 2005).

Prior opinion, arguments, and points of view

The results of Experiment 1 and 2 also speak to the impact of prior opinion on decisions and, in the case of Experiment 1, the kinds of arguments that individuals generate. In order for the prompts to affect decisions in Experiment 1, individuals in the main must generate one-sided arguments; that is, persuasions in the case of a counterfactual prompt and dissuasions in the case of the semifactual prompt. Given that there was a range of opinion on GM crop research and no difference between the groups in their prior opinions, a prompt must have at temporarily overridden for some individuals within each condition, any myside bias. Nor was the production of an undermining argument strongly tied prior opinion. Instead, the results of Experiment 1 suggest that the generation of a single argument in opposition to the prompt does not yield the same outcomes as when a single argument is generated consistent with the prompt. There was a significant difference in funding only in the latter case. This suggests that the prompt may have framed the problem (cf. Koehler, 1991) and, on the present proposal, led individuals to assume the presence of potential enabling factors (given a counterfactual prompt) or disabling factors (given a semifactual prompt).

Such results attest to the rhetorical power of everyday strategies for influencing opinion but also indicate that just as a prompt to think hypothetically, does not fully constrain what individuals think, so a conditional statement such as "If the Kyoto accord is ratified there will be a downturn in the economy" used by Thompson et al. (2005) should not prevent individuals from thinking of a dissuasive, undermining, argument.

Although prior opinion was not predictive of the kinds of arguments generated, it was still a predictor of funds allocated and so it is reasonable to infer that the act of mentally simulating a future possibility temporarily at

least moderated the effects of prior opinion. In contrast to Experiment 1, prior opinion on GM crop research was not predictive of estimates in Experiment 2. In Experiment 1, individuals imagined themselves to be members of the research committee allocating such funds whereas in Experiment 2 they imagined themselves to be advisors to such a committee. Adopted viewpoint may be one factor that allows a decoupling of prior belief on decisions. It may be that the advisory role emphasises a more decontextualised mode of thinking (i.e., system 2 in terms of Evans, 2003; Thompson et al., 2005) whereas the participant role entrains the default contextualised mode of thinking (i.e., system 1 thinking). An alternative but not unrelated possibility is that the advisory role simply focuses attention on the argumentative properties of the case (see Kray & Gonzalez, 1999, cited above, for work on choosing versus advising).

The present findings reinforce the findings of Thompson et al. (2005) that point of view is an important variable in understanding informal argument. It is likely to be critical in understanding the factors that lead individuals to generate dissuasive arguments. Thompson et al. (2005) showed that inviting individuals to think of the conditional from their own, as opposed to the writer's, perspective, elicited different inferences (see Green, 1996b, for an example of the effects of such perspective shifts in the context of consumer advertising). Prompting a shift in perspective is likely to be one factor influencing the incidence of dissuasions, or, indeed, whether persuasions or dissuasions are generated at all. Some individuals in Experiment 1 adopted a "research focus" which ignored the merits of GM crop research and focused on methodological matters.

Granted that point of view or how the problem is framed (Koehler, 1991) is one factor that affects how people argue, the nature of the problem may be important too. Stanovich and West (2007) propose that beliefs differ in the degree of myside bias that they induce. Some beliefs may resist counterarguments. The present studies did not address this question but did presuppose that opinions reflect complex affective-cognitive and motivational structures (see Green et al., 2006). Opinions on specific issues may then be part of a network of beliefs. Principal component analysis of the opinion data pooled over Experiments 1 and 2 revealed two components that accounted for 44.9% of the variance. Component 1 (accounting for 25.7%) showed the strongest loadings on GM crop research, human cloning, and nuclear power. The loadings in decreasing order were: human cloning (0.761); GM crop research (0.707); nuclear power (0.547); joining the Economic Monetary Union, EMU (0.336); electronic tagging (0.218); and free trade (0.046). Component 2, by contrast, showed the strongest loadings for free trade, electronic tagging, and EMU. The loadings in decreasing order were: free trade (0.785); electronic tagging (0.472); EMU (0.410); cloning (0.050); GM crop research (-0.197); and nuclear power

(-.321). A possible description of these two components is that the first refers to views about intervention in the natural world and the second refers to view on intervention in human affairs. It may be as Stanovich and West (2007) propose that beliefs vary in the myside bias they engender but these beliefs are part of broader networks representing cultural/metaphysical orientations to the world.

Future studies

In both studies, arguments provided a reason for action or a decision (e.g., Davidson, 1963) whether in terms of a person's own judgements or in terms of the judgements they believe others should make in the light of the presented arguments. They therefore reinforce prior research that has examined the role of presented and self-generated arguments in the context of mock verdict decisions (Green & McCloy, 2003). Individuals decide in favour of a plaintiff or of a defendant in a trial when their mental simulation of their model of the events (see Kahneman & Tversky, 1982) yields an effective explanation (i.e., an abductive explanation) for the state of affairs. This view of an intimate connection between arguments, causal models, and mental simulation leads to other predictions.

Heller (2006) proposed, in the context of accounting for differences in conviction rates between circumstantial and direct evidence, that it is the ease with which individuals can imagine the defendant guilty or not guilty that accounts for their verdicts. It is easier to mentally simulate direct evidence.

This suggests that a policy will be preferred if it is easy to imagine the action bringing about the intended state of affairs. The ease of such simulation (cf. Sanna & Schwartz, 2003) may then provide the cognitive basis for individuals' estimates of the conditional probability of the consequent given the antecedent. As noted in the Introduction, it is this conditional probability that underlies judgements of the probability of a conditional statement such as "If policy X is carried out it will deliver a benefit" (see, for example, Evans & Over, 2004). On the basis of the results presented here, relative to a semifactual prompt, a counterfactual prompt should lead to a stronger endorsement of the conditional "If GM crop research is funded sufficiently that there will be benefits for the population" except when individuals envisage a disabling factor expressed as a dissuasion.

More generally, ease of mental simulation should affect another aspect of the causal model: the perceptions of the strength of causal paths and not just the structure of those paths. If so, it should also be a factor in the assessment of the perceived strength of an argument.

The ease with which individuals can imagine a future state of affairs or imagine problems achieving that state of affairs may also be a factor

influencing their judgements of what makes one case more persuasive than another. Experiment 2 showed that individuals differ in their views of the persuasive effects of different cases that have the same policy goal. Such differences merit further enquiry. As noted, prior research using simple inferences (e.g., Osherson et al., 1990) indicates that individuals consider independent arguments as providing better support for an inductive conclusion. However, there was no such unanimity in Experiment 2. As suggested earlier, differences in preference for real-world persuasive arguments may reflect individual differences in the ease of mentally simulating different models, different assumptions about how arguments are appraised (e.g., Kuhn, 1991; Weinstock et al., 2004) or different views or construals of the concerns of those taking policy decisions deriving, in part perhaps, from differences in the models of the world evoked in the participants by the different arguments. Precisely how arguments are expressed is also likely to be important. Expression will affect the perceived relevance of the issue to an individual and the precise wording may affect the nature of invited inferences (cf. Thompson et al., 2005) and so the precise nature of the causal model that is constructed.

Conclusion

On the theoretical front, the results of these experiments are consistent with the view that arguing informally involves the construction of a dual mental representation: one is a mental causal model that represents the linkage between an action and a state of affairs and the other represents arguments that refer to that structure. Disabling a causal path is equivalent to a dissuasive argument and the impact of such an argument depends on the causal structure already represented. The dual representation view predicts that ease of mental simulation will have wide-ranging effects on judgements of argument strength and assessments of the value of a policy option. However, it also points to the need to study the rhetorical properties of arguments because informal argument is embedded in the pragmatics of discourse.

Manuscript received 3 November 2006
 Revised manuscript received 8 June 2007
 First published online 3 September 2007

REFERENCES

- Baron, J. (1995). Myside bias in thinking about abortion. *Thinking & Reasoning*, 1, 221–235.
 Bonnefon, J. F., & Hilton, D. J. (2004). Consequential conditionals: Invited and suppressed inferences from valued outcomes. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 30, 28–37.

- Bühner, M. J., Cheng, P. W., & Clifford, D. (2003). From covariation to causation: A test of the assumption of causal power. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 29, 1119–1140.
- Byrne, R. M. J. (1989). Suppressing valid inferences with conditionals. *Cognition*, 31, 61–83.
- Carroll, J. S. (1978). The effect of imagining an event on expectations for the event: An interpretation in terms of the availability heuristic. *Journal of Experimental Social Psychology*, 14, 88–96.
- Collins, D. J., & Shanks, D. R. (2006). Conformity to the power PC theory of causal induction depends on the type of probe question. *Quarterly Journal of Experimental Psychology*, 59, 225–232.
- Cummins, D. D. (1995). Naïve theories and causal deduction. *Memory and Cognition*, 19, 274–282.
- Davidson, D. (1963). Actions, reasons and causes. *Journal of Philosophy*, 60, 685–700.
- Epley, N., & Gilovich, T. (2006). The anchoring-and-adjustment heuristic. *Psychological Science*, 17, 311–318.
- Evans, J. St. B. T. (2003). In two minds. *Trends in Cognitive Sciences*, 7, 454–459.
- Evans, J. St. B. T., Handley, S. J., & Over, D. E. (2003). Conditionals and conditional probability. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 29, 321–335.
- Evans, J. St. B. T., & Over, D. E. (2004). *If*. Oxford, UK: Oxford University Press.
- Gigerenzer, G. (1999). *Simple heuristics that make us smart*. Oxford, UK: Oxford University Press.
- Green, D. W. (1996a). Models, arguments and decisions. In J. Oakhill, & A. Garnham (Eds.), *Mental models in cognitive science: A festschrift for Philip Johnson-Laird* (pp. 119–137). Hove, UK: Psychology Press.
- Green, D. W. (1996b). Inferring health claims: A case study. *Forensic Linguistics*, 3, 299–321.
- Green, D. W. (2000). Argument and opinion. In J. García-Madruga, N. Carriedo, & M. J. González-Labra (Eds.), *Mental models in reasoning* (pp. 57–67). Madrid: UNED.
- Green, D. W. (2007). A mental model theory of informal argument. In W. Schaeken, A. Vandierendonck, W. Shroyens, & G. d'Ydewalle (Eds.), *The mental models theory of reasoning: Refinements and extensions* (pp. 189–208). Hove, UK: Psychology Press.
- Green, D. W., Applebaum, R., & Tong, S. (2006). Mental simulation and argument. *Thinking & Reasoning*, 12, 31–61.
- Green, D. W., McClelland, A., Muckli, L., & Simmons, C. (1999). Arguments and deontic decisions. *Acta Psychologica*, 101, 27–47.
- Green, D. W., & McCloy, R. (2003). Reaching a verdict. *Thinking & Reasoning*, 9, 307–333.
- Heller, K. J. (2006). The cognitive psychology of circumstantial evidence. *Michigan Law Review*, 105, 241–305.
- Hetts, J. J., Boninger, D. S., Armor, D. A., Gleicher, F., & Nathanson, A. (2000). The influence of anticipated counterfactual regret on behaviour. *Psychology & Marketing*, 17, 345–368.
- Hogarth, R. M., & Einhorn, H. J. (1992). Order effects in belief updating: The belief-adjustment model. *Cognitive Psychology*, 24, 1–55.
- Johnson-Laird, P. N. (1983). *Mental models: Towards a cognitive science of language, inference and consciousness*. Cambridge, UK: Cambridge University Press.
- Kahneman, D., & Tversky, A. (1982). The simulation heuristic. In D. Kahneman, P. Slovic, & A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases* (pp. 201–208). New York: Cambridge University Press.
- Koehler, D. (1991). Explanation, imagination and confidence in judgement. *Psychological Bulletin*, 110, 499–510.
- Kray, L., & Gonzalez, R. (1999). Differential weighting in Choice versus Advice: I'll do this, you do that. *Journal of Behavioural Decision-Making*, 12, 207–217.

- Kuhn, D. (1991). *The skills of argument*. Cambridge, UK: Cambridge University Press.
- Loomes, G., & Sugden, R. (1982). Regret theory: An alternative theory of rational choice under uncertainty. *Economic Journal*, 92, 805–824.
- McCloy, R., & Byrne, R. M. J. (2002). Semifactual “even if” thinking. *Thinking & Reasoning*, 8, 41–67.
- Oaksford, M., & Chater, N. (2003). Conditional probability and the cognitive science of conditional reasoning. *Mind and Language*, 18, 359–379.
- Osherson, D., Smith, E. E., Wilkie, O., Lopez, A., & Shafir, E. (1990). Category-based induction. *Psychological Review*, 97, 185–200.
- Over, D. E., Manktelow, K. I., & Hadjichristidis, C. (2004). Conditions for the acceptance of deontic conditionals. *Canadian Journal of Experimental Psychology*, 58, 96–105.
- Pearl, J. (2000). *Causality: Models, reasoning and inference*. Cambridge, UK: Cambridge University Press.
- Pennington, N., & Hastie, R. (1993). Reasoning in explanation-based decision-making. *Cognition*, 49, 123–163.
- Perkins, D. N. (1985). Post primary education has little impact on informal reasoning. *Journal of Educational Psychology*, 77, 562–572.
- Politzer, G. (2005). Uncertainty and the suppression of inferences. *Thinking & Reasoning*, 11, 5–33.
- Politzer, G., & Carles, L. (2001). Belief revision and uncertain reasoning. *Thinking & Reasoning*, 7, 217–234.
- Richard, R., de Vries, N. K., & van der Pligt, J. (1998). Anticipated regret and precautionary sexual behaviour. *Journal of Applied Social Psychology*, 28, 1411–1428.
- Rips, L. R. (1999). Reasoning and conversation. *Psychological Review*, 105, 411–441.
- Sanna, L. J., & Schwarz, N. (2003). Debiasing the hindsight bias: The role of accessibility experiences and (mis)attributions. *Journal of Experimental Social Psychology*, 39, 287–295.
- Shafir, E., Simonson, I., & Tversky, A. (1993). Reason-based choice. *Cognition*, 49, 11–36.
- Sloman, S. A., & Lagnado, D. (2005). Do we “do”? *Cognitive Science*, 29, 5–39.
- Spence, A., & Townsend, E. (2006). Implicit attitudes towards genetically modified (GM) foods: A comparison of context-free and context-dependent evaluations. *Appetite*, 46, 67–74.
- Stanovich, K. E., & West, R. F. (2007). Natural myside bias is independent of cognitive ability. *Thinking & Reasoning*, 13, 225–247.
- Stevenson, R. J., & Over, D. E. (1995). Deduction from uncertain premises. *Quarterly Journal of Experimental Psychology*, 48A, 613–643.
- Thompson, V. A., Evans, J. St. B. T., & Handley, S. J. (2005). Persuading and dissuading by conditional argument. *Journal of Memory and Language*, 53, 238–257.
- Toplack, M. E., & Stanovich, K. E. (2003). Association between myside bias on an informal reasoning task and amount of post-secondary education. *Applied Cognitive Psychology*, 17, 851–860.
- Tversky, A., & Kahneman, D. (1974). Judgement under uncertainty: Heuristics and biases. *Science*, 185, 1124–1130.
- van Eemeren, F. H., & Grootendorst, R. (1992). *Argumentation, communication and fallacies: A pragma-dialectical perspective*. Hillsdale, NJ: Lawrence Erlbaum Associates Inc.
- Walton, D. N. (1989). Dialogue theory for critical thinking. *Argumentation*, 3, 169–184.
- Weinstock, M., Neuman, Y., & Tabak, I. (2004). Missing the point or missing the norms? Epistemological norms as predictors of student’s ability to identify fallacious arguments. *Contemporary Educational Psychology*, 29, 77–94.

APPENDIX: CASE VARIANT

The variant ensured that any effects generalised to new content. Specifically, it ensured they were not a product of the content-common argument or of the dependent arguments. For clarity's sake, the variant presented in the Materials section is termed the original case. The new common argument in the variant was the second argument in the original independent argument case (i.e., *Research into GM crops will lead to new varieties of vegetable with increased resistance to damaging pests, decreasing the use of harmful pesticides and so boosting resistance to disease in humans*). In turn, the common argument in the original case (*GM crop research will also create new varieties of rice that can grow in saltier conditions overcoming the threat of less fresh water for farming and so ensuring supplies of rice*) became the second argument in the independent argument case of the variant. A new second argument was written for the dependent argument case (*Such vegetables will also reduce the costs of production for low-income farmers, improve their standards of living and health and reduce the threat of social unrest in non-urban areas*).

Version 1: Independent argument case

Research into GM crops will lead to new varieties of vegetable with increased resistance to damaging pests, decreasing the use of harmful pesticides and so boosting resistance to disease in humans.

GM crop research will also create new varieties of rice that can grow in saltier conditions overcoming the threat of less fresh water for farming and so ensuring supplies of rice.

Version 2 – Dependent argument case

Research into GM crops will lead to new varieties of vegetable with increased resistance to damaging pests, decreasing the use of harmful pesticides and so boosting resistance to disease in humans. Such vegetables will also reduce the costs of production for low-income farmers, improve their standards of living and health and reduce the threat of social unrest in non-urban areas.