

Outcome Knowledge, Regret, and Omission Bias

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Subjects made or evaluated decisions in hypothetical scenarios. We manipulated knowledge about the outcome and act vs omission in four cases. In case 1 (production processes), acts (changing the process) were considered better than omissions when the decision maker did not know the outcome or knew that it was better than the status quo. Acts were considered worse than omissions once the decision maker learned that the foregone option would have led to an even better outcome. In case 2 (medical treatment), act vs omission again interacted with gain vs loss (relative to the status quo) unless the outcome of the foregone option was known, in which case act vs omission interacted with better vs worse (of the two options). In case 3 (fetal testing), subjects tolerated less risk of miscarriage when a potential for regret was present (because the test with the risk of miscarriage, although better, might miss disorders that another test would detect). This effect was greater for actions than omissions. In case 4 (vaccination), subjects showed less tolerance of vaccine risk when the decision maker would know about the outcome of vaccination or nonvaccination. Thus, the bias toward omission (not vaccinating) is greater when potential regret is present, and potential regret is greater when knowledge of outcomes is expected. © 1995 Academic Press, Inc.

When a decision leads to a bad outcome, relative to what might have been, people think that the decision was worse if the outcome resulted from action than if it resulted from inaction (Baron & Ritov, 1994; Kahneman & Tversky, 1982; Miller & Taylor, in press; Ritov & Baron, 1990; Spranca, Minsk, & Baron, 1991). This

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result has been called omission bias. One way in which omission bias might occur is that people might expect greater regret for bad effects of actions than for bad effects of omissions. This is because acts tend to be seen as more causal than omissions (Spranca *et al.*, 1991), and blame, including self-blame and regret, depends on perception of causality (e.g., Fincham & Jaspers, 1980). Regret can affect decisions if decision makers avoid options that could produce it. Such anticipated regret might be especially conspicuous when the decision maker expects to know the outcome of the choice not taken, because learning that the outcome was bad and could have been avoided will evoke regretful feelings. This paper provides evidence for the link among omission bias, outcome knowledge, and regret. It also shows an effect of knowing only the outcome of the chosen option, as opposed to the foregone option.

Regret, as Sugden (1985) points out, has two components. One component has to do with feelings of responsibility, blame, and subjective evaluation of the quality of the decision. The other component pertains to evaluation of a chosen option by comparison of the outcome that occurred to the one that might have occurred. The first component of regret may occur even without knowing what would have happened had one chosen differently. The second component, however, must depend to a large extent on the availability of outcome information. Hence, the extent of uncertainty resolution is expected to affect evaluation of outcomes and consequently choice as well, through regret. (However, it is possible to think about how we would feel if we knew the outcome, even if we never will.)

Comparison of the obtained outcome to alternative outcomes has been shown to affect omission bias. Baron and Ritov (1994) found that acts leading to a worse outcome than the alternative outcome were judged as worse than omissions that lead to the worse of the two outcomes, regardless of whether these out-

comes were gains or losses relative to the status quo. Miller and Taylor (in press) obtained the same result, although they did not manipulate the status quo. This bias is at least partially explained by norm theory. What actually happened is compared to what might have been, with the outcome of omission usually considered a neutral reference point. People think that a bad outcome of an act is particularly bad if it could have been avoided by doing nothing, but they are less inclined to think that a bad outcome of an omission is particularly bad because it could have been avoided through some action.

The bias toward omission has been found also in cases in which the outcome of the option not chosen will never be known. People are reluctant to vaccinate their child, for example, even if the risk of death from the vaccine is lower than the risk of death from the disease (Ritov & Baron, 1990). Hence, the role of comparison to alternative outcomes in generating omission bias in evaluation and choice needs to be further examined.

Decisions under uncertainty vary in the extent to which uncertainty is resolved after the decision is made. For example, in choosing to invest in stock A rather than stock B, one eventually comes to know the value of both stocks. We shall call this type of situation, in which uncertainty is resolved for all options, complete knowledge. In other situations, uncertainty is resolved only for the chosen alternative. For instance, in deciding whether to vaccinate one's child against a disease, only one outcome is obtained: that of the chosen option. If one has chosen to vaccinate, the outcome of vaccination is obtained, but one will never know for certain what would have happened had one chosen not to vaccinate. We call this partial knowledge. Finally, there are situations in which the decision maker knows *no outcome, neither the outcome of the chosen option nor that of the foregone option*. We call this no knowledge.

In the present studies, subjects evaluated hypothetical decisions, both before and after the outcome is known. We asked whether the evaluation of the decision depends on whether the outcome resulted from an act or an omission, and on whether the outcome will be known or not, that is, on knowledge. We contrast all three knowledge conditions—full, partial, and none—whenever possible. We ask about the extent of omission bias in each of these three knowledge conditions. If omission bias is caused by anticipated regret over actions more than omissions, then we would expect more bias with more knowledge.

In particular, with full knowledge, regret will be greatest when the outcome of action leads to a worse outcome than the outcome of inaction (which will be eventually known). If such an event could happen with

an action, the subject will consider the action less good as a choice, because of the anticipation of this regret.

In partial knowledge we hypothesize that the outcome that occurred is compared to the most salient or most easily imaginable alternative state. This could be the status quo, or some other state. It may also be the predicted outcome of the foregone option, but this is not necessarily the case. Whatever the comparison state, outcomes are likely to be regarded as better or worse than this state. Consequently, omission will be preferred if the outcome is better than the comparison state, whereas action is likely to be preferred if the outcome is worse.

In the case of no knowledge, people should be less inclined to think at all about how they will feel about the comparison of outcomes to what might have occurred. Instead, they will make decisions more on the basis of expected consequences. Alternatively, subjects might think about various possible ways of filling in what might happen for both chosen and unchosen options, as assumed implicitly by regret theory in its original form (Bell, 1982; Loomes & Sugden, 1982). Our main hypothesis, however, is that this does not happen all the time, so that the effects of anticipated regret on decisions are at least greater when some knowledge is expected than when it is not.

The four experiments vary in the situations used and in whether the subjects are asked to predict the feelings of someone else (Experiment 1), put themselves in someone else's position (Experiments 2 and 4), or imagine themselves in a situation (Experiment 3). We know of no previous studies of regret or omission bias that find effects of such differences, and in some of our own studies we have looked explicitly for them (Ritov & Baron, 1990; Baron & Ritov, 1994).

A few previous studies have examined the effect of anticipated knowledge on possible regret effects, although none has examined the effect of knowledge on omission bias as such. Ritov (1994) found that anticipation of complete knowledge led to some preference reversals in choice between gambles. When complete knowledge was associated with high probability of regret, expectation of complete knowledge increased preference for regret-minimizing choices. Kelsey and Schepanski (1991) found no effect of anticipated knowledge in hypothetical taxpayer decisions, but they used a between-subject design with a small number of cases and subjects. Simonson (1992) found that subjects who were led to anticipate their feelings made choices that were more easily justified, such as purchasing a familiar brand or buying an item on sale now rather than waiting for a better sale. Subjects may have seen these options as defaults, in which case Simonson's results would agree with those we find here. Josephs, Larrick, Steele, and Nisbett (1992) reported evidence that ex-

pected outcome knowledge affected choices of subjects low in self-esteem but not of subjects high in self-esteem. They suggest that regret is a threat to self-esteem so it is avoided when self-esteem is fragile. (We do not measure self-esteem in the present studies.)

The present study also provides additional evidence for anticipated-regret effects of any sort. Early demonstrations of anticipated-regret effects (e.g., Loomes, 1987) showed that decisions were affected by the pairing of outcomes with uncertain states. For example, lottery A (with 100 tickets) yields \$24 if any of tickets 1–9 are drawn; B yields \$16 for 10–21. Most people choose A because more regret will occur if 1–9 are drawn than if 10–21 are drawn. But most people prefer lottery C, yielding \$16 for 1–12, over A because the regret with 1–9 is much reduced. Note that the probability and prize in B and C are the same. Starmer and Sugden (1993), however, found that these results were artifactual; they resulted from presenting the outcomes from C in two columns (1–9 and 10–12). Thus, the evidence for anticipated-regret effects comes largely from the studies just cited, plus one other study, that of Beattie, Baron, Hershey, and Spranca (1994), which did find an effect of the pairing of outcomes within a state: subjects were less willing to make decisions at all when their choice led to different outcomes in different states.

EXPERIMENT 1

In this experiment, subjects were presented with a hypothetical managerial decision, expected to increase efficiency. The manager described had decided either to implement a proposed new procedure or not, in a between-subject design. Subjects were asked to judge the manager's satisfaction with his decision under three knowledge conditions, one at a time: the outcome of his decision is not known yet, the outcome is known but the outcome of the alternative option (adopted by another factory) is not, and, finally, both outcome are known. The outcome of the decision in all cases is positive: the efficiency has increased. However, the alternative outcome, when it is known, turns out to be better still.

We hypothesize that, in the complete knowledge condition, as the manager learns that his decision led to the worse of the two possible outcomes, satisfaction will be lower in case of action than in case of omission. In the partial knowledge condition, on the other hand, the manager who learns that his decision led to an efficiency increase is likely to be more satisfied if this resulted from an act rather than an omission. As suggested earlier, assumptions concerning the outcome of one's choice, relative to the outcome of the foregone option, are less likely to be made if the outcome of nei-

ther alternative is known yet. Hence, under no knowledge, the distinction between omission and commission might be reduced.

Method

Ninety-one industrial engineering students at Ben Gurion University completed the questionnaire during regular class sessions. Each subject was randomly assigned to one version, act or omission.

In both versions subjects were presented with a situation in which a company, owning two "twin" production plants, was considering the possibility of implementing a certain change in the production system, designed to increase efficiency. The implementation of the change would not incur any extra costs. The proposed change was brought before the board of directors, and pros and cons were voiced. As the board could not reach a unanimous decision, each of the two managers of the production plants was given the choice whether to implement the proposed change in his plant.

Next, subjects in the act version were told that the manager of plant A decided to implement the change (in the omission version they were told that the manager decided not to implement the change). Following the description of the problem and the decision of the manager, subjects were told that it is getting close to a year's time since the decision, but the calculation of the year's production costs has not yet been completed. Subjects were asked to imagine the manager's satisfaction with his decision, at this point in time, when the outcome information is not yet available to him. A 9-point scale was used, ranging from "little satisfaction" to "very high satisfaction." After making the rating, half the subjects in each version were told, "The manager of plant A knows that the manager of plant B has made the opposite decision. The announcement of production costs in plant B is expected shortly."

In both versions, subjects completed the first part without knowing that a second part of the questionnaire was to follow. After subjects completed the first part, the second part was handed out. In this part subjects were told, "At the end of this year it was found that the production costs of the plant were 7% lower than the production costs the previous year." Subjects were then asked to re-judge the manager's satisfaction with his decision concerning the change in the production system, now that the outcome of the decision has become known.

Finally, after the second part has been completed, a third part of the questionnaire was handed out. In this part the following information was added: "The data for both plants were now made public. The manager of plant A has just learned that, in plant B, where the

opposite decision was made, the production costs were 9% lower than the production costs the previous year." Subjects were asked, once again, to judge the satisfaction of plant A manager with his decision, now that he knows the outcome of both options. The same scale was used as before.

Results

The between-subject manipulation (within each version) of knowledge that the other manager made the opposite decision did not significantly affect the responses, so the results were combined across this factor. The mean responses to the three parts of each version are presented in Table 1. Clearly satisfaction was dramatically affected by the availability of information concerning outcomes ($F_{2,88} = 27.60, p < .001$ for the main effect of outcome information). In all versions satisfaction increased upon learning the positive outcome of the manager's decision, and decreased, later, when the subjects learned that the alternative choice had produced even better results than the choice made by the manager of plant A.

The overall omission effect is almost significant ($F_{1,89} = 3.31, p = .07$ for the between-subject omission factor). However, the omission factor interacted with outcome information ($F_{2,88} = 9.75, p < .001$). Action was rated higher than omission in the first part of the questionnaire, in which no outcome information was available ($F_{1,89} = 4.10, p < .05$), as well as in the second part, once the positive outcome of the manager's choice was made known ($F_{1,89} = 18.64, p < .001$). Action ratings became lower than omission ratings in the final part, when the better outcome of the foregone option was made known, although this effect by itself was not significant ($F_{1,89} = 1.76, p = .19$). (The failure to get a significant difference did not result from a floor effect for satisfaction ratings: only six subjects used the "little satisfaction" response, five in the omission condition.)

EXPERIMENT 2

In this experiment, subjects rated happiness with outcomes for partial and complete outcome knowledge for medical treatments, in a within-subject design.

TABLE 1
Mean Responses, Experiment 1

	Knowledge			Mean
	None	Partial	Full	
Omission	5.43	6.80	4.61	5.61
Action	6.07	8.26	4.00	6.11
Mean	5.72	7.47	4.33	

Both gains and losses from the status quo were examined. In the complete-knowledge condition, gain vs loss was crossed orthogonally with better vs worse. The terms better and worse refer to comparison of the outcome that occurred to the outcome that would have occurred if the alternative option had been chosen. Thus, even a loss could be the better outcome if the alternative option would have led to an even worse outcome. Baron and Ritov (1994), using completely described outcomes, found an interaction between act vs omission and better vs worse: when the act led to the worse outcome, ratings were particularly low. We found no interaction between act vs omission and gain vs loss, although gain ratings were higher than loss ratings.

Baron and Ritov did not examine partially described outcomes. In this condition, subjects might compare the outcome achieved to the status quo rather than to the outcome of the alternative option. Act vs omission might then interact with gain vs loss: subjects might regard an act leading to a loss as particularly bad. They might use the status quo as a reference point, or they might even assume that the outcome of the foregone option would be the status quo.

Method

Subjects were 64 students solicited by a sign on a walkway at the University of Pennsylvania. They came from both that university and the Philadelphia College of Pharmacy Science. They were paid \$6/h for completing this questionnaire and others.

We asked subjects to take the role of a physician making decisions about treatment. The scenarios involved, respectively, a patient with high blood pressure (50% above normal) and a patient with high cholesterol (also 50% above normal). The patient had just moved from another city, and the previous physician had prescribed a treatment, which was the default (omission) option. The physician in question could either change the treatment or leave it. Outcomes were described in terms of percentages above normal after treatment. For example, in the gain-worse condition, the treatment led to 30% above normal but the foregone option would have led to 10% above normal. The treatment always led to a 20% increase (loss) or decrease (gain), and, when complete information was provided, the foregone option was always either 20% better or worse than the actual outcome. One of the first two scenarios was presented with only partial information. The other was presented with partial information and then complete information; subjects were told that the outcome of the foregone option would be known after results of a research study were reported, and they were asked how they would feel about the outcome that occurred

both before and after they were told the results of the research. The partial-information condition was presented first (with blood pressure) for about half of the subjects and second (with cholesterol) for the other half. Subjects rated their feelings about each outcome "on a scale from 100 to -100, where zero represents neither happiness nor unhappiness."

Results

Table 2 shows the mean ratings for each condition. (The columns labeled "means of better and worse" are based on the complete information condition.) The overall omission bias is not significant in any condition. When better vs worse was not specified, acts were rated higher than omissions for gains ($p = .000$ for partial knowledge; $p = .001$ for complete; Wilcoxon tests were used because many differences were zero) but lower than omission for losses ($p = .000$ for partial; $p = .005$ for complete).

When better vs worse was specified, however, this interaction between act vs omission and gain vs loss was no longer significant: the interaction term for gain vs loss and act vs omission was higher before the alternative outcome was specified than after it is specified ($p = .014$ by a Wilcoxon test comparing the two interaction terms). Instead, acts were rated higher than omissions for the better outcome but lower than omissions for the worse outcome. Although neither of these effects was significant by itself, the difference between them was significant ($p = .026$, Wilcoxon test). (Order of conditions did not affect any results reported here.) This interaction was found by Baron and Ritov (1994) in several experiments. In sum, act vs omission interacts with better vs worse when complete outcomes are specified but with gain vs loss when partial outcomes are specified (so that better vs worse is undefined). Subjects seem to compare the outcomes of action (especially) to the alternative outcome when it is known and to the status quo otherwise.

The first two experiments examined subjects' evaluation of outcomes and their satisfaction with the deci-

sions which led to resolved outcomes. We found that evaluation of both decisions and outcomes was affected by knowledge of alternative outcomes. However, the regret associated with knowing the alternative outcome interacted with the omission factor in evaluation of acts and omissions. To the extent that people consider potential regret when making decisions, regret effects in evaluation of outcomes should reflect on actual choice in decision making. The next two experiments examine the way anticipation of possible regret, and expectation of outcome knowledge (possibly leading to regret) affect decisions in two hypothetical situations.

EXPERIMENT 3

In this experiment, we presented subjects with hypothetical situations in which they had to choose between two fetal testing procedures, one completely safe and the other involving some risk of a miscarriage. However, the "risky" test has the advantage of having a higher detection rate of serious disorders. The potential for regret was manipulated within subjects by varying the degree of overlap between the particular disorders detected by the "safe" test and those detected by the risky test. Thus, for example, if every disorder detected by the safe test is also detected by the risky test, then taking the risky test eliminates the possibility of regret concerning the choice of test, associated with giving birth to a disordered child. If, on the other hand, there is no substantial overlap in detection potential, one could experience regret following the birth of a disordered child, even though one had chosen (and taken) the risky test. (A within-subject comparison of these conditions is helpful because subjects vary considerably in their tolerance for risk.)

These two regret conditions were crossed, between subjects, with action vs omission. Thus, the default (omission) could be either the safe or the risky test, or there could be no default. If subjects are more sensitive to the possibility of regret when it is associated with the outcome of action, then they might be more affected by the regret manipulation when the safe test serves as the default than in other cases.

Method

Subjects were 115 industrial engineering students at Ben Gurion University, tested during regular class sessions, and 109 students were solicited as in Experiment 2. Subjects were randomly assigned to the different versions of the questionnaire. Nationality of the subjects—or sex, or age, or marital status, or number of children—did not affect the results, so these variables

TABLE 2
Mean Ratings for Each Condition of Experiment 2

	Partial information		Complete information		Mean of better and worse	
	Omit	Act	Omit	Act	Omit	Act
Gain	42	57	45	56	23	23
Loss	-51	-65	-50	-61	-14	-16
Gain better			59	64		
Loss better			11	17		
Gain worse			-12	-18		
Loss worse			-39	-50		

are ignored henceforth, although they were asked about at the end of the questionnaire.

The questionnaire was described as dealing "with decisions concerning fetal testing during pregnancy. These tests are designed to determine whether the fetus suffers from any severe disorder (such as Down's syndrome). If the tests uncover such a severe disorder, it is possible to terminate the pregnancy."

Subjects were instructed to imagine that they were expecting a child. They were informed of two different possible tests (here, the no-regret condition):

Test A. The disorders detected by this test exist in 3 out of 1000 embryos. This test does not involve any risk.

Test B. The disorders detected by this test exist in 6 out of every 1000 embryos. Every disorder detected by Test A will also be detected by Test B. In addition, other disorders, which cannot be detected by Test A, will be detected as well. Test B involves some risk of miscarriage.

The questionnaire went on to explain that for various (unspecified) reasons it is not possible to take both tests. Subjects were asked to decide which one of the two tests they would prefer to take. The response was made by indicating the highest level of risk (of miscarriage) at which Test B will still be preferred to Test A. The specific wording of the response was: "I will prefer Test B to Test A, as long as the risk of miscarriage, following administration of Test B, will not be over _____ percent." The blank was filled by circling a number on a scale. The scale range from 0 to 2.6%, with an additional point described as "more than 2.6%."

In the second part (regret condition), subjects were asked to compare Test A and Test C, assuming that Test B does not exist. The disorders detected by Test C exist in 6 out of 1000 embryos. However, the disorders detected by Test C are different from the ones detected by Test A. That is, some disorders detected by Test A will not be detected by Test C. Test C also involves some risk of miscarriage.

As in the first part, here too, subjects were asked to indicate the highest level of risk (associated with Test C) at which they would still choose Test C over Test A.

The order of the two parts was reversed, for approximately half of the subjects. Order did not affect the results.

Three versions of the questionnaire differed in terms of a specified default option. In the No-default version, no default was specified. In the Risky-default version, the default was the riskier test. Thus, subjects were told: "By the routine procedure you were assigned to take Test B (or Test C, at the second stage). However, if you prefer to take Test A you can be re-assigned with no difficulty." The Safe-default version had the safe

test (Test A) as the default. The description of the default was parallel to the one given in the risky-default version. The three versions of the questionnaire were otherwise identical.

Results

The mean response to the two parts of each version are shown in Table 3. Order of presentation of Test B and Test C did not significantly affect the response, hence the results for the two orders were combined. Across the three versions, subjects were willing to take higher risk in the no-regret condition than in the regret condition (87 vs 24 subjects, $p = .000$, Wilcoxon test). However, the three versions differed in the magnitude of this effects ($p = .052$ by the Kruskal-Wallace "non-parametric analysis of variance" on the difference between regret and no-regret; $p = .020$ for Risky-default vs Safe-default). The Safe-default condition also differed from the No-default condition ($p = .050$, one tailed), but the Risky-default did not differ from the No-default condition. The basic regret vs no-regret effect was not quite significant in the Risky-default condition (21 vs 9 subjects, $p = .055$ one-tailed Wilcoxon test), but it was clearly significant in each of the other conditions (29 vs 9 for No-default, 37 vs 6 for Safe-default, $p = .000$ for each). (The three conditions did not differ significantly in mean risk tolerance combining the regret and no-regret conditions.)

Assuming that the birth of a child with severe disorders is much worse than a miscarriage, the potential for regret in taking Test C is much higher than the potential for regret in taking Test B. The present results indicate that people are more sensitive to regret when it is associated with the outcome of action rather than omission. When the riskier option is the default, keeping it requires no action. Indeed, in that case, subjects did not show notable differentiation between Test B (no regret) and test C (regret). However, when taking the riskier test required action, subjects' responses reflect greater willingness to take the risk when the potential for regret is lower (Test B).

EXPERIMENT 4

To examine the relation between act vs omission and knowledge, we used a vaccination case similar to that

TABLE 3
Mean Percentage of Risk Tolerance for Test B and Test C, in Each Version, Experiment 3

Version	Test B (no-regret)	Test C (regret)	Mean
No default	.685	.510	.598
Risky default	.759	.668	.713
Safe default	.776	.497	.637
Mean	.738	.554	

used by Ritov and Baron (1990). The decision was whether or not to vaccinate children against a potentially fatal flu, given that the vaccine itself can also be fatal. The case was presented with full, partial, and no knowledge, in a within-subject design. In the full-knowledge case, the decision maker would know both the outcome that occurred and the outcome that would have occurred if the other option (vaccinate vs not vaccinate) had been chosen. Omission bias is defined as unwillingness to vaccinate even though vaccination reduces overall loss of life.

Method

The questionnaire was given to 137 subjects solicited as in Experiment 2. It began, "A type of flu can be fatal to young children. A vaccine can prevent the flu. The vaccine is extremely inexpensive and is given along with other vaccines, so no extra shots are required. The vaccine is also well researched: nothing can be learned from new data. However, the vaccine can also be fatal. Children who die from the vaccine would not necessarily have died anyway from the flu. Ten out of every 10,000 children will die from the flu if they are not vaccinated. You are a public health official in a foreign country, and you must decide whether to vaccinate the children in your district. You plan to leave soon, so you will not see the individual children after you make your decision."

The no-knowledge condition began, "You will never know what happens to any of the children, and you will never know what would have happened if you had decided differently." The partial-knowledge condition began, "After you leave, you will see reports about each child in your district. You will know which children died from the flu, if any, and which died from the vaccine, if any. But you will not know what would have happened if you had decided differently." The full-knowledge condition began, "After you leave, you will see reports about each child in your district. You will know which children died from the flu, if any, and which died from the vaccine, if any. Also, you will see, for each child, the results of a test to determine which vaccinated children would have died from the flu and which unvaccinated children would have died from the vaccine (These tests take a long time, and the decision whether to vaccinate has to be made now.) So you will know, for each child, both what happened and what would have happened had you decided differently."

To make sure that subjects understood the conditions, we asked four questions after each of these introductions: "Will you know which children died? If you vaccinated all the children, will you know what would have happened to each child if you had not vaccinated? If you do not vaccinated any children, will you know

what would have happened to each child if you had vaccinated? How many children out of 10,000 will die from the flu if you do not vaccinate them?" Half of the subjects received the conditions in this order and half in the reverse order. (Order did not affect any results.)

Subjects were then asked, "Would you want to vaccinate your patients if the death rate from the vaccine were each of the following?" They were given a list of rates: 0, 1, 3, 5, 7, 9, and 11 out of 10,000. They were asked to indicate whether they would vaccinate all children in each case. At the end of the questionnaire, subjects were asked why the difference between full and partial knowledge was relevant or not, and likewise for partial vs no knowledge.

Results

Omission bias was highest in the full-knowledge condition and lowest in the no-knowledge condition. Subjects' justifications supported the role of anticipated regret in this effect. Few subjects contributed to this result, however, because many subjects showed no difference between the conditions or misunderstood the task. Specifically, 40 subjects failed one or more of the test questions, leaving 97. Of these 97, 55 were willing to vaccinate at rates of 9 or 11 in all three cases—a result consistent with Ritov and Baron (1990)—and 4 were unwilling to accept any risk. Of the 38 remaining subjects, 19 showed no effect of knowledge, giving the same answer in all three cases. Of the remaining 19, 16 showed the hypothesized difference between full and no knowledge (the extreme cases) and 3 showed the reverse difference. A sign test is significant ($p = .002$, one tailed), indicating that our hypothesis accounts for most of the unequal responses. In sum, of the 38 subjects who willing to accept some risk but not always the optimal amount, almost half were influenced by knowledge.

For the 19 subjects who were affected in either direction by knowledge, the means for the three conditions (of the maximum acceptable vaccine risk) were 6.5, 5.1, and 4.1 for no, partial and full knowledge, respectively. The difference between no and partial was significant (11 as predicted, 1 reversed, $p = .003$) and the difference between partial and full was almost significant (8 vs 2, $p = .055$).

Subjects' explanations of their answers were consistent with our hypothesis, in that all mention anticipated feelings about outcomes as reasons for not vaccinating. Examples of justifications for no vs partial knowledge were:

This difference would affect my decision because I would know the individual children and families. It is easier on the conscience to make a decision not knowing who it affects. I wouldn't want to personally know who was affected because I would feel

guilty. The difference of knowing who dies or not comes into play because I needed to make a moral decision. Knowing what happened to the children made me realize how deadly the vaccine can really be. With this knowledge at hand, it would be hard for me to NOT change my position.

It does affect my decision because of the guilt involved. . . . No guilt, no paranoia.

Examples for full vs partial were:

This would affect my decision because it would be torture knowing that you are responsible for a child's death. At least with questions 1 and 2 [no and partial] you can't be sure.

I probably would be very upset and feel very guilty if I knew what kids died from the vaccine and not the flu. I would feel very responsible for taking a life that wasn't meant to be taken yet. Very upset!!

Knowing if the vaccine would or would not help is a very important factor. This makes the decision more of a reality. I could feel good about helping others or I could feel guilty and wonder what could have been. . . .

I suppose it all comes down to a question of conscience. After all, who wants that on your mind?

If children died because I vaccinated them, I would have to live knowing I killed them. If they died because I didn't vaccinate them, I would still feel that I killed them.

It is noteworthy that we found no cases in which subjects referred to outcomes as positive, e.g., as saving a life that might have otherwise been lost. This kind of framing of the situation is consistent with the existence of omission bias in this case, for it is found when the outcome is considered to be worse than the point of comparison.

DISCUSSION

We examined the effects of knowledge—full, partial, and none—and of action vs omission on several judgments and hypothetical decisions. Anticipated-regret effects were hypothesized to be greater under full knowledge, when it is possible to know what would have happened if the foregone option had been chosen. If regret is greater for actions than omissions, then differences between action and omission should be greatest under full knowledge. Under partial knowledge, people might make reasonable assumptions about the foregone option, or they might compare the outcome to the status quo. Here, regret effects might still be obtained. Without any knowledge, when people think about decisions, they may pay less attention to the feelings they would have about the outcomes associated with different options.

Experiment 1 found that a manager's satisfaction with his decision was higher for acts than omissions before any outcome was known. This result conflicts somewhat with previous findings (Spranca *et al.*, 1991), but it is possible that subjects expected a good

outcome, in which case the result is consistent with other findings of a preference for acts when the outcome is good (Baron & Ritov, 1994). Satisfaction was also higher for acts when the outcome was revealed as better than the status quo, but it was worse for acts with full knowledge, when it was revealed that the outcome of the foregone option was even better.

Experiment 2 supported our interpretation of Experiment 1 by showing that action vs omission interacts with gain vs loss under partial knowledge but interacts with better vs worse (and not with gain vs loss) under full knowledge. Recall that better vs worse was defined with respect to the foregone option, while gain vs loss was defined relative to the status quo. Thus, in thinking about acts and omission under partial knowledge, people compare outcomes to some expected outcome (perhaps a good outcome in Experiment 1) or to the status quo. Once information about the outcome of foregone options is revealed, however, people compare the chosen option to the foregone option.

Experiment 3 compared a decision in which regret was possible for the more effective fetal-testing option to a decision in which regret was not possible. The potential for regret arose because the more effective test might miss some disorders detected by the other test. Subjects would tolerate less risk of a miscarriage in the regret condition, unless the risky test was the default, in which case no action was required to stick with it. This result amounts to an interaction between omission vs commission and potential regret. Of course, this experiment involved only partial knowledge.

Experiment 4 found an interaction between act vs omission and knowledge. Subjects were less willing to tolerate less risk from a vaccine when they would know the outcome of vaccination than when they would not, and even less risk when they would know both the outcome of vaccination and nonvaccination (the foregone option). The case of full knowledge, of course, is the one in which potential regret is most salient. Subjects' explanations were consistent with the hypothesis that potential regret is greater for action than omission.

In sum, then, we have found evidence that people anticipate regret when they expect to be able to compare a bad outcome to a better outcome that would have resulted from a foregone option. They evaluate decisions as worse when such a situation exists, and they are reluctant to choose options that might lead to such a situation, especially when these options involve action rather than inaction. The effect of potential regret is reduced when people do not expect to know the outcome of the option they will choose or the option that they did not choose. In these cases, people may think more in terms of expected utility.

We should note that many of our results may lack

generality in one way or another. Gilovich and Medvec (1994), for example, found that regret for decisions made recently was—in line with our findings—greater for acts than omission, but over the course of people's lives their greatest regrets were for omission. Advice from the old to the young is thus often, "Do it. You'll regret it if you don't." In addition, specific role relationships, like that between a doctor and a patient, might make omissions more regrettable (Haidt & Baron, in press) even to the point of being more regrettable than acts leading to the same outcome. Finally, regret may be greater when decisions affect others—as they do in our examples—than when they affect the self only (as suggested by Beattie *et al.*, 1994). Still, despite the lack of generality, we have shown that, in some situations, anticipated regret is greater for acts than omissions and that the anticipation of regret is greater when outcomes will be known.

What is the normative status of these effects? Regret itself can be considered a rational emotion insofar as it helps us make better decisions in the future. Likewise, the anticipation of regret, is in general a good reason (although not a decisive reason) against a choice. It is more difficult to see normatively why regret should depend as it does on the distinction between action and inaction, or why the effect of regret on decision making should depend on knowledge of outcomes. People might try to avoid this effect by forcing themselves to work through the possible outcomes of all options, thinking about how they would feel if they knew the outcome, even if they know that they will never know it.

One implication of our results is that, if people know about the effects of outcome knowledge, they may try to avoid such knowledge, especially if the effects of regret over a bad outcome are greater than the effect of rejoicing over a good one. Thus, investors who make more risky investments may try to make it more difficult for themselves to follow the ups and downs of their investments day by day (e.g., by making them through pension funds). More poignantly, some women who decided against having children before the genetic test for Huntington's chorea was discovered are reluctant to have the test after their childbearing years are over: the happiness that they are not subject to the disease would be mitigated by their regret over not having children because of their fear of passing it on.

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