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Out of sight – out of mind?
Information acquisition patterns in risky choice framing.

Abstract: *We investigate whether risky choice framing, i.e., the preference of a sure over an equivalent risky option when choosing among gains, and the reverse when choosing among losses, depends on redundancy and density of information available in a task. Redundancy, the saliency of missing information, and density, the description of options in one or multiple chunks, was manipulated in a matrix setup presented in MouselabWeb. On the choice level we found a framing effect only in setups with non-redundant information. On the process level outcomes attracted more acquisitions than probabilities, irrespective of redundancy. A dissociation between acquisition behavior and choice calls for a critical discussion of the limits of process-tracing measures for understanding and predicting choices in decision making tasks.*

Key words: *framing effect, process-tracing, mouselab*

Prospect theory (Kahneman & Tversky, 1979) is one of the most influential frameworks of risky decision making. A central distinction in prospect theory is between gains and losses, immortalized by Tversky and Kahneman's: 'losses loom larger than gains […]' (Tversky & Kahneman, 1981, p. 456). This asymmetry can be investigated when options are framed as if they were gains or losses, while being identical with respect to the final outcome. For instance, losing 500 after having been endowed with an amount of 1000 has the same net outcome (i.e., 500), as winning 500, without a prior endowment (Camerer, 2004; for meta-analyses see Kühberger, 1998; Kühberger, Schulte-Mecklenbeck, & Perner, 1999; Levin, Schneider, & Gaeth, 1998). Research into tasks of this type was pioneered by Tversky and Kahneman in their *Asian Disease Problem* (ADP, Tversky & Kahneman, 1981), which presents decision makers with variations in the description of the outcomes formulated either positively or negatively, i.e., as gains or as losses.

The classic ADP problem asks the participants to imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people, and that two alternative programs to combat the disease have been proposed. The programs are then described in either a positive: *If Program A is adopted, 200 people will be saved. If Program B is adopted, there is 1/3 probability that 600 people will be saved, and 2/3 probability that no people will be saved*, or a negative frame: *If Program C is adopted, 400 people die. If Program D is adopted, there is 1/3 probability that 0 people will die, and 2/3 probability that all people will die.* The modal finding of this type of risky choice framing is that respondents prefer program A over program B (i.e., the sure over the risky option) in a positive frame, but D over C (i.e., the risky over the sure option) in the negative frame.

Risky choice framing has been studied in a variety of different domains like gambles (Kühberger, 1998), medical choices (Llewellyn-Thomas, McGreal, & Thiel, 1995), bargaining (Neale & Bazerman, 1985), perinatal choices of parents (Haward, Murphy, & Lorenz, 2008),

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or political science (Chong & Druckman, 2007). Taken together, a wealth of findings testifies to the importance of framing in these research fields (Kühberger, 1998; Kühberger et al., 1999; Levin et al., 1998).

The present research

To provide an intuition on our approach, we will first analyze the ADP task in more detail. What are the constituent parts (we will call them 'entities' in what follows) of the classical ADP? The task has three parts (see full task text in Appendix A): (1) a cover story, (2) a sure option, and (3) a risky option. As intuitive as this might sound, it is probably wrong: is the cover story really one single entity? Closer inspection shows that the cover story contains pieces of information that vary widely: it includes information about a nation, a disease, an expectation, some possible reactions, their expectations; all to be understood as being part of a hypothetical situation. Thus, many pieces of information constitute one story, which also entails the possible options. What, then, is the correct level of construal: the story (a single entity), the parts (three entities), or the pieces of information (15 entities)? Often it is implicitly assumed that the story is the relevant level of construal, the argument being that you can change many features of the story (e.g., that not the US, but Europe is in danger; that there is a different disease; that the expectation of lives lost is different; …) without changing the nature of the task. Wagenaar, Keren and Lichtenstein (1988) systematically studied this assumption by translating the same deep structure, i.e., the representation of a problem, of one ADP-like decision problem into eleven *surface structures*, i.e., the story presented to the participant. Confronting participants with these variations resulted in a variety of different choices, despite the same deep structure of the task. This result calls a basic assumption of research in judgment and decision making into question, namely that processes can be best understood by studying the *deep structure*.

We investigate the influence of unpacking entities of the description of the ADP in even more detail. Through different visual presentations ('setups') we manipulate the number of entities presented to the participants. This is not different from what other researchers have done implicitly; we make this presentation effect explicit and test different setups as independent variables. This enables us to investigate the role of information density: dense packages, containing a large number of different entities in comparison to less dense packages containing only few entities. In what follows we will layout a set of hypotheses we study.

Effort Hypothesis. Kuo, Hsu, and Day (2009) argue that effortful processing (longer and more acquisitions) results in a stronger framing effect. Their argument is based on eye-movement data, showing that when people displayed framing effects, they invested more effort in the negative framing condition than in the positive framing condition. Here we investigate whether this can be replicated using a different process-tracing approach: the tracking of information acquisition via MouselabWeb (see Apparatus). We expect to replicate the findings of Kou et al. that negative framing leads to higher effort (i.e., more and longer acquisitions). This prediction is based on the general notion that losses loom larger than gains (Kahneman & Tversky, 1984), and is in line with mood effects processing (e.g. Schwarz, 2002), that also indicate more effortful processing with negative than with positive moods.

Acquisition Hypothesis. Information acquisition is, in a MouselabWeb framework, measured as the amount of information acquired from each cell. Acquisition behavior may be directed to outcomes or probabilities. For instance, Huber, Wider, and Huber (1997) and Tyszka and Zaleśkiewicz (2006) found that, when facing risky decisions, people quite often were not interested in receiving information about probabilities, focusing on outcomes instead. That is, they valued probability information less than outcome information. Similarly, Su et al., (2013), using eye-movement technology, found a higher percentage of fixations on outcomes compared to probabilities in gambles. We predict this pattern for our framing tasks with outcomes being acquired more often, and longer than probabilities.

Redundancy Hypothesis. Kahneman (2011, p. 85) proposed the WYSIATI heuristic (*What You See Is All That Is*). This heuristic suggests that people are attentive only to the information at hand and less attentive, or even non-attentive, to redundant information. WYSIATI has a direct application in risky choice framing tasks, since the description of the sure option is incomplete: it fails to mention the implied, possibly redundant, information, that '400 people will not be saved', if '200 people are saved' out of 600. There is growing evidence that, as predicted by WYSIATI, framing effects tend to disappear when the sure option is fully described (Kühberger & Gradl, 2011; Kühberger & Tanner, 2009). We will provide a direct test of the WYSIATI heuristic and predict that framing effects will be conditional on whether the sure option is fully described or not.

In Experiment 1 we will test the transfer of a traditional framing task into a MouselabWeb – matrix setup with separate cells for the risky and the sure option.

Experiment 1

Method

Participants. The data were collected within the virtual laboratory at the University of Bergen, Norway. Participants were 30 females (mean age 35.3 years, *SD* = 10.9 years), and 12 males (mean age 35.5 years, *SD* = 12.5 years).

Apparatus. MouselabWeb (Willemsen & Johnson, 2011) was used to present the information search tasks to the participants. MouselabWeb is a web-based process-tracing tool for investigating information acquisition processes in decision problems presented in an alternatives x dimensions matrix. Information in MouselabWeb is hidden behind the boxes (cells) of the information matrix. Moving the mouse pointer over a box on the screen uncovers information. If the pointer exceeds a threshold of time (in our case 20

milliseconds) over the box, the hidden information will be displayed, and the box will remain open until the pointer is moved out of the box again (see Schulte-Mecklenbeck, Pachur, & Hertwig, 2014 for a discussion of this issue). The program records the number, duration, and sequence of box openings.

Material. The first setup offers the information in two dense packages. This two-cell setup (Setup-2, see Figure 1) contained only the cells labeled 'Program A' and 'Program B'.

Figure 1. Two-cell setup. Information is displayed upon hovering over the cells.
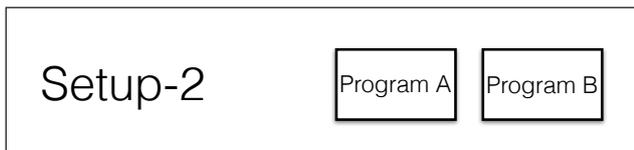
Moving the mouse over either cell displayed the relevant information (i.e., the outcome and its respective probability). Thus, moving the mouse over 'Program A' displayed 'save 200 people'; moving the mouse over 'Program B' displayed 'save 600 people with probability 1/3 and 0 people with probability 2/3'.[1]

Procedure. Participants received extensive instruction on how to acquire information and did an unrelated task to get acquainted to the MouselabWeb system before the actual experiment. The orientation of the matrix was counterbalanced between participants in a horizontal (one row) and a vertical (one column) layout to counteract possible effects of reading order (see Scherndl, Kühberger, & Schulte-Mecklenbeck, 2014 for a discussion).

Participants were first presented with the description of the scenario. After having read the scenario, they could proceed to the next screen where they were presented with the information matrix, completed their information search and indicated their choice. There was no time pressure or other indications how fast participants should solve the tasks. Participants were presented with two ADP-like (see Kühberger, 1995) problems, treated as a within-subject factor, in one of the two framing conditions (positive vs. negative), treated as a between-subject factor. We investigate only the effects of unpacking entities of the options, and do not study different cover stories in this research.

Results

Setup-2 Choices. In the two-cell setup (see Figure 1) we found a framing effect: in the positive framing condition a majority of participants (65%) chose the sure option, while in the negative framing condition only a minority (39%) chose the sure option ($\chi^2 = 5.1$, $df = 1$, $p = 0.024$, $d = .74$).

Setup-2 Acquisitions. Acquisitions were measured by recording the number of cell openings for Program A and Program B. The basic assumption is that if a cell is opened, it is attended to. Thus we measure the frequency of openings, and the duration of inspection times. These measures are averaged across problem versions (Asian disease and Avian flu), and summed over options (sure and risky).

We found no difference in the opening frequency of the two cells, sure option versus risky option (4.7 versus 5.2 openings, respectively). However, participants inspected Program B longer ($M_B = 24.9$ seconds) than Program A ($M_A = 9.5$ seconds; $t(56) = 5.9$, $p = .001$, $d = 1.58$). This is not surprising, as the number of information items is larger for Program B (12 pieces of information: 8 words + 4 numbers) than for Program A (3 pieces of information: 2 words + 1 number; see Appendix A for the full cell information). There was no difference in either length of information search or number of cell openings when we compared the two framing conditions (positive, negative).

Setup-2 Prediction of choices. To investigate the correspondence between information acquisition and choice we fit a binomial regression predicting choice (risky = 1, save = 0) by time spent on cells and number of cell openings. Neither predicted choices.

Discussion

In Experiment 1 we used the classic presentation of risky choice framing problems, adapted to the MouselabWeb technique. This basic setup (Setup-2) resulted in a framing effect on choice with a preference for the sure option in positive, and a preference for the risky option in negative framing. This effect replicates a long list of studies in decision research reporting a framing effect in various paper-and-pencil or computerized versions of the problems. To our knowledge our experiment is the first demonstration of a framing effect with the two options presented in separate cells of a MouselabWeb display, showing that the transfer into this medium works as expected.

On the process level, the difference in acquisitions (longer opening time of risky option cells) was expected and is most likely driven by the longer text describing the risky option. This text effect also overshadowed the potential effect of framing on inspections. Setup-2 probably leads to process data that are primarily driven by the unbalanced amount of information in the risky (12 pieces of information) versus the sure (3 pieces of information) option. We cannot resolve this problem in Setup-2 and hence will investigate it in more detail in Experiment 2 where each piece of information will be presented in an individual cell.

Experiment 2

In Experiment 2 we disentangle the amount of information presented in each cell of Setup-2 and utilize three setups that embody the WYSIATI principle: What you see is all there is. First, each piece of information is

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[1] In the experiment participants also saw two buttons to select either Program A or Program B.

presented in its own cell; second, two empty cells are added rendering the redundant information salient; finally, we will make the missing information explicit by presenting the redundant information of the sure option, too. To ease comparability of our three conditions we will report them in one experiment.

Method

Participants. The data were collected within the virtual laboratory at the University of Bergen, Norway. For each of the three conditions a new sample was drawn, these samples had the following structure: Setup-6: 127 participants (93 females, mean age 41.5 years, $SD = 14.1$ years; 34 males, mean age 34.9 years, $SD = 8.6$ years). Setup-6/2: 79 participants (58 females, mean age 36.1 years, $SD = 10.1$ years; 21 males, mean age 34.7 years, $SD = 10.2$ years). Setup-8: 79 participants (59 females, mean age 44.2 years, $SD = 9.7$ years; 20 males, mean age 40.8 years, $SD = 11.6$ years).

Apparatus. As in Experiment 1 we used MouselabWeb to present the tasks in the three conditions to our participants. The technical settings (mouseover-condition, thresholds…) were identical to Experiment 1.

Material. Experiment 2 unpacked the task into smaller entities in three different setups (see Figure 2). Each setup consisted of two options (sure or risky), with their unpacked outcomes (O) and probabilities (P). In Setup-6 each entity was unpacked into a single cell. This setup contained outcomes (for the ADP task: 200; 600; 0; for the Avian Flu task: 6000; 18000; 0), and probabilities (for both tasks: 1/3; 2/3; 1), for the two framing conditions ('survive' vs. 'die'), respectively, in separate cells.

Setup-6 was identical to Setup-2 in terms of how much information was available to the participant, there was no information added or withheld.

Figure 2. Overview of the three setups used in Experiment 2. O,P = Outcome, Probability; A, B = Program A (sure), Program B (risky); 1 = left OP-pair, 2 = right OP-pair
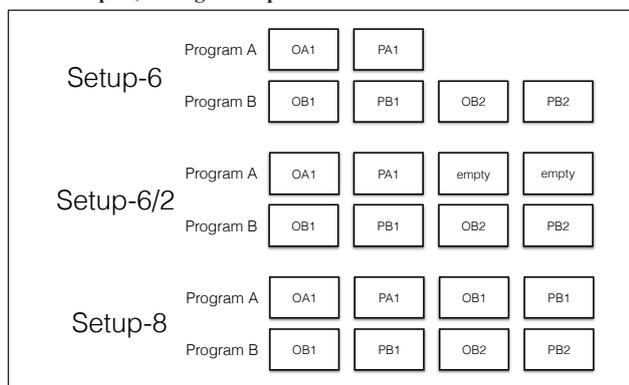
Inspection of the ADP reveals an asymmetry of description: the outcomes of the risky option (Program B) add up to the number of expected deaths (200 saved + 400 not saved = 600), while the outcomes of the sure option (Program A) do not (200 saved ≠ 600). Thus, the sure option is described incompletely (Kühberger & Gradl, 2011; Kühberger & Tanner, 2009). Two further setups were added to describe the sure option in a symmetric way. Setup-6/2 added cells showing that there is information missing in Program A (participants did not see the label 'empty' on their display, they had to open the cell to find out that there was no information available). That is, Setup-6/2 contained the same amount of information as the previous one. This tests whether a visual hint on missing information affects the framing effect. The final setup, Setup-8, explicitly contained the redundant information: that if 200 people will be saved for sure out of 600, '400 people will not be saved' with probability '1'.

Procedure. The procedure was equivalent to Experiment 1. In what follows we will report three levels of analysis for each setup (6, 6/2 and 8): choices, acquisitions, and prediction of choices.

Results Setup-6

Setup-6 Choices. We found a framing effect: the sure option was preferred in the positive framing condition (59%), but was not preferred in the negative framing condition (39% choosing the sure option; $\chi^2 = 8.8$, $df = 1$, $p = 0.003$, $d = .61$).

Setup-6 Acquisitions. We were primarily interested in differences on the level of outcomes (e.g., 200 saved) versus probabilities (e.g., 1/3). Hence, the analysis focused on these entities. We conducted separate two-factorial ANOVAs on clicks, and acquisition time, for information type (outcome, probability), and frame (positive, negative).

The average numbers of cell openings did not differ in the Setup-6 condition (outcomes: 7.1 vs. probabilities: 6.7 clicks, *n.s.*). Time spent on probabilities (MP = 7.9 seconds) versus outcomes (MO = 7.7 seconds; *n.s.*) also did not differ. This overall pattern held for a split into the two framing conditions: there was no significant difference between opening time and clicks between the positive and negative framing condition. In addition to these focused measures we also calculated the ratio of time/clicks spent on outcomes over the overall time/clicks for each task. This gives us a proportional measure of acquisitions of outcomes (AquO)in relation to acquisitions of probabilities. For both, time and clicks, acquisitions were distributed evenly between positive and negative framing conditions (0.54 vs. 0.50 for clicks; 0.51 vs. 0.52 for time, for positive versus negative frame respectively; see Table 1 for an overview for all three conditions).

Setup-6 Prediction of choices. To investigate the correspondence of acquisitions and choice we fit a binomial regression predicting choices (risky = 1, save = 0) by time spent on the information cells / number of clicks and framing condition. We found longer decision times when the risky option was chosen (M = 8.8 seconds) than when the sure option was chosen (M = 7.7 seconds; *Wald's z* = 2.4, $p = 0.018$). No other effect was significant.

Table 1. Overview of results for the three conditions: Setup 6, Setup 6/2 and Setup 8 for both framing conditions (positive, negative) and information types (outcomes, probabilities).

Setup	Framing	Infomrmation	Dependent variable				
# of cells			Mean Clicks	Mean Time	% Acquisitions of Outcomes (clicks)	% Acquisitions of Outcomes (time)	% choosing sure option
6	positive	Outcome	3.5	4.4	0.51	0.54	59
		Probability	3.5	3.9			
	negative	Outcome	3.6	3.5	0.52	0.50	39
		Probability	3.3	3.7			
6/2	positive	Outcome	6.1	7.5	0.54	0.58	41
		Probability	5.7	6.0			
	negative	Outcome	7.1	8.8	0.53	0.56	41
		Probability	6.5	6.8			
8	positive	Outcome	6.1	8.2	0.52	0.58	38
		Probability	5.3	6.2			
	negative	Outcome	6.8	8.3	0.52	0.53	50
		Probability	6.2	7.0			

Results Setup-6/2

Setup-6/2 Choices. In this setup we found no framing effect: in both framing conditions 41% of participants chose the sure option.

Setup-6/2 Acquisitions. The average number of cell openings did not differ between outcomes and probabilities in the 6/2 condition (6.7 versus 6.1 clicks). However, time spent on outcomes was longer (M_O = 8.2seconds) than time spent on probabilities (M_P = 6.4 seconds; $F(2,231) = 35.7$, $p = .001$, $d = 0.33$). The two empty information boxes mainly drove this overall effect. These boxes were opened 2.9 times on average (with a short inspection time of 2.2 seconds).The ratio measure (time/clicks spent on outcomes over the overall time/clicks for each task) was not significant between framing conditions (0.58 versus 0.6 respectively).

Setup-6/2 Prediction of choices. Rerunning the same analysis as above, we fit a binomial regression predicting choices (risky = 1, save = 0) by time spent on the information cells / clicks on cells and framing condition. We found no significant effect in this analysis.

Results Setup-8

Setup-8 Choices. We found no significant framing effect in this setup: 38% chose the sure option in the positive framing condition and 50% chose the sure option in the negative framing condition (*n.s.*).

Setup-8 Acquisitions. We calculated a two-factorial ANOVA on clicks and time with cell type (outcome, probability) and frame (positive, negative).The average number of cell openings did not differ for outcomes and probabilities (6.4 versus 5.7 clicks, n.s.). However, the time spent on outcomes was longer (M_O =8.4 seconds) than the time spent on probabilities (M_P =6.6 seconds; $F(2,231)$ = 4.2, $p = .041$, $d = 0.33$). There was no interaction with the framing condition. Our ratio measure resulted in 0.58 vs.

0.6 in the positive versus the negative framing condition, respectively.

Setup-8 Prediction of choices. A binomial regression predicting choices (risky = 1, save = 0) by time spent on the information cells and framing condition found a marginal effect with longer decision times in the positive framing condition when the risky option was chosen (M = 12.3 seconds) than when the save option was chosen (M = 8.7 seconds; *Wald's z* = 1.9, $p = 0.054$). No other effects were significant.

Discussion

Experiment 2 manipulated participant's exposition to information and investigated its effect on search and choice. Colloquially speaking we investigated whether 'out-of-sight = out-of-mind' or, to use Kahneman's (2011) notion: 'what you see is all there is' holds for framing information in an ADP like task. Three presentation setups were utilized to study this question: (1) In Setup-6 the information on the missing part of the sure option was left out of the presentation, as it is common practice in ADP tasks; (2) in Setup-6/2 we added a hint on this missing information with two empty boxes, indicating that there might be something of interest. However, this information was not explicitly provided; (3) finally, in Setup-8 the redundant, to-be-inferred, information was explicitly provided resulting in all 8 cells filled with content.

The basic finding, comparing these setups (see Table 1), was an *effect on choice*: the framing effect disappeared when the setup indicated that information was missing, irrespective of whether the redundant info was (Setup-8), or was not (Setup-6/2) provided explicitly. This is consistent with the idea introduced by Kühberger (1995) that people's tendency to consider only explicit information is one of the sources of the framing effect. In addition, it shows the WYSIATI-principle in action: if you see that something is not there, is different from not seeing it at all. We therefore confirm our redundancy hypothesis.

The second finding was *an effect on* acquisitions: participants acquired information longer on outcomes than on probabilities. This result is irrespective of the framing condition and confirms our acquisition hypothesis.

General Discussion

We investigated the effect of unpacking information on the framing effect and on information search. Our manipulation systematically varied two factors of the information presented: *density and redundancy*. (1) Information-density varies on a continuum from an information-dense setup, where all necessary information is condensed into in a single entity (Setup-2), to a less dense setup, where information is split up into small bits (Setups 6, 6/2, and 8). (2) Information-redundancy relates to how fully the sure option is presented in the task exposition. In a standard ADP problem (our Setup-2 or Setup-6), information on the redundant part of the sure option is always left out. We added an intermediate version containing a visual hint on the missing information but no additional information (Setup-6/2), and a version that explicitly provided the full information on the sure option. Hence, our procedure introduces variations in the surface structure of the task by manipulating the setup in an alternatives-by-dimensions matrix.

Choices. The findings on choices can be summarized quite succinctly: information-density was irrelevant for the choices in our framing task, since the classic framing effect was found in the dense (Setup-2), as well as less dense setup (Setup-6). In contrast, redundancy, manipulated by giving a visual hint that there is something missing (Setup-6/2 and Setup-8) versus not giving such a hint (Setup-2 and Setup-6) was relevant for choosing: the framing effect was only found in the non-redundant setups.

Experimental problems presented to participants need to be formulated in a linguistically meaningful and adequate way (Grice, 1975). This, more or less deliberately, results in task descriptions differing in information density: some problem descriptions are more dense than others. The present study is the first to test the effect of information density directly. Our general result is quite comforting for decision research: there seems to be no systematic effect on choices. Thus, it is of little consequence how problem descriptions are partitioned when the information is presented to participants.

In contrast to density, redundancy is relevant for choices. As our results show, making missing information salient even without changing the information content (Setup-6 vs. Setup-6/2) can be an important factor for choice behavior. Our study lines up with other findings showing that the introduction of seemingly redundant information can have serious consequences on judgment and choice (Magen, Dweck, & Gross, 2008).

Acquisitions. The findings on acquisitions are twofold. First, it is noteworthy that we did not find a difference between acquisitions of gains and losses: if losses loom larger than gains, one would expect more acquisitions of losses than of gains. Our results do not support this. This comes as a surprise, since studies using eye-tracking methodology usually find this difference (Kuo et al., 2009). The reason for the lack of differences in acquisitions may be due to the fact that all the information available was easy to acquire and digest. Thus, our simple arrangement may produce data that are not sensitive enough to show subtle differences in acquisition behavior. Modeling approaches that focus on acquisitions in a more sensitive manner may be necessary to show these effects (Gonzalez, Dana, Koshino, & Just, 2005).

Note, however, that we found evidence for a differential effect of acquisitions of the type of information (outcome vs. probability) in the ADP task. Closer inspection of the findings of Experiment 2 actually shows a clear picture: in all three setups, outcomes were inspected more frequently, and they were inspected longer. Duration differences might be explained by reading effects (reading and processing '200' could last longer than reading '1/3'), but frequency of cell openings cannot be explained by such effects. This pattern therefore is intriguing, and it is in line with findings for gambles (Su et al., 2013) and naturalistic settings (Huber et al., 1997; Tyszka & Zaleskiewicz, 2006).

Mapping acquisitions on choice. We found that it is difficult to relate our process-tracing data to choice. However, in other research with gambles (Johnson, Schulte-Mecklenbeck, & Willemsen, 2008), food stimuli (Schulte-Mecklenbeck, Sohn, Bellis, Martin, & Hertwig, 2013), forced choices (Glaholt & Reingold, 2009) or problem solving (Ellis, Glaholt, & Reingold, 2011) such a mapping could be shown and it remains an open question why this was not the case in our study.

We believe that the issue of linking processing of information and subsequent choices is of central importance for research in judgment and decision making in general and process-tracing studies in particular. One way to study this link in more detail might be to more clearly distinguish information acquisition from information integration during the decision making process (see Schulte-Mecklenbeck, Kühberger, & Ranyard, 2011a for a discussion of different phases). For most process-tracing techniques there is no easy way to accomplish this, other than dividing search into earlier and later halves or quarters, or other post-hoc definitions of phases. We presume that process measures collected in later phases of the decision making process should result in a better match of acquisitions and choice than those collected in earlier ones. Indeed, there is evidence showing such patterns (Graham, Orquin, & Visschers, 2012; Orquin & Mueller Loose, 2013). Another solution is to use different process-tracing techniques concurrently. As these methods differ with respect to the phases they tap into, their combination might help to disentangle them. For instance, information acquisition methods like Mouselab tag into earlier phases of decision making; eye-movements (Orquin & Mueller Loose, 2013)or mouse-movements (Schulte-Mecklenbeck, Murphy, & Hutzler, 2011b) probably capture the whole sequence, while verbal protocols (Ranyard & Svenson, 2011) mainly depict later phases of information

integration. In that sense, our study underscores the need for a multi-method approach (see also Payne & Venkatraman, 2011) to gain a more complete understanding of people's pre-decisional information search and their subsequent choices.

Appendix A

Asian Disease Problem and Avian Flu Problem

Task 1 closely resembles the classic Asian Disease Problem by Tversky and Kahneman (1981). Task 2 uses the same structure but a more up to date context of a possible Avian Flu outbreak in Europe with larger absolute numbers for the outcomes (the ADP outcomes were multiplied by 3000, the probabilities were kept the same).

Task 1: Asian Disease Problem - positive frame

Imagine that the United States is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the programs are as follows ...

Option A: save 200 people
Option B: save 600 people with probability 1/3 and 0 people with probability 2/3

Task 2: Avian flu Problem - positive frame

Imagine that the European Union is preparing for an outbreak of an unusual strain of avian flu, which is expected to kill 18000 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the programs are as follows ...

Option A: save 6000 people
Option B: save 18000 people with probability 1/3 and 0 people with probability 2/3

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