Judgment and Decision Making, Vol. 6, No. 7, October 2011, pp. 638–650

Numeracy as a precursor to pro-social behavior: The impact of numeracy and presentation format on the cognitive mechanisms underlying donation decisions

Stephan Dickert* Janet Kleber† Ellen Peters‡ Paul Slovic§

Abstract

Donation requests often convey numerical information about the people in need. In two studies we investigated the effects of numeracy and presentation format on the underlying affective and cognitive mechanisms of donation decisions. In Study 1, participants were presented with information about a victim in need, either in a frequency format or in a percentage format. In Study 2, we manipulated the identifiability and number of target victims. Our results demonstrate that donations of individuals lower in numeracy were more susceptible to changes in numeric presentation format than those higher in numeracy. Importantly, the underlying mechanisms for donations differed by numeracy. Whereas the mental image of the victim influenced donation decisions of less numerate people only, the estimated impact of a donation was positively correlated with donation amounts for both more and less numerate individuals.

Keywords: donation decisions, numeracy, mental images, affect.

1 Introduction

In reports of the effects of natural and man-made catastrophes (e.g., famines, floods, tsunamis, and wars), it is common to encounter statistics about the number of human lives affected. For example, the earthquake in Haiti on January 12th, 2010 affected 3 million people, of which approximately 230,000 lost their lives (BBC, 2010) and an estimated 200,000 families were left homeless (Save the Children, 2010). Although it may be difficult to truly comprehend the scope of such tragedies (Slovic, 2007), numerical figures are typically used to convey the enormity of suffering. Humanitarian aid organizations likewise use numerical information to communicate the needs of the victims and to entice benefactors to make financial contributions. The total number of lives affected, the estimated number of individuals that would benefit from a donation, and the ratio between them can all be important aspects in the decision to help. Potential donors are expected to understand and use such numerical information when deciding whether to support a humanitarian aid project. However, comprehension and use of this information may differ depending on how it is presented and who the potential donor is.

1.1 Effects of presentation format on donation decisions

The importance of how information about lives at risk is communicated has been highlighted by recent research on people's willingness to contribute financially to humanitarian causes. For example, an identified victim generally has greater chances of being helped than a statistical victim (Jenni & Loewenstein, 1997; Schelling, 1968; Small & Loewenstein, 2003; Small, Loewenstein, & Slovic, 2007). Moreover, the identification of people in need of help has stronger effects on charitable giving if the identified victim is a single individual victim compared to a group of victims (Kogut & Ritov, 2005b). Presentation of a single victim vs. a group of victims may alter donation behavior partly because individual targets are processed differently than group targets (Hamilton & Sherman, 1996; Susskind, Maurer, Thakkar, Hamilton, & Sherman, 1999). Dickert and Slovic (2009), for example, have demonstrated that presenting an individual as part of a larger group (rather than as a single victim) reduces affective reactions to that person.

Affective reactions, in turn, play an important role in the decision to help others (e.g., Batson, 1990; Kogut & Ritov, 2005a, 2005b, 2007; Loewenstein & Small, 2007; Slovic, 2007; Huber, Van Boven, McGraw, & Johnson-

We are grateful to the research group Intuitive Experts at the Max Planck Institute for financial support and help with data collection. This research was also supported in part by the US National Science Foundation under grant number SES1024808 to Decision Research and SES1047757 to Ohio State University.

*Max Planck Institute for Research on Collective Goods, Kurt-Schumacher.Str.10, 53113 Bonn, Germany. E-mail: dickert@coll.mpg.de

†University of Vienna

‡Ohio State University

§Decision Research and University of Oregon

Graham, 2011). These emotional responses as well as the general motivation to help seem to be influenced by the way information is processed. For example, presenting participants with a donation task after priming deliberation resulted in lower empathy and lower donations compared to priming affective reactions (Dickert, Sagara, & Slovic, 2011; Small et al., 2007). In addition to processing mode, empathic responses also seem to be related to the vividness, proximity and similarity of the donor to the victim (Loewenstein & Small, 2007). Information is generally more vivid when it is emotionally interesting, concrete, and psychologically close to the observer (Nisbett & Ross, 1980). A theoretical approach focusing on the vividness and concreteness of the mental images underlying affective reactions could explain research findings on effects of different presentation formats, such as the identifiability and singularity effects: Both the identification as well as presentation of a single victim (vs. victim group) result in more coherent mental images, which then lead to stronger affective reactions and higher donations (Kogut & Ritov, 2005a; Loewenstein & Small, 2007; Västfjäll, Peters, & Slovic, 2008).

Presentation modes that enhance the generation of mental images could, therefore, be conducive to eliciting donations. For example, describing the number of affected victims in a frequency format (e.g., 10 out of 100) might foster more concrete mental images than a probability format (e.g., 10% out of 100; Slovic, Finucane, Peters, & MacGregor, 2002). Additionally, people exhibit insensitivity to changes in victim number when the number grows large (i.e., psychophysical numbing; Fetherstonhaugh, Slovic, Johnson, & Friedrich, 1997; Frederick & Fischhoff, 1998; Friedrich et al., 1999; Slovic, 2007; see also Baron, 1997). This could be a result of less clear mental images as it is very difficult (if not impossible) to mentally process large groups of people to the same degree of detail as one is able to do with just a single individual. In addition to differences in presentation modes, however, when information about victims is presented in numerical form, differences in numeric ability (i.e., numeracy) between individual donors could result in different mental images underlying emotions and donations.

1.2 Influence of numeracy on information processing

The ability to understand and use numeric concepts to perform rudimentary mathematical operations, compare magnitudes, and comprehend ratio concepts (including fractions, proportions, percentages, and probabilities) is conceptualized as numeric ability or "numeracy" (Peters et al., 2006; Reyna & Brainerd, 2008; Reyna, Nelson, Han, & Dieckmann, 2009). Recent research has primarily investigated the effects of numeracy on information processing in health-related decisions, risk perception and risk communication (e.g., Fagerlin, Ubel, Smith, & Zikmund-Fisher, 2007; Keller, 2011; Lipkus & Peters, 2009; Lipkus, Samsa, & Rimer, 2001; Peters, Dieckmann, Dixon, Hibbard, & Mertz, 2007; Peters, et al., 2009; Peters, Hibbard, Slovic, & Dieckmann, 2007). In these studies, higher numeracy is related to better comprehension and integration of numerical information, usually leading to more informed and therefore better decisions. Additionally, differential access to numeric information might give rise to altered judgments regarding how effective a treatment or risk-reducing measure would be.

Highly numerate individuals also tend to be less influenced by the way numerical information is presented whereas less numerate generally benefit from an easily accessible, ordered and more concrete representation of the information (e.g., Galesic, Garcia-Retamero, & Gigerenzer, 2009; Peters, Dieckmann, et al., 2007). However, some research points to the possibility that this is not always the case. In more difficult numeric tasks, risk perception (Keller & Siegrist, 2009) and probabilistic reasoning (Chapman & Liu, 2009) vary by presentation format even for highly numerate individuals. Chapman and Liu (2009) found that presenting highly numerate participants with a Bayesian reasoning task in a frequency format resulted in better performance relative to a probability format. Less numerate participants' performance improved in the frequency format as well, but to a lesser degree. Thus, whether presentation formats influence performance of more or less numerate individuals seems to be task dependent.

The use of presentation formats that incorporate non-numerical information could further influence information processing differently for more and less numerate individuals. Dieckmann, Slovic and Peters (2009), for example, examined risk perceptions of terrorist forecasts and found that information was differentially processed depending on numeracy. Whereas highly numerate individuals focused more on the stated likelihood of a terrorist attack, those lower in numeracy were more influenced by narrative evidence and presumably by a more coherent causal mental representation that they formed from the narrative. This evidence suggests a different use of mental images underlying choices that is dependent on people's numeracy.

It may also be that the effects of presentation modes that enhance the generation of mental images from numbers (e.g., victim numbers, average contributions, etc.) depend on numeracy. The study by Dieckmann and colleagues (2009) suggests that less numerate individuals may build a more coherent mental image of the situation from narrative information, thus promoting more concrete information processing and likely resulting in

stronger affective reactions (Slovic et al., 2002, 2004). Because presentation formats also differ in their elicitation of mental images (e.g., frequencies vs. percentages), the effect of presentation formats on donations may be moderated by numeracy. In fact, risk perceptions appear to differ by number format and numeracy. Individuals lower in numeracy perceived greater danger from a mental patient when his potential dangerousness was described in a frequency versus a probability format whereas format made little difference to those higher in numeracy (Peters et al., 2006; see also Peters, Hart, & Fraenkel, 2011, for a medical example). Given these results, one would expect that the effects of presentation format (e.g., frequency vs. percentage) on donations would be stronger for less numerate individuals. Differences in risk perception and judgments could, however, not only be the result of highly numerate individuals having a clearer grasp and wider array of numerical information available. Instead, we propose that more and less numerate individuals recruit different processes based on mental imagery to arrive at their decisions.

In the current paper, two studies investigated the effects of presentation formats (of the numeric information about victims) and numeracy on the mechanisms underlying donation decisions (e.g., mental images). In Study 1, we examine the effects of frequency vs. probability format; in Study 2, we manipulate the identifiability and number of victims.

2 Study 1—Frequency vs. probability

Study 1 was designed to examine whether numeracy influences the mechanisms underlying donation decisions when presentation formats are varied. The donation task used in the current study employed either a relative frequency or a probabilistic presentation format of the number of donation recipients while simultaneously presenting the information about the total number of victims in need (i.e., the reference group: 1 out of 100 or 1% out of 100). Note that only the presentation format changes while the numeric information was identical. Research has shown that numeracy changes the perception of ratios of numerators (1) and denominators (100) with less numerate individuals confusing part-whole relations and giving greater weight to the numerator and underweighting the denominator (Peters, Slovic, Västfjäll, & Mertz, 2008; Peters et al., 2006; Reyna et al., 2009). In donation decisions, one might take the size of the reference group into account in order to gauge the extent of the suffering as well as the relative effectiveness of a donation. Thus, considering the size of the reference group has been found to influence the evaluation of humanitarian aid programs and the perception of help needed (Baron, 1997; Fetherstonhaugh et al., 1997; Slovic, 2007). We derived the following hypotheses concerning presentation format and its possible differential effects based on numeracy on donation decisions and their underlying mechanisms:

(H1) Presenting the victim in a relative frequency format should lead to higher donations than a probability format particularly for less numerate individuals who are more susceptible to changes in presentation formats.

(H2) Furthermore, we expect that lower numeracy should lead to more concrete imagery (Dieckmann et al., 2009; Peters et al., 2006) of the victim.

(H3) Finally, affective reactions to the victims are hypothesized to be related to the mental image of the victim (Slovic, 2007). More concrete images should increase affective reactions and therefore lead to higher donations.

2.1 Method

2.1.1 Participants and design

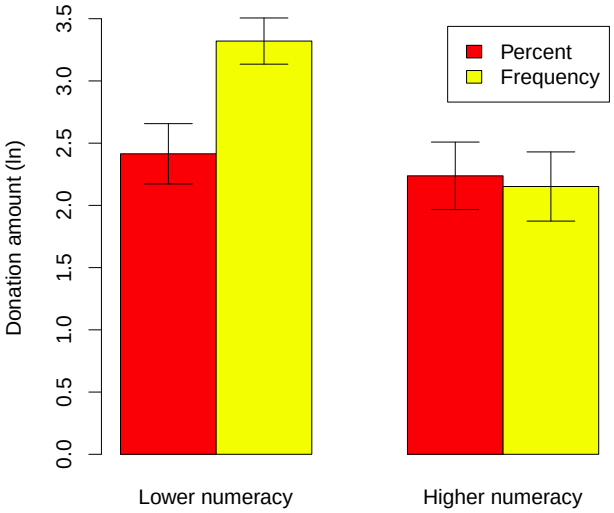
A total of 174 participants (47% female; M_{age}= 23.0; SD_{age} = 5.4) took part in this study, which lasted approximately 15 minutes and was included in a one hour experimental battery with unrelated study materials. They were paid 12 Euros (approximately $15.66) as compensation for their time.

We manipulated the format of the presentation of the victim in a frequency or a probability format. We further assessed participants' ability to transform frequency information into probabilistic information (and vice versa) with a numeracy measure. The primary dependent variable was participants' willingness to donate money to the victim. Additionally, we measured participants' affective reactions and mental images of the victim.

2.1.2 Materials and procedure

At the beginning of the study, participants were asked to imagine that they could contribute to a humanitarian aid organization with the aim of reducing hunger in Africa among poor children in danger of starvation. Their donation would always go to one child out of a group of 100 children; however, in the frequency condition the target child was presented as "one out of 100", whereas in the probability condition it was presented as "one percent out of 100". All other information about the victim was identical in both conditions. After reading the description of the victims' situation, participants indicated their willingness to donate (assessed as an open-ended question). On a separate page, affective reactions (adapted from Dickert, 2008; Dickert et al., 2011; Kogut & Ritov, 2005a, 2005b) were rated on a scale from 1 (don't agree at all) to 7 (completely agree). Specifically, these emotions included participants' sympathy, compassion, worry, sad-

Figure 1: Log-transformed donation amounts by numeracy and presentation format.



ness in regard to the victim, how much better participants would feel if they donated, anticipated regret if they did not donate, whether the victim deserves help in the view of the participant, and the perceived moral obligation to help.

Additionally, participants' mental image of the victim was assessed on the same scale as above with two statements: "When I put myself in the position of this one child (1% of the children), I can imagine its environment" and "When I picture this one child (1% of the children), I can construct a clear and coherent impression". Finally, numeracy was measured with a 15-item questionnaire used by Peters, Dieckmann and colleagues (2007). This questionnaire consists of items that require participants to compare and translate frequency information into probabilities (and vice versa), and includes such questions as "if the chances of winning a lottery prize are 1%, how many of 1000 people would you expect to win a prize?" and "if the chance of getting a viral infection is 0.0005, how many out of 10,000 people are expected to get infected?".

2.2 Results and discussion

2.2.1 Preliminary data analysis

Participants' numeracy scores ranged between 6 (40% correct) and 15 (100% correct) and a median split was used to classify people into lower (from 6 to 12; $n = 101$) and higher (from 13 to 15; $n = 73$) numeracy (Peters et al., 2006; see also MacCallum, Zhang, Preacher, & Rucker, 2002 for conditions justifying median splits) due to significant skew of the distribution, $z(\text{skew}) = -4.71$, $p < .01$. Donation amounts were winsorized on the high end (less than 7% of the data) and log-transformed to reduce skewness.[1] The affective reactions were combined into one affect scale (Cronbach's $\alpha = .85$), and participants' mental image ratings were aggregated into a mental image scale (Cronbach's $\alpha = .69$). All independent variables were mean-centered prior to analysis.

2.2.2 Effect of numeracy and presentation format on donations.

Hypothesis 1 was tested with an analysis of variance (ANOVA) with presentation format (frequency vs. percentage) and numeracy (lower vs. higher) as independent variables and donation amounts as the dependent variable. As expected, donations were a little higher in the frequency presentation format ($M = 2.82$, $SD = 1.53$) than in the probability presentation format ($M = 2.34$, $SD = 1.67$), $F(1, 170) = 2.94$, $p = .088$, $\eta_p^2 = .02$. Additionally, highly numerate individuals indicated that they would donate less ($M = 2.19$, $SD = 1.57$) than those lower in numeracy ($M = 2.86$, $SD = 1.60$), $F(1, 170) = 7.91$, $p < .01$, $\eta_p^2 = .04$.[2] The hypothesized interaction testing for differential effects of presentation format depending on numeracy was also significant, $F(1, 170) = 4.30$, $p = .04$, $\eta_p^2 = .03$. Further analyses revealed that presentation format influenced donations only for those lower in numeracy (see Figure 1). As predicted, less numerate individuals were willing to donate more money in the frequency format ($M = 3.32$, $SD = 1.31$) than in the probability format ($M = 2.41$, $SD = 1.73$), $t(99) = 2.86$, $p < .01$, $d = 0.59$. In contrast, among those higher in numeracy, donation amounts did not depend on presentation format ($M = 2.15$, $SD = 1.56$ and $M = 2.24$, $SD = 1.60$ for frequency and probability presentation formats, respectively), $t(71) = 0.23$, $p = .82$, $d = 0.06$.[3]

2.2.3 Effect of numeracy and presentation format on mental images

We conducted a similar ANOVA to test whether participants' mental images of the victim were dependent on presentation format and numerical ability (H2). Highly

[1] Before transformation: $z(\text{skew}) = 33.74$, $p < .01$; after transformation: $z(\text{skew}) = -2.65$, $p < .02$).

[2] The proportion of participants who were willing to donate anything at all did not depend on the condition (frequency = 84% vs. percent = 74%), χ^2 (1, $N = 174$) = 3.16, p = .075, nor numeric ability (high numeracy = 74% vs. low numeracy = 83%), χ^2 (1, $N = 174$) = 2.18, p = .14.

[3] A regression analysis ($F(3,170) = 4.28$, $p < .01$, $R^2 = .07$) with numeracy as a continuous predictor supported the main effects ($\beta = .16$, $p = .03$; and $\beta = -.21$, $p < .01$, for condition and numeracy, respectively). The interaction was no longer significant ($\beta = -.08$, $p = .27$), however the relationship of numeracy and donations was significantly negative in the frequency format (β = -.30, $p < .01$), whereas this is not the case for the probability format (β = -.13, $p = .24$).

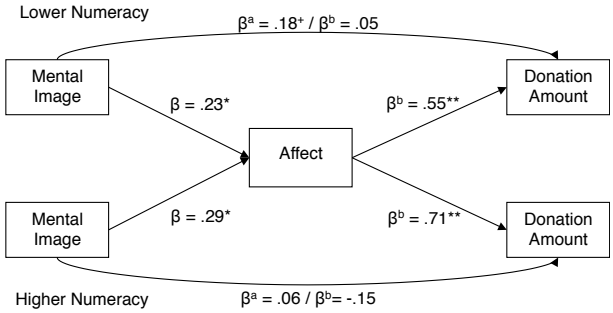
numerate individuals reported less clear and less coherent mental images of the victim (M = 3.18, SD = 1.41) compared to those lower in numeracy (M = 4.07, SD = 1.61), $F(1, 170) = 14.77$, $p < .01$, $\eta_p^2 = .08$, supporting the notion that higher numeracy corresponds to more abstract information processing. Participants reported clearer mental images in the frequency format (M = 3.82, SD = 1.70) than in the probability format (M = 3.57, SD = 1.47); however, this finding did not reach significance, $F(1, 170) = 1.44$, $p = .23$. The interaction with numeracy was also not significant, $F < 1$, $p > .88$. Accordingly, in the present study mental images seem to depend more on numeracy than on the numeric presentation format.[4]

2.2.4 Mental images underlying affective reactions and donations

To examine whether the relation between mental images, affective reactions and donation amounts is different for more and less numerate individuals, we conducted separate mediation analyses for both groups. In this analysis, we aggregated across presentation format because presentation format did not significantly influence mental images and our primary interest was to investigate whether the role of mental images in the construction of donation amounts differs by numerical ability (see Figure 2). We used Baron and Kenny's (1986) regression approach, while taking the recent critique and modifications suggested by Zhao, Lynch, and Chen (2010) and Preacher and Hayes (2008) into account. According to Baron and Kenny (1986), the prerequisite for mediation analyses is a significant relationship between a predictor variable (i.e., mental images) and a criterion (i.e., donations). However, recent approaches to mediation point out that this relationship is the "total effect" of the sum of direct and indirect effects including the mediator (i.e., affective reactions) and that mediation should be solely established by the presence of an indirect effect (Preacher & Hayes, 2008; Zhao et al., 2010).

Using the bootstrapping technique advocated by Preacher and Hayes (2008), our results demonstrated that affective reactions significantly mediated the effect of mental image on donation amounts (i.e., indirect effect: 95% CI [.03, .24]) for less numerate individuals.[5] After

Figure 2: Mediation analyses for Study 1



** $p < .01$, * $p < .05$

[a] Regression coefficients without the mediator (affective reaction) as predictor

[b] Regression coefficients with mental image and affective reaction as predictors

controlling for the indirect effect, no additional direct effect of mental images on donation amount remained (β = .05, p >.54). According to these results, for individuals with lower numeracy, clearer mental images were associated with stronger affective reactions, which in turn were related to higher donation amounts (i.e., indirect-only mediation; Zhao et al., 2010). For highly numerate individuals, the pattern of results is seemingly similar, as this mediating effect of affective reactions is also significant (95% CI [.06, .42]). However, when controlling for the mediating effect of affective reactions, the direct effect of mental images on donations was in the opposite direction of the indirect effect, ($\beta = -.15$, $p = .12$). While the indirect effect suggests that clearer mental images evoked stronger affective reactions (which in turn were associated with higher donations), the direct effect of mental images tended to decrease donations for highly numerate individuals (albeit not significantly). Most importantly, the difference in direct effects for more vs. less numerate individuals was significant, $z = 2.02$, $p < .05$, suggesting that the role of mental images in donation decisions depends on numeracy.

Taken together, the results of Study 1 support the notion that donation amounts among less numerate individuals were influenced by the presentation format whereas individuals with higher numeracy were not influenced by presentation format. Note, however, that we found this result only when dichotomizing numeracy. Possibly the effect of presentation formation was not linearly moderated by numeracy. However, the main effects of numeracy were independent of whether numeracy was dichotomized or continuous. Specifically, less numerate individuals indicated that they would donate more, and they reported a more concrete mental image of the victim. The effect of mental images on donation amounts was straightforward for those lower in numeracy; clearer

[4] A regression analysis with numeracy as a continuous variable ($F(3,170) = 4.69$, $p < .01$, $R^2 = .08$) confirmed that only numeracy significantly predicted mental images ($\beta = -.27$, $p < .001$) and that condition and the interaction did not ($\beta = .10$, $p = .20$; and $\beta = -.04$, $p = .59$, respectively).

[5] Confidence intervals are constructed for β-values, which are considered significant when zero is not included in the interval. The more conservative Sobel test (Sobel, 1982, 1987) for indirect effects showed that the effect of mental images on donation amount through its indirect effect via affective reactions was significant for both less and more numerate individuals (*Sobel test statistic* = 2.22, $p = .03$ and *Sobel test statistic* = 2.41, $p = .02$, respectively).

mental images were related to stronger affective reactions, which in turn were associated with higher donations. The indirect mediation was also present for individuals higher in numeracy; however the direct effect of mental images decreased their donation amounts relative to less numerate individuals. It should be noted that the concreteness of the mental images was dependent only on numeracy and not on the presentation formats that we used. Although frequency formats are likely more imagery provoking than probability formats (e.g., Slovic et al., 2002), it is possible that our presentation format manipulation was not strong enough to significantly influence mental images. Nonetheless, it is of interest that mental images were related to individual differences in numeracy, suggesting a propensity of low numerate individuals to engage in more concrete information processing (Dieckmann et al., 2009).

However, neither the findings of mental imagery nor the mediation analysis can fully account for the observed interaction between numeracy and presentation format on participants' intention to donate. Given that philanthropic acts are often dependent on a multitude of mechanisms working at the same time (Bekkers & Wiepking, 2007), mental imagery is likely not the only predictor of donations that differs by numeracy. Higher numeracy typically leads to a more complete consideration and integration of numeric information (Peters, Dieckmann, et al., 2007; Peters & Levin, 2008), which might highlight the total quantity of lives saved in our task as quite low and suggest that the help provided is not effective. As a result, the highly numerate may decrease their willingness to help (e.g., a "drop in the bucket" effect; Fetherstonhaugh et al., 1997). Study 2 will address this issue and examine the relationship between clearer mental images and effectiveness judgments and expand the present findings by using a donation task with a slightly less subtle manipulation of presentation mode.

3 Study 2—Identifiability and magnitude

Study 2 further examined the different processes underlying donation decisions in relation to numeracy and presentation formats. We designed Study 2 to take prior research on the effects of identifiability and victim number into account (Kogut & Ritov, 2005a, 2005b). Presentation formats that increase affective responses (e.g., identifying the victims) are likely to increase donations as well, and particularly so for single victims vs. groups of victims. The identification of victims produces an affect-rich mental representation that may highlight one's affective response as a decision cue for helping while attenuating the importance of numerical information about the size of the victim group (Gong & Baron, 2010; Hsee & Rottenstreich, 2004). Prior research has also demonstrated that numerical information is less important (and used less extensively) by lower numerate individuals and that they are more susceptible to changes in the presented format (e.g., Dieckmann et al., 2009). These results, together with our results from Study 1 on different mental images for high vs. low numeracy, suggest that an affect-rich presentation format (e.g., identification of victims) increases the willingness to donate for single vs. groups of victims particularly for individuals with lower numeracy. We tested this prediction in Study 2.

Moreover, we sought to replicate our findings from Study 1 regarding the different mechanisms underlying donation decisions for more and less numerate individuals. In addition to mental images, we also assessed how effective a donation was judged. Results from Study 1 suggest that individuals higher in numeracy incorporate more (numeric) information and possibly believe that a donation saving only a small amount of lives is ineffective. If this is the case, we would expect donation amounts to be positively related to effectiveness judgments for highly numerate individuals.

(H4) Consistent with prior research on donations (e.g., Small & Loewenstein, 2003), we expected that identifying the victims would lead to higher donations. Additionally, in line with Kogut and Ritov (2005a, 2005b), we predicted that donations would be higher for one vs. five victims only when the victims were identified. We expected that this pattern of results would be particularly visible for participants lower in numeracy.

(H5) We further expected to replicate results from Study 1 with regard to lower numeracy leading to clearer and more concrete mental images of the victim(s). Additionally, we hypothesized that the relationship between mental image and donations would be mediated by affect for less numerate individuals and not for the highly numerate.

(H6) Whereas donations from individuals lower in numeracy should be positively related to their mental images, donation amounts from individuals higher in numeracy should be positively related to how effective a donation is judged to be.

3.1 Method

3.1.1 Participants and design

Participants (N = 168; M_{age} = 23.9, SD_{age} = 5.1; 62% female) took part in this study, which was embedded in an experimental battery with unrelated study materials lasting approximately one hour. As in Study 1, on average, participants were compensated with 12 Euros for their effort.

In a 2 x 2 between-subjects design, we manipulated the presentation format (identified vs. unidentified) and the number of children who could be helped using a frequency format (1 vs. 5). The variables of interest included willingness to donate, affective reactions, the mental representation of the victim, and the expected impact of the donation.

3.1.2 Materials and procedure

The materials and procedure were similar to Study 1. We presented participants with a donation task in which they were asked to imagine that they could donate to a humanitarian organization that aids children in danger of starvation (see Appendix for an example). Depending on the condition, participants could donate to either one or five children and were informed that they were part of a group of 100 similar children in need of help. In the identified condition, the one child or the five children were identified by pictures, whereas in the unidentified condition they were represented by a number (1 vs. 5). Apart from the manipulations, all other information and measurements were identical in the four conditions. As in Study 1, participants indicated their donation amount with an open ended question, then on a separate page with scales for their affective reactions (i.e., sympathy, compassion, worry, sadness, anticipated regret, victims' deservingness, obligation to help, and how much better participants felt due to a donation) and mental image (i.e., coherence and cohesiveness of their impression of the victim). Additionally, we measured the estimated impact of the donation on a 7-point scale with the statement: "My donation would help to improve the life of this child (these five children)." At the end of the experimental battery, numeracy was assessed using the same scale as in Study 1.

3.2 Results and discussion

3.2.1 Preliminary data analyses

Prior to further analyses, we winsorized unusually high donation amounts (less than 7% of the distribution) and then log-transformed the winsorized donation amounts to reduce skewness (before transformation: z(skew) = 43.86, $p < .001$; after transformation: z(skew) = -1.20, p = .23). In the one identified victim condition, five different pictures of children were used. A one-way ANOVA revealed no significant differences in donation amounts across each of the five individual victims, $F(4, 36) = 1.96$, $p = .12$; as a result, they were combined into one identified victim condition. As in Study 1, due to significant skewness, z(skew) = -3.94, $p < .001$ in the numeracy variable, we used a median split to classify people as higher vs. lower in numeracy. Individual affective reactions were aggregated into a general affect scale (Cronbach's α = .85). All independent variables were mean-centered prior to analysis.

3.2.2 Effects of victim identification, number of victims and numeracy on donations.

To test whether identifying the victims led to higher donations (H4), we conducted an ANOVA with victim identification (identified vs. unidentified), number of victims (one vs. five) and numeracy (higher vs. lower) as factors and donation amount as the dependent variable. As hypothesized, participants were willing to donate more money when victims were identified (M = 2.98, SD = 1.62) than when they were not (M = 2.44, SD = 1.82), $F(1, 160) = 4.27$, $p = .04$, $\eta_p^2 = .03$. The main effects for number of victims and numeracy were not significant, Fs < 1, ps > .33.[6] However, the predicted interaction between victim identification and victim number was supported by the data, $F(1, 160) = 3.31$, $p = .07$, $\eta_p^2 = .02$, replicating findings by Kogut and Ritov (2005a). Specifically, when victims were identified, participants donated more to one (M = 3.22, SD = 1.69) than to five victims (M = 2.72, SD = 1.52), whereas the opposite pattern was observed for unidentified victims (M = 2.15, SD = 1.84, and M = 2.74, SD = 1.78, for one and five victims, respectively). Although the three-way interaction was not significant, $F < 1$, $p = .67$, further analyses showed that the two-way interaction between identifiability and number of victims was significant only for participants with lower numeracy scores, $F(1, 108) = 3.88$, $p = .05$, η_p^2 = .04 (for participants with higher numeracy scores, $F < 1$, $p > .40$). None of the other interactions was significant, Fs < 1.1, ps > .30.[7]

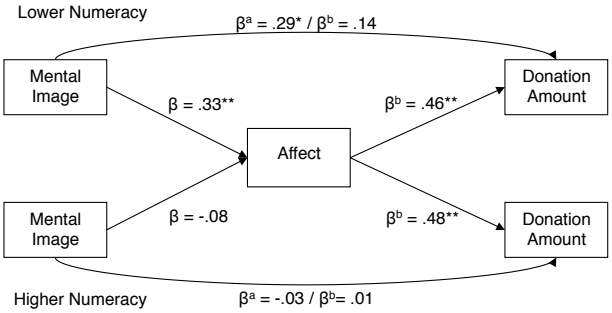
3.2.3 Mental images underlying affective reactions and donations.

We first asked whether the hypothesized effect of numeracy on mental image (H5) could be replicated in Study 2. We conducted an ANOVA with identifiability, number of victims, and numeracy as independent variables predicting participants' mental image. Consistent with Study

[6] The proportion of participants who were willing to donate anything at all was significantly higher in the identified victim condition (87%) than in the unidentified victim condition (74%), χ^2 (1, N = 168) = 3.94, p = .047. However, the proportion did not depend on whether there were one (78%) or five victims (83%), χ^2 (1, N = 168) = 0.81, p = .37, and also not on participants' numeracy score (80% for both high and low numerate individuals), χ^2 (1, N = 168) < 0.01, $p > .99$.

[7] A regression analysis ($F(7,160) = 1.69$, $p = .11$, $R^2 = .07$) with numeracy as a continuous predictor and all other variables revealed similar effects, such that only the main effect for identifiability ($\beta = .15$, p = .048) and the interaction between identifiability and scope ($\beta = -.16$, p = .04) significantly predicted donations. None of the other effects was significant, βs < .09 ps > .23

Figure 3: Mediation analyses for Study 2



** $p < .01$, * $p < .05$

[a] Regression coefficients without the mediator (affective reaction) as predictor

[b] Regression coefficients with mental image and affective reaction as predictors

1, less numerate individuals rated their mental image as stronger (M = 3.53, SD = 1.78) than those higher in numeracy (M = 2.96, SD = 1.53), $F(1,160) = 3.55$, $p = .06$, $\eta_p^2 = .02$. Additionally, mental images were clearer when victims were identified (M = 3.71, SD = 1.70) than when they were not (M = 2.99, SD = 1.66), $F(1,160) = 5.59$, $p < .02$, $\eta_p^2 = .03$. No other effects were significant, Fs < 1, ps > .68.[8] These results further support the notion that the mental image of the victims differs by numeracy. The fact that we found this result with substantially different presentation modes across the two studies supports our contention that less numerate individuals tend to construct clearer and more concrete mental images of the lives at risk, irrespective of how these lives are presented. In Study 2, the effect of victim identification on clearer mental images was additive to the effect of numeracy, as none of the interactions were significant.

The impact of mental image on donations (and the mediating effect of affective reactions) was analyzed in separate mediation analyses for participants with higher and lower numeracy (see Figure 3). We used the same technique to test for indirect and direct mediation effects as in Study 1 (see Baron & Kenny, 1986; Preacher & Hayes, 2008; Zhao, Lynch, & Chen, 2010). A significant relationship between mental images and donation amounts emerged for less numerate individuals ($\beta = .33$, $p < .01$) whereas donation amounts for highly numerate individuals were not associated with mental images ($\beta = -.08$, $p = .58$). Based on Preacher and Hayes' (2008) mediation technique, for less numerate individuals, we found a positive indirect effect of the affective reactions, 95% CI [.05, .26] but no direct effect ($\beta = .14$, $p = .10$) once the indirect effect has been taken into account, replicating results from Study 1.[9] Therefore, for less numerate participants, more concrete mental images were associated with higher donation amounts primarily through the mediating effect of stronger affective reactions. Conversely, there was no direct ($\beta = .01$, $p = .94$) or indirect effect (95% CI [-.24, .13]) of mental images on donation amounts among highly numerate individuals.

Table 1: Correlation matrix for less and more numerate individuals.

	Donation amount	Affect	Mental image	Impact
Less numerate				
Donation amount	1			
Affect	.51**	1		
Mental image	.29**	.32**	1	
Impact	.40**	.30**	.22*	1
More numerate				
Donation amount	1			
Affect	.48**	1		
Mental image	−.03	−.08	1	
Impact	.59**	.39**	−.35**	1

** $p < .01$, * $p < .05$.

According to these results, the effect of (concrete) mental images on donation amounts among the less numerate was mediated by affective reactions. Highly numerate individuals did not show this mediating effect in Study 2. Correlational analyses revealed that their (less concrete) mental images did not seem to be related to their donation amounts and affective reactions (see Table 1). Instead, and as hypothesized (H6), among highly numerate participants, donation amounts were more strongly related to the estimated impact of a donation ($r = .59$) rather than the mental image of the victim ($r = -.03$), $z = 3.14$, $p < .01$. Among less numerate individuals, this difference in correlations was not significant, $z = 1.01$, $p = .32$. Additionally, the relationship between mental images and impact judgments reversed depending on numeracy, $z = 3.52$, $p < .001$. Whereas clearer men-

[8] Results of regression analysis ($F(7,160) = 1.67$, $p = .12$, $R^2 = .07$) with numeracy as a continuous predictor confirmed the ANOVA results. The main effect of numeracy ($\beta = -.14$, $p = .07$) and identifiability ($\beta = .20$, $p < .01$) predicted mental images. None of the other effects was significant, βs < .04, ps > .64

[9] Using the more conservative Sobel test produced similar results (*Sobel test statistic* = 2.98, $p < .01$ and *Sobel test statistic* = −0.56, $p > .57$, for indirect effects of low and high numeracy, respectively).

tal images correlated positively with impact judgments for individuals lower in numeracy, those with higher numeracy scores had a negative correlation between mental images and impact judgments.

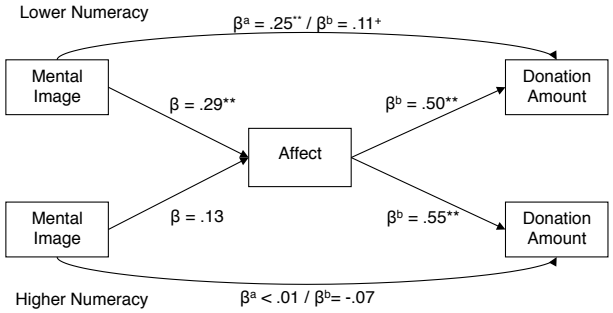
The finding that clearer mental images are related to negative impact judgments for high numerate individuals suggests that the mental images are qualitatively different depending on numerical skill. For example, the mental images of individuals with lower numeracy may be constructed such that they relate to aspects of the victim that are affectively arousing whereas images of individuals with higher numeracy may be related more to the numeric aspects that signal the hopelessness of the situation. Imagining the victims and their situation could focus the attention of the higher numerate individuals on the small proportion being helped and therefore reduce the impact judgments. These results are consistent with prior findings of highly numerate individuals drawing more affective meaning from numbers (Peters et al., 2006) and further buttress the notion that the role of mental images in donation decisions depends on people's numeracy. Donation amounts among the highly numerate were not related to their mental images but rather were associated with the estimated impact of the donation.

These findings are noteworthy since, in the current study, we did not observe mean donation amounts to depend on numeracy. Yet, factors believed to be relevant in the construction of the donation amount appear to depend on numeracy, as mental images (and their relation to the associated affective responses) of the underlying donations were different for more and less numerate individuals. Central to this difference is that a clearer picture of the victims was associated with greater impact judgments of a donation among less numerate individuals, whereas individuals with higher numeracy reported lower impact judgments when they had clearer mental images of the victims.

3.2.4 Combined mediation analysis

Recall that we found somewhat inconsistent results concerning the indirect effect of mental imagery on donation amounts for highly numerate individuals in Studies 1 and 2 (i.e., present in Study 1 and absent in Study 2). We combined our data to increase power and conducted the mediation analysis with all 342 participants (see Figure 4). Results revealed that the indirect effect was significant for less numerate individuals (95% CI [.07, .22]), whereas the direct effect was marginally significant (β = .11, p = .08). For highly numerate individuals, neither the direct ($\beta = -.07$, p = .38) nor the indirect effect (95% CI [-.05, .21]) of mental images on donations was significant. Therefore, when taking both studies into account, we found no evidence for mediation of the relation between mental imagery and donations through affect among highly numerate individuals. A moderated mediation (Preacher, Rucker, & Hayes, 2007) supported this difference with an almost significant interaction between mental image and numeracy, $b = -.18$, p = .076. The interaction suggests that the indirect effect of mental image on donations through affect was stronger for less numerate individuals than for highly numerate individuals.

Figure 4: Combined mediation analyses



** $p < .01$, * $p < .05$

[a] Regression coefficients without the mediator (affective reaction) as predictor

[b] Regression coefficients with mental image and affective reaction as predictors

4 General discussion

Donation requests typically confront people with numerical information related to the need of others. Whether it is the number of victims of a natural disaster, a proportion of lives affected by a disease, or the number of individuals benefiting from a specific charitable cause, this kind of information is conveyed with numbers. People's ability to comprehend those numbers and derive meaningful interpretations from them likely influences their decisions to help. We conducted two studies to examine the joint influence of numeracy and presentation format on people's willingness to donate money to a charitable cause and on the processes underlying these donations.

Recent investigations of the underlying mechanisms of pro-social behavior have stressed the role of affect and mental imagery (e.g., Batson, 1990; Dickert et al., 2011; Dickert & Slovic, 2009; Kogut & Ritov, 2005a, b; Slovic, 2007; Small et al., 2007). Our results extend this research by showing that the propensity to engage in mental imagery and to use it in donation decisions depends on numeracy. Those lower in numeracy formed a clearer mental representation of the victim(s) in both studies (consistent with Dieckmann et al., 2009) and a stronger re-

lationship between the mental image and affective reactions in Study 2. Moreover, results showed that the effect of the mental image on donations among the less numerate was mediated by affective responses that seemed to spring from the mental image as theorized by Slovic (2007). Higher numeracy, on the other hand, was related to a less clear mental image of the people in need and a diminished relationship between the mental image and donation amounts. Although affective reactions of highly numerate individuals may not always be influenced by mental imagery concerning the victims, these affective reactions nonetheless were associated with donations to the same degree as for less numerate individuals. Based on previous studies, we suspect that highly numerate individuals formed affective reactions from the magnitude of the numbers or number comparisons (e.g., Peters, in press; Peters et al., 2006). Furthermore, findings from Study 2 suggested that, among highly numerate individuals, the willingness to help also depended more on the estimated impact of a donation than the mental image attached to the victim(s).

Consistent with research on the effects of numeracy and presentation formats on risk perceptions and medical decision making (e.g., Dieckmann et al., 2009; Peters et al., 2006; Peters et al., 2011), our results suggest that less numerate participants were susceptible to changes in presentation format whereas highly numerate individuals were relatively unaffected. In Study 1, based on a median split, less numerate individuals donated more money when the victim was presented in a frequency format (i.e., one out of 100) compared to a percentage format (one percent of 100). In Study 2, only less numerate individuals' donations were influenced by both victim identification and changes in victim number.

Whereas previous research has mainly focused on the different sources of information that individuals higher vs. lower in numeracy have at their disposal, our results suggest that the processes by which individuals arrive at a decision differs by numeric skill. Thus, more and less numerate individuals initially may have the same information available, but they process that information differently and ultimately access and use different information. In our donation tasks, it is possible that highly numerate individuals did have access to number transformations that support concrete mental images (which would be consistent with other research), but instead used different decision cues in their donation decisions. Nonetheless, our results point towards the possibility that greater numeracy skills may be related to information processing with less concrete mental imagery as a default compared to those with lower numeracy skills.

4.1 Implications, limitations, and future research

Our conceptualization of mental imagery and its differential influence for more and less numerate individuals' willingness to donate could potentially be applied to a range of other decision making domains. It should be noted, however, that engaging in mental imagery is likely dependent both on personal as well as situational factors (e.g., Jiang & Wyer, 2009; Nisbett & Ross, 1980). Our research was geared specifically towards investigating differences in mental representations of other people in need and whether changes in presentation format and numerical ability affect charitable giving. As victims of catastrophes are typically presented in numerical format, we were interested in whether numeracy might influence the construction of donation amounts. Future research could expand on these findings and include more general measurements of the propensity to form mental images in a variety of contexts (e.g., Childers, Houston, & Heckler, 1985). Additionally, it would be interesting to test the effects of other personality factors associated with the concreteness of mental representations and its relation to giving (e.g., construal orientations).

In our studies we assessed affective reactions, mental images, and the estimated impact of donations after confronting people with the donation decision. It is possible that experienced affect can influence the perceived physical distance to the victim and the propensity to engage in more concrete mental representations (Van Boven, Kane, McGraw, & Dale, 2010). Similarly, it is conceivable that donation decisions influence affective reactions. However, based on the primacy-of-affect argument (e.g., Slovic et al., 2002; Zajonc, 1980), we maintain that affective reactions as well as mental images (Slovic, 2007) can precede donation decisions; in fact, Dickert and Slovic (2009) demonstrated that the ease with which mental images are formed influences sympathy responses to victims in need.

Using other presentation formats could further extend our studies. Donation situations in which the gist of the numerical information is opposite for frequency vs. probability formats would allow generalizing the effects of numerical ability to situations in which comparative judgments between different charitable causes have to be made (e.g., Pacini & Epstein, 1999; Peters et al., 2006; Reyna & Brainerd, 2008; Reyna et al., 2009). Additionally, the effects of increasing the number of charitable organizations within a donation request (Soyer & Hogarth, 2011) or volunteers (Carroll, White, & Pahl, 2011) might also relate to numeracy.

Finally, we acknowledge that the effects of numerical ability on willingness to donate probably do not supersede other relevant factors that influence charitable

giving. Naturally, for example, differences in abstraction and numerical presentations of victim statistics may be less important when financial constraints are present. Nonetheless, as information about people in need is often displayed in numerical format, we believe that a comprehensive picture of the underlying processes of donation decisions needs to take individual differences in numerical ability into account. The current paper suggests that the propensity to engage in concrete mental representations is weaker for individuals used to abstracting information from numbers, and that this is a key element in the underlying mechanisms of donation decisions.

References

Baron, J. (1997). Confusion of relative and absolute risk in valuation. *Journal of Risk and Uncertainty, 14*, 301–309.

Baron, R., & Kenny, D. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173–1182.

Batson, C. D. (1990). How social an animal? The human capacity for caring. *American Psychologist, 45*, 336–346.

BBC (2010, February 10). Haiti raises earthquake toll to 230,000. Retrieved from http://www.washingtonpost.com/wp-dyn/content/article/2010/02/09/AR2010020904447.html

Bekkers, R., & Wiepking, P. (2007). Generosity and philanthropy: A literature review, Available at SSRN: http://ssrn.com/abstract=1015507

Carroll, L. S., White, M. P., & Pahl, S. (2011). The impact of excess choice on deferment of decisions to volunteer. *Judgment and Decision Making, 6*, 629–637.

Chapman, G. B., & Liu, J. J. (2009). Numeracy, frequency, and bayesian reasoning. *Judgment and Decision Making, 4*, 34–40.

Childers, T. L., Houston, M. J., & Heckler, S. E. (1985). Measurement of individual-differences in visual versus verbal information-processing. *Journal of Consumer Research, 12*, 125–134.

Dickert, S. (2008). *Two routes to the perception of need: The role of affective and deliberative information processing in pro-social behavior.* University of Oregon, OR.

Dickert, S., Sagara, N., & Slovic, P. (2011). Affective motivations to help others: A two-stage model of donation decisions. *Journal of Behavioral Decision Making, 24*, 361–376.

Dickert, S., & Slovic, P. (2009). Attentional mechanisms in the generation of sympathy. *Judgment and Decision Making, 4*, 297–306.

Dieckmann, N. F., Slovic, P., & Peters, E. M. (2009). The use of narrative evidence and explicit likelihood by decision makers varying in numeracy. *Risk Analysis, 29*, 1473–1488.

Fagerlin, A., Ubel, P. A., Smith, D. M., & Zikmund-Fisher, B. J. (2007). Making numbers matter: Present and future research in risk communication. *American Journal of Health Behavior, 31*, S47-S56.

Fetherstonhaugh, D., Slovic, P., Johnson, S. M., & Friedrich, J. (1997). Insensitivity to the value of human life: A study of psychophysical numbing. *Journal of Risk and Uncertainty, 14*, 283–300.

Friedrich, J., Barnes, P., Chapin, K., Dawson, I., Garst, V., & Kerr, D. (1999). Psychophysical numbing: When lives are valued less as the lives at risk increase. *Journal of Consumer Psychology, 8*, 277–299.

Frederick, S., & Fischhoff, B. (1998). Scope (in)sensitivity in elicited values. *Risk and Decision Policy, 3*, 109–123.

Galesic, M., Garcia-Retamero, R., & Gigerenzer, G. (2009). Using icon arrays to communicate medical risks: Overcoming low numeracy. *Health Psychology, 28*, 210–216.

Gong, M., & Baron, J. (2011). The generality of the emotion effect on magnitude sensitivity. *Journal of Economic Psychology, 32*, 17–24.

Hamilton, D. L., & Sherman, S. J. (1996). Perceiving persons and groups. *Psychological Review, 103*, 336–355.

Hsee, C. K., & Rottenstreich, Y. (2004). Music, pandas, and muggers: On the affective psychology of value. *Journal of Experimental Psychology-General, 133*, 23–30.

Huber, M., Van Boven, L., McGraw, A. P., & Johnson-Graham, L. (2011). Whom to help? Immediacy bias in judgments and decisions about humanitarian aid. *Organizational Behavior and Human Decision Processes, 115*, 283–293.

Jenni, K. E., & Loewenstein, G. (1997). Explaining the "identifiable victim effect". *Journal of Risk and Uncertainty, 14*, 235–257.

Jiang, Y. W., & Wyer, R. S. (2009). The role of visual perspective in information processing. *Journal of Experimental Social Psychology, 45*, 486–495.

Keller, C. (2011). Using a familiar risk comparison within a risk ladder to improve risk understanding by low numerates: A study of visual attention. *Risk Analysis, 31*, 1043–1054.

Keller, C., & Siegrist, M. (2009). Effect of risk communication formats on risk perception depending on numeracy. *Medical Decision Making, 29*, 483–490.

Kogut, T., & Ritov, I. (2007). "One of us": Outstanding willingness to help save a single identified compa-

triot. *Organizational Behavior and Human Decision Processes, 104*, 150–157.

Kogut, T., & Ritov, I. (2005a). The "Identified victim" effect: An identified group, or just a single individual? *Journal of Behavioral Decision Making, 18*, 157–167.

Kogut, T., & Ritov, I. (2005b). The singularity effect of identified victims in separate and joint evaluations. *Organizational Behavior and Human Decision Processes, 97*, 106–116.

Lipkus, I. M., & Peters, E. (2009). Understanding the role of numeracy in health: Proposed theoretical framework and practical insights. *Health Education & Behavior, 36*, 1065–1081.

Lipkus, I. M., Samsa, G., & Rimer, B. K. (2001). General performance on a numeracy scale among highly educated samples. *Medical Decision Making, 21*, 37–44.

Loewenstein, G., & Small, D. A. (2007). The scarecrow and the tin man: The vicissitudes of human sympathy and caring. *Review of General Psychology, 11*, 112–126.

MacCallum, R. C., Zhang, S., Preacher, K. J., & Rucker, D. D. (2002). On the practice of dichotomization of quantitative variables. *Psychological Methods, 7*, 19–40.

Nisbett, R. E., & Ross, L. D. (1980). *Human Inference: Strategies and Shortcomings of Social Judgment*. Englewood Cliffs, NJ: Prentice-Hall.

Pacini, R., & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Journal of Personality and Social Psychology, 76*, 972–987.

Peters, E. (in press). Beyond comprehension: The role of numeracy in judgments and decisions. *Current Directions in Psychological Science.*

Peters, E., Dieckmann, N., Dixon, A., Hibbard, J. H., & Mertz, C. K. (2007). Less is more in presenting quality information to consumers. *Medical Care Research and Review, 64*, 169–190.

Peters, E., Dieckmann, N. F., Västfjäll, D., Mertz, C. K., Slovic, P., & Hibbard, J. (2009). Bringing meaning to numbers: The impact of evaluative categories on decisions. *Journal of Experimental Psychology: Applied, 15*, 213–227.

Peters, E. & Levin, I.P. (2008). Dissecting the risky-choice framing effect: Numeracy as an individual-difference factor in weighting risky and riskless options. *Judgment and Decision Making, 3*, 435–448.

Peters, E., Hibbard, J., Slovic, P., & Dieckmann, N. (2007). Numeracy skill and the communication, comprehension, and use of risk-benefit information. *Health Affairs, 26*, 741–748.

Peters, E., Hart, S., & Fraenkel, L. (2011). Informing patients: The influence of numeracy, framing, and format of side-effect information on risk perceptions. *Medical Decision Making, 31*, 432–436.

Peters, E., Slovic, P., Västfjäll, D., & Mertz, C. K. (2008). Intuitive numbers guide decisions. *Judgment and Decision Making, 3*, 619–635.

Peters, E., Västfjäll, D., Slovic, P., Mertz, C. K., Mazzocco, K., & Dickert, S. (2006). Numeracy and decision making. *Psychological Science, 17*, 407–413.

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research, 42*, 185–227.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879–891.

Reyna, V. F., & Brainerd, C. J. (2008). Numeracy, ratio bias, and denominator neglect in judgments of risk and probability. *Learning and Individual Differences, 18*, 89–107.

Reyna, V. F., Nelson, W. L., Han, P. K., & Dieckmann, N. F. (2009). How numeracy influences risk comprehension and medical decision making. *Psychological Bulletin, 135*, 943–973.

Save the Children (2010). Helping Haiti's Children the first three months of Save the Children's earthquake response. Retrieved from http://www.savethechildren.org/publications/emergencies/STC_Haiti_v6.pdf

Schelling, T. C. (1968). The Life you save may be your own. In S. B. Chase (Ed.), *Problems in public expenditure analysis.* Washington, DC: The Brookings Institute.

Slovic, P. (2007). "If I look at the mass I will never act": Psychic numbing and genocide. *Judgment and Decision Making, 2*, 79–95.

Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2002). The affect heuristic. In T. Gilovich, D. Griffin & D. Kahneman (Eds.), *Heuristics and biases: The psychology of intuitive judgment* (pp. 397–420). New York: Cambridge University Press.

Slovic, P., Finucane, M., Peters, E., & MacGregor, D. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis, 24*, 311–322.

Small, D. A., & Loewenstein, G. (2003). Helping a victim or helping the victim: Altruism and identifiability. *Journal of Risk and Uncertainty, 26*, 5–16.

Small, D. A., Loewenstein, G., & Slovic, P. (2007). Sympathy and callousness: The impact of deliberative thought on donations to identifiable and statistical vic-

tims. *Organizational Behavior and Human Decision Processes, 102*, 143–153.

Sobel, M. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhardt (Ed.), *Sociological Methodology* (pp. 290–313). San Francisco: Jossey-Bass.

Sobel, M. (1987). Direct and indirect effects in linear structural equation models. *Sociological Methods & Research, 16*, 155–176.

Soyer, E., & Hogarth, R. M. (2011). The size and distribution of donations: Effects of number of recipients. *Judgment and Decision Making, 6*, 616–628

Susskind, J., Maurer, K., Thakkar, V., Hamilton, D. L., & Sherman, J. W. (1999). Perceiving individuals and groups: Expectancies, dispositional inferences, and causal attributions. *Journal of Personality and Social Psychology, 76*, 181–191.

Van Boven, L., Kane, J., McGraw, A. P., & Dale, J. (2010). Feeling close: Emotional intensity reduces perceived psychological distance. *Journal of Personality and Social Psychology, 98*, 872–885.

Västfjäll, D., Peters, E., & Slovic, P. (2008). Affect, risk perception and future optimism after the tsunami disaster. *Judgment and Decision Making, 3*, 64–72.

Zajonc, R. (1980). Feeling and thinking: Preferences need no inferences. *American psychologist, 35*, 151–175.

Zhao, X., Lynch, J. G. Jr., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of Consumer Research, 37*, 197–206.

Appendix

Instructions for Study 2, unidentified condition with one target victim:

Imagine that you have the possibility to donate to an international humanitarian aid organization for children. This organization is officially accredited and targets developing countries in order to improve the situation of children through long-term programs and projects. Your donation would be used to alleviate the hunger in Africa.

Your donation would be specifically used for **one child** out of a group of 100 African children which all live in poor conditions and are at risk of starvation. With a financial donation you could improve the life of this child.

1. Would you want to donate money in order to save this child?

[*Please select*]

☐ Yes ☐ No

2. If yes, how much money would you donate?

Amount: _____€